World Economic and Financial Surveys

# World Economic Outlook

## October 2017

# Seeking Sustainable Growth

## Short-Term Recovery, Long-Term Challenges

INTERNATIONAL MONETARY FUND

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Cover and Design: Luisa Menjivar and Jorge Salazar
Composition: AGS, An RR Donnelley Company

**Cataloging-in-Publication Data**

**Joint Bank-Fund Library**

Names: International Monetary Fund.
Title: World economic outlook (International Monetary Fund)
Other titles: WEO | Occasional paper (International Monetary Fund) | World economic and financial surveys.
Description: Washington, DC : International Monetary Fund, 1980- | Semiannual | Some issues also have thematic titles. | Began with issue for May 1980. | 1981-1984: Occasional paper / International Monetary Fund, 0251-6365 | 1986-: World economic and financial surveys, 0256-6877.
Identifiers: ISSN 0256-6877 (print) | ISSN 1564-5215 (online)
Subjects: LCSH: Economic development—Periodicals. | International economic relations—Periodicals. | Debts, External—Periodicals. | Balance of payments—Periodicals. | International finance—Periodicals. | Economic forecasting—Periodicals.
Classification: LCC HC10.W79

HC10.80

ISBN 978-1-48431-249-0 (paper)
978-1-48432-114-0 (Web PDF)
978-1-48432-112-6 (ePub)
978-1-48432-111-9 (Mobi)

The *World Economic Outlook* (WEO) is a survey by the IMF staff published twice a year, in the spring and fall. The WEO is prepared by the IMF staff and has benefited from comments and suggestions by Executive Directors following their discussion of the report on September 21, 2017. The views expressed in this publication are those of the IMF staff and do not necessarily represent the views of the IMF's Executive Directors or their national authorities.

**Recommended citation:** International Monetary Fund. 2017. *Seeking Sustainable Growth: Short-Term Recovery, Long-Term Challenges.* Washington, DC, October.

Publication orders may be placed online, by fax, or through the mail:
International Monetary Fund, Publication Services
P.O. Box 92780, Washington, DC 20090, USA
Tel.: (202) 623-7430 Fax: (202) 623-7201
E-mail: publications@imf.org
www.imfbookstore.org
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ERRATUM

*Correction to Figure 3.6, panel 6 in Chapter 3 (page 125):* The data in panel 6 (Wildfire) are incorrect in the printed version of the report and the initial PDF posted online. The corrected figure panel appears in this version of the report posted online on Oct. 11, 2017.

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# ASSUMPTIONS AND CONVENTIONS

A number of assumptions have been adopted for the projections presented in the *World Economic Outlook* (WEO). It has been assumed that real effective exchange rates remained constant at their average levels during July 20 to August 17, 2017, except for those for the currencies participating in the European exchange rate mechanism II (ERM II), which are assumed to have remained constant in nominal terms relative to the euro; that established policies of national authorities will be maintained (for specific assumptions about fiscal and monetary policies for selected economies, see Box A1 in the Statistical Appendix); that the average price of oil will be $50.28 a barrel in 2017 and $50.17 a barrel in 2018 and will remain unchanged in real terms over the medium term; that the six-month London interbank offered rate (LIBOR) on US dollar deposits will average 1.4 percent in 2017 and 1.9 percent in 2018; that the three-month euro deposit rate will average –0.3 percent in 2017 and 2018; and that the six-month Japanese yen deposit rate will yield on average 0.1 percent in 2017 and 0.2 percent in 2018. These are, of course, working hypotheses rather than forecasts, and the uncertainties surrounding them add to the margin of error that would in any event be involved in the projections. The estimates and projections are based on statistical information available through September 22, 2017.

The following conventions are used throughout the WEO:

. . . to indicate that data are not available or not applicable;

– between years or months (for example, 2016–17 or January–June) to indicate the years or months covered, including the beginning and ending years or months; and

/ between years or months (for example, 2016/17) to indicate a fiscal or financial year.

"Billion" means a thousand million; "trillion" means a thousand billion.

"Basis points" refers to hundredths of 1 percentage point (for example, 25 basis points are equivalent to ¼ of 1 percentage point).

Data refer to calendar years, except in the case of a few countries that use fiscal years. Please refer to Table F in the Statistical Appendix, which lists the economies with exceptional reporting periods for national accounts and government finance data for each country.

For some countries, the figures for 2016 and earlier are based on estimates rather than actual outturns. Please refer to Table G in the Statistical Appendix, which lists the latest actual outturns for the indicators in the national accounts, prices, government finance, and balance of payments indicators for each country.

What is new in this publication:

- Data for Somalia are included in the emerging market and developing economies group composites. Somalia is classified as a member of the Middle East and North Africa region.
- Starting with the October 2017 WEO, the real GDP per capita data in Statistical Tables A1, B1, and B2 are shown at purchasing power parity. This differs from the treatment of these data in the April 2017 WEO and earlier issues, in which the data were shown in local national currency.

In the tables and figures, the following conventions apply:

- If no source is listed on tables and figures, data are drawn from the WEO database.
- When countries are not listed alphabetically, they are ordered on the basis of economic size.
- Minor discrepancies between sums of constituent figures and totals shown reflect rounding.

As used in this report, the terms "country" and "economy" do not in all cases refer to a territorial entity that is a state as understood by international law and practice. As used here, the term also covers some territorial entities that are not states but for which statistical data are maintained on a separate and independent basis.

Composite data are provided for various groups of countries organized according to economic characteristics or region. Unless noted otherwise, country group composites represent calculations based on 90 percent or more of the weighted group data.

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The data appearing in the WEO are compiled by the IMF staff at the time of the WEO exercises. The historical data and projections are based on the information gathered by the IMF country desk officers in the context of their missions to IMF member countries and through their ongoing analysis of the evolving situation in each country. Historical data are updated on a continual basis as more information becomes available, and structural breaks in data are often adjusted to produce smooth series with the use of splicing and other techniques. IMF staff estimates continue to serve as proxies for historical series when complete information is unavailable. As a result, WEO data can differ from those in other sources with official data, including the IMF's International Financial Statistics.

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# PREFACE

The analysis and projections contained in the *World Economic Outlook* are integral elements of the IMF's surveillance of economic developments and policies in its member countries, of developments in international financial markets, and of the global economic system. The survey of prospects and policies is the product of a comprehensive interdepartmental review of world economic developments, which draws primarily on information the IMF staff gathers through its consultations with member countries. These consultations are carried out in particular by the IMF's area departments—namely, the African Department, Asia and Pacific Department, European Department, Middle East and Central Asia Department, and Western Hemisphere Department—together with the Strategy, Policy, and Review Department, the Monetary and Capital Markets Department, and the Fiscal Affairs Department.

The analysis in this report was coordinated in the Research Department under the general direction of Maurice Obstfeld, Economic Counsellor and Director of Research. The project was directed by Gian Maria Milesi-Ferretti, Deputy Director, Research Department; Oya Celasun, Division Chief, Research Department; and Helge Berger, Assistant Director, Research Department and Head of the IMF's Spillover Task Force.

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The analysis has benefited from comments and suggestions by staff members from other IMF departments, as well as by Executive Directors following their discussion of the report on September 21, 2017. However, both projections and policy considerations are those of the IMF staff and should not be attributed to Executive Directors or to their national authorities.

# FOREWORD

The global cyclical upswing that began midway through 2016 continues to gather strength. Only a year and a half ago, the world economy faced stalling growth and financial market turbulence. The picture now is very different, with accelerating growth in Europe, Japan, China, and the United States. Financial conditions remain buoyant across the world, and financial markets seem to be expecting little turbulence going forward, even as the Federal Reserve continues its monetary normalization process and the European Central Bank inches up to its own.

These positive developments give good cause for greater confidence, but neither policymakers nor markets should be lulled into complacency. A closer look suggests that the global recovery may not be sustainable—not all countries are participating, inflation often remains below target with weak wage growth, and the medium-term outlook still disappoints in many parts of the world. The recovery is also vulnerable to serious risks. Financial markets that ignore these risks are susceptible to disruptive repricing, and are sending a misleading message to policymakers. Policymakers, in turn, need to maintain a longer-term vision and seize the current opportunity to implement the structural and fiscal reforms needed for greater resilience, productivity, and investment. The possibility that they don't—governments far too often wait for crises to push them into decisive action—is itself a source of risks to the outlook, as well as a barrier to more inclusive and sustainable growth. Recent economic progress provides a global environment of opportunity, and policymakers should not let their chance go to waste.

The current recovery is incomplete in some important ways: within countries, across countries, and over time.

*Within countries.* Even as negative output gaps close across the advanced economies, growth in nominal and real wages remains weak compared with past recoveries. Weak wage growth is one source of the surprisingly weak inflation that itself is a source of concern, as it leaves nominal interest rates low and makes encounters with the effective lower bound, the point at which central banks can no longer lower interest rates, more likely. Chapter 2 of this *World Economic Outlook* report studies the recent surprisingly slow growth of nominal wages, which reinforces a longer trend of stagnant median wages, rising income inequality, and job polarization such that middle-skill but well-paying jobs have become increasingly scarce. Those developments have stoked considerable popular anti-globalization backlash—one significant threat to the world economy—although technological developments and government policies together have played larger roles in increasing income inequality, and fears of faster automation are a current cause of anxiety. Emerging markets have faced similar pressures in the face of trade liberalization and technological change, but growth has in many cases lifted all deciles of their income distributions and attitudes toward trade's effects on labor markets remain largely optimistic.

*Across countries.* The current upswing reaches more broadly than any in a decade—roughly 75 percent of the world economy, measured by GDP at purchasing power parity—is sharing in the acceleration. But that means the glass is 25 percent empty, implying a drag on world growth and a potential source of destabilizing political shocks. Emerging and low-income commodity exporters, especially energy exporters, continue to struggle, as do several countries experiencing civil or political unrest, mostly in the Middle East, North and sub-Saharan Africa, and Latin America. And many of these same countries are the ones that are also most exposed to the negative impacts of climate change—already being felt via more frequent extreme weather events in some regions, such as heat waves and heavy precipitation. Chapter 3 focuses on the economic costs of climate change and the need for adaptation investments in low-income countries. Advanced economies will not be immune to future climate developments, however—through either direct impacts in some advanced regions, such as the coastal United States, or the spillovers from mass migrations and geopolitical instability emanating from poorer countries.

*Over time.* Behind recent positive growth developments, longer-term trend per capita growth rates in many economies will be lower than trend growth rates of the past. In particular, most advanced economies face medium-term growth rates significantly lower than in the decade before the global financial crisis of 2007–09. The reasons behind these slowdowns differ across countries. For some economies, notably China's, declining long-term growth is a natural result of rebalancing and convergence. For emerging commodity exporters, which benefited from China's own rapid manufacturing growth in years past, permanently lower export prices call for new growth models. For advanced economies, expected slow productivity growth and aging workforces play major roles. Lower trend per capita growth rates can be problematic for several reasons: they make it harder for the poor to raise their living standards; they raise the pain of reallocating resources in the face of economic changes; they deter productivity-enhancing investment; they harm the sustainability of publicly funded social safety nets; and they feed political resentment by undermining hopes for the future and beliefs about the fairness of economic outcomes. In turn, these forces could derail the baseline forecast.

The preceding gaps in the recovery challenge policymakers to action—action that should take place now, while times are good. Needed structural reforms differ across countries, but all countries have ample room for measures that would raise economic resilience along with potential output. For some countries where output gaps have closed, the time has come to think about gradual fiscal consolidation, to reduce swollen public debt levels and create buffers to be used in the next recession. Such actions could entail adverse spillovers abroad, as discussed in Chapter 4. Countries with more fiscal space can, however, offset the reduction in global demand—for example, through much-needed productive infrastructure investment or through fiscal spending that supports structural reforms. This global fiscal package can also help reduce excess global imbalances.

Critically important to inclusive and sustainable growth is investment in people at all life-cycle stages, but especially the young. Better education, training, and retraining can both ease labor market adjustment to secular economic transformation—coming from all sources, not only trade—and raise productivity. In the short term, the excessive youth unemployment that afflicts many countries urgently deserves attention. Investing in human capital should help to push labor's income share upward, contrary to the broad trend of recent decades—but governments should also consider correcting distortions that may have reduced workers' bargaining power excessively. In sum, policy should promote an environment conducive to sustainable real wage growth.

Numerous global problems require multilateral action. Priorities for mutually beneficial cooperation include strengthening the global trading system, further improving financial regulation, enhancing the global financial safety net, reducing international tax avoidance, fighting famine and infectious diseases, mitigating greenhouse gas emissions before they create more irreversible damage, and helping poorer countries, which are not themselves substantial emitters, adapt to climate change. If the strength of the current upswing makes the moment ideal for domestic reforms, its breadth makes multilateral cooperation opportune. Policymakers should act while the window of opportunity is open.

Maurice Obstfeld
*Economic Counsellor*

# EXECUTIVE SUMMARY

*The global upswing in economic activity is strengthening. Global growth, which in 2016 was the weakest since the global financial crisis at 3.2 percent, is projected to rise to 3.6 percent in 2017 and to 3.7 percent in 2018. The growth forecasts for both 2017 and 2018 are 0.1 percentage point stronger compared with the April 2017* World Economic Outlook *(WEO) forecast. Broad-based upward revisions in the euro area, Japan, emerging Asia, emerging Europe, and Russia—where growth outcomes in the first half of 2017 were better than expected—more than offset downward revisions for the United States and the United Kingdom.*

*But the recovery is not complete: while the baseline outlook is strengthening, growth remains weak in many countries, and inflation is below target in most advanced economies. Commodity exporters, especially of fuel, are particularly hard hit as their adjustment to a sharp stepdown in foreign earnings continues. And while short-term risks are broadly balanced, medium-term risks are still tilted to the downside. The welcome cyclical pickup in global activity thus provides an ideal window of opportunity to tackle the key policy challenges—namely to boost potential output while ensuring its benefits are broadly shared, and to build resilience against downside risks. A renewed multilateral effort is also needed to tackle the common challenges of an integrated global economy.*

The global pickup in activity that started in the second half of 2016 gained further momentum in the first half of 2017. Growth is projected to rise over this year and next in emerging market and developing economies, supported by improved external factors—a benign global financial environment and a recovery in advanced economies. Growth in China and other parts of emerging Asia remains strong, and the still-difficult conditions faced by several commodity exporters in Latin America, the Commonwealth of Independent States, and sub-Saharan Africa show some signs of improvement. In advanced economies, the notable 2017 growth pickup is broad based, with stronger activity in the United States and Canada, the euro area, and Japan. Prospects for medium-term growth are more subdued, however, as negative output gaps shrink (leaving less scope for cyclical improvement) and demographic factors and weak productivity weigh on potential growth.

Changes to aggregate growth forecasts relative to the April 2017 WEO are generally positive but modest, with some meaningful changes for specific country groups and individual countries.

- In line with stronger-than-expected momentum in the first half of 2017, the forecast sees a stronger rebound in advanced economies in 2017 (to 2.2 percent versus 2.0 percent foreseen in April), driven by stronger growth in the euro area, Japan, and Canada. In contrast, compared with the April 2017 WEO forecast, growth has been marked down for 2017 in the United Kingdom and for both 2017 and 2018 in the United States, implying a 0.1 percentage-point aggregate growth downgrade for advanced economies in 2018. Activity in the United Kingdom slowed more than anticipated in the first half of 2017; as for the United States, given the significant policy uncertainty, the forecast now uses a baseline assumption of unchanged policies, whereas in April it assumed a fiscal stimulus driven by then-anticipated tax cuts.
- Growth prospects for emerging and developing economies are marked up by 0.1 percentage point for both 2017 and 2018 relative to April, primarily owing to a stronger growth projection for China. The country's 2017 forecast (6.8 percent, against 6.6 percent in April) reflects stronger growth outturns in the first half of 2017 as well as more buoyant external demand. For 2018, the revision mainly reflects an expectation that the authorities will maintain a sufficiently expansionary policy mix to meet their target of doubling real GDP between 2010 and 2020. Growth forecasts have also been marked up for emerging Europe for 2017, reflecting stronger growth in Turkey and other countries in the region, for Russia for 2017 and 2018, and Brazil in 2017.

Financial market sentiment has generally been strong, with continued gains in equity markets in both advanced and emerging market economies. Given current expectations of a more gradual pace of monetary policy normalization compared with March, US long-term interest rates have declined by some 25 basis points since then, and the dollar has depreciated by more than 5 percent in real effective terms, with a commensurate real appreciation of the euro. Despite expectations of more robust global demand going forward, commodity prices have remained low, with oil prices reflecting stronger-than-anticipated supply.

Headline consumer price inflation has softened since the spring, as the boost to prices from the oil price recovery of 2016 has faded and the decline in oil prices in recent months has started to exert downward pressure. Despite stronger growth in domestic demand, core inflation has generally remained muted across advanced economies, reflecting still-weak wage growth (Chapter 2). Inflation is likely to rise only gradually toward central bank targets. Across emerging and developing economies, the waning of pass-through effects from earlier currency depreciations against the US dollar, and in some cases recent appreciations, have helped moderate core inflation rates.

Short-term risks are broadly balanced. On the positive side, the recovery could strengthen further, supported by strong consumer and business confidence and benign financial conditions. At the same time, in an environment of high policy uncertainty and geopolitical tensions, policy missteps—which the baseline assumes will be avoided—could take a toll on market confidence, resulting in tighter financial conditions and weaker asset prices.

Risks to growth in the medium term are still skewed to the downside, owing to several potential hazards:

- *A more rapid and sizable tightening of global financial conditions.* This could take the form of higher long-term interest rates in the United States and elsewhere, triggered by faster-than-expected monetary policy normalization or a decompression of term premia, with adverse repercussions for vulnerable economies. Monetary policy tightening in the euro area, if it had to come while the recovery in prices and growth is still lagging in highly indebted member economies, could pose risks for these economies if they have not undertaken the needed fiscal adjustment and implemented structural reforms to boost supply potential. Tighter global financial conditions could also result from a sharp decrease in global risk appetite from its currently strong levels, which would take a toll on macroeconomic activity through weaker confidence, lower asset valuations, and wider risk premia.
- *Financial turmoil in emerging market economies.* The upward revision to China's growth forecasts reflects a slower rebalancing of activity toward services and consumption, a higher projected debt trajectory, and diminished fiscal space. Unless the Chinese authorities counter the associated risks by accelerating their recent encouraging efforts to curb the expansion of credit, these factors imply a heightened probability of a sharp growth slowdown in China, with adverse international repercussions. Following a period of abundant credit supply, a sudden tightening of global financial conditions (and an associated US dollar appreciation) could expose financial fragilities in some emerging markets, imposing strains on economies with US dollar pegs, high leverage, and balance sheet mismatches.
- *Persistently low inflation in advanced economies*. If domestic demand were to falter, it could lead to a decline in medium-term inflation expectations, prolonging and reinforcing the weakness in inflation. Low inflation and nominal interest rates would in turn reduce central banks' capacity to lower real interest rates to restore full employment in an economic downturn.
- *A broad rollback of the improvements in financial regulation and oversight achieved since the global financial crisis*. Such a rollback could lower capital and liquidity buffers or weaken supervisory effectiveness, with negative repercussions for global financial stability.
- *An inward shift in policies*. A shift toward protectionism would reduce trade and cross-border investment flows, harming global growth.
- *Noneconomic factors*. These would include geopolitical tensions, domestic political discord, risks from weak governance and corruption, extreme weather events, and terrorism and security concerns, which could derail growth.

These risks are closely interconnected and can be mutually reinforcing. For example, an inward turn in policies could be associated with increased geopolitical tensions as well as with rising global risk aversion; noneconomic shocks can weigh directly on economic activity while shaking confidence and market sentiment; and a faster-than-anticipated tightening of global financial conditions or a shift toward protectionism in advanced economies could exacerbate capital outflow pressures on emerging markets.

The welcome cyclical pickup in global economic activity after disappointing growth over the past few years provides an ideal window of opportunity to undertake key reforms designed to boost potential output and ensure that its benefits are broadly shared and to build resilience against downside risks. With countries still facing differences in cyclical conditions, varied stances of monetary and fiscal policy remain appropriate. Completing the economic recovery and adopting strategies to ensure fiscal sustainability remain important goals in many economies.

Important areas of strategic focus include:

- *Raising potential output:* Structural reforms and growth-friendly fiscal policy are needed to boost productivity and labor supply, with differing priorities across countries. Looking ahead, ongoing structural transformation (labor-saving technological change and cross-border competition) demands comprehensive policy approaches, including policies that reduce the pain of adjustment and provide opportunities for all.
- *Securing the recovery and building resilience:* In advanced economies, monetary policy settings should remain accommodative until there are firm signs of inflation returning to targets. As documented in Chapter 2, still-subdued wage pressures mostly reflect remaining slack, not fully captured by headline unemployment rates. At the same time, stretched asset valuations and increasing leverage in some parts of the financial sector require close monitoring, with proactive micro- and macroprudential supervision, as necessary. The stance of fiscal policy should be aligned with structural reform efforts, taking advantage of favorable cyclical conditions to place public debt on a sustainable path while supporting demand where still needed and feasible. As Chapter 4 emphasizes, higher public spending designed to boost potential output can result in both domestic benefits as well as positive spillovers to other countries, especially if it involves economies with slack and monetary accommodation. Indeed, adopting these policy recommendations would help reduce external imbalances, notably for advanced economies with excess surpluses, where stronger domestic demand would offset negative demand effects from the needed rebalancing by deficit countries. In many emerging market and developing economies, fiscal space to support demand is limited, especially in commodity exporters. But monetary policy can generally be supportive, as inflation appears to have peaked in many countries. Exchange rate flexibility helps with the adjustment to commodity price shocks. Efforts to improve governance and the investment climate would also strengthen growth prospects. In low-income countries, many of which need to undertake durable fiscal adjustment efforts and reduce financial vulnerabilities, growth-enhancing reforms would help make the best use of the coming demographic dividend by spurring job creation.
- *Strengthening international cooperation:* For many of the challenges that the global economy confronts, individual country actions can be more effective if supported by multilateral cooperation. Preserving the global economic expansion will require policymakers to avoid protectionist measures and to do more to ensure that gains from growth are shared more widely. In addition to preserving an open trading system, key areas for collective action include: safeguarding global financial stability; achieving equitable tax systems and avoiding a race to the bottom; continuing to support low-income countries as they pursue their development goals; and mitigating and adapting to climate change. As Chapter 3 illustrates, many of the economies suffering the worst consequences of higher temperatures and changed weather patterns are those with the fewest resources to deal with these challenges. Richer countries will increasingly feel direct negative effects from unmitigated climate change, however, and will not be immune to spillovers from the rest of the world.

CHAPTER 1

# GLOBAL PROSPECTS AND POLICIES

*The pickup in growth projected in the April 2017* World Economic Outlook *(WEO) is strengthening. The global growth forecast for 2017 and 2018—3.6 percent and 3.7 percent, respectively—is 0.1 percentage point higher in both years than in the April and July forecasts. Notable pickups in investment, trade, and industrial production, coupled with strengthening business and consumer confidence, are supporting the recovery. With growth outcomes in the first half of 2017 generally stronger than expected, upward revisions to growth are broad based, including for the euro area, Japan, China, emerging Europe, and Russia. These more than offset downward revisions for the United States, the United Kingdom, and India.*

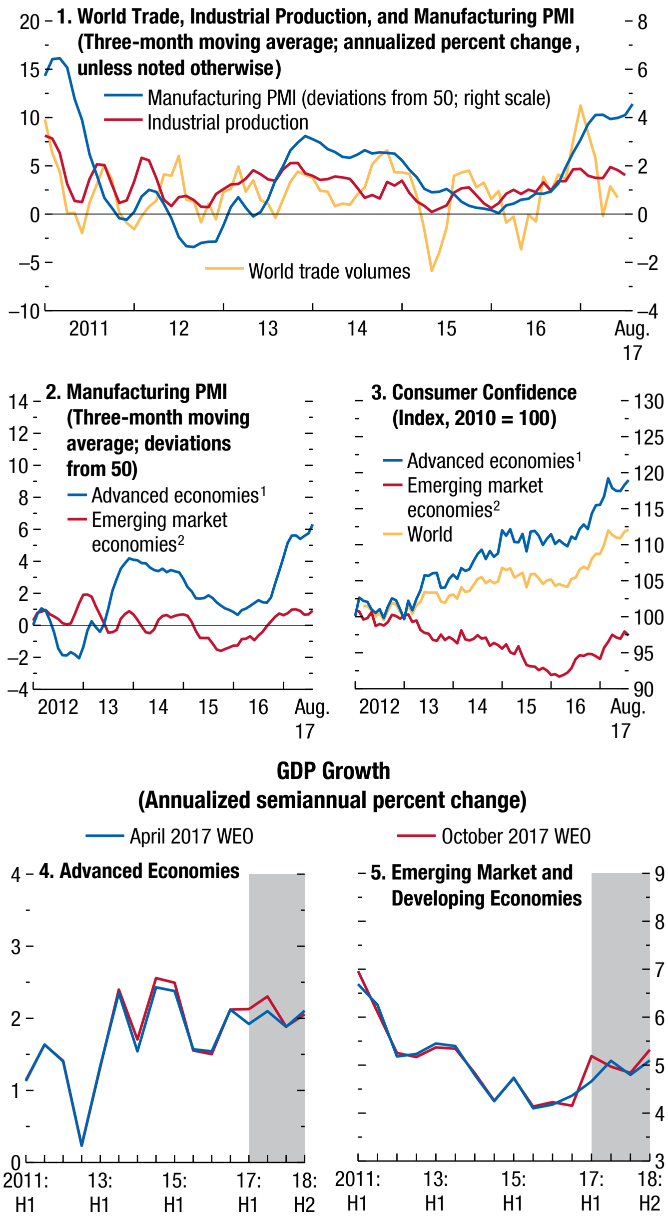
*However, the recovery is not complete: although the baseline outlook is better, growth remains weak in many countries. The outlook for advanced economies has improved, notably for the euro area, but in many countries inflation remains weak, indicating that slack has yet to be eliminated, and prospects for growth in GDP per capita are held back by weak productivity growth and rising old-age dependency ratios. Prospects for many emerging market and developing economies in sub-Saharan Africa, the Middle East, and Latin America are lackluster, with several experiencing stagnant per capita incomes. Fuel exporters are particularly hard hit by the protracted adjustment to lower commodity revenues.*

*Risks to the baseline are broadly balanced in the short term but skewed to the downside in the medium term. Short-term growth could increase further, as stronger confidence and favorable market conditions unleash pent-up demand, but setbacks are also possible. With high policy uncertainty, missteps—which the baseline assumes will be avoided—or other shocks could materialize, taking a toll on market confidence and asset valuations, and tightening financial conditions. Over the medium term, dealing with financial sector challenges will be essential. Minimizing the risk of a sharp slowdown in China will require the Chinese authorities to intensify their efforts to rein in the credit expansion. Many other economies need to guard against a buildup of financial stability risks in a global environment of easy finance and monitor the risks from volatility as advanced economies' central banks gradually withdraw stimulus. A decompression of risk premiums and higher long-term interest rates would expose fragilities, including by worsening public debt dynamics. Although progress has been made in addressing European banking sector issues, remaining problems need to be addressed forcefully to avoid weakening confidence and fears of adverse feedback loops between low demand, prices, and balance sheets in parts of the euro area. Persistently low inflation in advanced economies, which could ensue if domestic demand were to falter, also carries significant risks, as it could lead to lower medium-term inflation expectations and interest rates, reducing central banks' capacity to cut real interest rates in an economic downturn. Although the chances of advanced economy policies turning inward appear to have diminished in the near term, pressures for increased protectionism have not disappeared and ought to be resisted. A host of noneconomic risks, including intensified conflict and geopolitical tensions, also remain salient.*

*The welcome cyclical upturn after disappointing growth over the past few years provides an ideal window of opportunity to undertake critical reforms, thereby staving off downside risks and raising potential output and standards of living more broadly. Structural reforms and growth-friendly fiscal policy measures are needed to boost productivity and labor supply, with varying priorities across countries. In advanced economies, monetary policy should remain accommodative until there are firm signs of inflation returning to targets. At the same time, stretched asset valuations and increasing leverage in some market segments bear close monitoring, including through proactive micro- and macroprudential supervision, as necessary. Fiscal policy should be aligned with structural reform efforts, taking advantage of favorable cyclical conditions to place public debt on a sustainable path while supporting demand where still needed and feasible. In many emerging market and developing economies, fiscal space to support demand is limited, especially in commodity exporters. But monetary policy can generally be supportive because inflation appears to have peaked in many countries. Exchange rate flexibility helps the adjustment to external shocks. Efforts to improve governance and the investment climate would also strengthen growth prospects. Growth-enhancing*

**Figure 1.1. Global Activity Indicators**

Global activity strengthened in the first half of 2017, reflecting firmer domestic demand growth in advanced economies and China and improved performance in other large emerging market economies. Global manufacturing purchasing managers' indices indicate strong momentum continued into the third quarter.




Sources: CPB Netherlands Bureau for Economic Policy Analysis; Haver Analytics; Markit Economics; and IMF staff estimates.
Note: CC = consumer confidence; PMI = purchasing managers' index; WEO = *World Economic Outlook*.
[1]Australia, Canada (PMI only), Czech Republic, Denmark, euro area, Hong Kong SAR (CC only), Israel, Japan, Korea, New Zealand (PMI only), Norway (CC only), Singapore (PMI only), Sweden (CC only), Switzerland, Taiwan Province of China, United Kingdom, United States.
[2]Argentina (CC only), Brazil, China, Colombia (CC only), Hungary, India (PMI only), Indonesia, Latvia (CC only), Malaysia (PMI only), Mexico (PMI only), Philippines (CC only), Poland, Russia, South Africa, Thailand (CC only), Turkey, Ukraine (CC only).

*reforms would help low-income countries—many of which need to undertake durable fiscal adjustment efforts and reduce financial vulnerabilities—make the best use of the coming demographic dividend by spurring job creation.*

## Recent Developments and Prospects

### World Economy Keeping Its Momentum

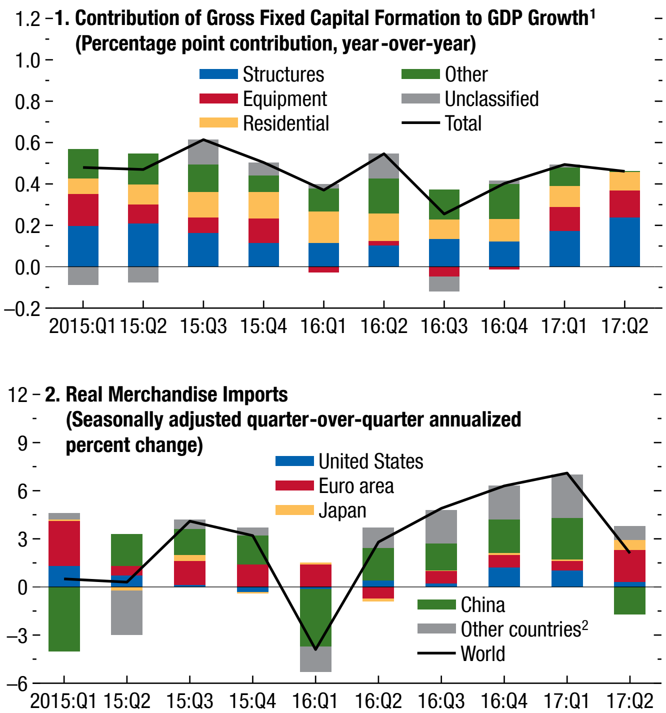
The pickup in global activity that started in 2016 gathered steam in the first half of 2017, reflecting firmer domestic demand growth in advanced economies and China and improved performance in other large emerging market economies. The continued recovery in global investment spurred stronger manufacturing activity (Figures 1.1 and 1.2). World trade growth moderated in the second quarter after expanding very briskly in the first. Global purchasing manager indices and other high-frequency indicators for July and August suggest that global growth momentum continued into the third quarter of 2017.

Among advanced economies, domestic demand and output grew faster in the first half of 2017 than in the second half of 2016. In the United States, weakness in consumption in the first quarter turned out to be temporary, while business investment continued to strengthen, partly reflecting a recovery in the energy sector. In the euro area and Japan, stronger private consumption, investment, and external demand bolstered overall growth momentum in the first half of the year. Growth in most of the other advanced economies, with the notable exception of the United Kingdom, picked up in the first half of 2017 from its pace in the second half of 2016, with both domestic and external demand contributing.

Among emerging market and developing economies, higher domestic demand in China and continued recovery in key emerging market economies supported growth in the first half of 2017. In India, growth momentum slowed, reflecting the lingering impact of the authorities' currency exchange initiative as well as uncertainty related to the midyear introduction of the country-wide Goods and Services Tax. Higher external demand boosted growth in other emerging market economies in East Asia. In Brazil, strong export performance and a diminished pace of contraction in domestic demand allowed the economy to return to positive growth in the first quarter of 2017, after eight quarters of decline. Mexico maintained growth momentum, despite uncertainty related to the renegotiation of the North American Free Trade Agreement and significant

**Figure 1.2. Global Fixed Investment and Trade**

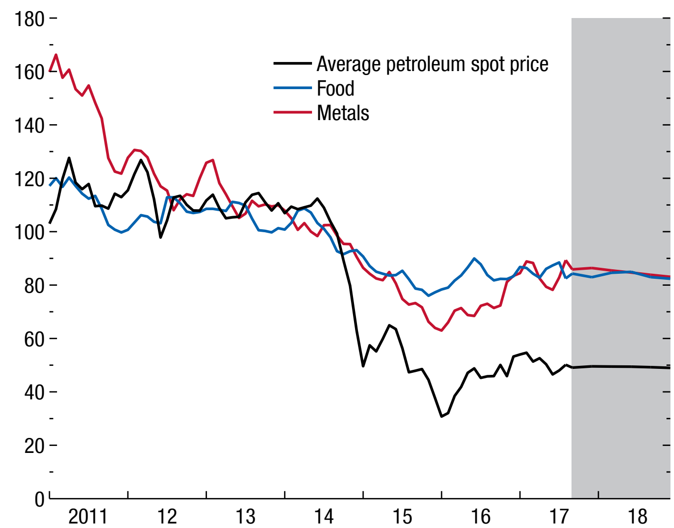
Investment began to pick up in the third quarter of 2016. Global trade accelerated as well, before moderating more recently.




Source: IMF staff calculations.
[1]Data for 2017:Q2 are based on preliminary estimates for Russia.
[2]Other countries include Brazil, Canada, India, Korea, Mexico, Russia, South Africa, Taiwan, Turkey, and the United Kingdom.

**Figure 1.3. Commodity Prices**
*(Deflated using US consumer price index; index, 2014 = 100)*

Commodity prices softened during the first half of 2017.




Sources: IMF, Primary Commodity Price System; and IMF staff estimates.

tightening of monetary policy over the past two years. Recovering domestic and external demand supported rebounding growth in Russia and Turkey. Internal and cross-border conflict in parts of the Middle East still weighed on economic activity, while Venezuela faced a political and humanitarian crisis amid a deepening recession.

### *Softer Commodity Prices*

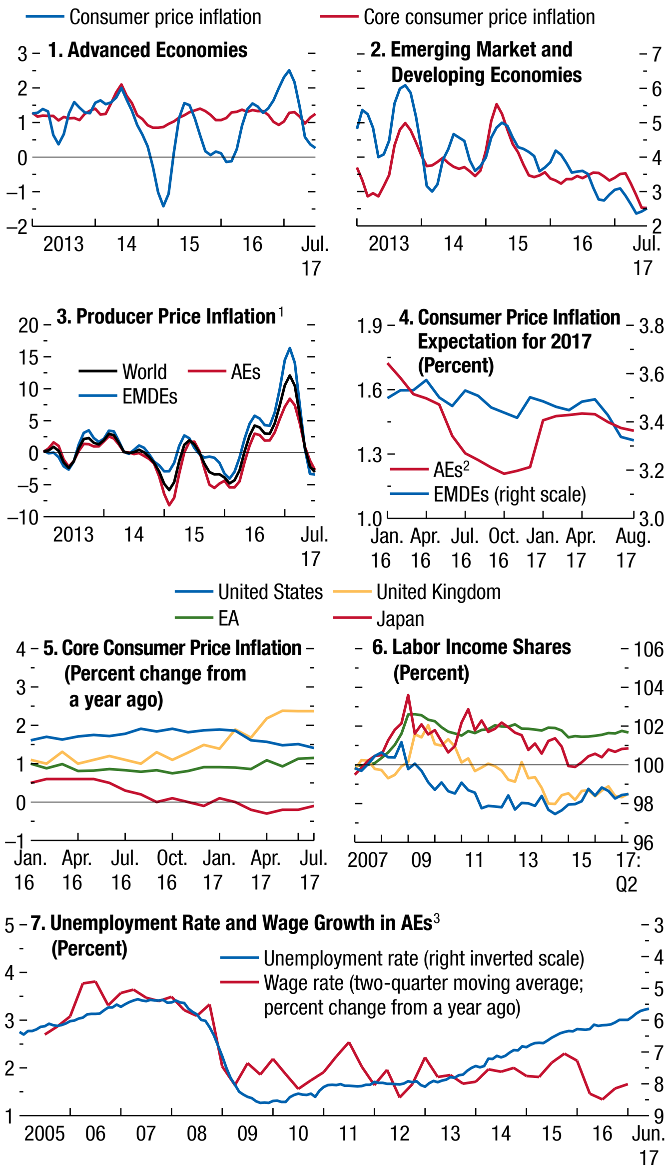
The IMF's Primary Commodities Price Index declined by 5 percent between February and August 2017—that is, between the reference periods for the April 2017 WEO and the current report (Figure 1.3). Some of the biggest price drops were among fuels:

- Oil prices fell by 8.1 percent between February and August, even as the Organization of the Petroleum Exporting Countries (OPEC) and some non-OPEC oil exporters announced in May that they would extend oil production cuts through the first quarter of 2018. The main drivers of lower prices were higher-than-expected US shale production and stronger-than-expected production recoveries in Libya and Nigeria. In addition, exports from OPEC countries remained at relatively high levels, even with lower production. Following some strengthening in recent weeks, oil prices stood at about $50 a barrel as of late August, still lower than in the spring.
- The natural gas price index—an average for Europe, Japan, and the United States—decreased by 9.6 percent from February to August 2017. The decline was mostly tied to seasonal factors and robust supply from the United States and Russia, and lower oil prices, which some natural gas prices are indexed to. The diplomatic rift between Qatar, the world's largest exporter of liquefied natural gas, and several other countries in the region, including Saudi Arabia, has not affected liquefied natural gas markets, as Qatar's exports have continued.
- The coal price index—an average of Australian and South African prices—increased by 16.5 percent between February and August 2017. Following the end of the disruption to coal transportation in Australia caused by Cyclone Debbie in late March, coal prices declined until June. Strong demand from

**Figure 1.4. Global Inflation**

*(Three-month moving average; annualized percent change, unless noted otherwise)*

Headline consumer price inflation has moderated since the spring, reflecting a decline in oil prices. While unemployment rates have continued to decline, wage growth remains subdued.




Sources: Consensus Economics; Haver Analytics; Organisation for Economic Co-operation and Development; and IMF staff calculations.

Note: AEs = Advanced economies (AUT, BEL, CAN, CHE, CZE, DEU, DNK, ESP, EST, FIN, FRA, GBR, GRC, HKG, IRL, ISR, ITA, JPN, KOR, LTU, LUX, LVA, NLD, NOR, PRT, SGP, SVK, SVN, SWE, TWN, USA); EA = euro area; EMDEs = emerging market and developing economies (BGR, BRA, CHL, CHN, COL, HUN, IDN, IND, MEX, MYS, PER, PHL, POL, ROU, RUS, THA, TUR, ZAF). Panel 6 is equalized to 100 in 2007 by shifting the level. Country list uses International Organization for Standardization (ISO) country codes.

[1]In panel 3, AEs excludes HKG, ISR, and TWN. EMDEs includes UKR; excludes IDN, IND, PER, and PHL.

[2]In panel 4, AEs includes AUS; excludes LUX.

[3]In panel 7, blue line includes AUS and NZL; excludes BEL. Red line includes AUS and MLT; excludes HKG, SGP, and TWN.

China helped prices recover. Starting July 1, China imposed coal import restrictions on several ports to limit the adverse impact of lower international prices on production. Together with the cutback of coal production in China and sporadic labor disputes in coal mines in Australia, these restrictions have put renewed upward pressure on prices.

Among nonfuel commodities, prices of metals were up modestly but agricultural commodity prices declined:

- Metal prices have increased modestly (0.8 percent) from February to August, with considerable variation across commodities. By June, the metal price index had reached its lowest point in eight months as demand projections (especially from the United States and China) were revised down. However, prices rebounded since and remained on an upward trajectory in August with the improvement in macroeconomic sentiment, especially in China. Copper and aluminum prices increased by slightly more than 9 percent between February and August 2017, reflecting strong demand and tight supplies; iron ore prices dropped by about 16 percent over the same period mainly because of an increase in supply from Australia, Brazil, and China.
- The IMF's agricultural price index declined by 5 percent between February and August 2017. Cereal prices rallied in June amid concerns over hot and dry weather in the Northern Hemisphere, but then declined substantially in August as forecasts for grain stocks at the end of the 2017–18 season increased unexpectedly. Meat prices increased on stronger-than-expected demand and tighter supplies.

### *Muted Inflation Pressures*

Headline consumer price inflation has softened since the spring as the boost to prices from the oil price recovery of 2016 has faded and the decline in oil prices (between March and July) has started to exert downward pressure (Figure 1.4). Expectations of consumer price inflation for the year have therefore diminished, especially in emerging market and developing economies.

Core inflation—inflation rates when fuel and food prices are excluded—has been generally soft. In most advanced economies, core inflation has failed to decisively increase toward central bank targets, even as domestic demand has gathered pace and unemployment rates have fallen compared with the previous year. Core inflation in the euro area has been stuck in low gear at about 1.2 percent since April (after hovering at just below 1 percent for a couple of years), while in Japan it remained slightly negative for six months through July. In the United States—where core inflation is higher—the annual change in the core personal consumption expenditure deflator (the Federal Reserve's preferred measure) declined from just below 2 percent in early 2017 to 1.4 percent in August. This decline in part reflected one-off factors (including a reduction in prices of cell phone plans and prescription drug prices). Many other advanced economies, including Australia, Canada, Denmark, Korea, Norway, and especially Taiwan Province of China, are also experiencing weak inflation pressure. The United Kingdom, where the strong depreciation of the pound since last summer has passed through into higher consumer prices, is an exception to this pattern.

Sluggishness in core inflation in advanced economies—a surprise in view of stronger-than-expected activity—has coincided with slow transmission of declining unemployment rates into faster wage growth. Real wages in most large advanced economies have moved broadly with labor productivity in recent years, as indicated by flat labor income shares (Figure 1.4, panel 6). As shown in Chapter 2, muted growth in nominal wages in recent years partly reflects sluggishness in labor productivity.[1] However, the analysis also reveals continued spare capacity in labor markets as a key drag: wage growth has been particularly soft where unemployment and the share of workers involuntarily working part time remain high. The corollary of this finding is that, once firms and workers become more confident in the outlook, and labor markets tighten, wages should accelerate. In the short term, higher wages should feed into higher unit labor costs (unless productivity picks up), and higher prices should, in turn, spur nominal wage growth in a self-reinforcing dynamic.

In many emerging market and developing economies, the waning of pass-through effects from earlier exchange rate depreciations and, in some cases, recent appreciations against the US dollar, have helped moderate core inflation rates. However, much of the softening of core inflation in emerging market economies in recent months can be attributed to India and Brazil, where a one-off drop in food price inflation in June and high excess capacity in the economy after two years of recession, respectively, have also contributed to weaker inflation. In China, core inflation remained broadly stable at about 2 percent in July. In contrast, some other countries in the Commonwealth of Independent States and the Middle East, North Africa, Afghanistan, and Pakistan region are experiencing continued inflationary pressures in 2017 as a result of exchange rate depreciations, the removal of subsidies, or increases in excise or value-added taxes.

### *Supportive Financial Conditions*

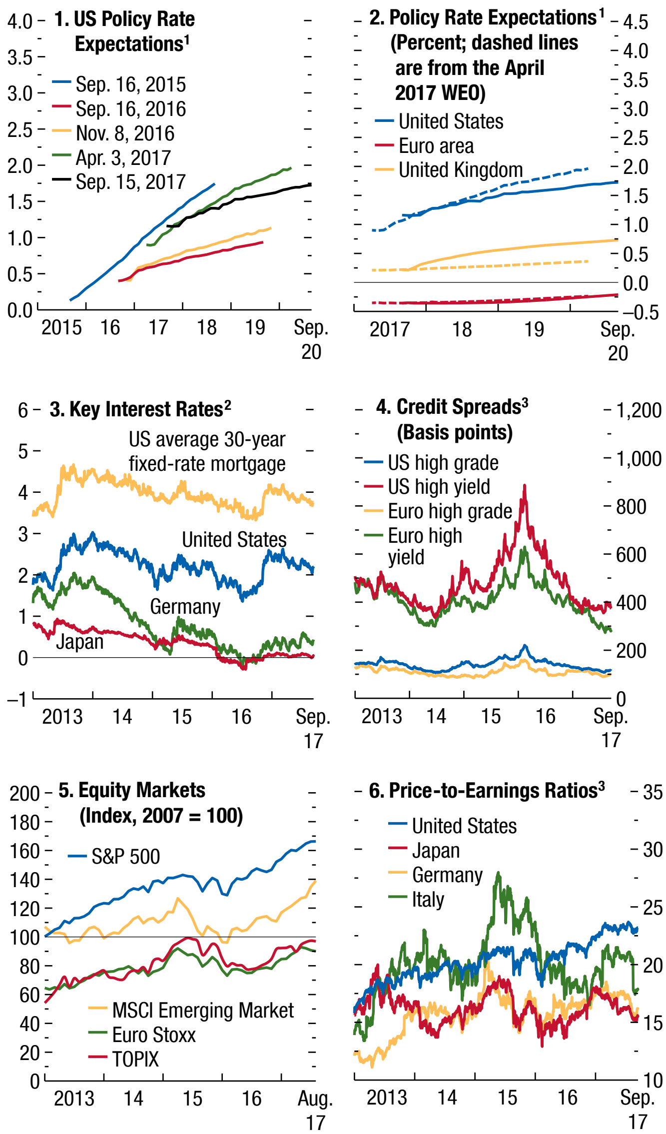
Market sentiment has remained strong and volatility low since the publication of the most recent (April 2017) WEO, even as expectations of US fiscal easing have dimmed. On the monetary policy front, the US Federal Reserve raised short-term interest rates in June to 1–1.25 percent, as expected. Following the Federal Open Market Committee announcement of September 20, markets priced in a 70 percent probability of one additional rate increase by the end of 2017. In most other advanced economies, the monetary policy stance remained broadly unchanged, except for Canada, which raised its policy rate by ¼ of a percentage point in July and September.

With markets pricing in a slightly more gradual normalization of US monetary policy than anticipated in the spring, given diminished expectations about fiscal stimulus, nominal yields on 10-year US Treasury bonds as of mid-September have declined by about 20 basis points from their March 2017 average (Figure 1.5). Long-term sovereign bond yields have remained broadly stable in Japan and Germany, risen by some 10 basis points in the United Kingdom, and declined by 20–30 basis points in France, Italy, and Spain, as spreads relative to German bund yields compressed sharply, particularly in the aftermath of the French presidential election. Equity markets in advanced economies have continued to rise in recent months amid strong earnings, further improvements in consumer

[1]The part of the wage-inflation weakening attributable to lower productivity growth would likely have little or no pass-through into weaker price inflation, given that the changes would have no net effect on conventionally measured unit labor costs. A broad slowdown in total factor productivity and an interrelated decline in capital accumulation have been the drivers of the slowdown in labor productivity (Adler and others 2017). Shifts in the composition of the labor force since the global financial crisis may also have exerted downward pressure on productivity and wages. These shifts include the expanded shares of female and older workers, whose participation rates have generally risen (Box 1.1). New entrants tend to be paid less than existing workers (Daly, Hobijn, and Pedtke 2017). A larger share of older workers has also been linked to slower productivity growth (Feyrer 2007; Aiyar, Ebeke, and Shao 2016; Adler and others 2017).

**Figure 1.5. Advanced Economies: Monetary and Financial Market Conditions**
*(Percent, unless noted otherwise)*

Market sentiment has been strong in advanced economies. Compared with the spring, a more gradual normalization of US monetary policy is anticipated and credit spreads remain compressed.




Sources: Bloomberg L.P.; Thomson Reuters Datastream; and IMF staff calculations.
Note: MSCI = Morgan Stanley Capital International; S&P = Standard & Poor's; TOPIX = Tokyo Stock Price Index; WEO = *World Economic Outlook*.
[1]Expectations are based on the federal funds rate futures for the United States, the sterling overnight interbank average rate for the United Kingdom, and the euro interbank offered forward rate for the euro area; updated September 15, 2017.
[2]Interest rates are 10-year government bond yields, unless noted otherwise. Data are through September 15, 2017.
[3]Data are through September 15, 2017.

and business confidence, and favorable macroeconomic data. Market volatility indicators remain low.

With narrowing interest differentials, the US dollar weakened in real effective terms by over 7 percent from March to mid-September 2017 (Figure 1.6, panel 1), more than reversing its gains after the US election, whereas the euro and the Canadian dollar appreciated by 6 percent on stronger growth prospects and higher policy rates in Canada. Among other currencies, the yen depreciated by about 3 percent and the Swiss franc and Korean won by 4 percent.

In emerging market economies, financial conditions since March generally have been supportive of a pickup in economic activity. Equity markets have strengthened (Figure 1.7); long-term interest rates on local-currency bonds have generally declined (Figure 1.8), China being the exception; and spreads on the Global Emerging Markets Bond Index have fallen slightly. As search for yield continues (Chapter 1 of the October *Global Financial Stability Report* [GFSR]), emerging market currencies have generally strengthened relative to the US dollar. As of August 2017, changes since March in real effective terms have generally been moderate (Figure 1.6, panel 2). The Mexican peso appreciated by 10 percent on tighter monetary policy and declining concerns about trade-related frictions with the United States, while the South African rand depreciated by 7 percent on domestic political uncertainty, the Brazilian *real* depreciated by over 4 percent on monetary policy easing and concerns about the reform agenda, and the Russian ruble depreciated by a similar amount on weakening oil prices.

Capital flows to emerging market economies have remained resilient in recent months, continuing their recovery after a sharp decline in late 2015 and early 2016. As discussed in Box 1.2, this pattern reflects a pickup in capital flows to China and a strong global recovery in nonresident portfolio inflows in the first half of 2017 (Figure 1.9, panel 1) as investor optimism about the global economic outlook improved and financial conditions eased.

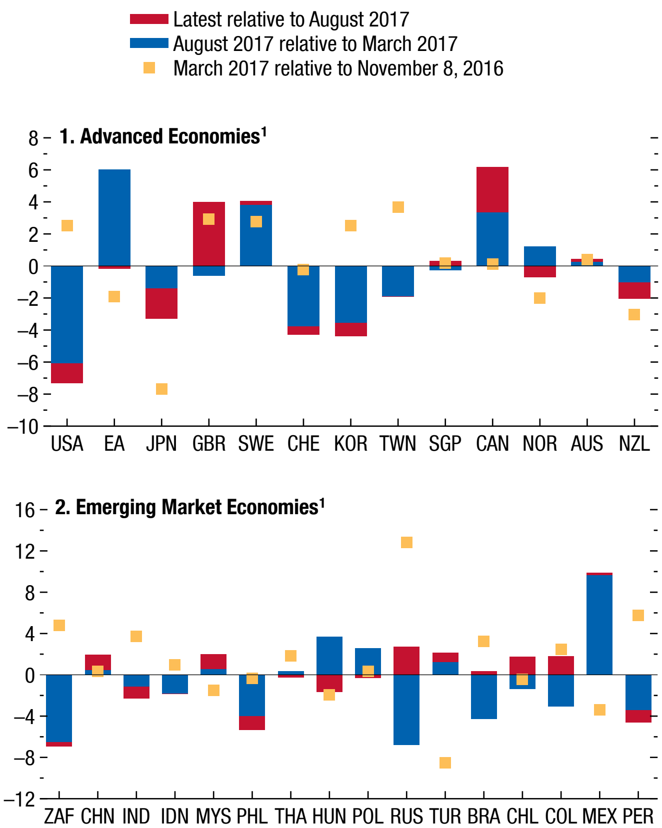
## Key Forces Shaping the Outlook

### *Continued Cyclical Recovery in Advanced Economies (and Revisions to Potential Output)*

In advanced economies, the ongoing cyclical recovery is stronger than previously projected. Indeed, positive surprises in growth in the first half of 2017 typically occurred in countries where estimates for output were below potential in 2016 (Figure 1.10,

### Figure 1.6. Real Effective Exchange Rate Changes, November 2016–September 2017
*(Percent)*

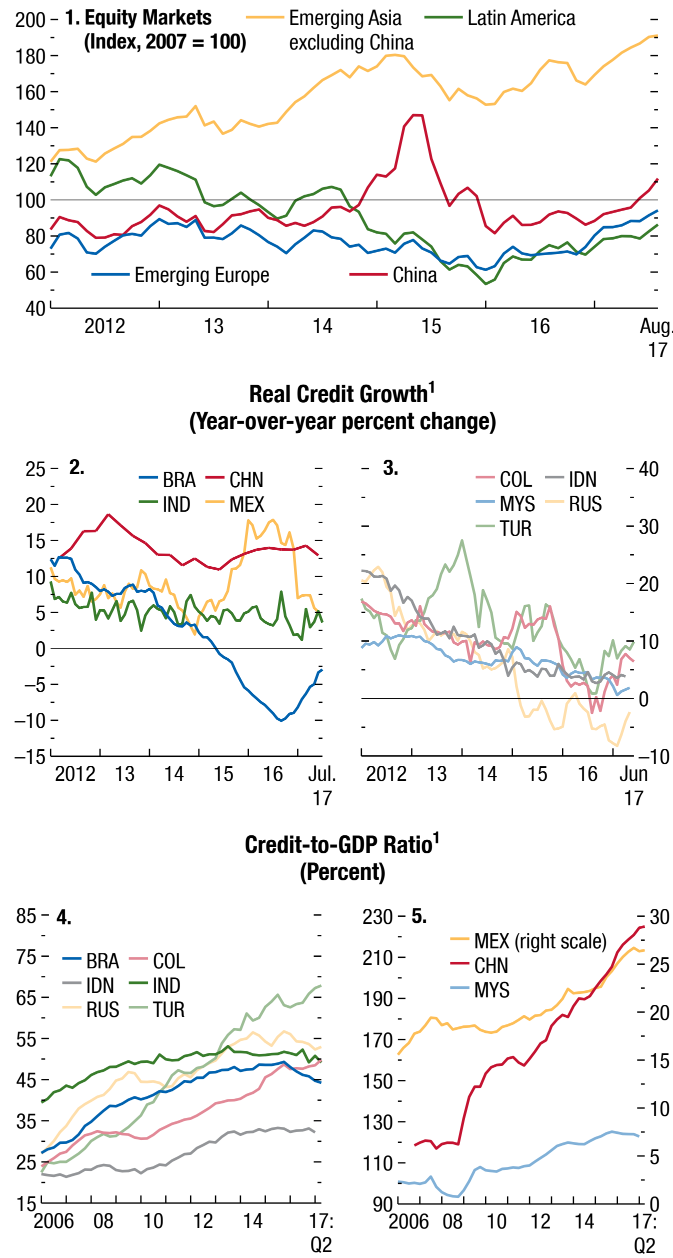
In real effective terms, the US dollar weakened by about 7 percent and the euro strengthened by 6 percent from March to August 2017. Changes in most emerging market currencies have been moderate.




Source: IMF staff calculations.
Note: EA = euro area. Data labels in the figure use International Organization for Standardization (ISO) country codes.
[1]Latest data available are for September 15, 2017.

### Figure 1.7. Emerging Market Economies: Equity Markets and Credit

Equity indices in emerging market economies have risen since the spring and credit growth remains supportive of a pickup in activity.



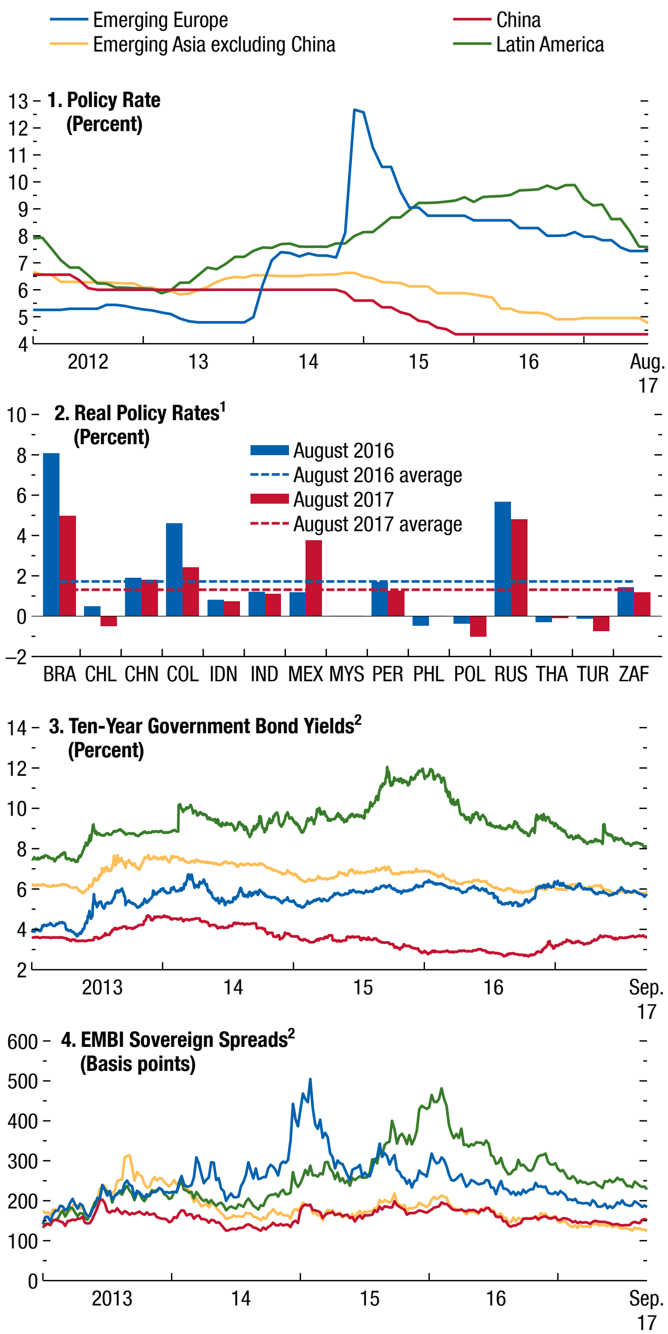

Sources: Bloomberg L.P.; Haver Analytics; IMF, International Financial Statistics (IFS) database; and IMF staff calculations.
Note: Data labels in the figure use International Organization for Standardization (ISO) country codes.
[1]Credit is other depository corporations' claims on the private sector (from IFS), except in the case of Brazil, for which private sector credit is from the Monetary Policy and Financial System Credit Operations published by Banco Central do Brasil, and China, for which credit is total social financing after adjusting for local government debt swaps.

panel 1). With growth generally above potential output, economic slack is gradually being reduced.

Positive revisions to growth have also come with some upward revisions to the estimated path of potential output. Indeed, despite an upward revision to the cumulative growth rate over 2016–18 relative to the October 2016 WEO forecast of about 0.7 percentage point, the forecast of the output gap for 2018 has been revised in absolute terms by only half as much. As Figure 1.10, panel 2 shows, the upward revision to growth exceeds the decline in the output gap for most individual countries. The difference is explained by slightly higher projected potential growth during this period (about

### Figure 1.8. Emerging Market Economies: Interest Rates

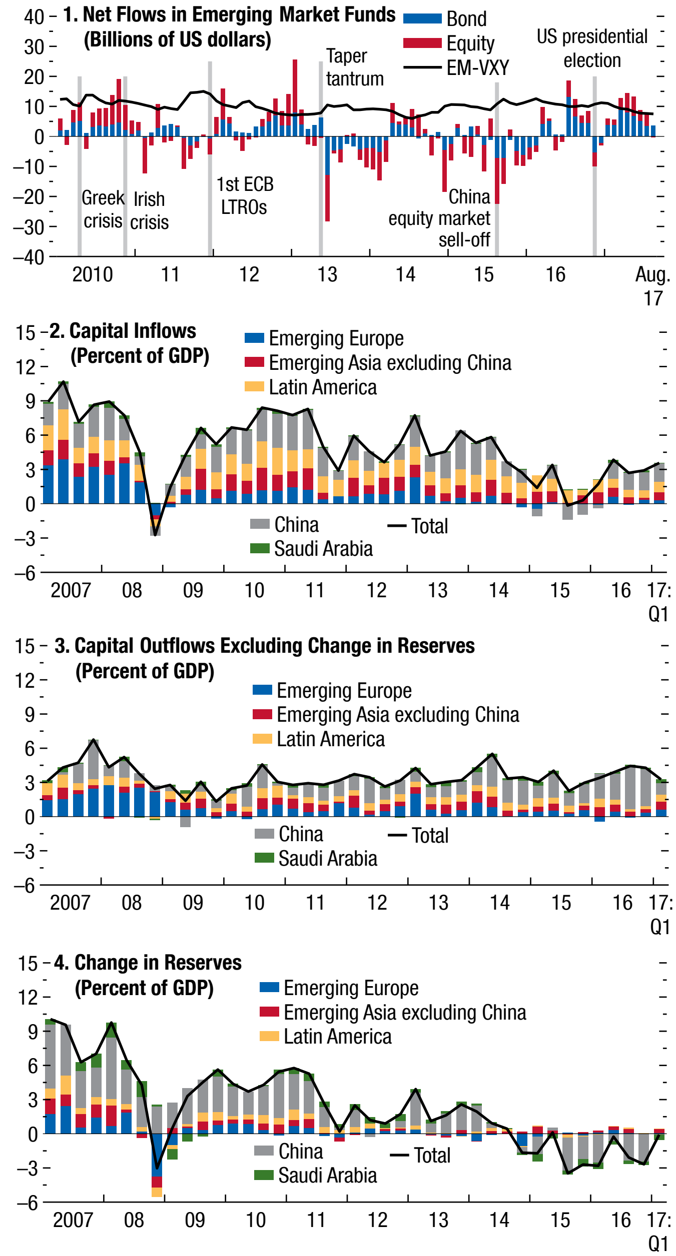
Long maturity yields on local currency debt have generally declined.




Sources: Bloomberg L.P.; Haver Analytics; IMF, *International Financial Statistics;* and IMF staff calculations.
Note: Emerging Asia excluding China comprises India, Indonesia, Malaysia, the Philippines, and Thailand; emerging Europe comprises Poland, Romania, Russia, and Turkey; Latin America comprises Brazil, Chile, Colombia, Mexico, and Peru. EMBI = J.P. Morgan Emerging Markets Bond Index. Data labels in the figure use International Organization for Standardization (ISO) country codes.
[1]Deflated by two-year-ahead *World Economic Outlook* inflation projections.
[2]Data are through September 15, 2017.

### Figure 1.9. Emerging Market Economies: Capital Flows

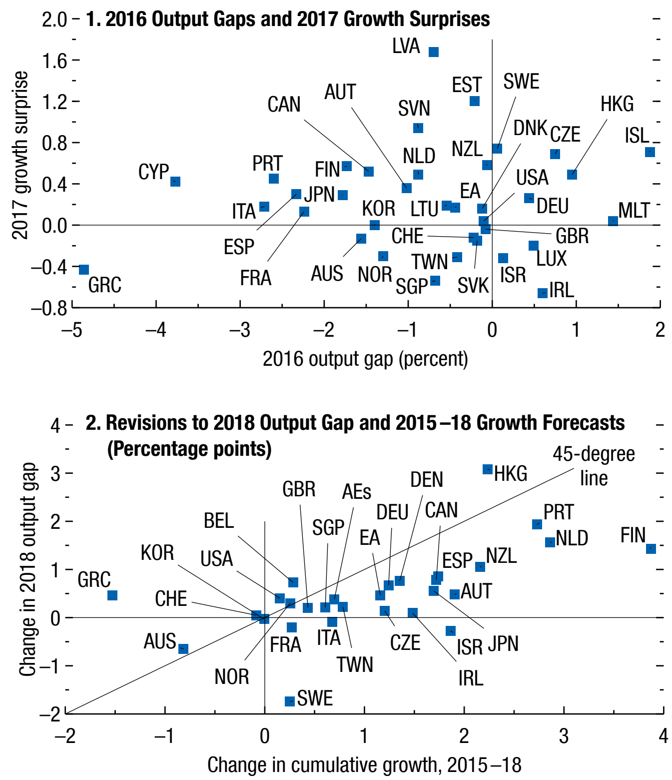
Capital flows to emerging market economies continued to recover.




Sources: Bloomberg L.P.; EPFR Global; Haver Analytics; IMF, *International Financial Statistics;* and IMF staff calculations.
Note: Capital inflows are net purchases of domestic assets by nonresidents. Capital outflows are net purchases of foreign assets by domestic residents. Emerging Asia excluding China comprises India, Indonesia, Malaysia, the Philippines, and Thailand; emerging Europe comprises Poland, Romania, Russia, and Turkey; Latin America comprises Brazil, Chile, Colombia, Mexico, and Peru. ECB = European Central Bank; EM-VXY = J.P. Morgan Emerging Market Volatility Index; LTROs = longer-term refinancing operations.

**Figure 1.10. Revisions to 2017 Growth and 2016 Output Gaps**
*(Percent)*

The ongoing cyclical recovery is stronger than previously projected, with positive growth surprises in the first half of 2017 typically occurring in countries with output below estimated potential in 2016.




Source: IMF staff estimates.
Note: In panel 1, 2017 growth surprises are differences between current growth estimates for H1:2017 and projections in the October 2016 *World Economic Outlook* (WEO). In panel 2, revisions to output gap and growth forecasts are relative to the October 2016 WEO. Japan's latest figures reflect comprehensive methodological revisions adopted in December 2016. Data labels in the figure use International Organization for Standardization (ISO) country codes. AEs = advanced economies; EA = euro area.

0.1 percentage point a year), driven by higher projected investment, which boosts productive capacity.

With output in 2017 remaining slightly below potential for the advanced economies group, the cyclical recovery still has some room to run. This assessment is consistent with still elevated unemployment rates in a few countries and relatively high shares of workers who would prefer to work full time but can only obtain part-time work (Chapter 2).

### *Medium-Term Growth in Advanced Economies—Structural Headwinds*

In the medium term, growth is expected to soften once gaps close (mostly expected in 2018–19) and output returns to growing at the same rate as its potential. Potential growth will be increasingly held back by slower growth in workforces as populations age and an increasing share of people enter retirement. The speed at which the aging process weighs on the labor force depends crucially on the labor force participation rates of various demographic groups. For the aggregate of advanced economies, labor force participation declined by 0.8 percentage point between 2007 and 2016 for the adult population, with a striking decline of 2.3 percentage points for men in contrast to a 0.7 percentage point increase for women (Box 1.1). Labor force participation rate changes differ notably across advanced economies, despite the overall similarity of demographic trends. For instance, the widely documented decline in the labor force participation rate in the United States contrasts with rising participation rates in many European countries, including Germany, Italy, and the United Kingdom. Policy efforts that encourage further participation by women and reverse declines for men could postpone or soften the demographic shift's drag on potential output.

Potential growth projections are also held back by the assumption that total factor productivity growth will recover only modestly from its low rate of the past few years and hence will stay well below the pace registered before the global financial crisis. Adler and others (2017) discuss in more detail the factors that can explain the decline in productivity growth over the past decade.

### *Emerging Market Economies and Convergence Prospects*

The growth rate for emerging market and developing economies is forecast to rise to 4.6 percent in 2017, 4.9 percent in 2018, and about 5 percent over the medium term. In per capita terms, growth rates are about 1.3 percentage points lower, but substantially above the per capita growth rate for advanced economies (1.4 percent, on average, during 2017–22), implying a gradual convergence in GDP per capita between the two country groups. For emerging market and developing economies, this pace of growth and convergence is slower than during the past decade, but faster than during 1995–2005.

Underlying these aggregate figures is substantial heterogeneity in economic performance across emerging market and developing economies—a theme explored in more detail in Box 1.3. The projected aggregate growth rate over 2017–22 is sustained by fast growth in the two largest countries, China and India, which account for more than 40 percent of GDP (whether measured at purchasing power parity or market rates) and more than 40 percent of the population of emerging market and developing economies.[2] Indeed, the forecast for growth in GDP per capita falls below the group's aggregate figure of 3.5 percent for about ¾ of emerging market and developing economies. And for 43 economies (28 percent of the total), per capita growth rates are projected to be lower than for advanced economies, implying a decline in relative living standards rather than convergence. Box 1.3 also shows that very small economies (with populations of less than 500,000 people) and fuel exporters are overrepresented among the economies with weak projected growth.

The challenges faced by very small economies, related to such factors as diseconomies of scale, lack of diversification, and the frequency of natural disasters, are well documented.[3] As also highlighted in previous WEOs, many commodity exporters—especially fuel exporters—are still struggling to adjust to sharply lower commodity prices relative to those prevailing earlier in the decade.

### *Adjustment to Terms-of-Trade Changes in Emerging Market and Developing Economies*

A modest cyclical recovery is at work in several emerging market and developing economies that underperformed in recent years because of terms-of-trade losses and idiosyncratic factors. The strength of the Chinese economy, as well as the broader cyclical rebound in manufacturing and trade, are providing some support to this recovery.

Commodity prices have declined modestly relative to the spring, but remain generally higher than their 2016 averages. Movements in commodity terms of trade imply relatively small projected gains and losses in disposable income when compared with the very large losses for commodity exporters during 2015–16 (Figure 1.11). Many countries heavily dependent on commodity revenues still have much of the needed fiscal and external adjustment ahead of them, as also discussed in the April 2017 *Fiscal Monitor*. So far, exchange rate flexibility has helped the adjustment—countries that allowed greater exchange rate flexibility have drawn less on their buffers (Box 1.4).

Looking ahead, growth in commodity exporters is forecast to recover further, contributing significantly to the projected pickup in global growth between 2016 and 2022 (the last year of the WEO forecast horizon) (Figure 1.12, panels 2–3). Nevertheless, growth in commodity exporters is projected to remain well below its historical average and will account for only a modest share of total growth for emerging market and developing economies as a group (Figure 1.12, panel 1). In contrast, growth is projected to remain high for the group of commodity-importing countries, which account for the lion's share of global growth, with higher growth in India and other commodity importers more than offsetting a slowdown in China. A similar pattern is at play for low-income developing countries, where growth in commodity importers is forecast to exceed that in commodity exporters (Figure 1.12, panel 4).

## The Forecast

### Policy and Other Assumptions

Fiscal policy at the global level is projected to remain broadly neutral in 2017 and 2018. The overall neutral stance masks some variation across countries and important changes relative to the April 2017 WEO assumptions. Among advanced economies, the fiscal stance (measured by the fiscal impulse) in 2017 is forecast to be broadly neutral, reflecting projected easing in Canada, Germany, Italy, and Korea; broadly neutral policy in Japan and the United States; and tightening in Spain (Figure 1.13, panels 1 and 2).[4]

For 2018, the forecast assumes moderate fiscal policy tightening in advanced economies, reflecting projected tightening in Japan, the United Kingdom, and to a lesser extent, the United States. The projected increase in the structural fiscal balance for the United States in 2018 in the current forecast is similar to the projection in the October 2016 WEO, but represents major tightening relative to the April 2017 assumptions (which included a fiscal impulse of 1½ percent of GDP between 2017 and 2019 on the basis of

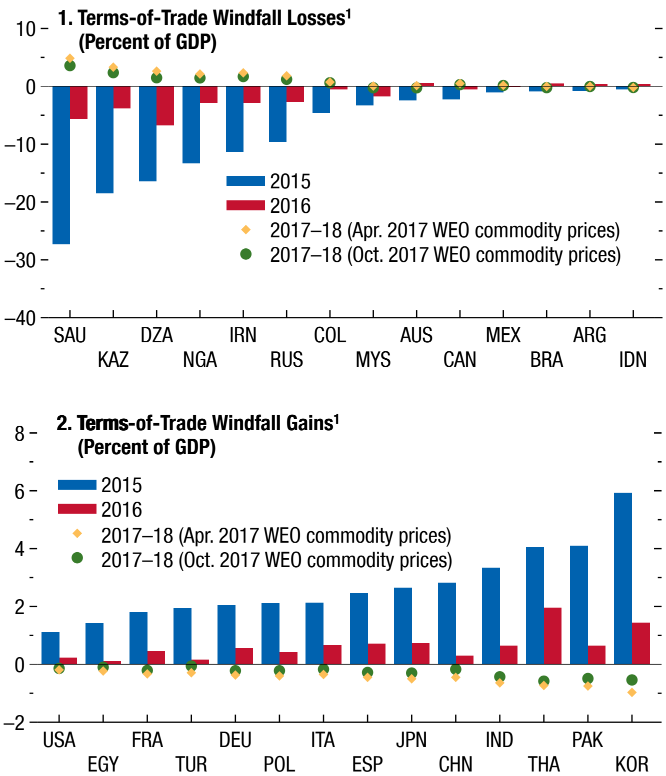
[2]At market rates, GDP in China in 2016 exceeded the combined GDP of the next largest 12 emerging market and developing economies ranked by size (India, Brazil, Russia, Mexico, Indonesia, Turkey, Saudi Arabia, Argentina, Poland, Islamic Republic of Iran, Thailand, Nigeria).

[3]For instance, see IMF (2016b). Chapter 3 explores the macroeconomic implications of changes in weather patterns for low-income countries.

[4]The fiscal impulse is defined as the change in the structural fiscal balance as a share of potential output.

### Figure 1.11. Emerging Markets: Terms-of-Trade Windfall Gains and Losses

Commodity terms-of-trade shifts imply relatively small projected gains and losses in disposable income when compared with the very large losses for commodity exporters during 2015–16.

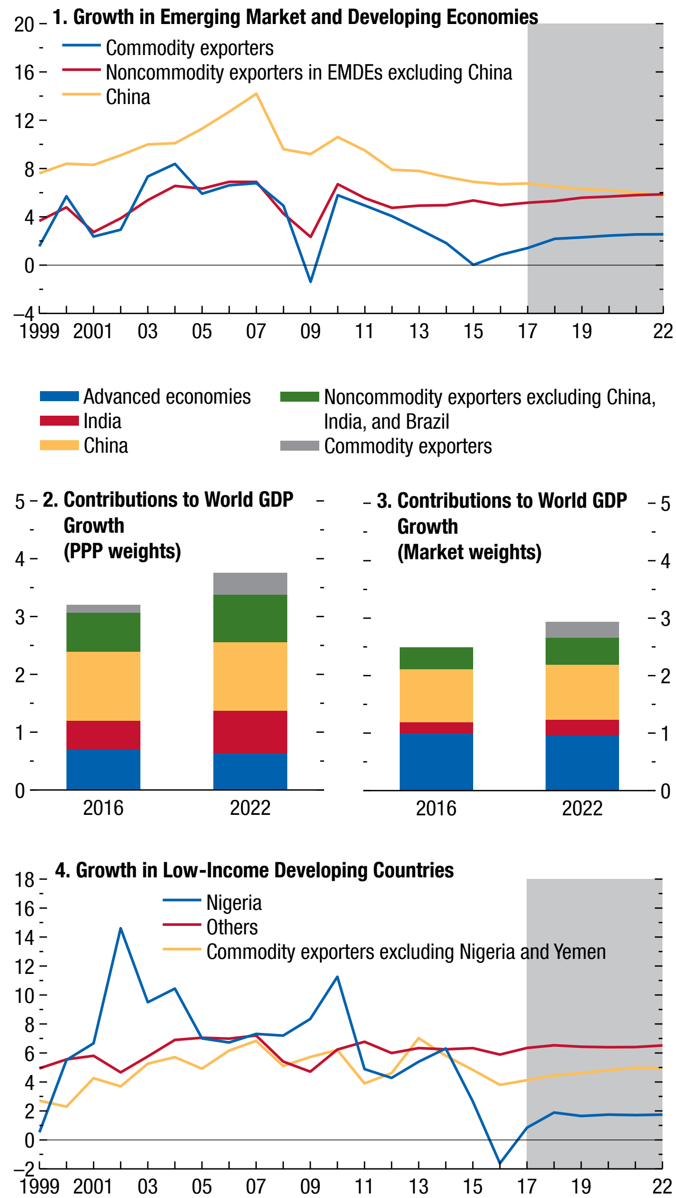



Source: IMF staff estimates.
Note: Data labels in the figure use International Organization for Standardization (ISO) country codes. WEO = *World Economic Outlook.*
[1]Gains (losses) for 2017–18 are simple averages of annual incremental gains (losses) for 2017 and 2018. The windfall is an estimate of the change in disposable income arising from commodity price changes. The windfall gain in year $t$ for a country exporting $x$ US dollars of commodity $A$ and importing $m$ US dollars of commodity $B$ in year $t-1$ is defined as $(\Delta p_t^A x_{t-1} - \Delta p_t^B m_{t-1}) / Y_{t-1}$, in which $\Delta p_t^A$ and $\Delta p_t^B$ are the percentage changes in the prices of $A$ and $B$ between year $t-1$ and year $t$, and $Y$ is GDP in year $t-1$ in US dollars. See also Gruss (2014).

### Figure 1.12. GDP Growth, 1999–2022

*(Percent)*

While commodity exporters are projected to grow at rates well below their historical averages, they are nevertheless expected to contribute significantly to the projected global growth pickup between 2016 and 2022.



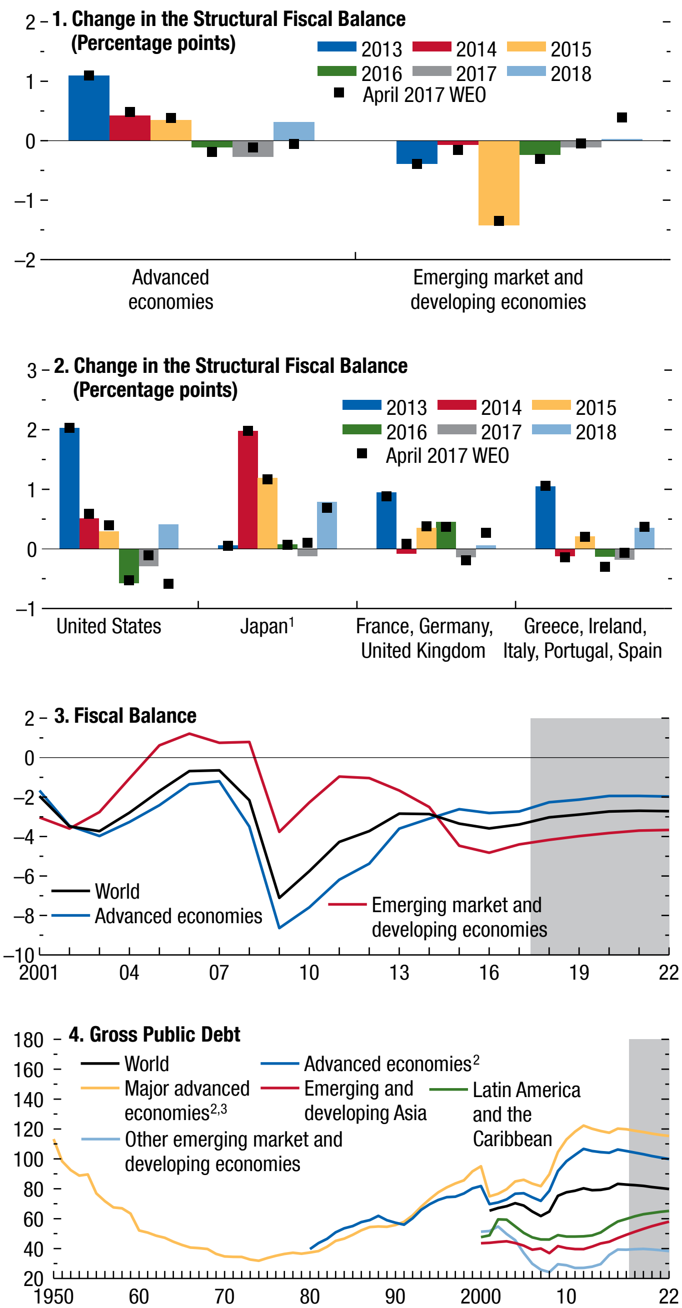

Source: IMF staff estimates.
Note: Commodity exporters includes fuel and nonfuel primary products exporters, as indicated in Table D of the Statistical Appendix, plus Brazil and Peru. EMDEs = emerging market and developing economies; PPP = purchasing power parity.

then-anticipated corporate and personal income tax reductions). In emerging market and developing economies, fiscal policy is expected to be broadly neutral in both 2017 and 2018. (The projected looser fiscal policy for the group in 2018 relative to the assumptions in April primarily reflects downward revisions for the structural fiscal balances of Brazil and China).

On monetary policy, the forecast assumes a somewhat more gradual normalization of the policy interest rate in the United States than projected in the April 2017 WEO. With US fiscal policy now set to be

**Figure 1.13. Fiscal Indicators**
*(Percent of GDP, unless noted otherwise)*

The projected overall neutral fiscal policy stance for 2017 and 2018 masks variation across countries.




Source: IMF staff estimates.
Note: WEO = *World Economic Outlook.*
[1]Japan's latest figures reflect comprehensive methodological revisions adopted in December 2016.
[2]Data through 2000 exclude the United States.
[3]Canada, France, Germany, Italy, Japan, United Kingdom, United States.

broadly neutral in 2017 and projected to tighten in 2018, monetary policy is projected to be moderately more accommodative than previously expected, given weaker projected demand and diminished inflation pressure. The US policy interest rate is projected to remain broadly unchanged at 100–125 basis points for the rest of 2017 and rise by about 75 basis points in 2018, reaching a long-term equilibrium rate of slightly less than 3 percent in 2020. In the euro area and Japan, the forecast assumes that monetary policy will remain very accommodative. Short-term rates are projected to remain negative in the euro area through 2018 and close to zero in Japan over the forecast horizon. The assumed monetary policy stances across emerging market economies vary, reflecting these economies' diverse cyclical positions. Given faster-than-expected declines in inflation rates in many larger economies, such as Brazil, India, and Russia, the projected level of monetary policy interest rates for the group is somewhat lower than in the April 2017 WEO.

Global financial conditions are assumed to remain accommodative, in line with the April projections. As discussed in Chapter 1 of the October 2017 GFSR, an easing of lending conditions in major economies is expected to offset the anticipated gradual rise in long-term interest rates, while the normalization of monetary policy in the United States and the United Kingdom is expected to proceed smoothly, without triggering large and protracted increases in financial market volatility. Except for several vulnerable economies, most emerging markets are expected to face generally accommodative financial conditions, with higher policy rates partially offset by a recovery in risk appetite, as reflected in generally contained sovereign bond spreads and the uptick in most equity markets.

Despite the recent decline in commodity prices, the IMF's commodity price index is expected to increase by 12.3 percent in 2017 from its average in 2016, and then fall slightly again in 2018, by 0.1 percent. After averaging \$43 a barrel in 2016, oil prices are expected to average \$50.3 a barrel in 2017 (down from \$55.2 a barrel in the April 2017 WEO), and stay at about that level in 2018. Nonfuel commodity prices are expected to strengthen in 2017–18 from their 2016 averages because of stronger demand for metals from China, tight supply conditions for food, and a general pickup in global demand.

Looking further ahead, futures markets point toward a slight rise in commodity prices by 2022.

While energy prices are expected to increase modestly because of growing demand in emerging markets, food prices are expected to fall moderately as some supply disruptions wane.

Finally, against a backdrop of elevated policy uncertainty, the forecast rests on the assumption that major policy missteps are avoided. For instance, negotiations on the future economic relations between the United Kingdom and the European Union (EU) are assumed to proceed without raising excessive uncertainty, and the arrangements are expected to eventually settle in a manner that avoids a very large increase in economic barriers.

## Global Outlook for 2017–18

World growth is projected to increase from 3.2 percent in 2016 to 3.6 percent in 2017 and 3.7 percent in 2018—an upward revision of 0.1 percentage point for both 2017 and 2018 relative to April. Economic activity is projected to pick up speed in all country groups except for the Middle East, and forecasts of the strength of the outlook by region have changed only modestly (Table 1.1).

In line with a stronger-than-expected rise in growth in advanced economies so far in 2017 (especially in the euro area), their projected growth rate has been revised upward to 2.2 percent for 2017 (from 2 percent projected in April)—a notable increase from 1.7 percent in 2016. The advanced economy forecast for 2018 is unchanged, with lower projected US growth (under the assumption that fiscal policy will not provide the previously envisaged boost to demand) offsetting higher projected growth in the euro area.

Growth is forecast to increase strongly in emerging market and developing economies, from an upwardly revised 4.3 percent in 2016 to 4.6 percent in 2017 and 4.9 percent in 2018, a 0.1 percentage point increase for 2017 and 2018 relative to the April forecast. The upward revisions to the growth forecast primarily reflect stronger projected activity in China and in emerging Europe for 2017 and 2018.

As discussed earlier, although commodity importers account for the lion's share of growth in emerging market and developing economies, the projected increase in growth from 2016 is driven primarily by stronger projected growth for commodity exporters, most notably Brazil and Russia, that experienced severe macroeconomic strains during 2015–16. As emphasized in previous WEO reports and in Box 1.3, prospects across emerging market and developing economies remain heterogeneous, with emerging Asian countries generally growing at a fast pace, but many countries in Latin America, sub-Saharan Africa, and the Middle East struggling with subpar performance.

## Growth Outlook for the Medium Term

Global growth is forecast to increase marginally beyond 2018, reaching 3.8 percent by 2021. With growth in advanced economies projected to gradually decline toward potential growth rates of about 1.7 percent once economic slack is eliminated, this further pickup in global activity is entirely driven by emerging market and developing economies. In these countries, growth is projected to increase to 5 percent by the end of the forecast period, with their impact on global activity boosted by their rising world economic weight. This forecast assumes some strengthening of growth in commodity exporters, though to rates much more modest than in 2000–15; a gradual increase in India's growth rate resulting from implementation of important structural reforms; continued strong growth in other commodity importers; and a lower but still high trend growth rate in China (Figure 1.12, panels 1–3).

## Growth Outlook for Individual Countries and Regions

### *Advanced Economies*

- The *US* economy is projected to expand at 2.2 percent in 2017 and 2.3 percent in 2018. The projection of a continuation of near-term growth that is moderately above potential reflects very supportive financial conditions and strong business and consumer confidence. The downward revision relative to the April WEO forecasts (of 2.3 and 2.5 percent for 2017 and 2018, respectively) reflects a major correction in US fiscal policy assumptions. Given the significant policy uncertainty, IMF staff's macroeconomic forecast now uses a baseline assumption of unchanged policies, whereas the April 2017 WEO built in a fiscal stimulus from anticipated tax cuts. Over a longer horizon, US growth is expected to moderate. Potential growth is estimated at 1.8 percent, reflecting the assumption of continued sluggish growth in total factor productivity and diminished growth of the workforce due to population aging.
- The *euro area* recovery is expected to gather strength this year, with growth projected to rise to 2.1 percent in 2017, before moderating to 1.9 percent in

**Table 1.1. Overview of the *World Economic Outlook* Projections**
*(Percent change, unless noted otherwise)*

| | | Projections | | Difference from July 2017 *WEO Update*[1] | | Difference from April 2017 *WEO*[1] | |
|---|---|---|---|---|---|---|---|
| | 2016 | 2017 | 2018 | 2017 | 2018 | 2017 | 2018 |
| **World Output** | **3.2** | **3.6** | **3.7** | **0.1** | **0.1** | **0.1** | **0.1** |
| **Advanced Economies** | **1.7** | **2.2** | **2.0** | **0.2** | **0.1** | **0.2** | **0.0** |
| United States | 1.5 | 2.2 | 2.3 | 0.1 | 0.2 | –0.1 | –0.2 |
| Euro Area | 1.8 | 2.1 | 1.9 | 0.2 | 0.2 | 0.4 | 0.3 |
| Germany | 1.9 | 2.0 | 1.8 | 0.2 | 0.2 | 0.4 | 0.3 |
| France | 1.2 | 1.6 | 1.8 | 0.1 | 0.1 | 0.2 | 0.2 |
| Italy | 0.9 | 1.5 | 1.1 | 0.2 | 0.1 | 0.7 | 0.3 |
| Spain | 3.2 | 3.1 | 2.5 | 0.0 | 0.1 | 0.5 | 0.4 |
| Japan[2] | 1.0 | 1.5 | 0.7 | 0.2 | 0.1 | 0.3 | 0.1 |
| United Kingdom | 1.8 | 1.7 | 1.5 | 0.0 | 0.0 | –0.3 | 0.0 |
| Canada | 1.5 | 3.0 | 2.1 | 0.5 | 0.2 | 1.1 | 0.1 |
| Other Advanced Economies[3] | 2.2 | 2.6 | 2.5 | 0.3 | 0.1 | 0.3 | 0.1 |
| **Emerging Market and Developing Economies** | **4.3** | **4.6** | **4.9** | **0.0** | **0.1** | **0.1** | **0.1** |
| Commonwealth of Independent States | 0.4 | 2.1 | 2.1 | 0.4 | 0.0 | 0.4 | 0.0 |
| Russia | –0.2 | 1.8 | 1.6 | 0.4 | 0.2 | 0.4 | 0.2 |
| Excluding Russia | 1.9 | 2.9 | 3.3 | 0.4 | –0.2 | 0.4 | –0.2 |
| Emerging and Developing Asia | 6.4 | 6.5 | 6.5 | 0.0 | 0.0 | 0.1 | 0.1 |
| China | 6.7 | 6.8 | 6.5 | 0.1 | 0.1 | 0.2 | 0.3 |
| India[4] | 7.1 | 6.7 | 7.4 | –0.5 | –0.3 | –0.5 | –0.3 |
| ASEAN-5[5] | 4.9 | 5.2 | 5.2 | 0.1 | 0.0 | 0.2 | 0.0 |
| Emerging and Developing Europe | 3.1 | 4.5 | 3.5 | 1.0 | 0.3 | 1.5 | 0.2 |
| Latin America and the Caribbean | –0.9 | 1.2 | 1.9 | 0.2 | 0.0 | 0.1 | –0.1 |
| Brazil | –3.6 | 0.7 | 1.5 | 0.4 | 0.2 | 0.5 | –0.2 |
| Mexico | 2.3 | 2.1 | 1.9 | 0.2 | –0.1 | 0.4 | –0.1 |
| Middle East, North Africa, Afghanistan, and Pakistan | 5.0 | 2.6 | 3.5 | 0.0 | 0.2 | 0.0 | 0.1 |
| Saudi Arabia | 1.7 | 0.1 | 1.1 | 0.0 | 0.0 | –0.3 | –0.2 |
| Sub-Saharan Africa | 1.4 | 2.6 | 3.4 | –0.1 | –0.1 | 0.0 | –0.1 |
| Nigeria | –1.6 | 0.8 | 1.9 | 0.0 | 0.0 | 0.0 | 0.0 |
| South Africa | 0.3 | 0.7 | 1.1 | –0.3 | –0.1 | –0.1 | –0.5 |
| *Memorandum* | | | | | | | |
| European Union | 2.0 | 2.3 | 2.1 | 0.2 | 0.2 | 0.3 | 0.3 |
| Low-Income Developing Countries | 3.6 | 4.6 | 5.2 | 0.0 | 0.0 | –0.1 | –0.1 |
| Middle East and North Africa | 5.1 | 2.2 | 3.2 | 0.0 | 0.2 | –0.1 | 0.0 |
| World Growth Based on Market Exchange Rates | 2.5 | 3.0 | 3.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| **World Trade Volume (goods and services)** | **2.4** | **4.2** | **4.0** | **0.2** | **0.1** | **0.4** | **0.1** |
| Imports | | | | | | | |
| Advanced Economies | 2.7 | 4.0 | 3.8 | 0.0 | 0.2 | 0.0 | –0.2 |
| Emerging Market and Developing Economies | 2.0 | 4.4 | 4.9 | 0.1 | 0.2 | –0.1 | 0.6 |
| Exports | | | | | | | |
| Advanced Economies | 2.2 | 3.8 | 3.6 | –0.1 | 0.2 | 0.3 | 0.4 |
| Emerging Market and Developing Economies | 2.5 | 4.8 | 4.5 | 1.0 | 0.0 | 1.2 | 0.2 |
| **Commodity Prices (US dollars)** | | | | | | | |
| Oil[6] | –15.7 | 17.4 | –0.2 | –3.8 | –0.3 | –11.5 | 0.1 |
| Nonfuel (average based on world commodity export weights) | –1.8 | 7.1 | 0.5 | 1.7 | 1.9 | –1.4 | 1.8 |
| **Consumer Prices** | | | | | | | |
| Advanced Economies | 0.8 | 1.7 | 1.7 | –0.2 | –0.1 | –0.3 | –0.2 |
| Emerging Market and Developing Economies[7] | 4.3 | 4.2 | 4.4 | –0.3 | –0.2 | –0.5 | 0.0 |
| **London Interbank Offered Rate (percent)** | | | | | | | |
| On US Dollar Deposits (six month) | 1.1 | 1.4 | 1.9 | –0.2 | –0.3 | –0.3 | –0.9 |
| On Euro Deposits (three month) | –0.3 | –0.3 | –0.3 | 0.0 | –0.1 | 0.0 | –0.1 |
| On Japanese Yen Deposits (six month) | 0.0 | 0.1 | 0.2 | 0.1 | 0.1 | 0.1 | 0.2 |

Note: Real effective exchange rates are assumed to remain constant at the levels prevailing during July 20–August 17, 2017. Economies are listed on the basis of economic size. The aggregated quarterly data are seasonally adjusted.
[1]Difference based on rounded figures for the current, July 2017 *World Economic Outlook Update*, and April 2017 *World Economic Outlook* forecasts.
[2]Japan's historical national accounts figures reflect a comprehensive revision by the national authorities, released in December 2016. The main revisions are the switch from the System of National Accounts 1993 to the System of National Accounts 2008 and the updating of the benchmark year from 2005 to 2011.
[3]Excludes the Group of Seven (Canada, France, Germany, Italy, Japan, United Kingdom, United States) and euro area countries.
[4]For India, data and forecasts are presented on a fiscal year basis and GDP from 2011 onward is based on GDP at market prices with fiscal year 2011/12 as a base year.

**Table 1.1** ***(continued)***

| | Year-over-Year | | | | Q4-over-Q4[8] | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Projections | | | | Projections | |
| | 2015 | 2016 | 2017 | 2018 | 2015 | 2016 | 2017 | 2018 |
| **World Output** | **3.4** | **3.2** | **3.6** | **3.7** | **3.2** | **3.2** | **3.7** | **3.7** |
| **Advanced Economies** | **2.2** | **1.7** | **2.2** | **2.0** | **1.9** | **2.0** | **2.2** | **1.9** |
| United States | 2.9 | 1.5 | 2.2 | 2.3 | 2.0 | 1.8 | 2.3 | 2.3 |
| Euro Area | 2.0 | 1.8 | 2.1 | 1.9 | 1.9 | 1.9 | 2.2 | 1.7 |
| Germany | 1.5 | 1.9 | 2.0 | 1.8 | 1.3 | 1.9 | 2.2 | 1.8 |
| France | 1.1 | 1.2 | 1.6 | 1.8 | 1.0 | 1.2 | 2.1 | 1.4 |
| Italy | 0.8 | 0.9 | 1.5 | 1.1 | 1.0 | 1.2 | 1.5 | 1.0 |
| Spain | 3.2 | 3.2 | 3.1 | 2.5 | 3.5 | 3.0 | 3.1 | 2.1 |
| Japan[2] | 1.1 | 1.0 | 1.5 | 0.7 | 1.1 | 1.7 | 1.4 | 0.5 |
| United Kingdom | 2.2 | 1.8 | 1.7 | 1.5 | 1.7 | 1.9 | 1.3 | 1.5 |
| Canada | 0.9 | 1.5 | 3.0 | 2.1 | 0.4 | 2.0 | 3.0 | 2.0 |
| Other Advanced Economies[3] | 2.1 | 2.2 | 2.6 | 2.5 | 2.0 | 2.5 | 2.5 | 2.6 |
| **Emerging Market and Developing Economies** | **4.3** | **4.3** | **4.6** | **4.9** | **4.4** | **4.2** | **5.0** | **5.2** |
| Commonwealth of Independent States | –2.2 | 0.4 | 2.1 | 2.1 | –2.8 | 0.6 | 1.9 | 2.2 |
| Russia | –2.8 | –0.2 | 1.8 | 1.6 | –3.3 | 0.3 | 1.9 | 2.0 |
| Excluding Russia | –0.6 | 1.9 | 2.9 | 3.3 | . . . | . . . | . . . | . . . |
| Emerging and Developing Asia | 6.8 | 6.4 | 6.5 | 6.5 | 6.9 | 6.2 | 6.6 | 6.5 |
| China | 6.9 | 6.7 | 6.8 | 6.5 | 6.8 | 6.8 | 6.5 | 6.5 |
| India[4] | 8.0 | 7.1 | 6.7 | 7.4 | 8.9 | 5.6 | 7.9 | 7.4 |
| ASEAN-5[5] | 4.9 | 4.9 | 5.2 | 5.2 | 4.9 | 4.8 | 5.3 | 5.2 |
| Emerging and Developing Europe | 4.7 | 3.1 | 4.5 | 3.5 | 4.8 | 3.8 | 2.6 | 4.7 |
| Latin America and the Caribbean | 0.1 | –0.9 | 1.2 | 1.9 | –1.3 | –1.1 | 1.7 | 2.0 |
| Brazil | –3.8 | –3.6 | 0.7 | 1.5 | –5.8 | –2.5 | 1.9 | 1.8 |
| Mexico | 2.6 | 2.3 | 2.1 | 1.9 | 2.5 | 2.3 | 1.0 | 3.2 |
| Middle East, North Africa, Afghanistan, and Pakistan | 2.7 | 5.0 | 2.6 | 3.5 | . . . | . . . | . . . | . . . |
| Saudi Arabia | 4.1 | 1.7 | 0.1 | 1.1 | 4.3 | 2.2 | 0.6 | 1.4 |
| Sub-Saharan Africa | 3.4 | 1.4 | 2.6 | 3.4 | . . . | . . . | . . . | . . . |
| Nigeria | 2.7 | –1.6 | 0.8 | 1.9 | . . . | . . . | . . . | . . . |
| South Africa | 1.3 | 0.3 | 0.7 | 1.1 | 0.3 | 0.4 | 1.1 | 0.8 |
| *Memorandum* | | | | | | | | |
| European Union | 2.3 | 2.0 | 2.3 | 2.1 | 2.3 | 2.1 | 2.2 | 2.0 |
| Low-Income Developing Countries | 4.7 | 3.6 | 4.6 | 5.2 | . . . | . . . | . . . | . . . |
| Middle East and North Africa | 2.6 | 5.1 | 2.2 | 3.2 | . . . | . . . | . . . | . . . |
| World Growth Based on Market Exchange Rates | 2.7 | 2.5 | 3.0 | 3.1 | 2.4 | 2.6 | 3.1 | 3.0 |
| **World Trade Volume (goods and services)** | **2.8** | **2.4** | **4.2** | **4.0** | **. . .** | **. . .** | **. . .** | **. . .** |
| Imports | | | | | | | | |
| Advanced Economies | 4.6 | 2.7 | 4.0 | 3.8 | . . . | . . . | . . . | . . . |
| Emerging Market and Developing Economies | –0.9 | 2.0 | 4.4 | 4.9 | . . . | . . . | . . . | . . . |
| Exports | | | | | | | | |
| Advanced Economies | 3.8 | 2.2 | 3.8 | 3.6 | . . . | . . . | . . . | . . . |
| Emerging Market and Developing Economies | 1.8 | 2.5 | 4.8 | 4.5 | . . . | . . . | . . . | . . . |
| **Commodity Prices (US dollars)** | | | | | | | | |
| Oil[6] | –47.2 | –15.7 | 17.4 | –0.2 | –43.4 | 16.2 | 1.4 | 1.1 |
| Nonfuel (average based on world commodity export weights) | –17.5 | –1.8 | 7.1 | 0.5 | –19.1 | 9.9 | 3.1 | 0.6 |
| **Consumer Prices** | | | | | | | | |
| Advanced Economies | 0.3 | 0.8 | 1.7 | 1.7 | 0.4 | 1.2 | 1.5 | 1.9 |
| Emerging Market and Developing Economies[7] | 4.7 | 4.3 | 4.2 | 4.4 | 4.6 | 3.7 | 3.9 | 3.7 |
| **London Interbank Offered Rate (percent)** | | | | | | | | |
| On US Dollar Deposits (six month) | 0.5 | 1.1 | 1.4 | 1.9 | . . . | . . . | . . . | . . . |
| On Euro Deposits (three month) | 0.0 | –0.3 | –0.3 | –0.3 | . . . | . . . | . . . | . . . |
| On Japanese Yen Deposits (six month) | 0.1 | 0.0 | 0.1 | 0.2 | . . . | . . . | . . . | . . . |

[5]Indonesia, Malaysia, Philippines, Thailand, Vietnam.
[6]Simple average of prices of UK Brent, Dubai Fateh, and West Texas Intermediate crude oil. The average price of oil in US dollars a barrel was $42.84 in 2016; the assumed price based on futures markets is $50.28 in 2017 and $50.17 in 2018.
[7]Excludes Argentina and Venezuela. See country-specific notes for Argentina and Venezuela in the "Country Notes" section of the Statistical Appendix.
[8]For World Output, the quarterly estimates and projections account for approximately 90 percent of annual world output at purchasing-power-parity weights. For Emerging Market and Developing Economies, the quarterly estimates and projections account for approximately 80 percent of annual emerging market and developing economies' output at purchasing-power-parity weights.

2018 (slightly stronger than the 1.8 percent growth estimated for 2016). The forecast is 0.4 percentage point and 0.3 percentage point higher for 2017 and 2018, respectively, relative to April. The increase in growth in 2017 mostly reflects an acceleration in exports in the context of the broader pickup in global trade and continued strength in domestic demand growth supported by accommodative financial conditions amid diminished political risk and policy uncertainty. Growth is forecast to pick up this year and moderate next year in *Germany* (2.0 percent in 2017 and 1.8 percent in 2018), hold steady this year and moderate next year in *Spain* (3.1 percent in 2017 and 2.5 percent in 2018), rise this year and next in *France* (1.6 percent in 2017 and 1.8 percent in 2018), and increase this year and soften next year in *Italy* (1.5 percent in 2017 and 1.1 percent in 2018). The medium-term outlook for the euro area remains subdued because projected potential growth is held back by weak productivity, adverse demographics and in some countries, a public and private debt overhang.

- Growth in the *United Kingdom* is projected to subside to 1.7 percent in 2017 and 1.5 percent in 2018. The 0.3 percentage point downward revision to the 2017 forecast relative to the April 2017 WEO is driven by weaker-than-expected growth outturns for the first two quarters of the year. The slowdown is driven by softer growth in private consumption as the pound's depreciation weighed on household real income. The medium-term growth outlook is highly uncertain and will depend in part on the new economic relationship with the EU and the extent of the increase in barriers to trade, migration, and cross-border financial activity.
- In *Japan*, momentum is driven by the strengthening of global demand and policy actions to sustain a supportive fiscal stance, and is expected to continue in 2017, with growth forecast at 1.5 percent. The pace of expansion is expected to weaken thereafter (to 0.7 percent in 2018), based on the assumption that fiscal support fades as currently scheduled, private consumption growth moderates, and the boost from 2020 Olympics-related private investment is offset by higher imports and slower projected growth in foreign demand. Over the medium term, a shrinking Japanese labor force will curtail GDP growth although, in per capita income terms, Japan's growth is projected to remain close to recent averages.
- In most other advanced economies, the pace of activity is expected to accelerate.
  - Growth in oil-exporting advanced economies is projected to recover. In 2017, it is forecast to rise to 1.4 percent in *Norway*, and increase (by about 1½ percentage points) to 3.0 percent in *Canada.* This growth pickup reflects reduced drag from the adjustment to lower oil and gas prices and accommodative fiscal and monetary policies. By contrast, growth is expected to soften temporarily to 2.2 percent in *Australia*, where housing investment and mining exports in the first half of the year were undermined by bad weather.
  - A pickup in growth for 2017 is projected in *Korea* (to 3.0 percent), *Hong Kong Special Administrative Region* (to 3.5 percent), *Taiwan Province of China* (to 2.0 percent), and *Singapore* (to 2.5 percent). A common driver behind this projected pickup (which is generally stronger than projected in the April 2017 WEO) is the recovery in global trade and China's import demand.

### *Emerging Market and Developing Economies*

- In *China*, growth is projected to notch up to 6.8 percent in 2017, and to slow to 6.5 percent in 2018. The upward revision to the 2017 forecast—0.2 percentage point relative to the April 2017 WEO—reflects the stronger-than-expected outturn in the first half of the year underpinned by previous policy easing and supply-side reforms. For 2018, the upward revision of 0.3 percentage point mainly reflects an expectation that the authorities will maintain a sufficiently expansionary policy mix (especially through high public investment) to meet their target of doubling real GDP between 2010 and 2020. Growth rates for 2019–22 have similarly been revised upward by 0.2 percentage point, on average, reflecting the assumed delay in withdrawing stimulus. Delay comes at the cost of further large increases in debt, however, so downside risks around this baseline have also increased.
- In the rest of emerging market and developing Asia, growth is expected to be vigorous and marginally higher than in the April 2017 WEO. Strong government spending and data revisions in *India* led to an upward revision of 2016 growth to 7.1 percent (6.8 percent in April), with upward revisions of about 0.2 percentage point, on average, for 2014 and 2015. However, the growth projection for 2017 has been revised down to 6.7 percent (7.2 percent in

April), reflecting still lingering disruptions associated with the currency exchange initiative introduced in November 2016, as well as transition costs related to the launch of the national Goods and Services Tax in July 2017. The latter move, which promises the unification of India's vast domestic market, is among several key structural reforms under implementation that are expected to help push growth above 8 percent in the medium term. In the ASEAN-5 economies (*Indonesia, Malaysia, Philippines, Thailand, Vietnam*), growth is expected to strengthen in 2017 to 5.2 percent (from 5 percent in April), partly because of stronger-than-expected external demand from China and Europe. Specifically, economic activity in 2017 is projected to expand by 5.2 percent in *Indonesia*, 5.4 percent in *Malaysia*, 6.6 percent in the *Philippines*, 3.7 percent in *Thailand*, and 6.3 percent in *Vietnam*.

- In *Latin America and the Caribbean*, where GDP contracted by almost 1 percent in 2016, real GDP is projected to increase by 1.2 percent in 2017 and 1.9 percent in 2018—broadly as in the April 2017 WEO. Although growth is holding up well in Central America and strengthening, on average, in the Caribbean, domestic demand continues to underperform in much of the rest of the region, and some idiosyncratic factors are playing a key role in shaping substantially different outlooks across countries.
  - In *Mexico*, growth is expected to soften to 2.1 percent in 2017 and 1.9 percent in 2018. Despite the uncertainty related to renegotiation of the North American Free Trade Agreement and a downward revision to economic activity in the United States, growth for 2017 has been revised upward by 0.4 percent since the April 2017 WEO, reflecting better-than-expected growth outturns for the first two quarters of the year and a recovery in financial market confidence. In the medium term, the assumed full implementation of the structural reform agenda is projected to lift growth to 2.7 percent.
  - After entering positive territory in the first half of 2017, growth in *Brazil* is expected to reach 0.7 percent for the year and 1.5 percent in 2018. A bumper crop and a boost to consumption, including from allowing workers to draw on savings accumulated in their severance accounts, led to an upward revision of half a percentage point in 2017 relative to the April forecast, but ongoing weakness in investment and an increase in political and policy uncertainty led to a downward revision of the 2018 forecast of 0.2 percentage point. A gradual restoration of confidence—as key reforms to ensure fiscal sustainability are implemented over time—is projected to raise growth to 2 percent in the medium term.
  - In *Argentina*, growth is projected to rebound to 2.5 percent in 2017 from last year's recession as higher real wages boost consumption; investment picks up, supported by public works; and exports benefit from stronger external demand. Growth is expected to remain about 2½ percent in 2018, as private domestic demand continues to improve gradually against the backdrop of tight macroeconomic policy settings (high real interest rates required by the disinflation process and the start of the fiscal consolidation). The intensification of the political crisis in *Venezuela* weighs heavily on economic activity, which is expected to contract by more than 10 percent in 2017 as oil production declines and uncertainty rises further. In *Chile*, growth is projected to be 1.4 percent in 2017 amid weakness in private fixed investment, mining output, and public consumption, and to recover to 2.5 percent in 2018 amid growing confidence, higher copper prices, and interest rate cuts implemented over the past few months. In *Colombia*, growth is projected to be 1.7 percent in 2017, amid continued adjustment to lower revenues. Higher infrastructure spending, investment-friendly tax reform, and the boost in confidence from the peace agreement are expected to raise growth to about 3.5 percent in the medium term.
- The outlook for the *Commonwealth of Independent States* continues to improve, following a deep recession in 2015 and very shallow growth in 2016, with growth projected at 2.1 percent in 2017 and 2018—an upward revision of 0.4 percentage point for 2017 relative to the April 2017 WEO. After two years of recession, economic activity in *Russia* is projected to expand by 1.8 percent in 2017, helped by stabilizing oil prices, easing financial conditions, and improved confidence. Over the medium term, however, growth is expected to remain about 1.5 percent, constrained by moderate oil prices, adverse demographics, and other structural impediments. Among other oil exporters, growth in *Kazakhstan* is projected to rise to 3.3 percent in 2017 on the back of strong oil production.

- In *emerging and developing Europe*, short-term growth has been revised upward to 4.5 percent (from 3.0 percent in the April 2017 WEO). This change is driven to an important extent by the revision to *Turkey*'s growth in 2017 to 5.1 percent (2.5 percent in April), reflecting a stronger-than-expected outturn in the first quarter of the year, driven in part by a recovery in exports after several quarters of contraction and a more expansionary fiscal stance. The outlook was also revised up for *Poland* (to 3.8 percent in 2017 and 3.3 percent in 2018), reflecting better-than-expected growth in the first half of 2017 and the expected pickup in EU-funded projects.
- Economic growth in *sub-Saharan Africa* is projected to reach 2.6 percent in 2017 and 3.4 percent in 2018 (broadly in line with the April forecast), with sizable differences across countries. Downside risks have risen because of idiosyncratic factors in the region's largest economies and delays in implementing policy adjustments. Beyond the near term, growth is expected to rise gradually, but barely above population growth, as large consolidation needs weigh on public spending. *Nigeria* is expected to emerge from the 2016 recession caused by low oil prices and the disruption of oil production. Growth in 2017 is projected at 0.8 percent, owing to recovering oil production and ongoing strength in the agricultural sector. However, concerns about policy implementation, market segmentation in a foreign exchange market that remains dependent on central bank interventions (despite initial steps to liberalize the foreign exchange market), and banking-system fragilities are expected to weigh on activity in the medium term. In *South Africa*, growth is projected to remain subdued at 0.7 percent in 2017 and 1.1 percent in 2018, despite more favorable commodity export prices and strong agricultural production, as heightened political uncertainty saps consumer and business confidence. In *Angola*, growth in 2017 has been revised upward to 1.5 percent (1.3 percent in April) because a downward revision to oil production in 2016 has raised the extent of the expected rebound. The outlook for fuel-importing countries is generally brighter, with an aggregate growth rate of 3.9 percent in 2017, rising to 4.4 percent in 2018.
- In the *Middle East, North Africa, Afghanistan, and Pakistan*, growth is projected to slow significantly in 2017 to 2.6 percent (from 5.0 percent in 2016) on the back of a slowdown in the *Islamic Republic of Iran's* economy after very fast growth in 2016 and cuts in oil production in oil exporters through March 2018 under the extended OPEC agreement. In 2018, growth is expected to increase to 3.5 percent, mostly reflecting stronger domestic demand in oil importers and a rebound of oil production in oil exporters. However, regional insecurity and geopolitical risks still weigh on the outlook. In *Saudi Arabia*, although non-oil growth is expected to strengthen somewhat this year, overall output is expected to be broadly flat as real oil GDP declines as a result of the commitments under the extended OPEC agreement. In 2018, growth is projected to increase to 1.1 percent, reflecting an increase in oil output associated with the expiration of the OPEC agreement. Economic prospects in *Pakistan* have improved, with growth expected to reach 5.3 percent in 2017 and 5.6 percent in 2018, benefiting from investment in the China-Pakistan Economic Corridor and strong private sector credit. In *Egypt*, growth was 4.1 percent in fiscal year 2017 according to preliminary estimates, and is forecast to reach 4.5 percent in 2018, supported by reforms aimed at correcting fiscal and external imbalances, restoring competitiveness, and creating jobs.

### Inflation Outlook for 2017–18

Headline inflation rates are projected to increase in both advanced and emerging market and developing economies, though somewhat less briskly than anticipated in the April 2017 WEO, partly reflecting weaker-than-expected oil prices. In advanced economies, inflation is forecast to pick up from 0.8 percent in 2016 to 1.7 percent in 2017, reflecting the continued cyclical recovery in demand and the increase in commodity prices in the second half of 2016. Headline inflation is expected to stay at 1.7 percent in 2018 before converging to 2 percent over the medium term. Inflation in emerging market and developing economies (excluding Argentina and Venezuela) is projected to remain roughly stable in 2017 and 2018 (at 4.2 percent and 4.4 percent, respectively—close to the 2016 estimate of 4.3 percent).

- Because of weaker fuel prices and negative shocks linked to cell phone prices and prescription drugs, headline inflation in the United States is expected to increase by less than envisioned in the April 2017 WEO, though it will still increase significantly. Consumer price inflation is projected to reach 2.1 percent in 2017 (2.7 percent in the April WEO), up from 1.3 percent in 2016. Core personal consumer expenditure inflation remains subdued and is projected to rise more slowly, slightly exceeding 2 percent in 2019 before returning to the medium-term objective of 2 percent targeted by the Federal Reserve.

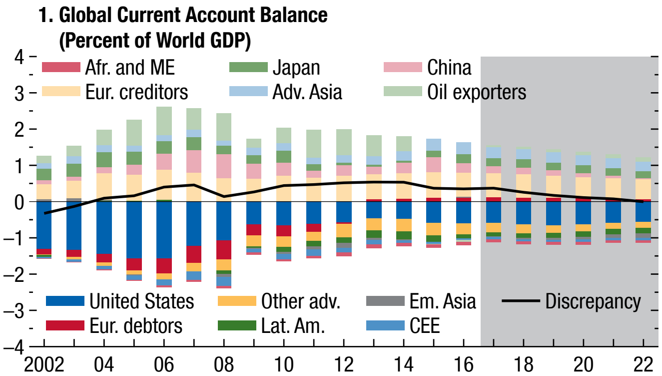
- Inflation is also projected to pick up in the euro area, from 0.2 percent in 2016 to 1.5 percent this year, mostly reflecting higher energy prices and the ongoing cyclical recovery in demand. But underlying inflation remains stubbornly low and wage growth subdued amid still-high unemployment in some countries. Headline inflation is projected to converge to core inflation as energy price effects dissipate and gradually approach the European Central Bank's objective of below but close to 2 percent over the next few years, reaching 1.9 percent only in 2021. In the United Kingdom, the headline inflation rate is projected to peak at 2.6 percent this year, up from 0.7 percent in 2016, before gradually declining to the Bank of England's target of 2 percent as the temporary effect of the pound's depreciation wanes and inflation expectations remain well anchored.
- Headline inflation rates are expected to return to positive territory in all advanced economies that experienced deflation in 2016. In particular, headline inflation in Japan, after being slightly negative in 2016, is expected to increase to 0.4 percent in 2017 on the back of higher energy prices on a year-over-year basis and a narrowing output gap. But inflation rates are projected to remain below the Bank of Japan's target throughout the forecast horizon.
- The modest increase in inflation rates projected for emerging market and developing economies as a group conceals sizable cross-country differences. Headline inflation in China is expected to remain tame at 1.8 percent in 2017, reflecting weakening food prices in recent months, and to pick up gradually to 2.6 percent over the medium term. Inflation rates in Brazil and Russia are forecast to decline faster than projected in the April 2017 WEO, reflecting stronger effects from negative output gaps, currency appreciations, and favorable supply shocks to food prices. In Mexico, headline inflation is expected to rise to 5.9 percent this year because of the liberalization of domestic fuel prices and pass-through from the peso's depreciation through January 2017, and to fall within Banco de México's tolerance band of 2–4 percent in 2018. In Argentina, annual consumer price index inflation is projected to decline sharply during 2017 and 2018 as the impacts of the large exchange rate depreciation and tariff adjustment in 2016 fade, the central bank maintains a tight monetary policy stance, and wage negotiations become more forward looking. After rising to 6.3 percent in 2016, headline inflation in South Africa is forecast to decline to 5.4 percent in 2017, which is within the target band; slowing wage growth, a widening output gap, and the easing of drought conditions are expected to more than offset the effect of higher oil prices and an increase in excise taxes. The inflation rate in Turkey has spiked, following the lira's depreciation, and is expected to remain above the 5 percent target throughout the forecast horizon. Inflation in 2017–18 is expected to remain elevated at two-digit levels in Angola and Nigeria, reflecting the persistent effects of past inflationary shocks coming from sharp currency depreciations (including of the parallel exchange rate) as well as higher electricity and fuel prices and, in the case of Nigeria, reflecting the assumption that monetary policy will remain accommodative going forward.

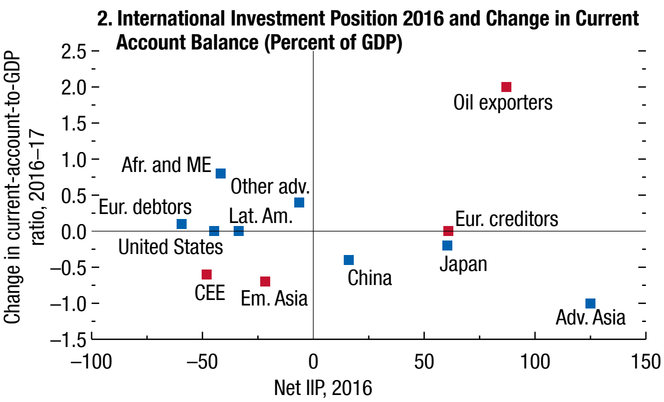
### External Sector Outlook

Global trade is estimated to have grown by 2.4 percent in 2016 in volume terms, the slowest pace since 2009, with weak growth in both advanced economies and emerging market and developing economies. In the former, weaker trade growth was related to an investment slowdown and inventory adjustment, especially during the first part of the year. In the latter, persistent weakness in trade growth was related to a protracted trade slowdown in China and a sharp import contraction in some commodity exporters facing macroeconomic strains, notably Latin America, sub-Saharan Africa, and the Commonwealth of Independent States. As discussed earlier, global trade growth picked up meaningfully in late 2016 and early 2017, reflecting a recovery in global demand and especially capital spending. Consequently, global trade growth is projected to rebound to about 4 percent in 2017 and into the medium term, about 1 percentage point higher than GDP growth at market exchange rates.

**Figure 1.14. Global Current Account Balances**

Global current account imbalances narrowed marginally in 2016 and are expected to further compress slightly in 2017.




Source: IMF staff estimates.
Note: Adv. Asia = advanced Asia (Hong Kong SAR, Korea, Singapore, Taiwan Province of China); Afr. and ME = Africa and the Middle East (Democratic Republic of the Congo, Egypt, Ethiopia, Ghana, Jordan, Kenya, Lebanon, Morocco, South Africa, Sudan, Tanzania, Tunisia); CEE = central and eastern Europe (Belarus, Bulgaria, Croatia, Czech Republic, Hungary, Poland, Romania, Slovak Republic, Turkey, Ukraine); Em. Asia = emerging Asia (India, Indonesia, Pakistan, Philippines, Thailand, Vietnam); Eur. creditors = European creditors (Austria, Belgium, Denmark, Finland, Germany, Luxembourg, Netherlands, Norway, Sweden, Switzerland); Eur. debtors = European debtors (Cyprus, Greece, Ireland, Italy, Portugal, Spain, Slovenia); Lat. Am. = Latin America (Argentina, Brazil, Chile, Colombia, Mexico, Peru, Uruguay); Oil exporters = Algeria, Azerbaijan, Iran, Kazakhstan, Kuwait, Nigeria, Oman, Qatar, Russia, Saudi Arabia, United Arab Emirates, Venezuela; Other adv. = other advanced economies (Australia, Canada, France, Iceland, New Zealand, United Kingdom).

Global current account imbalances have been broadly unchanged since 2013, with a marginal narrowing in 2016 that is projected to continue in 2017 and the following few years (Figure 1.14, panel 1). Their composition has shifted, becoming more heavily concentrated in advanced economies. Among creditor countries, the current account balance is projected to show some improvement in oil-exporting countries, thanks to the increase in oil prices since their 2016 troughs, and to decline slightly in China as imports recover. Among debtor countries, current account deficits are expected to moderate in countries in the "other advanced economies" group, including Australia and especially the United Kingdom.

Although there is no normative presumption that current account deficits and surpluses should be compressed, the IMF's 2017 *External Sector Report* highlights how in 2016 current account imbalances in some of the world's largest economies were too large in relation to country-specific norms consistent with underlying fundamentals and desirable policies. Current account balances are expected to move in a direction consistent with a narrowing of these excess imbalances, even under the assumption of constant real exchange rates underpinning the projections. The first panel of Figure 1.15 depicts on the horizontal axis the gap between the 2016 current account balance and its norm and, on the vertical axis, the projected change in the current account balance in 2017. The strong negative correlation (–0.6) implies that current account balances are expected to begin reducing gaps relative to the 2016 current account norm. The correlation is even stronger over a five-year horizon.

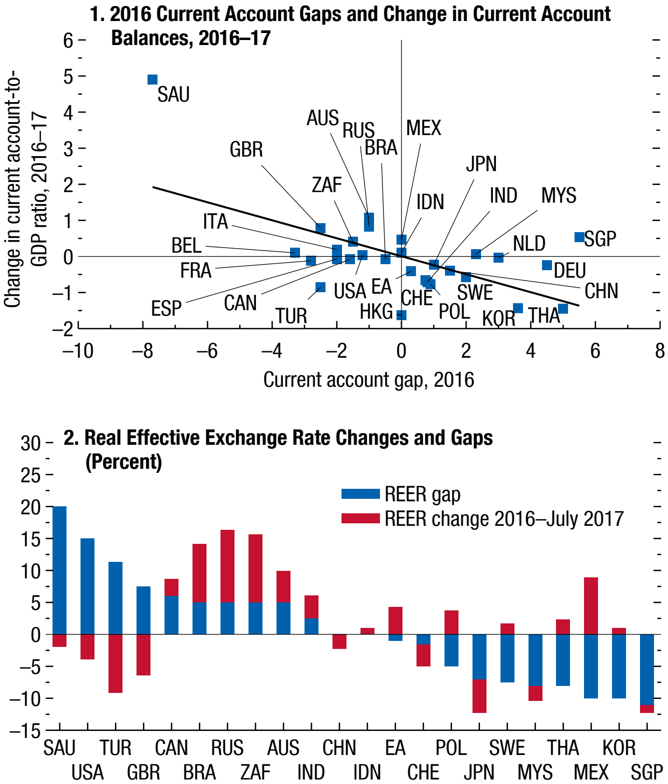
As panel 2 of Figure 1.15 illustrates, changes in real effective exchange rates between their 2016 average values and those in August 2017 are instead not systematically correlated with the exchange rate gaps for 2016 identified in the 2017 *External Sector Report*. One important factor reconciling these findings is the increase in commodity prices since their troughs in 2016, which has strengthened the real exchange rates of commodity exporters but is also expected to improve their current account balances.

Despite the minor narrowing of flow imbalances, creditor and debtor positions widened in 2016 and are projected to continue widening into the medium term relative to world GDP (Figure 1.16, panel 1). On the debtor side, the increase is explained entirely by an increase in net external liabilities in the United States, where the current account deficit is projected to remain about 2.5 percent of GDP over the next few years. In contrast, net external liabilities are projected to shrink further in euro area debtor countries. Among creditor countries, the increase in net external claims primarily reflects the projected continuation of large current account surpluses in European creditor countries (such as Germany, the Netherlands, and Switzerland) and advanced Asian economies.

Panel 2 of Figure 1.16 shows how creditor and debtor positions as a share of domestic GDP are projected to evolve over the next five years. It highlights further

### Figure 1.15. Real Exchange Rates and Current Account Balances in Relation to Economic Fundamentals

Current account balances are expected to narrow their gaps relative to the 2016 current account norm.



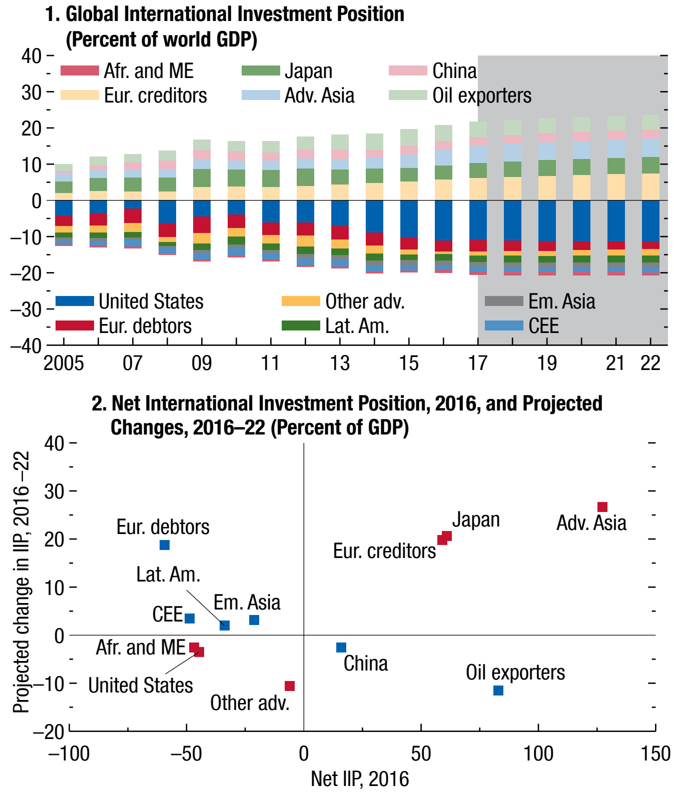

Source: IMF staff estimates.
Note: Data labels in the figure use International Organization for Standardization (ISO) country codes. EA = euro area; REER = real effective exchange rate.

growth in creditor positions among European creditor countries and advanced economies in Asia in the range of 20–25 percentage points of GDP; among debtor countries the largest reduction in net liabilities (close to 20 percentage points of GDP) is projected for euro area debtor countries. A few debtor countries or country groups are projected to see a modest deterioration in their net international investment position, with the US net external position worsening by about 3.5 percentage points of GDP. It is important to note that future exchange rate changes will affect the evolution of these positions, not only through their effect on the current account balance, but also through valuation effects.[5] Most countries,

[5]For instance, valuation changes in 2016 were notable in the United Kingdom, where depreciation of the pound turned the country into a net creditor as of 2016 by boosting the domestic-currency value of foreign-currency assets. The depreciation of the US dollar so

### Figure 1.16. Net International Investment Positions

Creditor and debtor international investment positions widened in 2016 and are projected to continue widening into the medium term.




Source: IMF staff estimates.
Note: Adv. Asia = advanced Asia (Hong Kong SAR, Korea, Singapore, Taiwan Province of China); Afr. and ME = Africa and the Middle East (Democratic Republic of the Congo, Egypt, Ethiopia, Ghana, Jordan, Kenya, Lebanon, Morocco, South Africa, Sudan, Tanzania, Tunisia); CEE = central and eastern Europe (Belarus, Bulgaria, Croatia, Czech Republic, Hungary, Poland, Romania, Slovak Republic, Turkey, Ukraine); Em. Asia = emerging Asia (India, Indonesia, Pakistan, Philippines, Thailand, Vietnam); Eur. creditors = European creditors (Austria, Belgium, Denmark, Finland, Germany, Luxembourg, Netherlands, Norway, Sweden, Switzerland); Eur. debtors = European debtors (Cyprus, Greece, Ireland, Italy, Portugal, Spain, Slovenia); Lat. Am. = Latin America (Argentina, Brazil, Chile, Colombia, Mexico, Peru, Uruguay); Oil exporters = Algeria, Azerbaijan, Iran, Kazakhstan, Kuwait, Nigeria, Oman, Qatar, Russia, Saudi Arabia, United Arab Emirates, Venezuela; Other adv. = Other advanced economies (Australia, Canada, France, Iceland, New Zealand, United Kingdom).

especially advanced economies, are net creditors in foreign currency and net borrowers in domestic currency; consequently, an exchange rate depreciation implies improvement in the net external position through an increase in the domestic-currency value of net foreign-currency assets, with an appreciation having the opposite effect.

far in 2017, if not reversed, would similarly contribute to reducing the United States' net external liability position.

The shifting constellation of global macroeconomic policies and associated exchange rate movements could lead flow imbalances to widen again, further expanding stock imbalances. In the future, stronger reliance on domestic demand growth in some creditor countries, especially those with the policy space to support it, would help facilitate domestic and global rebalancing while sustaining world growth. In the United States, which already has close to full employment, fiscal policy measures designed to gradually enhance productive capacity along with demand, anchored in a medium-term fiscal consolidation plan to reverse the rising ratio of public debt to GDP, would result in more sustained growth and help contain external imbalances.

## Risks

### More Balanced, but Still to the Downside in the Medium Term

In the near term, risks to the global growth forecast appear two-sided and broadly balanced. On the upside, momentum could prove to be more durable than expected amid strong consumer and business confidence, for instance, in the euro area and in East Asia, and near-term growth could exceed the forecast. On the downside, policy uncertainty is more of a concern than usual, reflecting, for example, difficult-to-predict US regulatory and fiscal policies, the potential adoption of trade restrictions, negotiation of the United Kingdom's relationship with the EU post-Brexit, and geopolitical risks. A perceived likelihood of more inward-looking policies could trigger a correction in asset valuations and an increase in financial market volatility from its current very low levels. In turn, a correction in asset valuations and higher financial market volatility could knock down spending and confidence more generally, especially in countries with financial vulnerabilities. Finally, Hurricane Harvey creates uncertainties for the US economy in the near term; the net effect on GDP will depend on how quickly economic activity in the affected region recovers (including port activity and operations reliant on oil and gas infrastructure) and then, on the upside, how large and fast the rebuilding effort will be.

Beyond the immediate term, risks are skewed to the downside and stem from a host of financial tensions, a possible inward-looking policy shift and persistently low inflation in advanced economies, and a range of noneconomic factors.

#### *Financial Tensions*

*Financial stability risks in China*: The revised growth forecast for China embeds slower rebalancing of activity toward services and consumption, a higher debt trajectory, and diminished fiscal space available to respond in case of an abrupt adjustment. Unless the Chinese authorities counter the associated risks by accelerating their recent encouraging efforts to curb the expansion of credit, these factors imply a heightened probability of a sharp slowdown in China's growth. Such an adjustment could be triggered, for instance, by a funding shock (in the short-term interbank market or in the funding market for wealth-management products), the imposition of trade barriers by trading partners, or a return of capital outflow pressures because of a faster-than-expected normalization of US interest rates. A growth slowdown in China would have adverse repercussions for other economies through weaker trade, commodity prices, and confidence.

*Tightening of global financial conditions:* Continued easy monetary conditions in advanced economies can seed excesses and leave the financial system (and the economic recovery) vulnerable to an abrupt decompression of risk premiums. Chapter 1 of the October 2017 GFSR presents a downside scenario in which these risks materialize, entailing a sizable output cost. An eventual repricing of risk could be triggered by a multitude of shocks, including faster-than-expected normalization of US monetary policy or a rise in global risk aversion. As discussed in the October 2017 GFSR, the search for yield amid historically low interest rates has pushed investors to move beyond their traditional risk mandates and is already causing a buildup of credit and liquidity risks and increased vulnerability to market risks in some countries and market segments. For instance, in the United States, credit risks are rising, as suggested by rising leverage in parts of the non-energy corporate sector and evidence of an erosion of underwriting standards in the corporate bond market. Even as the strength and health of banking systems continue to improve, policies still have a vital role to play in managing risks in the nonbank financial sector.

*Risks of capital flow reversals*: Corporate leverage has increased substantially in several emerging market economies (in addition to China) since the global financial crisis, with high levels of foreign currency–denominated corporate debt issuance. As discussed in the April 2017 GFSR, corporate leverage has started to decline from peak levels in some economies, reflecting, in part, a downturn in capital expenditure in extractive industries. Against this backdrop, net financial flows to emerging market and developing economies have picked up over the past year, as the current account balances of commodity exporters have shrunk and global risk appetite has recovered. Following a period of abundant credit supply, a sudden tightening of global financial conditions could expose financial fragilities, especially where buffers may be wearing thin after a period of macroeconomic strains and financial volatility. For instance, faster-than-expected monetary policy normalization in the United States could cause reversals in capital flows to emerging markets and an appreciation of the US dollar, imposing strains on economies with high leverage, balance sheet mismatches, or exchange rates pegged to the US dollar. At the same time, to the extent that such monetary policy tightening reflects a stronger outlook for the US economy, US trading partners would benefit from positive demand spillovers.

*Challenges facing euro area banks*: The euro area banking sector has made further progress with balance sheet cleanup since the spring, and bank credit growth to the nonfinancial private sector has been positive since mid-2015 (though below GDP growth). Nonetheless, nonperforming loan (NPL) ratios were still high in the first quarter of 2017, at about 5.7 percent for the euro area, and greater than 10 percent in six countries (including Italy, which accounts for about 30 percent of the euro area's NPL stock). Profitability also remains a challenge, with stubbornly high cost-to-asset ratios, especially for medium- and small-size banks. As discussed in Chapter 1 of the October 2017 GFSR, about one-third of global systemically important banks (mostly European banks) are not expected by analysts to generate sustainable returns, even by 2019. Low earnings hinder banks' ability to build cushions against unexpected losses and to raise capital in markets. Without a more concerted effort to clean up balance sheets and improve banks' cost efficiency, financial stability concerns and fears of adverse feedback loops among weak demand, prices, and balance sheets could be reignited in parts of the euro area. If political risks were to reemerge, for instance, an accompanying rise in long-term interest rates would worsen public debt dynamics, especially if inflation were to remain weak.

*Financial deregulation*: As discussed in Box 1.2 of the April 2017 GFSR, a broad rollback of the strengthening of financial regulation and oversight achieved since the global financial crisis—both nationally and internationally—could lower capital and liquidity buffers or weaken supervisory effectiveness, with negative repercussions for global financial stability.

### *A Retreat from Cross-Border Economic Integration*

Slow growth in median incomes since the global financial crisis and a longer-term trend of worsening income distributions have contributed to disillusionment with globalization in advanced economies—notably in the United States and parts of Europe. Over the longer term, a failure to lift potential growth and make growth more inclusive in advanced economies could exacerbate the risk of a retreat from cross-border integration and hinder the political consensus for necessary market-friendly reforms. Greater protectionism could disrupt global supply chains (Yi 2003; Bems, Johnson, and Yi 2010; Koopman, Wang, and Wei 2014), reduce global productivity, and make tradable consumer goods less affordable, harming low-income households disproportionately (Fajgelbaum and Khandelwal 2016). Similarly, indiscriminate curbs on immigration would hinder a channel for alleviating labor force constraints in aging societies and reduce opportunities for skills specialization and productivity growth over the long term.[6]

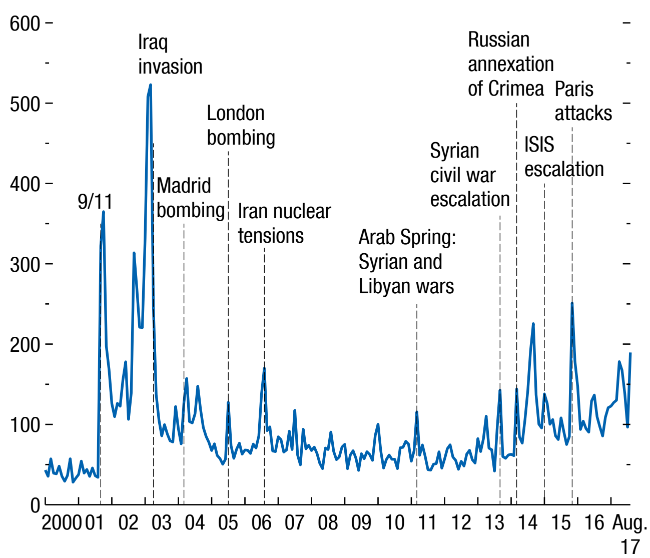
### *Persistently Low Inflation in Advanced Economies*

In many advanced economies, steady progress toward central bank inflation targets has been elusive, reflecting in part the slow reduction of spare capacity in labor markets. An environment of persistently subdued inflation (which could ensue if domestic demand were to falter) can carry significant risks by leading to a belief that central banks are willing to accept below-target inflation, thereby reducing medium-term inflation expectations.[7] Low inflation and interest rates would reduce central banks' capacity to lower real interest rates to restore full employment in an economic downturn. Real wages would also be less flexible, and when demand falters, firms would be more likely to resort to laying off workers to reduce costs, amplifying the recessionary impulse. In sum, prolonged below-target inflation deepens the

[6]Chapter 4 of the October 2016 WEO analyzes the impact of immigration flows on productivity growth in recipient countries.
[7]Chapter 3 of the October 2016 WEO provides a fuller discussion.

**Figure 1.17. Geopolitical Risk Index**
*(Index)*

Geopolitical risks have risen in recent months.




Source: Caldara and Iacoviello (2017).
Note: ISIS = Islamic State.

downside risks to advanced economies' medium-term growth prospects.

### *Noneconomic Factors*

Rising geopolitical tensions and domestic political discord can hurt global market sentiment and confidence, burdening economic activity. For many countries severely affected by such factors, the baseline scenario assumes a gradual easing of tensions. However, these episodes may turn out to be more protracted, delaying recovery in these economies. Measures of geopolitical risk have risen in recent months (Figure 1.17), and recent research shows that higher geopolitical tensions can weigh on global activity.[8]

Weak governance and large-scale corruption can also undermine confidence and popular support, taking a heavy toll on domestic activity. Other noneconomic factors weighing on growth in certain regions include the damaging effect of weather-related disasters, including the persistent effects of drought in eastern and southern Africa. If these factors intensify, the hardship in directly affected countries, especially smaller developing economies, would rise commensurately.

The risks discussed above are interdependent and can be mutually reinforcing. For example, a shift toward inward-looking policy approaches to cross-border trade, investment, and migration can increase geopolitical tensions and global risk aversion. In addition, noneconomic shocks can weigh directly on near-term economic activity and hurt longer-term confidence and market sentiment. Also, faster-than-anticipated tightening of global financial conditions or a shift toward protectionism in advanced economies could create capital outflow pressures from emerging markets.

## Fan Chart

A fan chart analysis—based on equity and commodity market data as well as the dispersion of inflation and term spread projections of private sector forecasters—yields a balance of risks that remains slightly tilted to the downside for 2017 and 2018 (Figure 1.18). Despite the broadly unchanged balance of risks around the global growth forecast, the contributions of selected risk factors have changed. Relative to the estimates made in October 2016, the distribution of term premiums forecasts and the prices of S&P 500 Index options now imply more upside risk to growth in 2017 and less upside risk to growth in 2018, likely reflecting less upbeat views for US fiscal stimulus over the medium term and optimistic valuations in the US stock market—both of which leave less room for upward surprises. At the same time, the distribution of inflation forecasts and oil price options imply somewhat more downside risk than a year ago, suggesting that analysts see greater scope for inflation and oil prices to surprise on the upside and dampen growth (an upward surprise in inflation could lead central banks to tighten monetary policy earlier than markets currently predict, while higher-than-expected oil prices would subtract from consumer disposable income).

The probability of a recession over a four-quarter horizon has declined relative to the probability computed in March 2017 in the euro area, Japan, and the Latin America 5 group (Brazil, Chile, Colombia, Mexico, and Peru), consistent with higher projected growth rates. Recession probabilities are broadly unchanged for the United States and other regions (Figure 1.19). Deflation risks—as measured by the esti-

[8]Caldara and Iacoviello (2017) construct an index of geopolitical risk and document how increases in the index have historically been associated with negative effects on a broad set of economic activity indicators.

mated probability of a decline in the price level four quarters ahead—have declined for the euro area and Japan, reflecting stronger projected growth in domestic demand. Deflation probabilities have increased slightly from low levels in the East Asia region, where inflation has softened in several economies in recent months, and for the Latin America 5 group, where inflation is projected to decline further over the coming year (as pass-through from earlier currency depreciations fade and negative output gaps continue to exert downward pressure on inflation in some economies).

## Policy Priorities

The main cross-cutting policy challenges are to boost potential output and ensure that its benefits are broadly shared, and to build resilience against downside risks. With countries now facing divergent cyclical conditions, varied monetary and fiscal policy stances remain appropriate—and completing the economic recovery and adopting strategies to ensure fiscal sustainability are still imperatives for many economies.

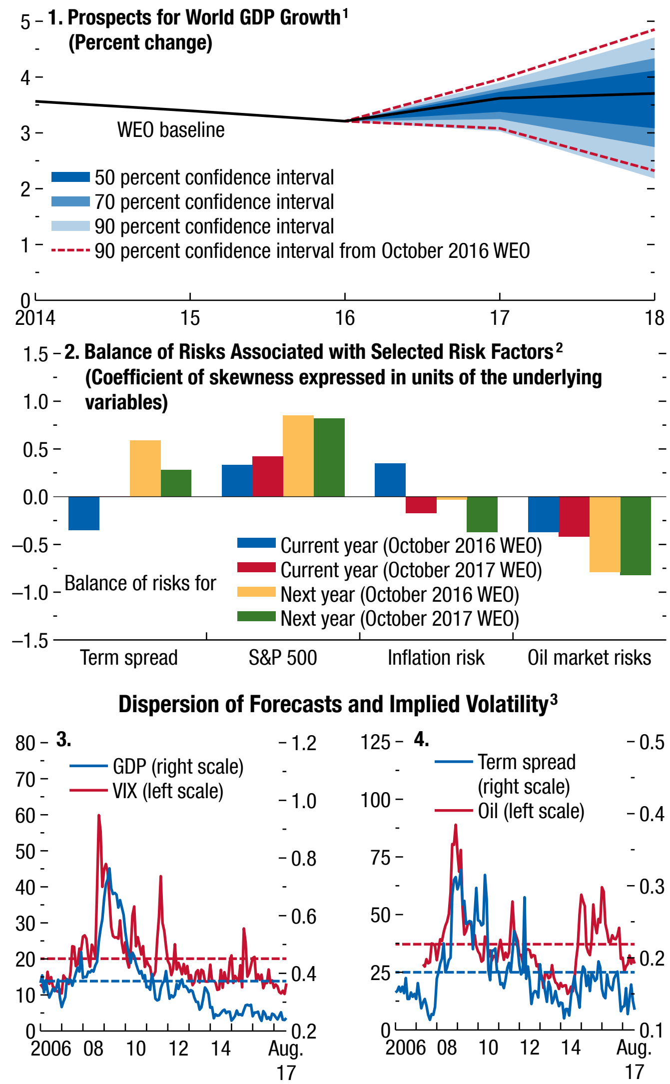
The urgency for structural reform is particularly high in advanced economies, where crisis legacies, demographic shifts, and continued weak productivity trends are restraining potential growth; but also in many emerging market and developing economies, many of which need to activate new sources of growth.

The cyclical upswing opens an ideal window of opportunity for making progress with reforms, especially those that have more powerful economic benefits when implemented in times of strong demand (such as reforms to job protection and unemployment benefits, as discussed in Chapter 2 of the April 2016 WEO). By the same token, where aggregate demand is still weak, macroeconomic policy needs to be supportive to foster reform implementation.

By acting together, policymakers could amplify the beneficial effects of reforms and help reduce downside risks to the outlook. The model simulations in Scenario Box 1 show that the IMF's macroeconomic policy advice for the Group of Twenty economies (in addition to what is already assumed in the WEO baseline) would have key global benefits, especially if implemented at the same time. The policy stimulus in countries with fiscal space would strengthen external demand for countries needing fiscal consolidation, buffering the near-term drag on activity; in advanced economies, tightening policy, the net effect on output of spillovers from abroad and domestic policy tight-

### Figure 1.18. Risks to the Global Outlook

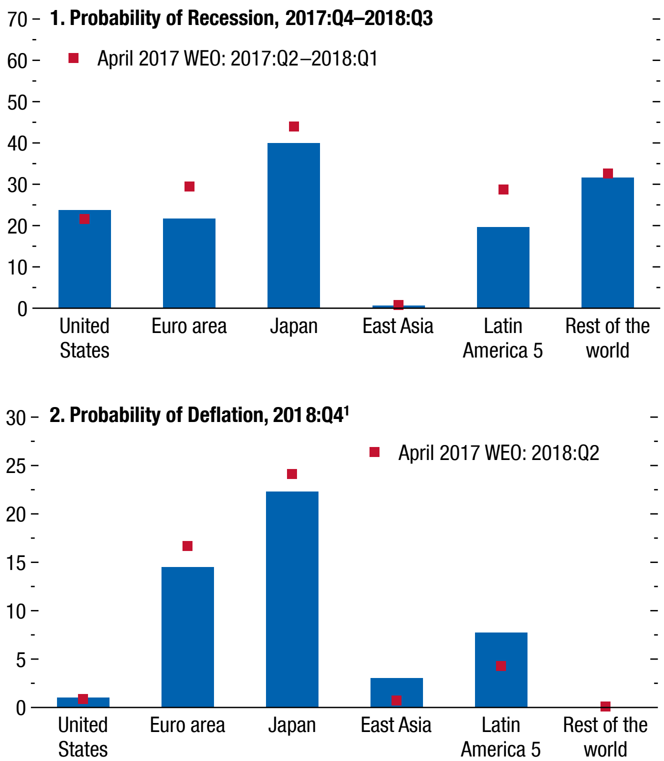
The balance of risks implied by the fan chart analysis is slightly tilted to the downside in 2017 and 2018.




Sources: Bloomberg L.P.; Chicago Board Options Exchange (CBOE); Consensus Economics; Haver Analytics; and IMF staff estimates.
[1]The fan chart shows the uncertainty around the October 2017 *World Economic Outlook* (WEO) central forecast with 50, 70, and 90 percent confidence intervals. As shown, the 70 percent confidence interval includes the 50 percent interval, and the 90 percent confidence interval includes the 50 and 70 percent intervals. See Appendix 1.2 of the April 2009 WEO for details. The 90 percent intervals for the current-year and one-year-ahead forecasts from the October 2016 WEO are shown.
[2]The bars depict the coefficient of skewness expressed in units of the underlying variables. The values for inflation risks and oil market risks enter with the opposite sign since they represent downside risks to growth.
[3]GDP measures the purchasing-power-parity-weighted average dispersion of GDP growth forecasts for the Group of Seven economies (Canada, France, Germany, Italy, Japan, United Kingdom, United States), Brazil, China, India, and Mexico. VIX is the CBOE Standard & Poor's (S&P) 500 Implied Volatility Index. Term spread measures the average dispersion of term spreads implicit in interest rate forecasts for Germany, Japan, the United Kingdom, and the United States. Oil is the CBOE crude oil volatility index. Forecasts are from Consensus Economics surveys. Dashed lines represent the average values from 2000 to the present.

### Figure 1.19. Recession and Deflation Risks
*(Percent)*

Relative to the spring, recession probabilities have declined for the euro area, Japan, and the Latin America 5 group and are broadly unchanged for the United States and other regions. Deflation risks have declined for Japan and the euro area.




Source: IMF staff estimates.
Note: East Asia comprises China, Hong Kong SAR, India, Indonesia, Korea, Malaysia, the Philippines, Singapore, Taiwan Province of China, and Thailand; Latin America 5 comprises Brazil, Chile, Colombia, Mexico, and Peru; Rest of the world comprises Argentina, Australia, Bulgaria, Canada, Czech Republic, Denmark, Israel, New Zealand, Norway, Russia, South Africa, Sweden, Switzerland, Turkey, the United Kingdom, and Venezuela. April 2017 WEO data refer to simulations run in March 2017. WEO = *World Economic Outlook*.
[1]Deflation is defined as a fall in the price level on a year-over-year basis in the quarter indicated in the figure.

ening would be positive. Overall, implementing the recommended policies would increase global fiscal sustainability and lead to permanently higher private investment and potential output. The boost to global demand would also magnify the effects of structural reforms on potential output.[9] Beyond these quantifiable macroeconomic benefits, the recommended policy measures would also help reduce downside risks to the global growth outlook.

[9]Based on IMF (2017d), which presents results for a similar scenario incorporating, in addition, the impact of structural reforms.

## Policies—Advanced Economies

Although cyclical positions across advanced economies are varied, most of the larger economies are still estimated to be operating somewhat below potential and are experiencing inflation rates below central bank targets (Figure 1.20). Potential growth faces headwinds from population aging and a widespread slowdown in productivity growth.

Although income distribution has remained broadly stable in most advanced economies in recent years, ongoing advances in labor-saving technologies and cross-border competition—important drivers of higher income inequality during the past few decades—suggest that inclusiveness cannot be taken for granted. Deliberate policy efforts are needed in many countries to ensure that most people see their living standards improve as national income increases.

### *Safeguarding the Momentum and Addressing the Remaining Crisis Legacies*

With a lack of steady progress toward bringing inflation closer to target and stabilizing long-term inflation expectations around those levels, monetary policy in advanced economies should chart an accommodative course. Although wage and price pressures are likely to pick up once the recovery firms further, a tendency for core inflation to repeatedly fall short of expectations calls for a cautious risk-management approach to reducing accommodation or progressing with normalization. A generalized perception that central banks will let inflation run below target for a prolonged period could lead to a downshift of long-term inflation expectations, which, in an environment of low equilibrium real interest rates, would be costlier and more difficult to reverse than a temporary overshoot in inflation.

The US Federal Reserve should stay on a data-dependent, well-communicated, and gradual path to normalization. The Bank of Japan should maintain a sustained accommodative stance, including its target for long-term interest rates. And the European Central Bank should wait for concrete evidence of a steady pickup in inflation before reducing the extent of accommodation. At the same time, stretched asset valuations and increasing leverage in some financial market segments bear close monitoring, and proactive micro- and macroprudential supervision, where necessary, remains important to ensure that appropriately easy monetary conditions do not fuel financial stability risks.

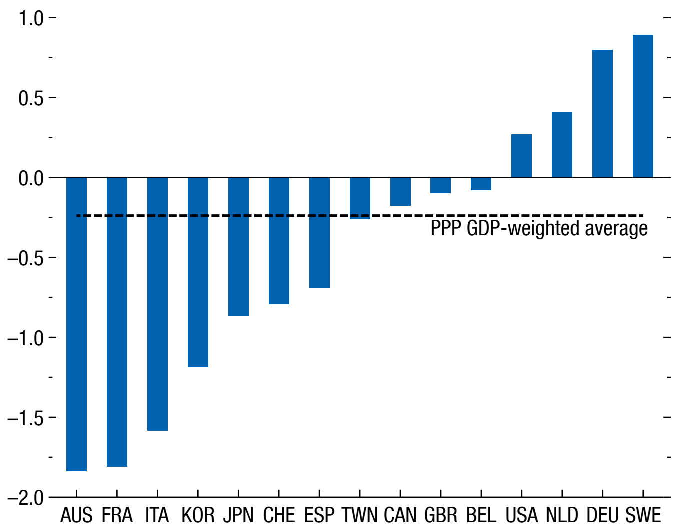
Fiscal policy should, in principle, also be calibrated with cyclical conditions but, in many advanced economies with remaining slack, it is constrained by the need to avoid potentially destabilizing public debt dynamics or to rebuild buffers. Given the need to secure the recovery and bolster inclusiveness, the composition of spending and revenues and any consolidation measures should be made as growth- and distribution-friendly as possible.

In the United States, where output is approaching potential, the consolidation should start in 2018. And in the short term, avoiding political brinkmanship over appropriations and promptly raising the debt ceiling are essential. In the euro area, countries with very low deficits and relatively low debt should use fiscal space to support structural reforms and boost public investment to raise potential growth. For instance, a more expansionary stance in Germany, where tax buoyancy amid an economic recovery is adding to fiscal space, would permit a much-needed increase in public investment while generating positive spillovers to countries with deficient demand. Avoiding a re-emergence of fiscal surpluses would also help correct the external imbalances of Germany. Indeed, as Chapter 4 emphasizes, higher public spending designed to boost potential output can have both domestic benefits as well as positive spillovers to other economies, especially those with economic slack and monetary accommodation. By contrast, gradual fiscal adjustment accompanied by growth-friendly measures is appropriate for Italy and France. In view of remaining economic slack and exceptionally weak core inflation, Japan should withdraw fiscal support very gradually, including through a gradual increase in the consumption tax rate over several years to bring the primary balance to a debt-stabilizing level, while prioritizing demand-friendly structural reforms. In the United Kingdom, where uncertainty about the outcome of negotiations with the EU weighs on sentiment and investment, a gradual consolidation path remains appropriate.

Strengthening resilience and securing the recovery in the euro area will also require accelerating the repair of bank balance sheets and durably improving banking system profitability. Only a comprehensive and proactive approach to reducing NPLs can lift the drag on credit growth and eliminate risks of an adverse feedback mechanism among weak inflation, balance sheets, investment, and productivity. Measures to accelerate the reduction of NPLs can include broadening European Central Bank guidance on NPL management to smaller banks, faster modernization and harmonization of insolvency regimes, and stimulating distressed debt markets by facilitating national asset-management firms. To raise bank profitability sustainably, further business-model upgrading, cost rationalization, and consolidation remain critical; a proactive approach to bank resolution could help provide incentives for action in these areas. Faster progress is also needed for completing the Banking Union (with a common, effective deposit insurance scheme and common fiscal backstop) and advancing the Capital Markets Union plan.

**Figure 1.20. Advanced Economy Output Gaps, 2017**
*(Percent of potential GDP)*

Most large advanced economies are estimated to be operating below potential.




Source: IMF staff estimates.
Note: Data labels in the figure use International Organization for Standardization (ISO) country codes. PPP = purchasing power parity.

### *Bolstering Medium-Term Potential Output and Inclusiveness*

A cyclical upswing provides a golden opportunity for adopting structural reforms and will amplify and accelerate their beneficial effects. Policymakers can safeguard and improve prospects for potential output through measures to expand labor supply and create an environment conducive to stronger productivity growth. Many of these reforms would also help raise the inclusiveness of income gains, and some would broaden economic opportunities across the skills spectrum. Reform priorities vary across countries, depending on the key impediments to potential output, but generally fall into the following areas:

- *Distribution-friendly fiscal policies*: As discussed in depth in the October 2017 *Fiscal Monitor*, governments seeking to improve equity in incomes and opportunities can rely on fiscal policy as a powerful redistributive tool. For many advanced economies with high public debt, limited fiscal space, and high tax and spending levels, fiscal and redistributive objectives should be achieved through revenue-neutral increases in tax progressivity, spending reallocations, and improved spending efficiency. In advanced economies where tax progressivity has declined in the past few decades, raising the top marginal tax rates and reducing opportunities for tax avoidance and evasion, especially for high-income earners, could improve the distribution of income. Many advanced economies also have room to significantly increase the taxation of immobile capital and wealth.
- *Investment in human capital*: Ensuring broad-based access to high-quality education promotes productivity and a more equitable distribution of income over the long term. It also raises the adaptability of the workforce to structural transformation, including a persistent shift in work and employment relations (with a greater incidence of part-time work in many advanced economies and a greater share of workers on temporary contracts), as highlighted in Chapter 2. Short-term measures to help households through economic downturns or technology- and trade-related displacement include active labor market policies (that help workers find jobs in expanding sectors) and social safety nets (to smooth the effects of temporary income loss and keep workers attached to the labor force). In the longer term, attaining inclusive and sustainable growth amid continued structural change will require adequate education, skills building and retraining, and policies (such as credit access) to facilitate geographic mobility. In the United States, policy priorities include supporting early childhood education and science, technology, engineering, and mathematics programs, and rethinking the financing model for public schools and funding for tertiary education to improve outcomes for youth from lower- and middle-income households. Apprenticeship and vocational programs have worked well in some countries to offer attractive careers (for example, in Germany) and can be upgraded in many countries, for instance, in France and the United States.
- *Investment in physical infrastructure*: Empirical evidence from advanced economies suggests that, if done right, infrastructure investment brings both short- and long-term benefits: an increase in public investment of 1 percent of GDP can raise the level of output by 1½ percent over the medium term (Abiad, Furceri, and Topalova 2016). After three decades of almost continuous decline, public investment in infrastructure and the stock of public capital as a share of output are near historic lows in advanced economies. Many countries could take advantage of the favorable funding environment to improve the quality of the existing infrastructure stock and implement new projects (see Chapter 3 of the October 2014 WEO). Countries with deficits in infrastructure include Australia, Canada, Germany, the United Kingdom, and the United States. Priorities vary but, in most cases, include upgrading surface transportation and improving infrastructure technologies (in high-speed rail, ports, telecommunications, broadband), as well as green investments.
- *Fostering greater labor supply*: Population aging will exert downward pressure on labor force participation rates in most advanced economies in the coming years, with growth in the workforce projected to decline from about 0.8 percent a year in 1995–2015 to about half that rate by 2022 (based on October 2017 WEO forecasts). To counter this decline, policymakers could raise the statutory retirement age (where doing so would help close funding gaps in pension systems) and take measures to accelerate the narrowing of gender gaps in labor force participation. Gender gaps could be narrowed by eliminating tax provisions that discourage second earners in households (Italy, Japan, United States), ensuring the availability of affordable child care (Canada, Germany, Italy, Japan, United Kingdom, United States), fostering flexible work arrangements (Canada, Japan), and offering family-friendly benefits such as parental leave (Canada, United States). In aging societies, ensuring the affordability of elderly care is also crucial, given that, if care is too expensive, it would typically be the secondary earners in households—typically women—who shoulder the burden of unpaid work at home. Immigration reform could also help expand the labor force, limit the increase in dependency ratios, and raise productivity and labor force growth in some countries (through, for example, skills-based immigration reform in the United States, continued targeted

immigration policy in Canada, and allowing more use of foreign workers in Japan). In Europe, integration of refugees into the workforce should be facilitated through swift processing of asylum applications, language training, job search assistance, better recognition of migrants' skills through credential systems, and support for entrepreneurship.

- *Product and labor market reforms*: Persistently sluggish productivity in some countries has led to greater emphasis on product and labor market reforms, especially given the scarcity of fiscal space. These reforms have been found to raise productivity and employment and to improve resilience to shocks.[10] Priorities include lower barriers to entry into professional services, certain network industries, or retail trade (for example, Australia, Greece, Italy, Japan, Spain); employment protection legislation reforms to reduce labor market duality, such as easing hiring and dismissal regulations for regular workers (for example, France, Portugal, Spain); reform of unemployment insurance and strengthening of active labor market policies and professional training and apprenticeship systems (for example, France); cutting of labor tax wedges (France, Germany, Italy); and reform of wage bargaining frameworks to ease the realignment of wages with productivity (Italy, France). Some countries also have scope to improve the business climate and the quality of public administration (Italy, Portugal). At a central level, the EU has room to provide better incentives for reforms at the national level with targeted funds from the EU budget and outcome-based benchmarking of reforms. Efforts to deepen single market integration—especially in the digital services, transport, and energy sectors—would also help raise productivity in EU members.

## Policies—Emerging Market Economies

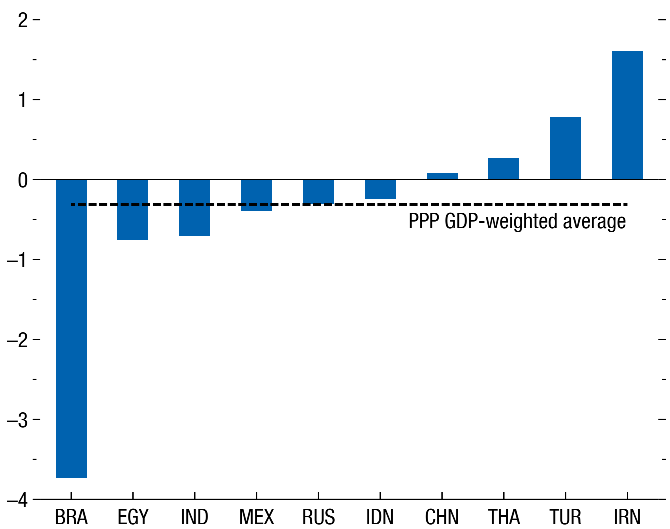
A critical challenge facing many emerging market economies is to preserve and extend the improvements in living standards achieved in recent decades. Priorities vary greatly, reflecting heterogeneity in cyclical positions and in the main impediments or risks to attaining strong medium-term growth.

### *Navigating Cyclical Conditions*

Cyclical conditions are even more diverse in emerging market and developing economies than in advanced economies, but output gaps are estimated to be negative in most of the larger countries in the group (Figure 1.21). The scope for easing fiscal policy to support economic activity is constrained, however, given that most countries have limited fiscal buffers and need to return their public finances to a sustainable footing. In several cases, the limited fiscal space reflects the incomplete withdrawal of the stimulus injected during the global recession, or a continued loosening in fiscal policy in recent years.

**Figure 1.21. Emerging Market and Developing Economy Output Gaps, 2017**
*(Percent of potential GDP)*

Cyclical conditions are diverse in emerging market and developing economies.




Source: IMF staff estimates.
Note: Data labels in the figure use International Organization for Standardization (ISO) country codes. PPP = purchasing power parity.

In Brazil, tackling the unsustainable expenditure mandates, including through reform of the pension system, is of first-order importance for restoring stronger confidence and fostering sustained growth in private investment. Should the economy recover faster than expected, a more front-loaded fiscal adjustment than envisaged in the budget would be warranted.

Mexico's gradual fiscal consolidation strategy remains appropriate, given the resilience of the economy and the desirability of setting public debt on a downward slope. Meanwhile, with its economy emerging from recession after an adjustment period, Argentina should accelerate its fiscal consolidation in 2018.

[10]A review can be found in Banerji and others (2017).

In China, the composition of fiscal policy should favor the rebalancing of the economy, and the augmented deficit should be gradually lowered to a debt-stabilizing level. The pace of deficit reduction planned in Russia would appropriately entail a steady adjustment to lower oil prices, but should be built on more permanent and better-targeted measures than currently envisaged.

In Saudi Arabia, a gradual but sustained fiscal consolidation to eliminate the budget deficit over several years would strike the right balance between safeguarding activity and preserving fiscal buffers.

As currencies have stabilized or gained against the US dollar since the spring, inflation has continued to decline in many emerging market economies, more recently helped by the decline in oil prices. Disinflation has been more rapid than expected in some countries, such as Brazil, India, and Russia, which has allowed monetary policy easing in recent months. Monetary policy will need to stay tight in countries where inflation rates remain well above central bank targets, such as in Argentina and Turkey. In China, where monetary accommodation should be gradually reduced, the monetary policy framework could be made more effective by phasing out monetary targets, resuming progress toward a more flexible exchange rate, and improving communications.

Exchange rate flexibility has served many emerging market and developing economies well in recent years. It has helped support capital inflows where domestic and external financial conditions have tightened, and helped safeguard growth and limit the drawdown of fiscal and reserve buffers following terms-of-trade declines in commodity exporters. Wherever possible, exchange rates should be used as the main buffer against external shocks.

Strengthening financial resilience is an overarching priority for emerging market and developing economies. In China, minimizing the risk of a sharp economic slowdown will require intensification of the authorities' current efforts to tighten supervision, rein in the expansion of credit, and tackle the underlying stock of bad assets.

Many other emerging market and developing economies with open capital accounts need to be mindful of a possible buildup of financial stability risks in an environment of easy global monetary conditions, and be aware of the risks from volatility as the US Federal Reserve gradually withdraws stimulus. Net capital inflow pressures for emerging market economies are likely to persist so long as monetary policy settings remain broadly accommodative and equilibrium real interest rates remain low in advanced economies. Countries receiving buoyant capital inflows may need to step up efforts in financial sector supervision and regulation to manage vulnerabilities, deter excessive borrowing, and help ensure that financing flows to projects that contribute to raising aggregate productivity.

Where an important share of external borrowing is undertaken directly by the corporate sector, curtailing any tax preferences for debt (over equity finance) could help keep the risk of overborrowing in check. Ensuring efficient corporate insolvency and restructuring frameworks would also help achieve faster and less costly resolution of problems should repayment difficulties arise as global financing conditions gradually become less accommodative.

### *Bolstering Medium-Term Potential Output and Inclusiveness*

Safeguarding and furthering past gains in per capita incomes and living standards is imperative across emerging market and developing economies in light of the sizable development needs of most countries. Some countries that are projected to maintain strong growth rates in the baseline forecast will need to keep the main downside risks in check (for instance, in China, where it would be advisable to deemphasize near-term growth targets and focus on reforms that would enhance the sustainability of growth). Countries with modest medium-term growth prospects will urgently need to tackle the most binding structural impediments to growth. Priorities vary, but, in many countries, include improving the quality of infrastructure and education, strengthening governance, enhancing the business climate, and facilitating greater female labor market participation, as well as a host of product and labor market reforms and further trade integration.

- *Inclusiveness*: As discussed in the *Fiscal Monitor*, emerging market and developing economies generally have higher levels of inequality than advanced economies but, in many cases, their lower administrative capacity and limited fiscal space restrict the fiscal tools available for redistribution. For countries with low administrative capacity and larger informal sectors, setting a relatively high tax-exempt threshold for the personal income tax and gradually decreasing it as administrative capacity improves would help increase compliance as well as progressivity over time. Reducing opportunities for tax avoidance and evasion, especially for high-income earners, is also important. Indirect taxation (such as a value-added tax or a consumption tax) has still the potential to be progressive, if revenues are used to finance progressive spending and if complemented by excise taxes on luxury goods. Improving access to quality education and health care for the disadvantaged is also crucial for improving equity. In education, efforts should be focused on eliminating enrollment gaps in primary and secondary education, especially for the disadvantaged, and expanding the role of private financing and student loans for higher education. In the area of health care, the priority is to achieve universal health coverage with a broad package of essential health services. Improving efficiency of social spending is also crucial.

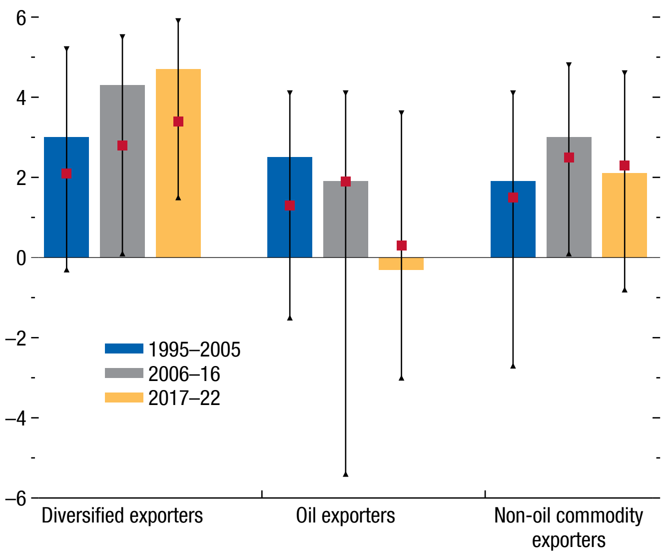
- *Infrastructure:* In emerging market economies and low-income countries, infrastructure provision per capita is still a fraction of that in advanced economies. Inadequate infrastructure is widely judged a key barrier to growth and development, especially in Latin America and sub-Saharan Africa. Selecting public infrastructure projects with diffused productivity gains and raising the efficiency of public infrastructure spending are principal challenges for many economies. In Brazil, ongoing efforts to make the infrastructure concessions program more attractive to investors while improving the standards of governance and program design would help alleviate key supply-side bottlenecks and support near-term demand. In Colombia, implementation of the authorities' infrastructure agenda would help reduce a historical infrastructure gap, foster private investment, and help exporters access markets.
- *Institutions:* Many emerging market and developing economies have substantial scope to improve the climate for business and investment. Decisive actions to enhance governance and the rule of law would help rein in corruption, strengthening business confidence and providing a boost to investment in some countries (for example, Brazil, Mexico, Peru). Strengthening institutions can also help reduce country risk perceptions and act as a countervailing force against a possible tightening of global financial conditions. Many countries could simplify regulations and administrative procedures for starting a business, increase the efficiency of the legal system, and reduce regulatory uncertainty (for example, Turkey, South Africa).
- *Unleashing greater labor supply*: Labor force participation rates for women are much lower than those for men in emerging market and developing economies (the average gap is close to 30 percentage points for emerging market economies of the Group of Twenty). Gender gaps in labor force participation not only hold back potential output, but also limit women's economic and social opportunities, harming inclusiveness. Priority reforms include eliminating legal barriers that prevent women from working, improving infrastructure, and enhancing gender equality in accessing social services, finance, and education (for example, India).
- *Product and labor market regulations and trade policies*: Fostering greater competition in domestic product and service markets, simplifying labor market regulations, and removing barriers to trade are also important broad reform areas for many economies, and involve a varied set of priorities. In South Africa, for example, further progress is needed to facilitate entry by new firms into power generation, transportation, and telecommunications, which would reduce the cost of key business inputs and thereby foster growth and job creation. The recent agreement to introduce a national minimum wage, combined with a code of good practice for collective bargaining, has the potential to raise living standards for those below the poverty line. At the same time, its employment impact will need to be carefully monitored, with the government standing ready to introduce complementary measures for vulnerable sectors, such as small and medium-sized enterprises. Further labor market reforms are advisable to ensure that wages are determined by firm-specific conditions. In India, simplifying and easing labor market regulations and land acquisition procedures are long-standing requirements for improving the business climate. Expanding the role of market forces in the economy is a priority in China and will entail removing barriers to entry in the highly closed services sector and allowing state-owned enterprises to face harder budget constraints. Productivity could be fostered by reducing tariff and nontariff barriers to international trade (for instance, Brazil, China, and India).

### Policies—Low-Income Developing Countries

As with the broader group of emerging market and developing economies, low-income developing countries dependent on commodity exports continue to face weaker economic prospects than those countries

**Figure 1.22. Per Capita Real GDP Growth across Low-Income Developing Countries**
*(Percent)*

Low-income developing economies dependent on commodity exports continue to face weaker economic prospects than those with more diversified export bases.




Source: IMF staff estimates.
Note: Bars denote PPP GDP weighted averages; red markers indicate the medians; and black markers denote the top and bottom deciles of per capita GDP growth in the country groups. Country groups are defined in IMF (2015).

with more diversified export bases (Figure 1.22).[11] With policy adjustments to lower oil revenues delayed, fiscal deficits in some commodity-exporting low-income countries remain large, external positions are weaker, and financial sector vulnerabilities are emerging. Although GDP is set to grow in most commodity-exporting low-income countries in 2017, fuel exporters are projected to do worse than nonfuel commodity exporters. By contrast, countries with more diversified export bases have recorded relatively strong growth, which is expected to continue at a rapid clip, in part, with the benefit of lower oil bills. Robust growth, however, has not always translated into improved fiscal and external current account positions, reflecting limited progress in adopting countercyclical policies and higher public sector spending.

Total public debt and debt service have therefore risen sharply across low-income developing countries, with about one-third at "high" risk of external debt distress or already in debt distress, and one-third at "moderate" risk.[12] Many low-income developing countries continue to experience conflict and security disruptions (Afghanistan, Chad, Somalia, South Sudan, Yemen, a few parts of Nigeria), whereas parts of sub-Saharan Africa face food insecurity related to droughts (The Gambia, South Sudan, Somalia).

With divergent prospects, policy priorities continue to differ across low-income developing countries.

- Prospects for commodity exporters are heavily influenced by the process of adjustment to lower commodity prices. The adjustment needs to continue and, in some cases, accelerate, based on comprehensive and internally consistent sets of policies. Fiscal policy needs to be better calibrated to contain debt accumulation while protecting outlays key to growth prospects, such as priority capital expenditures and social spending. In many countries, improvements in domestic revenue mobilization and continued rationalization of spending needs, along with concessional financing, are necessary to underpin successful adjustment processes. Allowing greater exchange rate flexibility—where an option—could act as a shock absorber and facilitate adjustment, supported by monetary policy settings to contain the inflation pressures that may result from currency depreciations. Financial stability needs to be maintained through enhanced financial sector regulation and supervision and by addressing emerging financial sector vulnerabilities, including increased domestic arrears and NPLs. Countries in or at high risk of debt distress need to accelerate the adjustment and limit nonconcessional external borrowing.
- Policy priorities for diversified low-income developing countries vary. However, an overarching goal for these economies should be to strike a better balance between spending for development and social needs and improving public debt sustainability by rebuilding fiscal positions and foreign reserves holdings while growth is strong.

Across all low-income countries, better debt management would also help those exposed to global financial markets cope with volatility in capital inflows, balance sheet currency exposures, and the prospect of monetary policy normalization in the United States. Over the long term, the 2030 Agenda for Sustainable Develop-

[11]Classifications of low-income countries according to commodity dependence can be found in IMF (2015).

[12]Based on the Debt Sustainability Framework for Low-Income Countries, as described in IMF (2013b).

ment identifies a broad range of issues that will require action to deliver durable and inclusive growth. Within this framework, generating sustainable and resilient growth will require steps to promote diversification and structural transformation and bridge infrastructure gaps. In particular, efforts to boost domestic revenue mobilization, strengthen debt management, and ensure that public spending is efficient and well targeted would contribute to scaling up infrastructure investment without endangering public debt sustainability. To make growth more inclusive and resilient, policies should be oriented toward creating jobs and encouraging gender equality, promoting environmental sustainability, boosting access to financial services, and strengthening the redistributive role of fiscal policy to protect the most vulnerable.

## Multilateral Policies

Strong, sustainable, balanced, and inclusive growth requires a well-functioning, cooperative, multilateral framework for international economic relations. Because national policies create spillovers across countries, all countries are better served when policymakers engage in regular dialogue and work within agreed mechanisms to resolve disagreements. At the same time, the international community continuously needs to adapt the multilateral system to the changing global economy. Active dialogue and cooperation will help improve and modernize rules while addressing individual countries' valid concerns. This process will ensure continued mutual benefits and evenhandedness and, together with strong domestic policies, help avoid a broad withdrawal from multilateralism, either through widespread protectionism or competitive races to the bottom in taxation and financial and regulatory oversight. Multilateral cooperation is also vital for addressing important longer-term challenges in the global economy, including providing support to low-income countries for meeting development goals and mitigating and adapting to climate change.

### *Maintaining Rules-Based, Open Multilateral Trade with Broadly Shared Gains*

Cross-border economic integration through trade openness has been a critical source of productivity growth and resilience over the past several decades for countries at all income levels.[13] Hundreds of millions were lifted out of poverty in emerging market and developing economies during a period of rapid cross-border integration, helping reduce global income inequality. However, global trade has slowed dramatically in recent years, mostly reflecting weakness in aggregate demand, but also the slower pace of new trade reforms and an uptick in protectionist measures. And trade rules have not kept pace with the evolving global economy; for example, integrated global production structures require more coherent rules across several policy areas, such as goods trade, services trade, investment policy, and intellectual property.

Rolling back temporary barriers to trade introduced since the global financial crisis and reducing trade costs would support the nascent recovery in trade, reigniting an important driver of global productivity growth. To that end, pressing ahead with an ambitious trade agenda is crucial. A global trading system—with strong, well-enforced rules that continue to adjust to promote competition and a level playing field—remains critical (IMF, World Bank, and WTO 2017). Addressing tariff barriers in sectors where they remain high, such as agriculture, and implementing commitments under the Trade Facilitation Agreement, which came into effect in February 2017, can significantly reduce trade costs in traditional areas. Advancing trade reforms in services and in other areas, such as digital trade, and improving cooperation in investment policies can make positive contributions to cross-border trade flows and global growth; although progress is best made at the global level, ambitious, broad-based regional agreements that address these "frontier" areas of trade policy can also be helpful. As discussed in Chapter 1 of the April 2017 WEO, open trade policies should be complemented by comprehensive policy approaches at national levels to reduce adjustment pains and provide opportunities for all.

### *Cooperation for Maintaining Global Financial Stability*

Maintaining robust national financial regulatory regimes, including in countries and regions with systemic financial systems, such as China, Europe, and the United States, and recapitalizing institutions and cleaning up balance sheets where necessary produces positive spillovers for global financial stability.

[13]A body of research has documented that economic integration together with technological progress has increased the efficient use of global resources, boosted incomes, and expanded access to goods and services. For a recent summary, see Baldwin (2016). See also Wacziarg and Welch (2008); Costinot and Rodríguez-Clare (2013); and Fajgelbaum and Khandelwal (2016).

In addition, there is an urgent need to finalize the international financial regulatory reform agenda by tackling outstanding challenges, such as the regulation and oversight of financial institutions, including nonbanks; ensuring regulators can resolve globally systemic financial institutions effectively; and strengthening the resilience of central counterparty clearing for derivatives. Coordinated and collective action is needed to manage risks to financial stability from cyberattacks, money laundering, and terrorism financing. Closer cross-border regulatory cooperation is also needed to address the pressures that several countries have experienced in correspondent banking relationships, which play a key role in facilitating global trade, remittances, and economic activity. As shown in Box 1.5, remittances have grown in global importance and are a key mechanism for sustaining consumption in the face of income shocks.

Last, the high degree of international financial interconnectedness and vulnerability in some regions calls for a closely coordinated and adequately resourced global financial safety net as well as stronger frameworks for the prevention and resolution of debt crises.

### *Cooperation on International Taxation Issues*

As increased capital mobility across borders has fueled international tax competition, governments have found it more challenging to finance their budgets without increasing taxes on labor income or imposing regressive consumption taxes. International corporate income tax evasion and avoidance through, for example, profit shifting to lower tax jurisdictions, could further erode popular support for international trade and investment integration. Policymakers can make more meaningful progress toward equitable tax systems (that prevent an increasing share of after-tax income from accruing to owners of capital) if their national efforts to safeguard revenues are backed by multilateral cooperation.

### *Noneconomic Challenges*

Multilateral cooperation is also indispensable for addressing important medium-term global challenges, such as meeting the 2030 Sustainable Development Goals, and providing financial support to vulnerable economies and fragile states that face the greatest development needs and, in many cases, deep economic and security challenges. The international community will have a key role to play in fostering and coordinating financial and other types of support for countries most vulnerable to climate change. As discussed in Chapter 3, increases in temperature have vastly unequal effects across the world, with the brunt of adverse consequences borne by those who can least afford it and those who have contributed the least to the rising threat of climate change. Low-income countries will likely suffer disproportionately from further global warming, which is expected to trigger more severe droughts, storms, and epidemics. Coupled with rising sea levels, these effects could feed social unrest and refugee flows, with important cross-border implications. A concerted multilateral effort to help vulnerable economies cope with the consequences of climate change and stem the man-made causes of global warming is amply justified from both equity and efficiency perspectives.

## Scenario Box 1. Impact of Recommended Policies in the Group of Twenty Economies

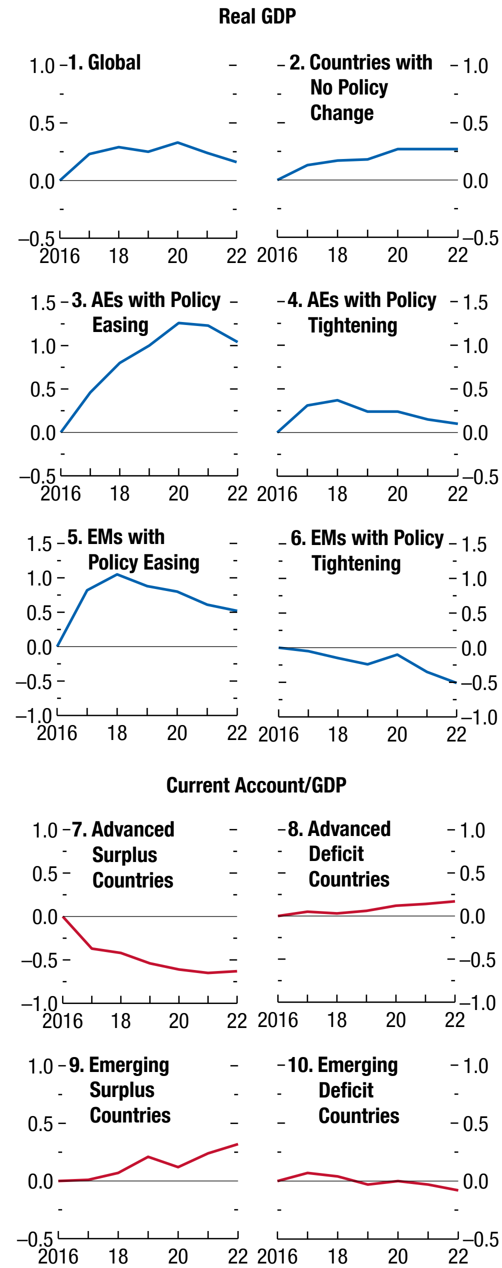
The IMF's G20 Model (G20MOD) is used here to estimate the global impact of implementing the IMF's Article IV monetary and fiscal policy advice to the Group of Twenty (G20) countries that is in addition to what is assumed in the *World Economic Outlook* (WEO) baseline.[1] A qualitative indicator of the recommended policy measures relative the WEO baseline is presented in Scenario Table 1. Less than half of G20 advanced and emerging market economies ease policy. For advanced economies, fiscal policy is eased in Germany, Japan, and Korea, and monetary policy accommodates that easing. In emerging market economies, fiscal policy is eased in the near term in Saudi Arabia, while additional monetary stimulus is provided in Mexico and Russia. Many remaining G20 countries tighten policy. Fiscal policy is tightened in France, Italy, Spain, the United States, Argentina, Brazil, China, India, Indonesia, and Turkey. Monetary policy is also tightened in China and Turkey. Several G20 countries—Australia, Canada, South Africa, and the United Kingdom—along with non-G20 countries have no discretionary changes in monetary or fiscal policy stances relative to the WEO baseline. However, recommendations for many G20 countries include budget-neutral increases in infrastructure spending that on balance act to stimulate activity owing to the resulting positive impact on productivity and thus private investment and real incomes.

The net impact over the WEO horizon is to raise global GDP (Scenario Figure 1). GDP is higher in all groups of countries except emerging market economies that are tightening policy. The positive spillovers from easing countries more than offset the own impacts in advanced economies that are tightening policy. However, the magnitude of the dampening impact of tighter policy in emerging market economies is too large to be offset by the policy easing elsewhere and largely reflects the relative importance of China and the magnitude of the policy tightening there.[2]

The mix of recommended policies has several benefits at the global level. The policy stimulus in countries with fiscal space strengthens external demand for those countries needing fiscal consolidations. This buffers the

**Scenario Figure 1. Group of Twenty Macro Scenario**

*(Percent difference from baseline)*




Source: IMF staff estimates.
Note: AEs = advanced economies. EMs = Emerging market economies.

[1]The quantification of the fiscal and monetary policy advice is based on IMF (2017d).

[2]Part of the tightening in fiscal policy in China is related to restructuring of state-owned enterprises to facilitate product market reforms, the benefits of which accrue over the medium term and are not included here, but can be found in IMF (2017d).

## Scenario Box 1 *(continued)*

### Scenario Table 1. Assumed Policy Actions Relative to the WEO Baseline

Color Key:
- Ease substantially
- Ease moderately
- Accommodate
- Tighten moderately
- Tighten substantially
- No change

| | Monetary | Fiscal[1] Near term | Fiscal[1] Long term |
|---|---|---|---|
| **Advanced Economies Easing Policy** | | | |
| Germany | Accommodate | Ease moderately | Ease substantially |
| Japan | Accommodate | Ease moderately | Tighten moderately |
| Korea | Accommodate | Ease substantially | Ease substantially |
| **Advanced Economies Tightening Policy** | | | |
| France | Accommodate | No change | Tighten substantially |
| Italy | Accommodate | No change | Tighten substantially |
| Spain | Accommodate | Tighten moderately | Tighten substantially |
| United States | No change | Tighten moderately | Tighten substantially |
| **Emerging Market Economies Easing Policy** | | | |
| Mexico | Ease substantially | No change | No change |
| Russia | Ease moderately | No change | No change |
| Saudi Arabia | No change | Ease substantially | Tighten substantially |
| **Emerging Market Economies Tightening Policy** | | | |
| Argentina | No change | No change | Tighten substantially |
| Brazil | No change | Tighten substantially | Tighten substantially |
| China | Tighten moderately | Ease moderately | Tighten substantially |
| India | No change | Tighten moderately | Tighten moderately |
| Indonesia | No change | Tighten moderately | Tighten moderately |
| Turkey | Tighten substantially | Tighten substantially | Tighten substantially |
| **No Policy Changes** | | | |
| Australia | No change | No change | No change |
| Canada | No change | No change | No change |
| South Africa | No change | No change | No change |
| United Kingdom | No change | No change | No change |
| Other euro area | Accommodate | No change | No change |
| Non-Group of Twenty | No change | No change | No change |

Source: IMF staff compilation.
[1]Defined as the difference between the projected and recommended level of the cyclically adjusted primary balance.

near-term negative impact on activity while increasing overall global fiscal sustainability. In the medium term, lower global public debt reduces global real interest rates, leading to permanently higher private investment and potential output. External imbalances also improve, but not everywhere. For advanced economies where external imbalances have recently widened, these policy measures yield an improvement, with current accounts falling in surplus countries and rising in deficit countries. For emerging market economies, however, external imbalances rise modestly. In large part, this reflects the scale of adjustment in China and its impact on domestic demand and thus imports.[3] In addition to these quantifiable macroeconomic benefits, the recommended policy measures also help to reduce risks to the outlook, lowering the probability of sharp adjustments down the road and raising medium-term sustainable growth.

[3]It is worth noting that IMF Article IV policy advice also includes structural and other reform measures that are not included here and those measures, particularly for China, will help to reduce external imbalances.

## Box 1.1. Labor Force Participation Rates in Advanced Economies

In advanced economies, fewer people in the adult population (those 15 and older) have been working or actively looking for work since the turn of the century.[1] This mild downturn in the labor force participation rate began around 2000, appears to have picked up since 2007, and is generally projected to continue and eventually gather pace as populations age.

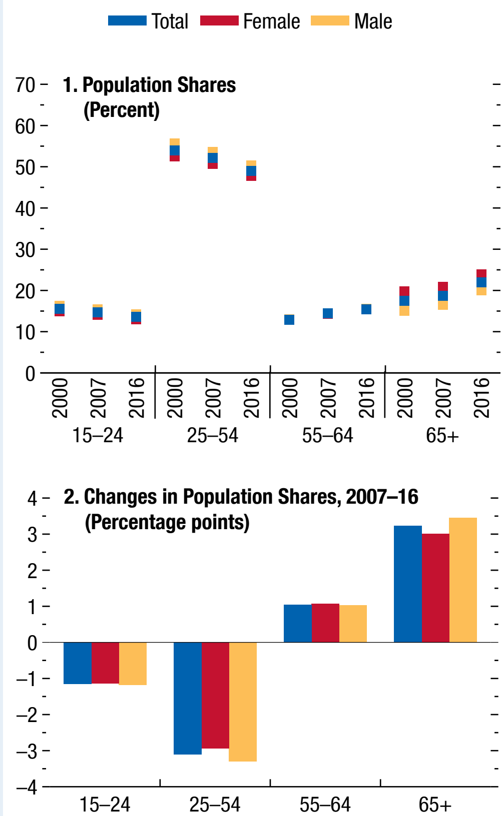
Population aging generally puts downward pressure on the overall participation rate. In advanced economies, the population shares of young (age 15–24) and prime-age workers (age 25–54) have been declining, while those of the 54–64 and 65+ age groups have been rising (Figure 1.1.1). Given that the 54–64 and especially the 65+ age groups have lower participation rates than the prime-age group, these shifts tend to lower the overall participation rate.

But beneath the headline figures, the variations in how participation rates within various age and gender groups have changed are striking, with remarkable gains in the participation rates of women in some countries. If such gains continue and broaden, the demographic transition may not immediately translate into a slowdown in the growth of the labor force. This heterogeneity (as well as some evidence of convergence in participation rates) also suggests that there is scope for policies to postpone the adverse effects of the demographic transition on the growth rate of the workforce.

### *Age Groups*

For the adult population of advanced economies as a whole, labor force participation rates declined by 0.8 percentage point since 2007.[2] Participation rates declined for the young (age 15–24—the group with the largest cross-country dispersion in participation rates), in part because more people stay in school for longer.[3] For the 25–54 age group, where participation remains the highest, rates have been mostly flat in total, though with starkly divergent paths for men and women, with men's participation rate declining and women's increasing. Participation rates of both men and women in the 55–64 age group showed a sharp rise, and the 65+ participation rates also rose for both genders, especially after 2007 (Figure 1.1.2).[4]

**Figure 1.1.1. Population Shares by Age Group and Gender**




Sources: Organisation for Economic Co-operation and Development; and IMF staff calculations.
Note: The figure shows population-weighted averages across 31 advanced economies.

Prepared by Zsóka Kóczán, with research assistance from Ava Hong.

[1] Unless stated otherwise, the figures for advanced economies in this box refer to the combined workforces and working-age populations of 31 advanced economies, which account for about 95 percent of the total population of countries classified as advanced economies in the *World Economic Outlook* (WEO).

[2] The total labor force participation rate can be written as the population-share weighted average of the participation rates of different age groups:

$$LFPR_t = \sum_{i=1}^{4} LFPR_t^i \frac{pop_t^i}{pop_t}.$$

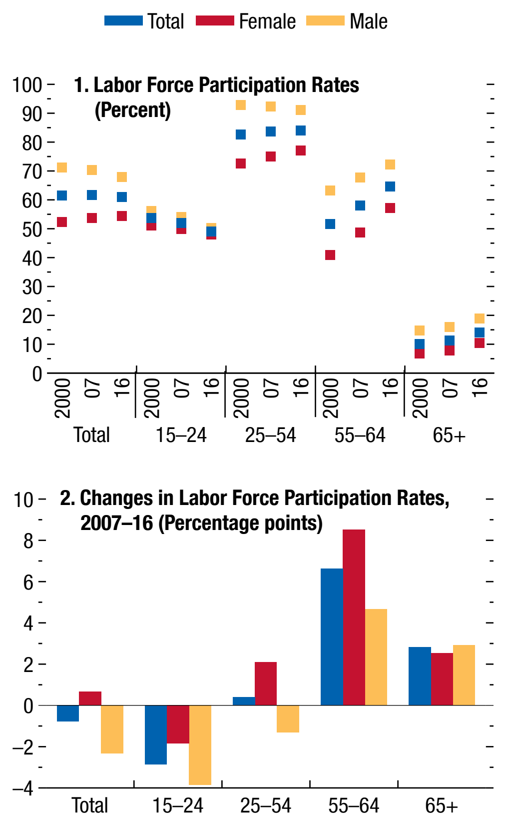
Here, *i* refers to the following age groups: 15–24, 25–54, 55–64, 65+. Results are robust to using a finer breakdown of age groups into five- or 10-year intervals.

[3] As discussed, for instance, by Balleer, Gómez-Salvador, and Turunen (2009); Aaronson and others (2014); Council of Economic Advisors (2014); Canon, Kudlyak, and Liu (2015); and Dvorkin and Shell (2015).

[4] Declining participation rates of the young and prime-age men are highlighted by Balleer, Gómez-Salvador, and Turunen

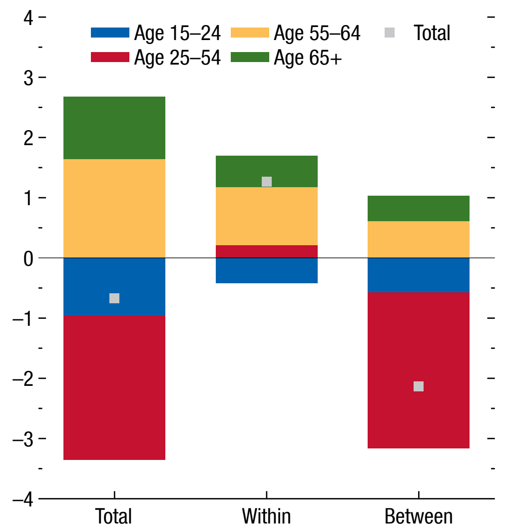
## Box 1.1 *(continued)*

**Figure 1.1.2. Labor Force Participation Rates by Age Group and Gender**




Sources: Organisation for Economic Co-operation and Development; and IMF staff calculations.
Note: The figure shows population-weighted averages across 31 advanced economies.

**Figure 1.1.3. Decomposition of Change in Labor Force Participation Rate, 2007–16**




Source: IMF staff calculations.
Note: Total population across 31 economies normalized to 1. Within and between changes are based on, respectively, population and labor force participation rates held constant at 2007 levels. Between changes include the small interaction effect.

Shifting population shares have tended to push overall participation rates down, while rising participation rates within some age groups have tended to increase them. This effect can be documented using a shift-share decomposition, as illustrated in Figure 1.1.3. The figure decomposes changes in overall participation rates into changes in participation rates within each age group while holding their population shares fixed ("within changes"), a shift in the relative sizes of age groups while holding participation rates fixed ("between changes"), and an interaction term:

$$\Delta LFPR_t = \sum_{i=1}^{4}(\Delta LFPR_t^i PS_0^i + LFPR_0^i \Delta PS_t^i - \Delta LFPR_t^i \Delta PS_t^i)$$

where $PS_t^i = \frac{pop_t^i}{pop_t}$ is the population share and $t = 0$ refers to year 2007, the initial year. The contribution of the interaction term (combining changes in participation rates and changes in group sizes) is typically very small and is included in the "between change" in Figure 1.1.3.

This decomposition suggests that the decline in overall participation rates was driven by aging—captured by "between changes"—while "within changes" would have acted to increase participation rates: the contribution of the decline in the participation rates of the young is more than offset by the increase in participation rates of the age 25 and

(2009), Dvorkin and Shell (2015), Council of Economic Advisors (2016), and Krause and Sawhill (2017). In European economies, this stands in contrast with rising female labor force participation, which has been declining in the United States (for example, Krause and Sawhill 2017). Balleer and others (2009) examine the drivers of the increase in labor force participation rates during the precrisis period in the euro area and predict a fall in participation rates over the following years based on an age and cohort analysis.

## Box 1.1 *(continued)*

older groups.[5] This finding reflects a continuation of precrisis trends; at the same time, the drags from shifts toward the older age groups and from the decline in the participation rates of the young were more pronounced after 2007.

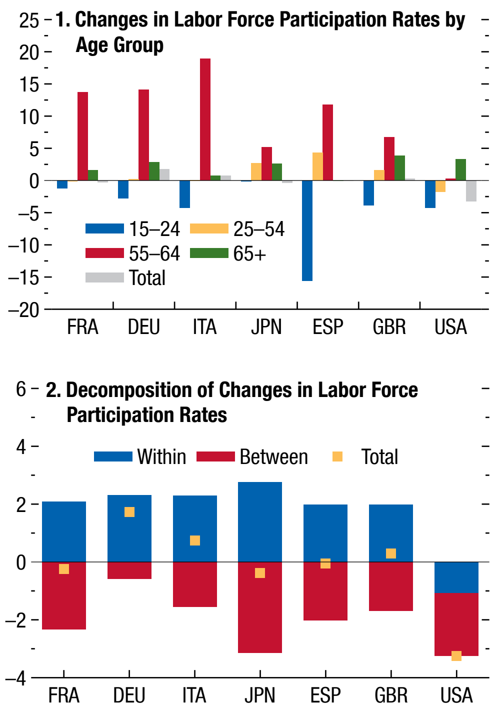
This broad pattern—aging weighing on participation rates, and rising participation of older workers more than offsetting the falling rates of younger workers—holds across most of the large European economies. Their net effect is positive in Germany, Italy, and the United Kingdom (Figure 1.1.4).[6] In the United States, the decline in the participation rate of prime-age workers (ages 25–54) has compounded the effects of aging. Because of the decline in the participation rate of US prime-age workers, the United States makes a sizable contribution to the decline in the overall sample of advanced economies. In fact, the overall labor force participation rate of the remaining 30 countries increased by 0.4 percentage point between 2007 and 2016.

### *Gender*

The 0.8 percentage point decline in participation between 2007 and 2016 masks a striking divergence between men and women: men's participation rate fell by 2.3 percentage points during this period, while that of women increased 0.7 percentage point. A shift-share decomposition similar to that shown in Figure 1.1.3, but further splitting age groups by gender, confirms such differences for the 25–54 age group in particular, where participation rates of men have been falling but those of women have been rising.[7] This pattern became more pronounced after the global financial crisis (Figure 1.1.5): in the precrisis years male participation rates in this group still increased in Germany and Italy (and showed only a very small drop in France and the United Kingdom), so that the overall contribution of the 25–54 age group to participation rates was positive, while postcrisis the declining rates for men more

**Figure 1.1.4. Changes in Labor Force Participation, Select Advanced Economies, 2007–16**

*(Percentage points)*




Sources: Organisation for Economic Co-operation and Development; and IMF staff calculations.
Note: Within and between changes are based on, respectively, population and labor force participation rates held constant at 2007 levels. Between changes include the small interaction effect. Labels in the figure use International Organization for Standardization (ISO) country codes.

than offset the effects of rising rates for women. The United States again stands out from other large advanced economies, with declining participation rates of prime-age women, and, to a greater extent, of men.[8] Over time, there has been some convergence of participation rates, especially of female participa-

[5]This is in line with the findings of Aaronson and others (2014), who examine the causes of the decline in participation rates in the United States and highlight the role of structural forces, such as aging.

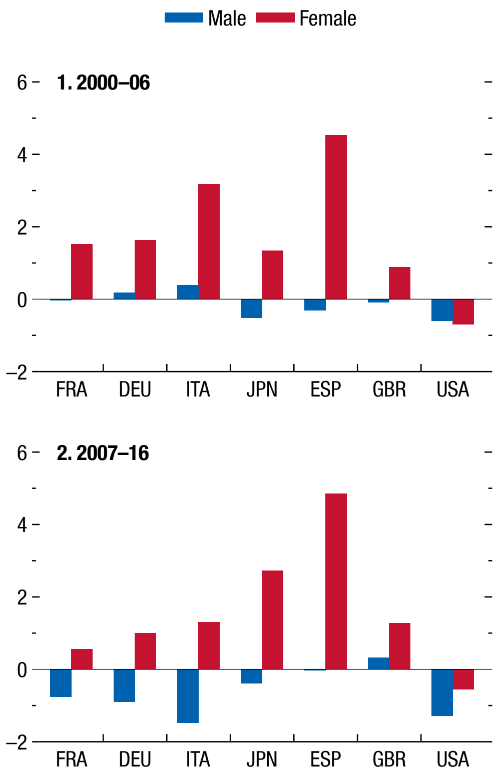
[6]As expected, the effects of aging are most pronounced in Japan. The increase in participation rates of the 55–64 group is largest in continental Europe.

[7]Changes in the participation rates of other age groups and the effects of aging act in the same direction for males and females.

[8]Council of Economic Advisors (2016) documents the trend of declining prime-age male labor force participation in the United States over the past half century and examines a number of potential explanations. The analysis suggests that reductions in the demand for labor, especially for lower-skilled men, appear to be an important component of the decline in prime-age male labor force participation.

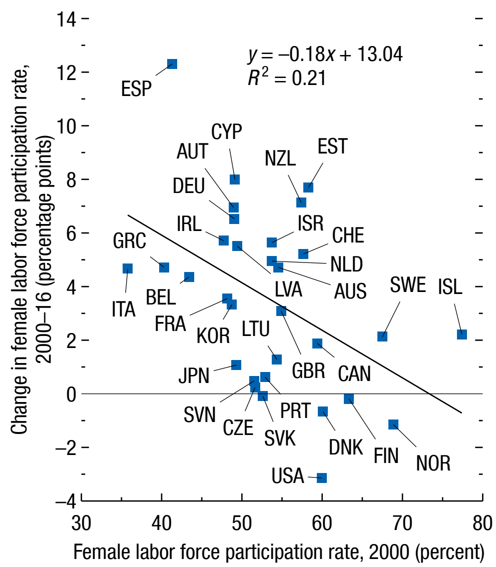
## Box 1.1 *(continued)*

**Figure 1.1.5. Changes in Labor Force Participation Rates for the 25–54 Age Group by Gender, Select Advanced Economies**
*(Percentage points)*




Source: Organisation for Economic Co-operation and Development.
Note: Labels in the figure use International Organization for Standardization (ISO) country codes.

**Figure 1.1.6. Convergence in Female Labor Force Participation Rates**




Source: Organisation for Economic Co-operation and Development.
Note: Labels in the figure use International Organization for Standardization (ISO) country codes.

tion rates: countries where participation rates were lower in 2000 tended to see larger increases, while those with the highest rates saw smaller increases or outright declines (Figure 1.1.6).[9]

### *Outlook and Policy Implications*

Looking ahead, demographics are likely to continue to play a prominent role in determining the path of the aggregate labor force participation rate. Over the longer term, the downward influence of aging on the aggregate labor force participation rate is likely to dominate. This will restrain growth in the "potential labor force" (affected by the size and age composition of the working-age population and the participation rates of the demographic groups) and hence potential output, as noted in Chapter 3 of the April 2015 WEO.

Policies to raise participation would help slow the decline in the labor force growth rate, in turn slowing the rise of the dependency ratio and thereby supporting fiscal sustainability. Eliminating policies that discourage second earners in households, ensuring the availability of affordable child care and elderly care, fostering flexible work arrangements, and offering family-friendly benefits, such as parental leave, would generally be beneficial.

---

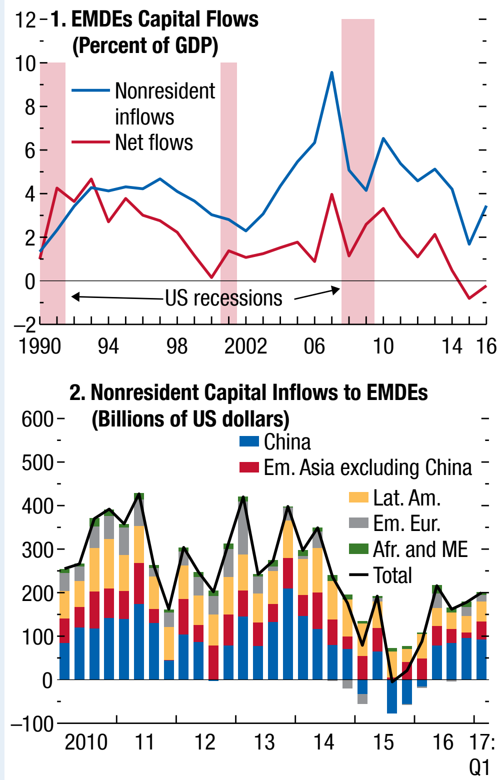
[9]Blau and Kahn (2013) examine the drivers of this convergence and find that the expansion of family-friendly policies (including parental leave and part-time work entitlements) in other Organisation for Economic Co-operation and Development countries can explain close to 30 percent of the relative decrease in US women's labor force participation. However, they note that these policies also appear to encourage part-time work and employment in lower-level positions: in the United States, women are more likely than in other countries to have full-time jobs and to work as managers or professionals.

**Box 1.1 *(continued)***

However, given the divergent paths in participation rates across the countries highlighted above, policy priorities vary with country-specific circumstances. In the United States, where both male and female prime-age participation rates have been declining, more targeted measures may be needed (see IMF 2017a). Immigration reform would also raise the size of the labor force and boost participation rates and could largely offset further declines in participation caused by aging.

## Box 1.2. Will the Revival in Capital Flows to Emerging Markets Be Sustained?

**Figure 1.2.1. Capital Flows to Emerging Market and Developing Economies**




Sources: Haver Analytics; and IMF staff estimates.
Note: Afr. and ME = Africa and the Middle East; Em. Asia = emerging Asia; Em. Eur. = emerging Europe; EMDEs = emerging market and developing economies; Lat. Am. = Latin America.

Capital flows to emerging markets slumped to a multidecade low in 2015, prompting concerns that outflow pressures could trigger a broader economic downturn and lead to crises in those economies (see Chapter 2 of the April 2016 *World Economic Outlook*). A useful measure for illustrating the unusual downturn is *nonresident capital inflows*, which are defined as the net acquisition of emerging market assets by foreign investors (also referred to as *gross inflows*). As a share of emerging market GDP, nonresident inflows fell to 1.6 percent in 2015, the lowest level since 1990 (Figure 1.2.1, panel 1). Another useful measure is *net capital flows*, which is defined as nonresident inflows less net outward investment by emerging market economy residents excluding official reserves accumulation. Net capital flows turned negative in 2015 for the first time in at least 35 years, reaching –1.0 percent of emerging market GDP, and remained negative the following year.

In recent quarters, however, capital inflows to emerging markets have revived. Total nonresident capital inflows to emerging markets are estimated to have averaged $200 billion in the first two quarters of 2017, up from a quarterly average of $120 billion in 2015–16 (Figure 1.2.1, panel 2). Net capital flows have also turned up in recent quarters, reaching $115 billion in the first half of 2017. The sharp downturn and the recent revival in both measures of capital flows can be attributed to two main developments—the evolution of China's financial account and a rollercoaster ride in portfolio flows to emerging markets.

### *Stabilization of External Pressures in China*

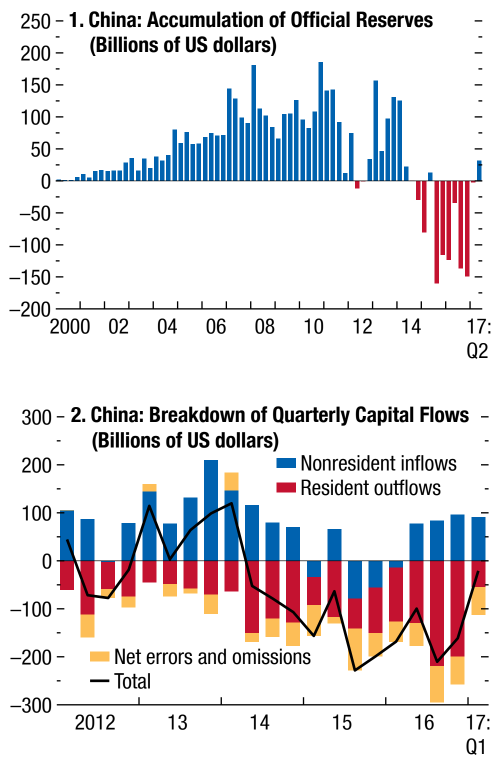
China experienced a sharp decline in nonresident capital inflows between the third quarter of 2015 and the first quarter of 2016. During this period, concerns about the possibility of a sharp depreciation of the Chinese renminbi prompted the repayment of dollar debt by Chinese firms. In addition, foreign investors sought to reduce their exposures to renminbi assets, especially offshore bank deposits. Because those funds had been on-lent by Chinese banks' foreign affiliates to banks domiciled on the mainland, the mainland banks had to repay those loans, thus further reducing total external debt (see McCaulay and Shu 2016). External pressures prompted large reserves interventions by the central bank, which kept renminbi depreciation in check (Figure 1.2.2, panel 1).

Initially, the capital flows reversal was driven primarily by a reduction in Chinese liabilities to the rest of the world, while resident outward investment continued to grow broadly in line with previous trends (Figure 1.2.2, panel 2). Nonresident inflows recovered in the second quarter of 2016, but at that point domestic investors began to move more and more money out of the country by acquiring foreign assets. Since the beginning of 2017, resident outflow pressures have abated following tighter enforcement of capital flow management measures, weakening in the US dollar, and a pickup in growth momentum. Net capital outflows (including

The author of this box is Robin Koepke, with research assistance from Gavin Asdorian.

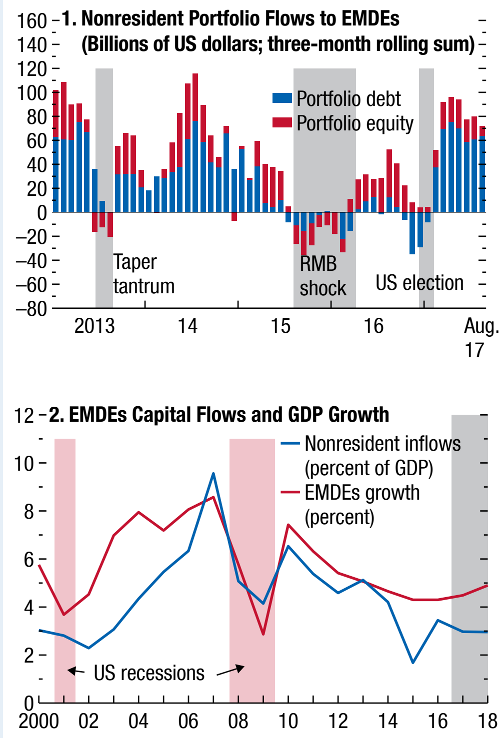
## Box 1.2 *(continued)*

**Figure 1.2.2. China: Reserves and Capital Flows**




Sources: Haver Analytics; and IMF staff estimates.

**Figure 1.2.3. Latest Capital Flows Trends and Prospects**




Sources: Haver Analytics; and IMF staff estimates.
Note: EMDEs = emerging market and developing economies; RMB = renminbi.

errors and omissions) eased to about $20 billion in the second quarter of 2017 (from a peak of $210 billion in the third quarter of 2016), which also marked the first quarter of central bank reserves accumulation in China since the second quarter of 2015.

### *A Rollercoaster Ride in Emerging Market Portfolio Flows*

The second development behind the recent slump and revival of capital flows to emerging markets was a rollercoaster ride in portfolio inflows that began with the taper tantrum in mid-2013 (Figure 1.2.3, panel 1). During that episode, investors reacted strongly to signals from the US Federal Reserve that it would start tapering purchases of bonds sooner than previously expected. Rising US market interest rates weighed on emerging market asset prices as foreign investors began to pare their emerging market exposures.

In mid-2015, portfolio equity and debt inflows again came under significant pressure when concerns about possible renminbi devaluation intensified. From the third quarter of 2015 to the first quarter of 2016 global investors sold a net $52 billion in emerging market stocks and bonds, exceeding outflows of an estimated $32 billion during the taper tantrum. The episode was a stark illustration of China's growing importance for global financial markets and the world economy, and for other emerging market economies in particular.

After a modest recovery in 2016, portfolio flows were hit by renewed repricing of US bonds after the US election in November 2016. This time, the jump in US bond yields was driven by expectations of fiscal expansion and deregulation that would support growth and prompt faster monetary tightening. Similar to the taper tantrum episode, investors responded by

## Box 1.2 *(continued)*

curtailing their emerging market positions, reflected in a reversal, albeit short-lived, of portfolio flows.

Starting in early 2017, portfolio flows to emerging markets recovered as investor sentiment about the global economy improved and financial conditions eased. Against the backdrop of a rally in global stock markets, foreign purchases of emerging market stocks and bonds rose to an estimated $205 billion year-to-date through August, more than twice the total for 2015–16.

### *Other Factors*

Aside from these two explanatory factors, a number of other developments have shaped capital flow dynamics in recent years. An important idiosyncratic shock was Russia's sharp reversal of nonresident capital inflows beginning in 2014, when its conflict with Ukraine escalated. Since then, annual nonresident inflows to Russia have averaged $120 billion (0.4 percent of emerging market GDP) less than in 2011–13.

A mitigating factor for the slowdown in net capital flows to emerging market economies in 2015–16 was reduced resident outward investment from most emerging market economies (with the notable exception of China). Resident investment abroad by emerging market economies excluding China averaged $171 billion less annually in 2015–16 than in the three previous years, reflected in reduced outward direct investment ($72 billion), portfolio investment ($51 billion), and other investment ($48 billion). The decline in resident outward investment itself seems to have been driven primarily by reduced foreign inflows, reflecting the two-way nature of capital flows. In particular, an influx of foreign capital into local markets may, directly or indirectly, provide funding for domestic investors to acquire foreign assets. The fact that local investors in emerging markets did not seek to take more money abroad during this period may also indicate, with the benefit of hindsight, that rapid asset sales by foreign investors were exaggerated relative to changes in fundamentals of emerging market economies.

### *Capital Flows Outlook*

Looking ahead, capital flows are expected to continue to recover at a moderate pace. Nonresident inflows to emerging market economies are projected at 3 percent of GDP in 2017, up from 2.6 percent in 2016 (Figure 1.2.3, panel 2). A robust economic outlook should help emerging market economies attract solid inflows, with aggregate real GDP growth projected to rise to 4.6 percent and 4.9 percent in 2017 and 2018, respectively, from 4.3 percent in 2015 and 2016.[1] Strong growth should benefit all components of capital flows, but would be expected to boost inflows of foreign direct investment particularly, given that such inflows are relatively more dependent on domestic factors (see Koepke 2015 for a literature survey).

However, the external environment could turn less favorable in the coming years, given the prospect of monetary policy normalization in the major advanced economies. Rising interest rates and a gradual unwinding of central bank asset purchases under the baseline forecast are likely to exert some drag on portfolio flows and bank-related inflows to emerging markets. Debt flows are generally most sensitive to changes in external interest rates, suggesting that foreign purchases of emerging market bonds and cross-border bank lending could see some retrenchment in the years ahead.

Moreover, downside risks to capital flows remain significant. For example, the major central banks could tighten monetary policy faster than currently expected, which could cause risk appetite toward emerging market assets to suffer a setback from the buoyant conditions that have prevailed during the past six months, triggering sizable outflows from emerging markets (see Chapter 1 of the October 2017 *Global Financial Stability Report*).

[1]The analysis in Chapter 2 of the April 2016 *World Economic Outlook* finds that slowing emerging market growth contributed to the deceleration in capital flows to emerging markets in recent years.

## Box 1.3. Emerging Market and Developing Economy Growth: Heterogeneity and Income Convergence over the Forecast Horizon

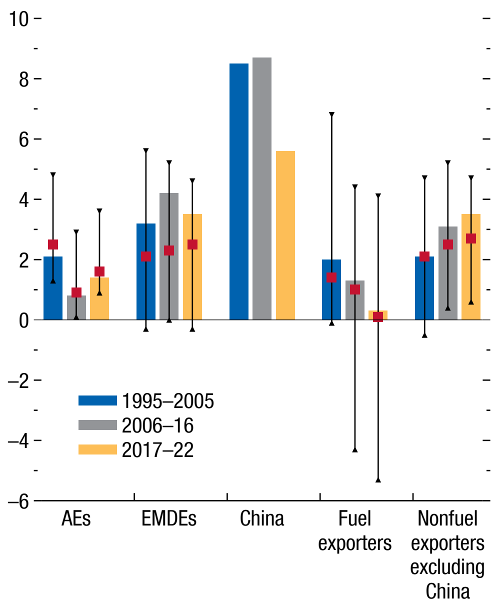
Per capita real GDP growth in emerging market and developing economies is projected to pick up from 3.2 percent in 2017 to 3.6 percent in 2019 and stay at about 3.7 percent in 2020–22 (Figure 1.3.1). The growth differential relative to advanced economies, where real per capita growth is projected to average 1.4 percent between 2017 and 2022, suggests some catching up between the two groups. However, the headline growth figures for emerging market and developing economies are heavily influenced by the largest economies in the group and conceal substantial differences across countries.[1] Zooming in on countries' growth prospects reveals that they are not as favorable for some economies in the group as the headline figures would suggest.

### *Heterogeneity*

In general, there are sizable differences in emerging market and developing economy growth rates

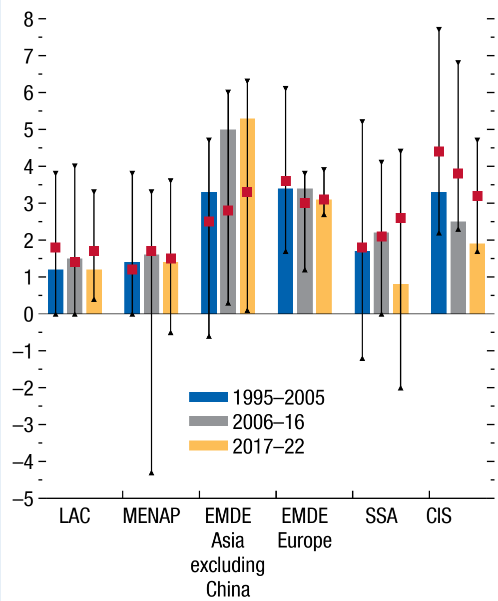
[1]Per capita real income for each group is calculated by summing real GDP at purchasing power parities and dividing by total population for the group.

**Figure 1.3.1. Per Capita Real GDP Growth across Country Groups**
*(Percent)*




Source: IMF staff estimates.
Note: Bars denote PPP (purchasing power parity) GDP weighted averages; red markers indicate the medians; and black markers denote the top and bottom deciles of per capita GDP growth in the country groups. The fuel and nonfuel exporter subgroups are defined in Table D of the Statistical Appendix and cover EMDEs only. AEs = advanced economies; EMDEs = emerging market and developing economies.

**Figure 1.3.2. Per Capita Real GDP Growth, Emerging Market and Developing Economies, by Region**
*(Percent)*




Source: IMF staff estimates.
Note: Bars denote PPP (purchasing power parity) GDP weighted averages; red markers indicate the medians; and black markers denote the top and bottom deciles of per capita GDP growth in the country groups. CIS = Commonwealth of Independent States; EMDE = emerging market and developing economies; LAC = Latin America and the Caribbean; MENAP = Middle East, North Africa, Afghanistan, and Pakistan; SSA = sub-Saharan Africa.

The author of this box is Francesco Grigoli.

## Box 1.3 *(continued)*

### Table 1.3.1. Correlates of Growth Projections, EMDEs, 2017–22[1]

| | |
|---|---|
| Fuel Exporters | –1.977*** |
| | (0.398) |
| Sub-Saharan Africa | 0.116 |
| | (0.522) |
| EMDE Asia | 0.754 |
| | (0.595) |
| EMDE Europe | 0.562 |
| | (0.433) |
| Latin America and the Caribbean | 0.315 |
| | (0.459) |
| Commonwealth of Independent States | 0.826* |
| | (0.449) |
| Small Countries[2] | –1.210*** |
| | (0.408) |
| Ln per Capita Real GDP in 2011 (PPP) | 0.132 |
| | (0.218) |
| Per Capita Real GDP Growth (2012–16) | 0.376*** |
| | (0.089) |
| Real GDP Growth in Trading Partners (2017–22) | 0.019 |
| | (0.178) |
| Constant | 0.535 |
| | (2.260) |
| Observations | 147 |
| $R^2$ | 0.495 |

Source: IMF staff estimates.
Note: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. EMDE = emerging market and developing economy; PPP = purchasing power parity.
[1] Dependent variable in the regression is projected growth in per capita real GDP averaged over 2017–22. The sample of EMDEs excludes Libya, Yemen, and Venezuela, whose forecasts are affected by idiosyncratic factors.
[2] Defined here as countries with a population of less than half a million.

across regions (Figure 1.3.2). Per capita growth in Asian emerging market and developing economies is significantly higher than in other regions. Likewise, the emerging market economies of Europe, followed by those in the Commonwealth of Independent States, are generally experiencing stronger per capita growth than those in sub-Saharan Africa, the Middle East and North Africa, and Latin America and the Caribbean. The fast pace of per capita income growth in Asia is driven to an important extent by China (as suggested by Figure 1.3.1) as well as India. Differences in *median* growth rates across regions are more modest.

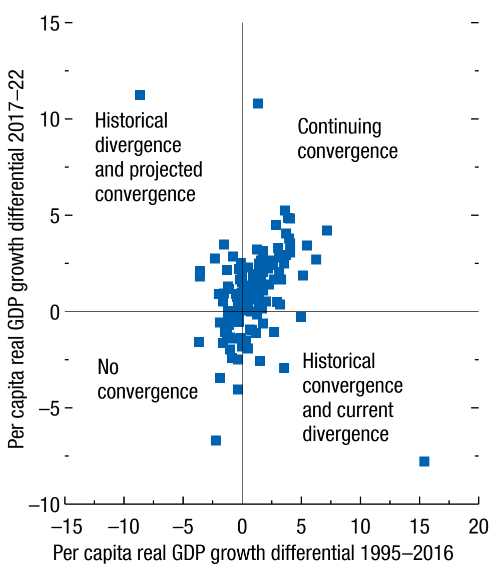
An even starker difference in per capita growth rates exists between fuel-exporting and fuel-importing emerging market and developing economies. The median growth rate for fuel exporters was lower than that for fuel importers in 1995–2005 and especially in 2006–16, and is forecast to diverge further in 2017–22 (as shown by the red markers in Figure 1.3.1). Regression analysis of the average projected growth rates over the 2017–22 period on a set of indicator variables and controls confirms dependence on fuel exports and population size as the most important factors underlying the diversity in countries' growth forecasts (Table 1.3.1). Fuel exporters' projected growth rates are almost 2 percentage points lower, on average, over the 2017–22 period, reflecting an ongoing adjustment to persistently lower oil prices, which, in some cases, involves reforms expected to deliver growth dividends only in the medium and long term.[2] The results also indicate that small countries (defined here as those with populations of less than half a million people) are projected to experience 1¼ percentage points lower growth, on average, than other countries, suggesting the importance of such factors as diseconomies of scale, lack of diversification, and vulnerability to natural disasters. Once dummy variables for fuel exporters and small countries are included in the regressions, the regional dummies are no longer significant.[3]

Even within the fuel-exporter and importer groups, however, there is significant heterogeneity. Among fuel importers, for example, China, India, Vietnam, and Bangladesh have grown, on average, by almost 6 percent annually from 1995 to 2016; their growth rates are projected to moderate slightly to 5.8 percent over 2017–22. For the median fuel importer, the annual per capita growth rates are 2.4 percent and 2.8 percent, respectively, over those periods. Among exporters, Angola, Azerbaijan, Kazakhstan, and Turkmenistan registered per capita growth rates, on average, of about 6 percent during 1995–2016, while the median fuel-exporter country grew by 1.7 percent a year over the same period.

[2]Substituting a commodity-exporter dummy for the fuel-exporter dummy returns insignificant results, suggesting that nonfuel commodity exporters are projected to perform relatively better than fuel exporters in per capita real GDP growth.
[3]The results are generally robust to including historical growth calculated over different periods (as opposed to 2012–16 as in the regression presented in Table 1.3.1), as well as to estimating the regressions by weighted least squares. Running the same regressions with October 2016 WEO data yields similar results for the fuel-exporter dummy, albeit with a smaller coefficient. Dropping large countries, such as China and India, does not affect the results.

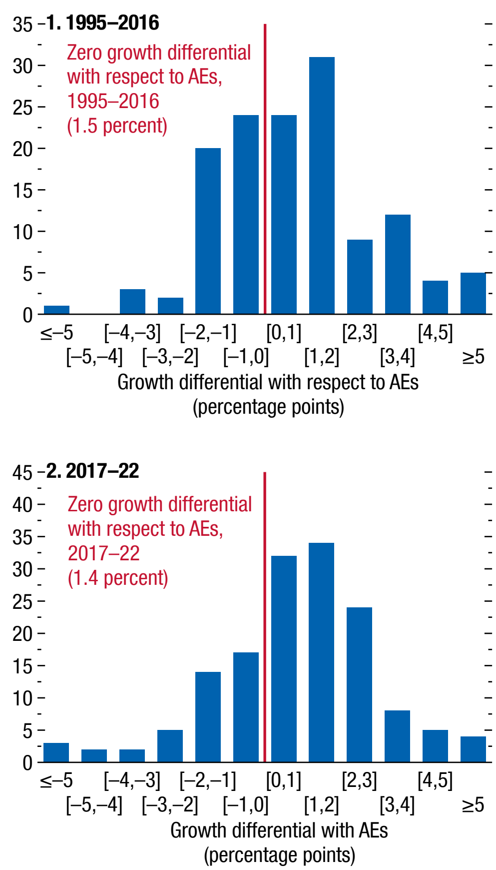
**Box 1.3 *(continued)***

**Figure 1.3.3. EMDEs' per Capita Real GDP Growth Differentials vis-à-vis Advanced Economies: 1995–2016 versus 2017–22**
*(Percentage points)*




Source: IMF staff estimates.
Note: The figure depicts countries' per capita real GDP growth rates averaged over 1995–2016 (*x*-axis) against their projected growth rates averaged over 2017–22 (*y*-axis), in both cases expressed as a deviation from the per capita real GDP growth rate for advanced economies averaged over the same period. EMDEs = emerging market and developing economies.

**Figure 1.3.4. Distribution of EMDE per Capita Real GDP Growth Differentials with Respect to Advanced Economies**
*(Number of countries)*




Source: IMF staff estimates.
Note: The figure depicts the number of countries with growth rates (in deviation from the advanced economy growth rate over the same period) in the intervals shown in the *x*-axis. AEs = advanced economies; EMDE = emerging market and developing economy.

### *Convergence toward Advanced Economy Income Levels*

Even though the aggregated figures suggest some convergence toward advanced economy income levels over the forecast horizon, the picture is less bright for a sizable fraction of emerging market and developing economies.[4] Under current WEO projections, slightly less than three-quarters of the economies in the group are expected to experience per capita income growth rates higher than those of advanced economies over 2017–22. The rest—43 economies representing about 14 percent of the emerging market and developing economy population—are projected to lag further behind advanced economies in terms of GDP per capita (Figure 1.3.4).[5]

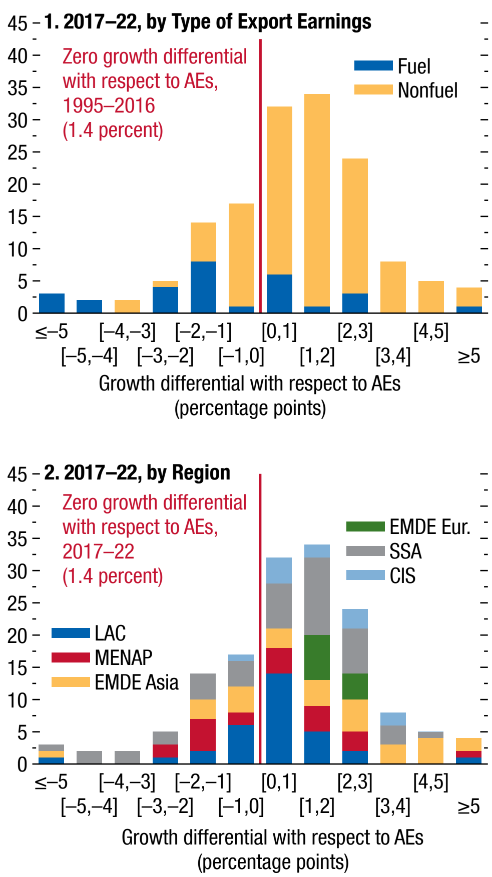
In general, emerging market and developing economies with faster per capita income growth than

[4]For an analysis of emerging market and developing economies' growth performance compared with that of advanced economies over the past four decades, see Chapter 2 of the April 2017 WEO.

[5]The existence of convergence groups or clubs has been widely discussed and tested in the literature on income convergence (Durlauf and Johnson 1995; Desdoigts 1999; Durlauf and Quah 1999; Canova 2004).

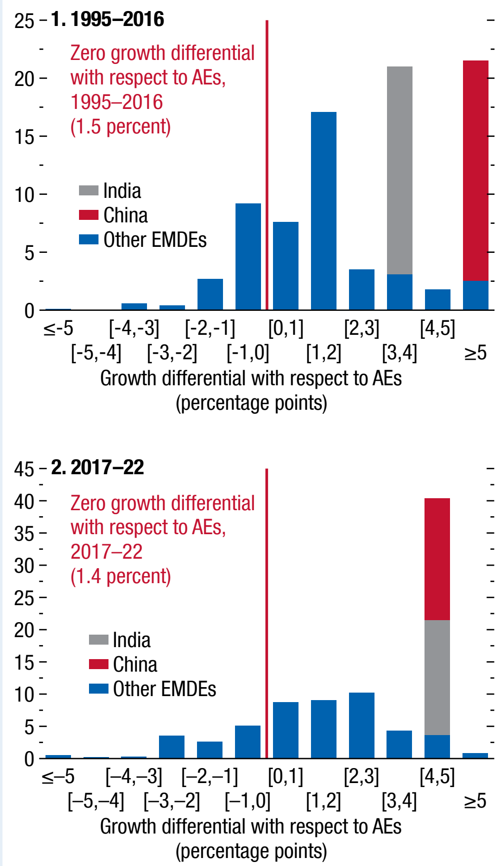
## Box 1.3 *(continued)*

**Figure 1.3.5. Distribution of EMDE per Capita Real GDP Growth Differentials with Respect to Advanced Economies, by Type of Export Earnings and Region**
*(Number of countries)*




Source: IMF staff estimates.
Note: The figure depicts the number of countries with growth rates (in deviation from the advanced economy growth rate over the same period) in the intervals shown in the *x*-axis. AEs = advanced economies; CIS = Commonwealth of Independent States; EMDE = emerging market and developing economy; LAC = Latin America and the Caribbean; MENAP = Middle East, North Africa, and Pakistan; SSA = sub-Saharan Africa.

**Figure 1.3.6. Distribution of EMDE Population by per Capita Real GDP Growth Rate**
*(Population shares)*




Source: IMF staff estimates.
Note: The figures depict the share of the total EMDE population in countries with growth rates in the intervals shown on the *x*-axis. AEs = advanced economies; EMDE = emerging market and developing economy.

advanced economies over the past two decades are projected to continue to grow faster, as shown by the strong overlap between those countries that exhibited convergence in 1995–2016 and those that are projected to converge over the forecast horizon (that is, with most of the countries falling into the upper right quadrant in Figure 1.3.3). Convergence is expected to be led by fuel importers, especially those in emerging market and developing Asia and sub-Saharan Africa (Figure 1.3.5), and by countries with larger populations, that is, China and India (Figure 1.3.6). It is disappointing that almost 18 percent of emerging market and developing economies failed to converge toward advanced economy income levels in 1995–2016 and are not projected to do so in the next five years; and 9 percent of countries were converging in 1995–2016,

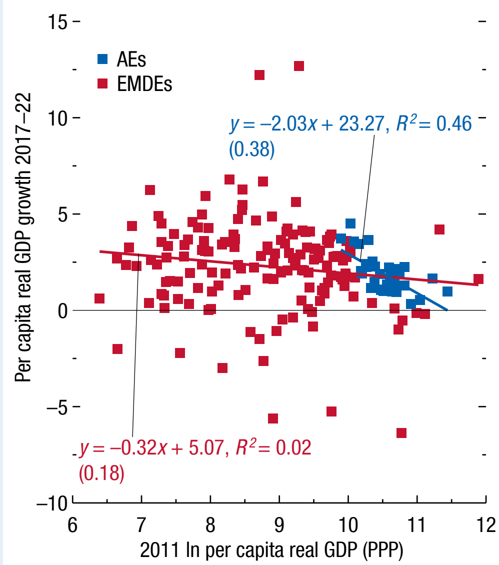
## Box 1.3 *(continued)*

but are projected to increasingly fall behind advanced economy income levels over the projection period. On the brighter side, about 19 percent of emerging market and developing economies were not converging in 1995–2016, but are now projected to do so (Figure 1.3.3).

Growth projections for emerging market and developing economies do not indicate income convergence *within* the group. Per capita real GDP growth rates among emerging market and developing economies in 2017–22 are not projected to be significantly higher (at 5 percent significance level) in countries with relatively low incomes (Figure 1.3.7).[6] By contrast, per capita real GDP growth forecasts for advanced economies display a negative and significant relationship (at 5 percent significance level) with income levels in 2011, indicating further income convergence within the advanced economy group over the forecast horizon, despite more homogeneous income levels.

Finally, a country's growth rate does not always foretell matching gains in income for the majority of the population. In China and India, for example, where real per capita GDP grew by 9.6 percent and 4.9 percent a year, respectively, in 1993–2007, the median household income is estimated to have grown less—by 7.3 percent a year in China and only 1.5 percent a year in India.[7]

**Figure 1.3.7. Projected per Capita Real GDP Growth Rates and 2011 Real Income Levels, AEs and EMDEs**




Source: IMF staff estimates.
Note: The blue and red lines are fitted based on regressions of projected growth rates (averaged over 2017–22) on real per capita real GDP levels in 2011 (at purchasing power parity) on AE and EMDE samples, respectively. The number in parentheses in the regression equation is the standard error of the estimated coefficient on real per capita real GDP levels in 2011. AEs = advanced economies; EMDEs = emerging market and developing economies; PPP = purchasing power parity.

[6]The lack of a significant correlation (at 5 percent significance level) between levels of 2011 per capita real GDP and projected growth rates holds even when countries growing more slowly than advanced economies are excluded from the sample.

[7]Based on data from the World Panel Income Distribution database of Lakner and Milanovic (2015).

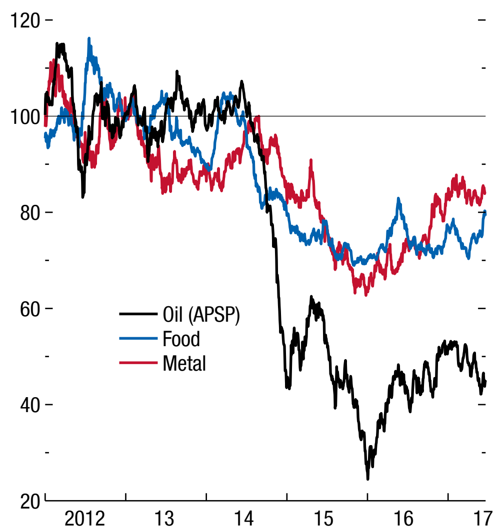
## Box 1.4. Macroeconomic Adjustment In Emerging Market Commodity Exporters

Commodity prices have fallen dramatically in recent years, with food and metal products losing about 20 percent in value since 2012–13, and oil prices halving over the past three years (Figure 1.4.1). Commodity prices have not rebounded in the past three years to their peak levels, and medium-term forecasts suggest that they are unlikely to do so. This box documents the significant macroeconomic adjustments under way in many commodity-exporting emerging market and developing economies in the wake of these price shocks.

The analysis is based on a sample of 48 commodity-exporting emerging market and developing economies, about half of which are low-income countries. The economies are grouped by their main commodity exports (fuel, metals, or food) and exchange rate regime during 2013–17.[1]

As shown in Figure 1.4.2, many commodity-exporting emerging market and developing economies maintain either currency pegs—predominantly relative to the US dollar, but in some cases to currencies such as the euro—or flexible exchange rate regimes. Nevertheless, almost half of the commodity exporters with pegs in 2013 have subsequently adjusted their exchange rate regimes ("regime adjustment" in the figure), typically moving to either a more flexible regime or devaluing the currency in response to a large commodity terms-of-trade decline. A significant number of fuel-exporting countries have abandoned pegs (Figure 1.4.2, panel 1). In general, terms-of-trade losses were largest for countries with pegs to the US dollar (Figure 1.4.3).

**Figure 1.4.1. Commodity Prices**
*(Index; January 1, 2013 = 100)*




Sources: Bloomberg L.P.; and IMF staff calculations.
Note: APSP = average petroleum spot price.

### *External Adjustment*

Countries with flexible exchange rates have seen sizable nominal depreciations since 2013, which translated into real depreciations, making them the only group whose real effective exchange rates adjusted to the commodity-price shock (Figure 1.4.4). Countries with currencies fixed to the US dollar, by contrast, experienced appreciation in nominal and real effective terms (with the nominal appreciation reflecting the general strengthening of the US dollar vis-à-vis other currencies). Exchange rates fixed to other currencies—mostly the euro—saw a depreciation in nominal terms vis-à-vis the dollar, which induced some real effective exchange rate adjustment. Finally, the largest nominal depreciations were observed among the economies that adjusted their regimes but, in most cases, this nominal depreciation did not translate into sizable depreciations in real effective terms because inflation increased in tandem.[2]

The authors of this box are JaeBin Ahn, Eugenio Cerutti, and Ksenia Koloskova.

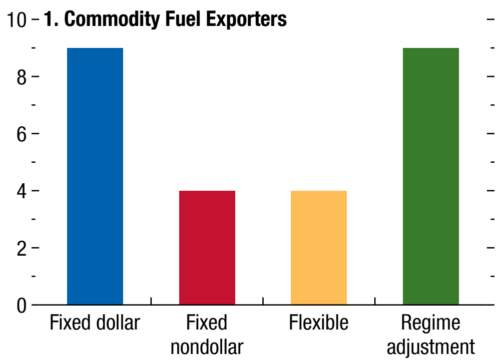
[1]As in Chapter 2 of the October 2015 *World Economic Outlook*, a country is defined as a commodity exporter if it meets the following two criteria: (1) commodities constituted at least 35 percent of the country's total exports, on average, between 1962 and 2014; and (2) net commodity exports accounted for at least 5 percent of its gross trade (exports plus imports), on average, between 1962 and 2014. From the sample of 52 countries, which satisfy these criteria, Libya, Syria, Venezuela, and Yemen are omitted due to data constraints. The classification by type of main export is derived using World Bank World Development Indicators data, based on the shares of different types of commodity exports in total merchandise exports for 1999–2015.

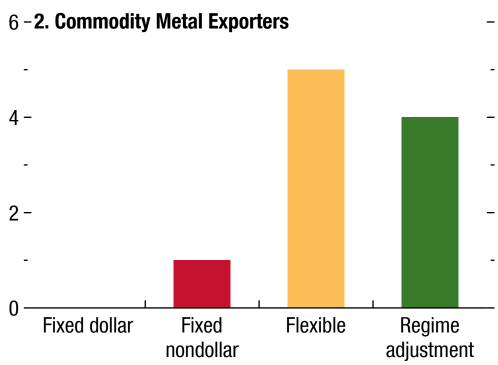
[2]Analysis in this box does not consider parallel/black market exchange rates.

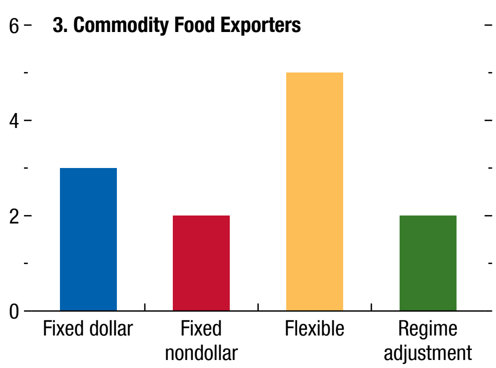
## Box 1.4 *(continued)*

### Figure 1.4.2. Exchange Rate Regimes of Commodity-Exporting Emerging Market and Developing Economies

*(Number of countries)*



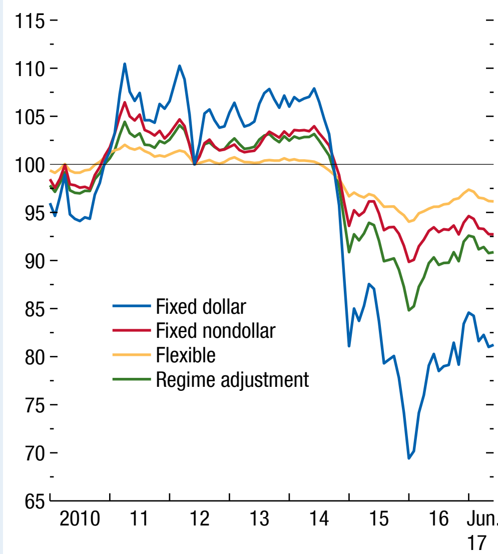




Source: IMF staff calculations.
Note: Regime adjustment covers fixed exchange rate regimes that devalued their parity or changed the exchange rate regime toward more flexibility during 2013–17.

### Figure 1.4.3. Commodity Terms of Trade

*(Index; June 2012 = 100; PPP weighted)*



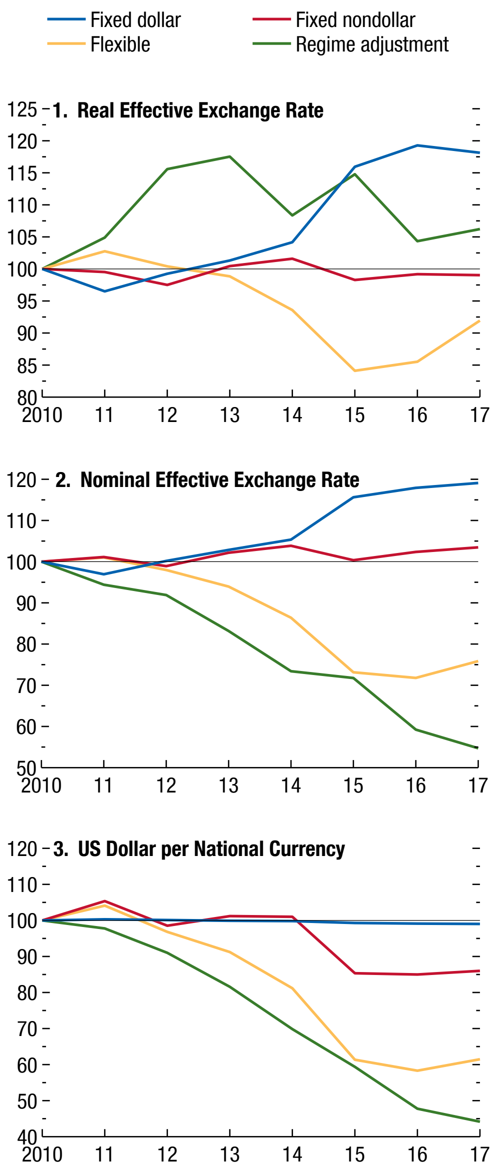

Source: Gruss 2014.
Note: PPP = purchasing power parity.

In response to terms-of-trade shocks that directly affect the external balance, net export volume could adjust, partly offsetting the initial impacts of the shocks. The change in real exchange rates in response to the terms-of-trade shock facilitates this external adjustment through the expenditure-switching channel. Such real effective exchange rate adjustment and the associated switch in expenditures are expected to be more pronounced in countries with a flexible exchange rate regime (Adler, Magud, and Werner 2017; IMF 2017b). Panel 1 of Figure 1.4.5 confirms this notion and shows that, despite facing bigger terms-of-trade shocks, countries with fixed exchange rates experienced the smallest adjustment in net exports, whereas those with flexible exchange rate regimes saw strong net export adjustments, which more than offset their terms-of-trade shocks. Export volumes did not react much, on average, across the different exchange rate regimes, likely reflecting the insensitivity of commodity exports to the exchange rate as well as these countries' limited export diver-

## Box 1.4 *(continued)*

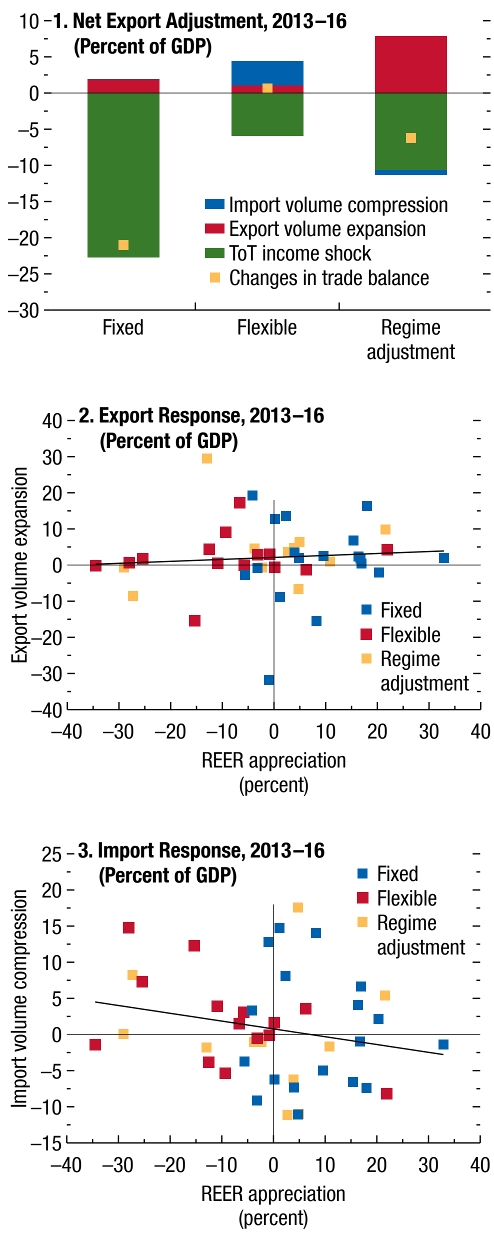
### Figure 1.4.4. Evolution of Exchange Rates

*(Index; 2010 = 100; PPP weighted)*




Sources: IMF, *Information Notice System;* and IMF staff calculations.
Note: Yearly average for 2010–16; as of June for 2017. PPP = purchasing power parity.

### Figure 1.4.5. Net Export Adjustment, 2013–16




Source: IMF staff calculations.
Note: REER = real effective exchange rate; ToT = terms of trade.

## Box 1.4 *(continued)*

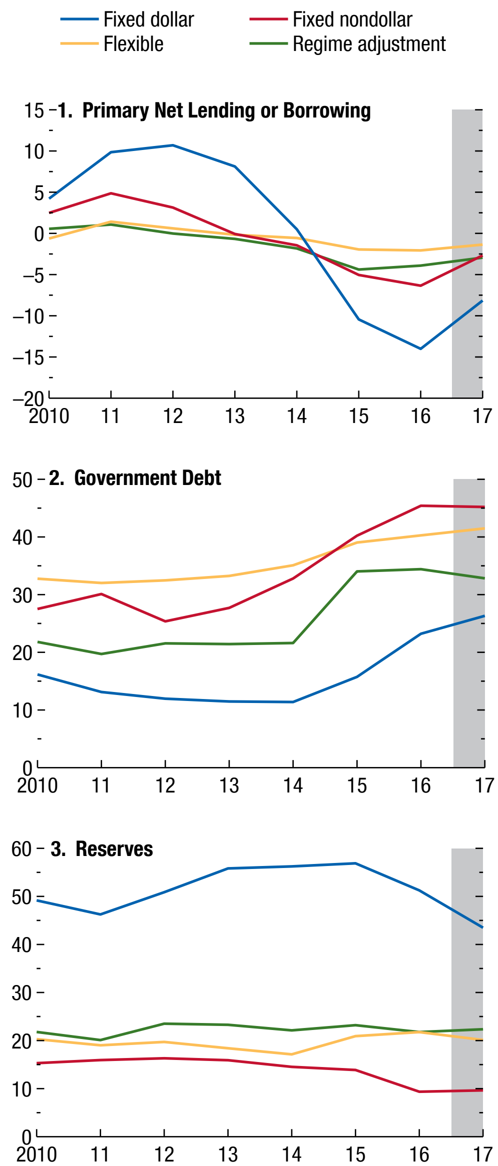
sification (Figure 1.4.5, panel 2). The stark contrast in the behavior of net exports stems mainly from the extent of import contraction. In turn, this could be attributed to expenditure-switching effects in flexible regime countries (and lack thereof in fixed regime countries) (Figure 1.4.5, panel 3) as well as the varying extent to which countries used their fiscal buffers, as discussed next.

### *Fiscal and Macroeconomic Adjustments*

In the aftermath of the shock, countries with fixed exchange rates used their fiscal and external buffers to a greater extent than did those with more flexible exchange rates. As shown in Figure 1.4.6, countries with currency pegs incurred large fiscal deficits in the aftermath of the commodity price decline, which were heavily financed with higher borrowing, decreasing reserves, and/or other past savings (such as deposits in sovereign wealth funds). Countries that have had a regime adjustment also increased their borrowing—but less than did countries that maintained pegs. They have also relied much less on reserves, likely due to their low initial levels (which may have contributed to the regime change in many cases). Those countries with flexible exchange rates managed to keep budgets balanced throughout 2013–16 and avoided the depletion of reserves.

Assessing whether flexible exchange rates have helped safeguard GDP growth is more challenging. Countries with pegs to the dollar had greater terms-of-trade losses than the others to begin with (Figure 1.4.3), so they would be expected to see weaker growth if they were not utilizing buffers. Zooming in on the subsample of fuel exporters (which experienced terms of trade losses at the same time), Figure 1.4.7, panel 1 shows that the decline in growth rates were generally comparable across countries with different types of exchange rate regimes (with the exception of those with pegs to currencies other than the US dollar, which is a small group). All in all, countries with dollar pegs shored up their GDP growth rate to keep it on par with growth in the countries with flexible exchange rates despite experiencing larger terms-of-trade losses—but with a greater reliance on buffers.

**Figure 1.4.6. Fiscal Indicators**
*(Percent of GDP; PPP weighted)*

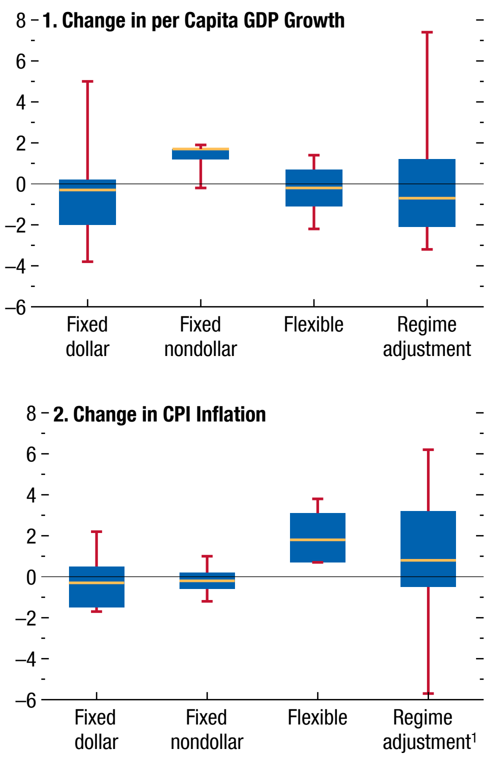



Source: IMF staff estimates.
Note: PPP = purchasing power parity.

**Box 1.4 *(continued)***

**Figure 1.4.7. Change in per Capita GDP Growth and Inflation in Fuel Exporters, Conditional on CToT**

*(Percent; average 2014–16 versus average 2011–13)*




Source: IMF staff calculations.
Note: The horizontal line inside each box represents the median; the upper and lower edges of each box show the top and bottom quartiles; and the red markers denote the maximum and minimum. CPI = consumer price index; CToT = commodity terms of trade.
[1]Minimum value excludes outlier value for the Islamic Republic of Iran (–16.3).

Turning to inflation rates, countries that experienced large depreciations/devaluations—those with flexible exchange rates and those that have adjusted regimes—saw, on average, a larger increase in consumer price inflation because of exchange rate pass-through (although the increase was relatively contained—between 1 percent and 3 percent for most countries, conditional on their commodity terms-of-trade shocks) (Figure 1.4.7, panel 2).

## Box 1.5. Remittances and Consumption Smoothing

The number of people living outside their country of birth increased by nearly 60 percent over 1990–2015 to about 250 million, or 3 percent of the world's population. Migrants typically maintain strong ties with their home countries, remitting part of their labor income earned in their destination country to their families staying behind.

The recorded US dollar value of remittances to emerging market and developing economies increased fivefold during 1990–2015, nearly three times the value of official development assistance. By 2015, 98 countries received remittance inflows greater than 1.5 percent of GDP, with nearly one-third receiving inflows exceeding 10 percent of GDP (Figure 1.5.1). While some significant "remittance corridors" are entirely between emerging market and developing economies, about 45 percent of remittances flow from advanced economies to emerging market and developing economies. As such, remittances have the potential to be an increasingly important mechanism for sharing income risks on a global scale.

Although remittances play a positive long-term role in economic and social development, this box focuses on an arguably no-less-critical role—that of mitigating cyclical risks to household consumption stemming from major macroeconomic shocks that often hit emerging market and developing economies, particularly the poorer ones.[1,2] In principle, deep integration into the global financial system can smooth the effects of such idiosyncratic income shocks on household consumption through borrowing and lending in capital markets.[3] However, poorer countries are known to face a host of fric-

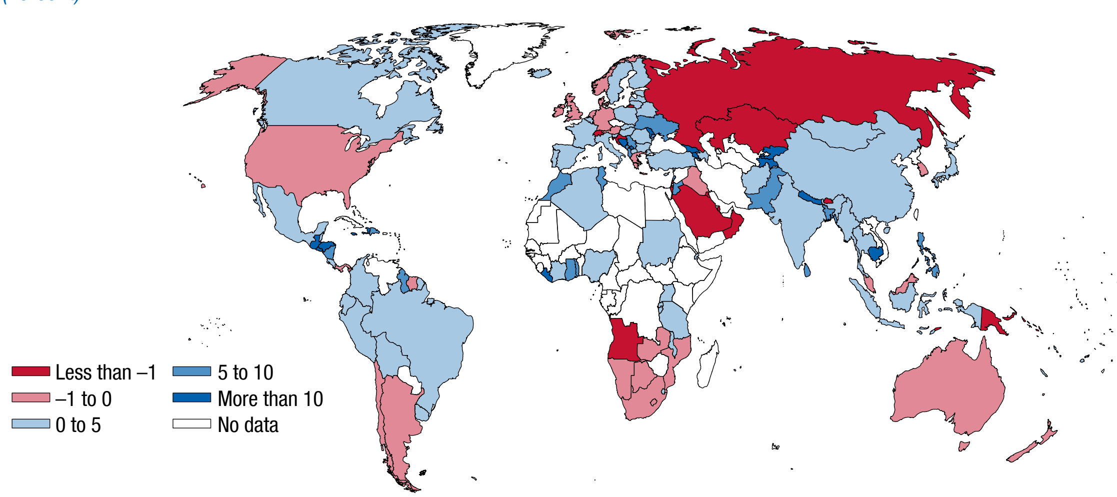
The authors of this box are Kimberly Beaton, Luis Catão, and Zsóka Kóczán.

[1]For instance, by promoting financial deepening, reducing poverty, and increasing fiscal resources—see Adams and Page (2005); Jongwanich (2007); and Giuliano and Ruiz-Arranz (2009). While other research has also pointed to possible negative effects of remittances on growth—for instance, associated with losses in external competitiveness due to exchange rate appreciations brought about by higher remittances, Rajan and Subramanian (2005) find that such Dutch Disease effects often associated with foreign aid do not appear to extend to private remittances.

[2]Ratha (2003); Hadzi-Vaskov (2006); Bugamelli and Paterno (2009); Chami, Hakura, and Montiel (2009); Combes and Ebeke (2011); De and others (2016); and Beaton and others (2017) consider the importance of remittances as a risk-sharing arrangement to smooth consumption in developing countries generally. Beaton, Cevik, and Yousefi (2017) explicitly consider the importance of remittances in smoothing consumption under fiscal shocks. Few studies have focused on the role of remittances in smoothing commodity price shocks.

[3]Kose, Prasad, and Terrones (2009) define consumption smoothing as delinking fluctuations in idiosyncratic consumption growth from fluctuations in income, to maintain a steady pace of household consumption over time.

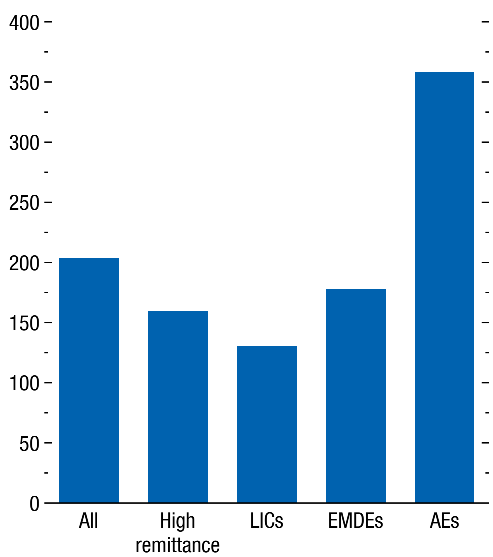
**Figure 1.5.1. Net Remittances as a Share of Output, 2015**
*(Percent)*




Sources: IMF, World Economic Outlook database; World Bank, Migration and Remittances database; and IMF staff calculations.

**Box 1.5 *(continued)***

**Figure 1.5.2. Financial Integration**
*(Percent of GDP)*




Source: IMF staff calculations.
Note: "High remittance" refers to those countries with remittance inflows greater than the median of 1.5 percent of GDP over 1990–2014. Financial integration refers to de facto financial integration measured by the sum of external assets and liabilities (as a share of GDP) from the data set by Lane and Milesi-Ferretti (2017) in 2014. AEs = advanced economies; EMDEs = emerging market and developing economies; LICs = low-income countries.

tions that limit international financial integration (Figure 1.5.2); these impediments can, in turn, greatly constrict the effectiveness of the textbook capital-market-based mechanism for smoothing consumption. The main questions addressed in this box, therefore, is the extent to which remittances help overcome this financial imperfection and whether their effectiveness varies across types of shocks and characteristics of sending and receiving countries.

A first stab at answering this question is to note that remittances are the least volatile component of balance of payments flows (Figure 1.5.3, panel 1). Their volatility is even lower than that of foreign direct investment flows, which are well known to be less volatile than equity and portfolio financial flows. Remittances are also significantly less positively correlated with GDP than foreign portfolio investment and foreign direct investment flows.[4] The stabilizing role of remittances also stands out when comparing the volatility of the current account including remittances to that excluding remittances: if remittances had little effect on current account volatility, one would expect to see a cluster of points (one for each country) along a 45-degree line in the second panel of Figure 1.5.3. Instead, a far larger cluster of points is observed above the line, suggesting that remittances help stabilize the current account, particularly in countries where the value of remittances is sizable relative to GDP.

While remittances appear to help stabilize the current account and are typically less correlated with GDP than other external financing flows, what matters directly for societal welfare is the extent to which household consumption is stabilized following shocks to domestic income. Consumption growth tends to be far more volatile in many, if not all, emerging market and developing economies than in advanced economies. A much-touted benefit of international *financial* integration would be the elimination of this "imperfection" in international risk sharing; yet that goal remains elusive for most countries (see Prasad and others 2003; and Kose, Prasad, and Terrones 2009). The question is whether greater international labor market integration can help mitigate such financial market imperfections through remittance flows and, if so, under what circumstances and country characteristics.

This question can be examined in a standard econometric model of risk sharing. Defining country-specific (that is, idiosyncratic) household consumption and output growth in country $i$ at time $t$ as $\Delta\tilde{c}_{it} = \Delta c_{it} - \Delta\overline{c}_t$ and $\Delta\tilde{y}_{it} = \Delta y_{it} - \Delta\overline{y}_t$, where $\Delta\overline{c}_t$ is global household consumption growth and $\Delta\overline{y}_t$ is global GDP per capita growth, the relevant regression model can be written as:

$$\Delta\tilde{c}_{it} = \beta_1\Delta\tilde{y}_{it} + \beta_2 R_{it}\Delta\tilde{y}_{it} + \beta_3 FI_{it}\Delta\tilde{y}_{it} + \phi REER\ it + \lambda_t + \alpha_i + \varepsilon_{it}, \quad (1.5.1)$$

where $\lambda_t$ and $\alpha_i$ denote time and country fixed effects and $\varepsilon_{it}$ is the error term. $R_{it}$ and $FI_{it}$ are, respectively,

[4]This is true for both gross and net flows, as well as for correlations in levels and in first differences in a broad cross-country panel spanning 1990–2015. Looking at bilateral remittance flows, Frankel (2011) finds that remittances are mostly countercyclical for the recipient country. Yet, in some cases, remittances sent primarily for investment motives can be procyclical, even if to a lesser extent than portfolio or foreign direct investment flows.

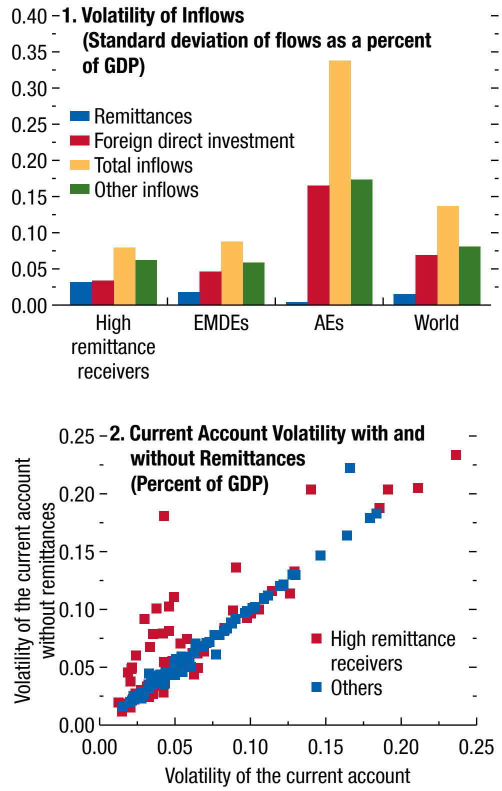
## Box 1.5 *(continued)*

the remittances-to-GDP ratio and the sum of gross foreign assets and liabilities as a share of GDP (the usual de facto measure of international financial integration; see Lane and Milesi-Ferretti 2017).[5]

If financial markets were perfect, consumption risk would be shared equally across countries and relative income growth would not matter for consumption, so $\beta_1 = \beta_2 R_{it} = \beta_3 FI_{it} = 0$. At the other extreme—absent all risk sharing through foreign borrowing and investment—$\beta_1 + \beta_2 R_{it} + \beta_3 FI_{it}$ should be equal to one. Given financial market imperfections, $\beta_1$ is never zero; yet greater financial and labor market integration should help reduce the overall correlation between idiosyncratic consumption and output growth, implying that the coefficients on the interaction terms, $\beta_2$ and $\beta_3$, are expected to be negative.

Results of the estimation of equation (1.5.1) confirm that remittances facilitate consumption smoothing. Estimates of equation (1.5.1) indicate that the expected negative signs on the coefficients are typically observed and, more crucially, that $\beta_2$ is statistically significant—that is, remittances reduce the dependence of consumption on the home country GDP and thus improve risk sharing.[6] On a broad cross-country basis (which includes countries receiving both high and low remittances as well as more and less financially integrated countries), about 27 percent of variation in income that is smoothed is due to remittances (Figure 1.5.4, panel 1, first bar). In other words, for any extra dollar of income lost (for whatever reason) in the home country, consumption falls by only 63 cents, all else constant. The quantitative importance of remittances also far exceeds that yielded by the financial integration term (as measured by $\beta_3 FI_{it}$ in equation (1.5.1)). Subsequent bars in panel 1 of Figure 1.5.4 show that the effects can be somewhat larger (as a proportion of the total smoothed component) for high-remittance countries, during major country-specific financial shocks (financial crises),

**Figure 1.5.3. Smoothing Effects of Remittances**



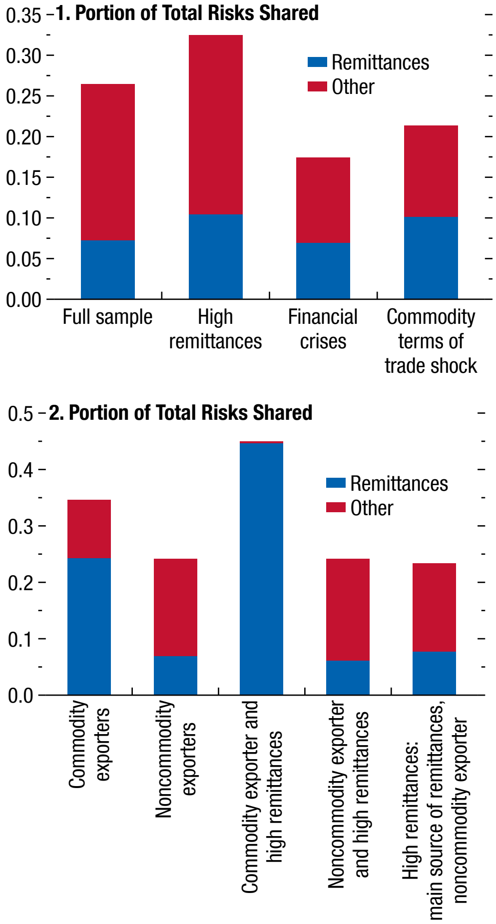

Sources: World Bank Remittances database; and IMF staff calculations.
Note: Total inflows refers to total capital inflows to a country; other inflows refers to flows other than foreign direct investment, portfolio, equity, derivatives, or reserves. Volatility refers to the standard deviation. AEs = advanced economies; EMDEs = emerging market and developing economies.

[5]Except for the second and third terms on the right-hand side of equation (1.5.1), this regression specification has been standard in the macro literature on international risk sharing (for example, Obstfeld 1993; Lewis 1996; Kalemli-Ozcan, Sorensen, and Yosha 2003; Kose, Prasad, and Terrones 2009). It was first expanded to consider the financial integration interaction term by Sorensen and others (2005) and then augmented to include the remittances interaction term by De and others (2016) and later by Beaton, Cevik, and Yousefi (2017) and Beaton and others (2017). Catão and Chang (2017) show how the micro foundations of the standard risk-sharing equation emanate from a model of costly financial transfers at the household level, implying that the coefficient on the relative income term is effectively a measure of financial frictions; and that under these circumstances, the coefficient $\varphi$ on the real effective exchange rate (defined as appreciation, denoting a rise in the index) can take either a positive or a negative sign (as with frictionless financial markets). They also show that that coefficient is influenced by country-specific pricing structures in goods markets, and so is bound to display considerable cross-country heterogeneity and be less precisely estimated in pooled regressions. Underlying econometric work for this box supports that prior, so that coefficient is unimportant in the present context.

[6]This result is consistent with De and others (2016); Beaton and others (2017); and Beaton, Cevik, and Yousefi (2017).

**Box 1.5 *(continued)***

**Figure 1.5.4. Contribution of Remittances to Consumption Risk Sharing**




Source: IMF staff calculations.
Note: Estimates of the portion of total risks shared are based on coefficients from panel regressions of idiosyncratic consumption growth on idiosyncratic output growth and its interactions with indicators for remittances and financial integration (Lane and Milesi-Ferretti 2017). High remittance countries refers to those countries with remittance inflows greater than the median of 1.5 percent of GDP over 1990–2014. A financial crisis is defined as either a banking crisis as measured by the interval between the start and the end of a banking crisis from the banking crises database by Laeven and Valencia (2008, 2010, 2012) or an external crisis as defined by Catão and Milesi-Ferretti (2014). A negative commodity terms-of-trade shock is defined as a negative value of the detrended component of a country's commodity terms of trade based on Gruss (2014).

and during cyclical contractions in the commodity terms of trade.

Breaking the sample up by country characteristics reveals that, if the receiving country is a commodity exporter, the contribution of remittances to consumption smoothing is higher than that for noncommodity exporters (Figure 1.5.4, panel 2, first two bars). If the country is a high-remittance receiver and a commodity exporter (third bar), the contribution is overwhelming. Finally, the source country of remittances also matters: if the source country is a noncommodity exporter, the percentage contribution to total consumption smoothing is higher than if the host country is a commodity exporter (comparing the relative portions in the last bar of Figure 1.5.4, panel 2, to that of the second bar of panel 1).[7]

These findings indicate that remittances have played a significant role in consumption smoothing in less financially integrated emerging market and developing economies, particularly during periods of local financial crises and falling commodity prices. The results also indicate that the main destination country of the migrant pool matters: if the remittances-receiving country is a commodity exporter and the remittances-sending country is not, the risks to consumption are more effectively shared.

The overarching conclusion is that international labor market integration can help fill at least some of the consumption smoothing gap caused by the limited role of financial market integration, particularly in poorer countries. Considering such benefits, policy measures that help reduce the cost of remittances (such as those aimed at preserving correspondent banking relationships) and foster international labor market integration—so that remittances can play a fuller role in transferring resources during asymmetric shocks to receiving countries—can significantly enhance worldwide sharing of consumption risk.

[7]Through converse reasoning, the contribution of remittances to risk sharing should also be higher than average if the sending country is a commodity exporter and the receiving country is a net commodity importer: in this case, booming commodity prices should increase remittances out of the sending country, mitigating the negative effects of lower income in the receiving country caused by adverse terms of trade (and vice versa). Unfortunately, the remittances data sample for this subcase is small and estimates are bound to be less precise and are therefore not reported.

# Special Feature: Commodity Market Developments and Forecasts

*Commodity prices have decreased since the release of the April 2017* World Economic Outlook *(WEO). Despite the extension of the production agreement by the Organization of the Petroleum Exporting Countries (OPEC), oil prices declined amid stronger-than-expected shale production in the United States. After declining earlier this year, metal prices have bounced back since June, in line with the improvement in macroeconomic sentiment. Agricultural prices declined on account of large supplies, but weather contributed to volatility in grain markets.*

The IMF's Primary Commodities Price Index declined 5.0 percent between February 2017 and August 2017, the reference periods for the April 2017 and current WEO forecasts, respectively (Figure 1. SF.1, panel 1). While energy and food prices declined substantially, by 6.5 percent and 4.3 percent, respectively, metal prices increased modestly, by 0.8 percent. Oil prices declined amid strong crude oil production in the United States. Natural gas prices fell because of lower demand. Coal prices increased, and remained high.

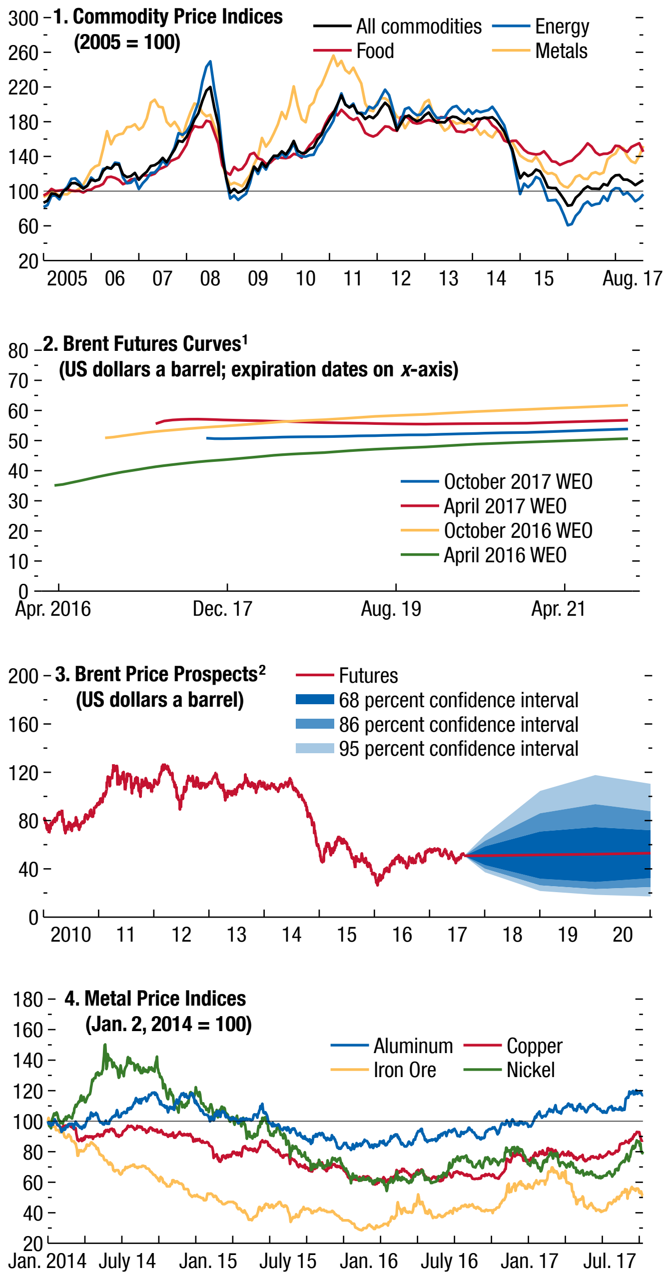
## Oil Market: Eyes on US Production

On May 25, 2017, OPEC agreed to extend to March 2018 the production agreement in place since January this year. The agreement entails a cut of 1.2 million barrels a day (mbd) from October 2016 production. Russia and other non-OPEC countries agreed to stick to current production, implying additional cuts of about 0.6 mbd from the October 2016 level (bringing the total cuts to 1.8 mbd).

Notwithstanding efforts by the oil exporters participating in the production agreement, oil prices had fallen to less than $44 a barrel by late June, the lowest since November 2016, right before the initial production cuts were announced. The main drivers were stronger-than-expected US shale production and stronger-than-expected production recovery in Libya and Nigeria, which are exempt from production cuts. In addition, exports from OPEC countries appeared to be sustained at relatively high levels, even with lower production.

The authors of this feature are Christian Bogmans (team leader), Rachel Yuting Fan, and Akito Matsumoto, with research assistance from Lama Kiyasseh.

**Figure 1.SF.1. Commodity Market Developments**




Sources: Bloomberg L.P.; Thomson Reuters Datastream; IMF, Primary Commodity Price System; and IMF staff estimates.
Note: WEO = *World Economic Outlook.*
[1] WEO future prices are baseline assumptions for each WEO and derived from future prices. October 2017 WEO prices are based on August 15, 2017, closing.
[2] Derived from prices of futures options on August 15, 2017.

Since then, oil prices have rebounded, to about $50 a barrel as of late August, in response to signs of a slowdown in US production growth. US inventories increased dramatically in June 2017, but declined sharply in July and August. The US Energy Information Administration expects US crude production in 2018 to reach 9.9 mbd, exceeding the previous high of 9.6 mbd recorded in 1970. The International Energy Agency expects demand growth to increase from 1.3 mbd in 2016 to 1.6 mbd in 2017 and then to soften to 1.4 mbd in 2018. Hurricane Harvey impacted US refinery capacity in late August and spot gasoline prices increased sharply. However, crude oil prices and medium-term gasoline futures reacted much less, partially because crude inventories were large, and reduced production of refined oil translates into weaker demand for crude oil.

The natural gas price index—an average for Europe, Japan, and the United States—decreased by 9.6 percent between February 2017 and August 2017, reflecting seasonal factors and firm supply from the United States and Russia.[1] Lower oil prices add extra downward pressures in countries where oil-linked pricing is more common. Markets were relatively unfazed when Saudi Arabia and a coalition of countries severed diplomatic ties with Qatar, the world's largest LNG exporter, as exports from Qatar continue.

The coal price index—an average of Australian and South African prices—increased by 16.5 percent from February 2017 to August 2017. This increase follows an initial decline caused by the end of the disruption to coal transportation in Australia due to Cyclone Debbie on March 28, 2017. However, strong demand from China helped prices recover. In addition, sporadic labor disputes in Australian mines provided additional support, while import restrictions by China put downward pressure on prices, especially for lower-quality coals.

Oil futures contracts point to a gradual increase of prices to about $53 a barrel in 2022 (Figure 1.SF.1, panel 2). Baseline assumptions for the IMF's average petroleum spot prices, based on futures prices, suggest average annual prices of $50.3 a barrel in 2017—an increase of 17.4 percent from the 2016 average—and $50.2 a barrel in 2018 (Figure 1.SF.1, panel 3).

Uncertainty remains around the baseline assumptions for oil prices, although risks are balanced. Upside risks include unscheduled outages and geopolitical events, especially in the Middle East and Latin America as the United States put additional sanctions on Venezuela. Although these development could cause oil market disruptions, high inventories—including drilled but uncompleted wells—and the rapid response by shale producers should prevent sharp price rises in the near future. As oil markets focus on the US production/inventory figure, Hurricane Harvey may influence crude markets significantly if it turns out that physical damages to infrastructure or labor force dislocation are larger than initially assessed. Natural gas markets face additional uncertainty due to the Qatar crisis and renewed tensions between Russia and the United States after the United States approved new sanctions against Russia.

## Metals: China in the Mix

Metal prices have increased by 0.8 percent between February and August 2017, with considerable variation across commodities. By June the metal price index had reached its lowest point in eight months due to slower demand growth in China and the United States. However, prices rebounded since and continued to do so into August with the improvement in macroeconomic sentiment, especially in China.

Iron ore prices dropped by 35 percent between February and June 2017, mainly driven by expansion of production by big producers in Australia and Brazil attempting to increase market share. Iron ore inventories at Chinese ports reached an all-time high of more than 140 million tons by late June, up 40 percent from the year before, according to data from Thomson Reuters Datastream. With steel prices in China soaring again, however, China's steel producers increased output to a record high of 74 million tons in July. This, in turn, drove up demand for the key ingredient in steelmaking, especially for higher-grade ores that increase the efficiency of steel mills and help lower air pollution. As a result, the price of iron ore rallied by 29 percent from its low in June, reaching an average of $74.6 per ton in August.

Copper prices tumbled between February and early May, after strikes at major mines in Chile and Peru

[1]The IMF's natural gas price index is a weighted average of US Henry Hub prices, Netherland's Title Transfer Facility prices, and Argus Northeast Asia liquefied natural gas (LNG) prices. Up to December 2016, the index is the average of US Henry Hub, German border prices from Russia (long-term contract), and Japanese LNG import prices from Indonesia (Japanese Custom-cleared Crude indexed). The update reflects the increased importance of spot markets.

ended, and the export ban in Indonesia was temporarily lifted. However, with supply from Chile again disrupted and larger-than-expected demand, copper prices rebounded since June. In August, further boosted by China's possible ban by the end of 2018 on imports of scrap metals, copper stood 9.2 percent higher than in February, reaching its highest level since November 2014. The partial resumption of ore exports from Indonesia had also put downward pressure on nickel prices in the first half of 2017. Then, buoyed by solid demand for stainless steel, particularly in China's construction sector, the price of nickel experienced a strong recovery through July and was up by 2.3 percent in August compared with February.

Aluminum prices increased by 9.1 percent from February 2017 to August 2017, supported by a global shortage outside of China that, according to data from the World Bureau of Metal Statistics, began in the fall of 2016. By mid-August 2017, London Metal Exchange warehouse inventories of aluminum were 44 percent lower than in mid-January, hitting their lowest point since 2008. On top of the increase so far, futures prices are pointing to a sharp rise in prices, likely fueled by expectations that China will cut its production capacity because of environmental concerns. Zinc rallied by 4.8 percent between February and August to a near 10-year high, following stock reductions, tight supplies and strong demand for steel galvanization, especially from Chinese infrastructure development.

The IMF metal price index is projected to rise briefly in the second half of 2017, followed by a gentle decline. The annual index for 2017 is expected to increase by 20.6 percent from its 2016 level, reflecting the earlier surge this year, while futures are pointing to a slight decline throughout 2018, with the current projection for the fourth quarter of 2018 0.4 percent below the level for the third quarter of 2017.

Downside risks to the outlook for metal prices include credit tightening and a slowing down of China's property market, which consumes more than half of the world's metal production. However, the Caixin Manufacturing Purchasing Managers' Index increased to 51.6 in August, indicating further expansion of the world's biggest manufacturing sector in the near term. Upside risks also include vigorous capacity cuts in China and the possibility of greater restrictions on international trade, such as those potentially arising from the US Section 232 investigations for steel and aluminum.

## Price Swings in Agricultural Markets

The IMF's agricultural price index decreased by 4.9 percent from February 2017 to August 2017, with the sub-indices of food, beverages, and agricultural raw materials decreasing by 4.3 percent, 4.3 percent, and 6.9 percent, respectively. The decline has been fairly uniform across different food groups as well; the indices for cereals lost 4.0 percent, sugar 27.5 percent, vegetable oils 6.5 percent, and beverages 4.3 percent, with only the index for meat seeing gains, of 6.3 percent.

Wheat prices decreased by 5.6 percent from February 2017 to August 2017. As hot, dry weather on the US Great Plains and in France raised doubts about yields in the Northern Hemisphere, prices increased sharply in June. The price rally was followed, however, by a 20.3 percent decline, month-on-month, in August, after the United States Department of Agriculture unexpectedly raised its forecast of grain stocks at the end of the 2017–18 season for reasons that include prospects of a record upcoming Black Sea harvest of wheat.

Maize prices declined too, by 8.8 percent. Weather in the corn-growing regions of the United States did not affect prices much, and corn supplies, including from other major producing countries in South America, remain abundant. Soybean prices trended downward from February because supply from South America remains plentiful following a record harvest in Brazil, even though a stronger *real* discourages farmers from selling their produce. Prospects of a relatively large upcoming US soybean crop increased on good weather conditions in the critical growing month of August, also putting downward pressure on prices.

Palm oil prices fell by 12.0 percent from February 2017 to August 2017, as production in Malaysia and Indonesia continued to rebound from the 2015–16 El Niño, and are expected to increase further, partly because of seasonal factors. Indeed, palm oil future curves remain in "backwardation," indicating that supply is expected to be relatively more abundant in the future. With China continuing to sell off its reserves, and the upcoming US crop not severely affected by Hurricane Harvey, cotton prices declined by 6.8 percent between February 2017 and August 2017. Furthermore, output in the 2017–18 season is expected to be buoyant in major producers, including China, India, Pakistan, and the United States.

Pork prices increased substantially up to July amid stronger demand and tighter supplies. Following increases in global supplies, prices have slumped, although they still stood 10.1 percent higher in August compared to February this year (based on monthly averages). While supplies are expected to increase further in the second half of 2017, strong global demand implies that markets are expected to clear at higher year-over-year prices. Similarly, the price of beef climbed steadily, by 2.4 percent, because export demand for red meat was stronger than expected and leaner cattle contributed to weaker US supply growth. As the number of cattle on US feedlots has increased unexpectedly during summer, prices are expected to soften in the second half of this year.

Projections for grain prices have been revised substantially downward because concerns over hot, dry weather that sparked a rally in grain markets in June this year have waned, and forecasts for grain stocks at the end of the 2017–18 season increased in August. Annual food prices are now expected to increase by 3.6 percent in 2017 and an additional 1.1 percent in 2018. Food prices are expected to decline slightly again for the years thereafter for reasons that include potentially better supply conditions for some commodities.

Weather disruptions and variability are an upside risk to the forecast for agricultural prices. As of September 2017, there is an increasing chance (about 55 percent to 60 percent) of a La Niña onset during the Northern Hemisphere fall and winter of 2017–18. The increased use by governments of agricultural support policies is another upside risk. Downside risks may arise if China sells more than anticipated from its large reserves of grains, sugar, and cotton.

**Annex Table 1.1.1. European Economies: Real GDP, Consumer Prices, Current Account Balance, and Unemployment**
*(Annual percent change, unless noted otherwise)*

| | Real GDP | | | Consumer Prices[1] | | | Current Account Balance[2] | | | Unemployment[3] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Projections | | | Projections | | | Projections | | | Projections | |
| | 2016 | 2017 | 2018 | 2016 | 2017 | 2018 | 2016 | 2017 | 2018 | 2016 | 2017 | 2018 |
| **Europe** | **2.1** | **2.5** | **2.2** | **0.9** | **2.5** | **2.4** | **2.2** | **2.4** | **2.3** | . . . | . . . | . . . |
| **Advanced Europe** | **1.8** | **2.1** | **1.9** | **0.4** | **1.6** | **1.6** | **2.7** | **2.9** | **2.9** | **8.7** | **7.9** | **7.6** |
| Euro Area[4,5] | 1.8 | 2.1 | 1.9 | 0.2 | 1.5 | 1.4 | 3.5 | 3.1 | 3.0 | 10.0 | 9.2 | 8.7 |
| Germany | 1.9 | 2.0 | 1.8 | 0.4 | 1.6 | 1.5 | 8.3 | 8.1 | 7.7 | 4.2 | 3.8 | 3.7 |
| France | 1.2 | 1.6 | 1.8 | 0.3 | 1.2 | 1.3 | –1.0 | –1.1 | –0.8 | 10.0 | 9.5 | 9.0 |
| Italy | 0.9 | 1.5 | 1.1 | –0.1 | 1.4 | 1.2 | 2.6 | 2.7 | 2.3 | 11.7 | 11.4 | 11.0 |
| Spain | 3.2 | 3.1 | 2.5 | –0.2 | 2.0 | 1.5 | 1.9 | 1.9 | 2.0 | 19.6 | 17.1 | 15.6 |
| Netherlands | 2.2 | 3.1 | 2.6 | 0.1 | 1.3 | 1.4 | 8.5 | 10.0 | 10.0 | 5.9 | 5.1 | 4.9 |
| Belgium | 1.2 | 1.6 | 1.6 | 1.8 | 2.2 | 1.5 | –0.4 | –0.3 | 0.0 | 7.9 | 7.5 | 7.3 |
| Austria | 1.5 | 2.3 | 1.9 | 1.0 | 1.6 | 1.8 | 1.7 | 2.1 | 2.2 | 6.0 | 5.4 | 5.3 |
| Greece | 0.0 | 1.8 | 2.6 | 0.0 | 1.2 | 1.3 | –0.6 | –0.2 | –0.1 | 23.6 | 22.3 | 20.7 |
| Portugal | 1.4 | 2.5 | 2.0 | 0.6 | 1.6 | 2.0 | 0.7 | 0.4 | 0.3 | 11.1 | 9.7 | 9.0 |
| Ireland | 5.1 | 4.1 | 3.4 | –0.2 | 0.4 | 1.5 | 3.3 | 3.4 | 3.5 | 7.9 | 6.4 | 5.9 |
| Finland | 1.9 | 2.8 | 2.3 | 0.4 | 0.8 | 1.2 | –1.1 | 0.4 | 0.4 | 8.8 | 8.7 | 8.1 |
| Slovak Republic | 3.3 | 3.3 | 3.7 | –0.5 | 1.2 | 1.4 | –0.7 | 0.3 | 0.2 | 9.6 | 8.1 | 7.5 |
| Lithuania | 2.3 | 3.5 | 3.5 | 0.7 | 3.5 | 2.0 | –0.9 | –1.6 | –1.4 | 7.9 | 7.0 | 6.5 |
| Slovenia | 3.1 | 4.0 | 2.5 | –0.1 | 1.6 | 1.8 | 5.2 | 5.0 | 4.9 | 8.0 | 6.8 | 6.4 |
| Luxembourg | 4.2 | 3.9 | 3.6 | 0.0 | 1.2 | 1.3 | 4.7 | 4.7 | 4.9 | 6.4 | 5.9 | 5.5 |
| Latvia | 2.0 | 3.8 | 3.9 | 0.1 | 3.0 | 3.0 | 1.5 | –0.3 | –1.5 | 9.6 | 9.0 | 8.7 |
| Estonia | 2.1 | 4.0 | 3.7 | 0.8 | 3.8 | 3.4 | 1.9 | 1.8 | 1.4 | 6.8 | 8.4 | 9.0 |
| Cyprus | 2.8 | 3.4 | 2.6 | –1.2 | 0.8 | 0.7 | –5.3 | –3.8 | –2.7 | 13.0 | 11.8 | 10.7 |
| Malta | 5.5 | 5.1 | 4.4 | 0.9 | 1.3 | 1.6 | 7.9 | 8.9 | 8.8 | 4.7 | 4.4 | 4.5 |
| United Kingdom[5] | 1.8 | 1.7 | 1.5 | 0.7 | 2.6 | 2.6 | –4.4 | –3.6 | –3.3 | 4.9 | 4.4 | 4.4 |
| Switzerland | 1.4 | 1.0 | 1.3 | –0.4 | 0.5 | 0.6 | 10.5 | 9.9 | 9.4 | 3.3 | 3.0 | 3.0 |
| Sweden | 3.2 | 3.1 | 2.4 | 1.1 | 1.6 | 1.6 | 4.5 | 3.9 | 3.7 | 7.0 | 6.6 | 6.3 |
| Norway | 1.1 | 1.4 | 1.6 | 3.6 | 2.1 | 2.0 | 5.0 | 5.5 | 5.7 | 4.7 | 4.0 | 3.8 |
| Czech Republic | 2.6 | 3.5 | 2.6 | 0.7 | 2.3 | 1.8 | 1.1 | 0.6 | 0.1 | 4.0 | 2.8 | 3.0 |
| Denmark | 1.7 | 1.9 | 1.8 | 0.3 | 1.0 | 1.4 | 7.9 | 7.3 | 7.0 | 6.2 | 5.8 | 5.8 |
| Iceland | 7.2 | 5.5 | 3.3 | 1.7 | 1.8 | 2.6 | 7.9 | 6.2 | 6.1 | 3.0 | 2.8 | 3.2 |
| San Marino | 1.0 | 1.2 | 1.3 | 0.6 | 0.9 | 1.0 | . . . | . . . | . . . | 8.6 | 8.0 | 7.4 |
| **Emerging and Developing Europe[6]** | **3.1** | **4.5** | **3.5** | **3.3** | **6.0** | **5.7** | **–1.8** | **–2.4** | **–2.5** | . . . | . . . | . . . |
| Turkey | 3.2 | 5.1 | 3.5 | 7.8 | 10.9 | 9.3 | –3.8 | –4.6 | –4.6 | 10.9 | 11.2 | 10.7 |
| Poland | 2.6 | 3.8 | 3.3 | –0.6 | 1.9 | 2.3 | –0.2 | –1.0 | –1.2 | 6.2 | 4.8 | 4.0 |
| Romania | 4.8 | 5.5 | 4.4 | –1.6 | 1.1 | 3.3 | –2.3 | –3.0 | –2.9 | 5.9 | 5.3 | 5.2 |
| Hungary | 2.0 | 3.2 | 3.4 | 0.4 | 2.5 | 3.2 | 5.5 | 4.8 | 4.2 | 5.1 | 4.4 | 4.3 |
| Bulgaria[5] | 3.4 | 3.6 | 3.2 | –1.3 | 1.1 | 1.4 | 4.2 | 2.5 | 1.9 | 7.7 | 6.6 | 6.4 |
| Serbia | 2.8 | 3.0 | 3.5 | 1.1 | 3.4 | 3.0 | –4.0 | –4.0 | –3.9 | 15.9 | 16.0 | 15.6 |
| Croatia | 3.0 | 2.9 | 2.7 | –1.1 | 1.1 | 1.2 | 2.6 | 3.8 | 3.0 | 15.0 | 13.9 | 13.5 |

Note: Data for some countries are based on fiscal years. Refer to Table F in the Statistical Appendix for a list of economies with exceptional reporting periods.
[1]Movements in consumer prices are shown as annual averages. Year-end to year-end changes can be found in Tables A6 and A7 in the Statistical Appendix.
[2]Percent of GDP.
[3]Percent. National definitions of unemployment may differ.
[4]Current account position corrected for reporting discrepancies in intra-area transactions.
[5]Based on Eurostat's harmonized index of consumer prices except for Slovenia.
[6]Includes Albania, Bosnia and Herzegovina, Kosovo, FYR Macedonia, and Montenegro.

## Annex Table 1.1.2. Asian and Pacific Economies: Real GDP, Consumer Prices, Current Account Balance, and Unemployment

*(Annual percent change, unless noted otherwise)*

| | Real GDP | | | Consumer Prices[1] | | | Current Account Balance[2] | | | Unemployment[3] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Projections | | | Projections | | | Projections | | | Projections | |
| | 2016 | 2017 | 2018 | 2016 | 2017 | 2018 | 2016 | 2017 | 2018 | 2016 | 2017 | 2018 |
| **Asia** | **5.4** | **5.6** | **5.5** | **2.3** | **2.3** | **2.8** | **2.5** | **2.1** | **1.9** | **. . .** | **. . .** | **. . .** |
| **Advanced Asia** | **1.7** | **2.2** | **1.7** | **0.5** | **1.0** | **1.2** | **4.5** | **4.3** | **4.2** | **3.6** | **3.4** | **3.4** |
| Japan | 1.0 | 1.5 | 0.7 | –0.1 | 0.4 | 0.5 | 3.8 | 3.6 | 3.8 | 3.1 | 2.9 | 2.9 |
| Korea | 2.8 | 3.0 | 3.0 | 1.0 | 1.9 | 1.9 | 7.0 | 5.6 | 5.4 | 3.7 | 3.8 | 3.6 |
| Australia | 2.5 | 2.2 | 2.9 | 1.3 | 2.0 | 2.2 | –2.6 | –1.6 | –2.4 | 5.7 | 5.6 | 5.4 |
| Taiwan Province of China | 1.5 | 2.0 | 1.9 | 1.4 | 1.0 | 1.4 | 14.0 | 13.8 | 13.9 | 3.9 | 3.8 | 3.8 |
| Singapore | 2.0 | 2.5 | 2.6 | –0.5 | 0.9 | 1.3 | 19.0 | 19.6 | 19.5 | 2.1 | 2.2 | 2.1 |
| Hong Kong SAR | 2.0 | 3.5 | 2.7 | 2.6 | 2.0 | 2.2 | 4.6 | 3.0 | 3.1 | 2.7 | 2.6 | 2.6 |
| New Zealand | 3.6 | 3.5 | 3.0 | 0.6 | 2.2 | 2.0 | –2.8 | –3.6 | –3.8 | 5.1 | 4.9 | 4.6 |
| Macao SAR | –2.1 | 13.4 | 7.0 | 2.4 | 1.5 | 2.2 | 27.4 | 33.0 | 34.5 | 1.9 | 2.0 | 2.0 |
| **Emerging and Developing Asia** | **6.4** | **6.5** | **6.5** | **2.8** | **2.6** | **3.2** | **1.4** | **0.9** | **0.7** | **. . .** | **. . .** | **. . .** |
| China | 6.7 | 6.8 | 6.5 | 2.0 | 1.8 | 2.4 | 1.7 | 1.4 | 1.2 | 4.0 | 4.0 | 4.0 |
| India[4] | 7.1 | 6.7 | 7.4 | 4.5 | 3.8 | 4.9 | –0.7 | –1.4 | –1.5 | . . . | . . . | . . . |
| **ASEAN-5** | **4.9** | **5.2** | **5.2** | **2.4** | **3.3** | **3.1** | **2.1** | **1.6** | **1.1** | **. . .** | **. . .** | **. . .** |
| Indonesia | 5.0 | 5.2 | 5.3 | 3.5 | 4.0 | 3.9 | –1.8 | –1.7 | –1.8 | 5.6 | 5.4 | 5.2 |
| Thailand | 3.2 | 3.7 | 3.5 | 0.2 | 0.6 | 1.0 | 11.5 | 10.1 | 8.1 | 0.8 | 0.7 | 0.7 |
| Malaysia | 4.2 | 5.4 | 4.8 | 2.1 | 3.8 | 2.9 | 2.4 | 2.4 | 2.2 | 3.5 | 3.4 | 3.2 |
| Philippines | 6.9 | 6.6 | 6.7 | 1.8 | 3.1 | 3.0 | 0.2 | –0.1 | –0.3 | 5.5 | 6.0 | 5.5 |
| Vietnam | 6.2 | 6.3 | 6.3 | 2.7 | 4.4 | 4.0 | 4.1 | 1.3 | 1.4 | 2.3 | 2.3 | 2.3 |
| **Other Emerging and Developing Asia[5]** | **5.6** | **6.3** | **6.3** | **5.2** | **5.5** | **5.4** | **–0.9** | **–1.9** | **–2.5** | **. . .** | **. . .** | **. . .** |
| *Memorandum* | | | | | | | | | | | | |
| Emerging Asia[6] | **6.5** | **6.5** | **6.5** | **2.7** | **2.5** | **3.1** | **1.5** | **1.0** | **0.8** | **. . .** | **. . .** | **. . .** |

Note: Data for some countries are based on fiscal years. Refer to Table F in the Statistical Appendix for a list of economies with exceptional reporting periods.
[1]Movements in consumer prices are shown as annual averages. Year-end to year-end changes can be found in Tables A6 and A7 in the Statistical Appendix.
[2]Percent of GDP.
[3]Percent. National definitions of unemployment may differ.
[4]See country-specific notes for India in the "Country Notes" section of the Statistical Appendix.
[5]Other Emerging and Developing Asia comprises Bangladesh, Bhutan, Brunei Darussalam, Cambodia, Fiji, Kiribati, Lao P.D.R., Maldives, Marshall Islands, Micronesia, Mongolia, Myanmar, Nauru, Nepal, Palau, Papua New Guinea, Samoa, Solomon Islands, Sri Lanka, Timor-Leste, Tonga, Tuvalu, and Vanuatu.
[6]Emerging Asia comprises the ASEAN-5 (Indonesia, Malaysia, Philippines, Thailand, Vietnam) economies, China, and India.

**Annex Table 1.1.3. Western Hemisphere Economies: Real GDP, Consumer Prices, Current Account Balance, and Unemployment**
*(Annual percent change, unless noted otherwise)*

| | Real GDP | | | Consumer Prices[1] | | | Current Account Balance[2] | | | Unemployment[3] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Projections | | | Projections | | | Projections | | | Projections | |
| | 2016 | 2017 | 2018 | 2016 | 2017 | 2018 | 2016 | 2017 | 2018 | 2016 | 2017 | 2018 |
| **North America** | **1.5** | **2.2** | **2.2** | **1.4** | **2.4** | **2.3** | **–2.5** | **–2.4** | **–2.6** | **. . .** | **. . .** | **. . .** |
| United States | 1.5 | 2.2 | 2.3 | 1.3 | 2.1 | 2.1 | –2.4 | –2.4 | –2.6 | 4.9 | 4.4 | 4.1 |
| Canada | 1.5 | 3.0 | 2.1 | 1.4 | 1.6 | 1.8 | –3.3 | –3.4 | –2.9 | 7.0 | 6.5 | 6.3 |
| Mexico | 2.3 | 2.1 | 1.9 | 2.8 | 5.9 | 3.8 | –2.2 | –1.7 | –2.0 | 3.9 | 3.6 | 3.7 |
| Puerto Rico[4] | –2.6 | –2.8 | –2.5 | –0.3 | 1.1 | 0.9 | . . . | . . . | . . . | 11.8 | 11.5 | 11.6 |
| **South America[5]** | **–2.6** | **0.6** | **1.6** | **. . .** | **. . .** | **. . .** | **–1.8** | **–1.9** | **–2.3** | **. . .** | **. . .** | **. . .** |
| Brazil | –3.6 | 0.7 | 1.5 | 8.7 | 3.7 | 4.0 | –1.3 | –1.4 | –1.8 | 11.3 | 13.1 | 11.8 |
| Argentina | –2.2 | 2.5 | 2.5 | . . . | 26.9 | 17.8 | –2.7 | –3.6 | –3.7 | 8.5 | 8.1 | 7.7 |
| Colombia | 2.0 | 1.7 | 2.8 | 7.5 | 4.3 | 3.3 | –4.3 | –3.8 | –3.6 | 9.2 | 9.3 | 9.2 |
| Venezuela | –16.5 | –12.0 | –6.0 | 254.4 | 652.7 | 2,349.3 | –1.6 | –0.4 | –1.3 | 20.6 | 26.4 | 29.8 |
| Chile | 1.6 | 1.4 | 2.5 | 3.8 | 2.3 | 2.7 | –1.4 | –2.3 | –2.8 | 6.5 | 7.0 | 6.8 |
| Peru | 4.0 | 2.7 | 3.8 | 3.6 | 3.2 | 2.3 | –2.7 | –1.5 | –1.6 | 6.7 | 6.7 | 6.7 |
| Ecuador | –1.5 | 0.2 | 0.6 | 1.7 | 0.7 | 0.7 | 1.4 | –0.7 | –1.6 | 5.2 | 5.1 | 5.3 |
| Bolivia | 4.3 | 4.2 | 4.0 | 3.6 | 3.2 | 5.1 | –5.7 | –4.7 | –4.8 | 4.0 | 4.0 | 4.0 |
| Uruguay | 1.5 | 3.5 | 3.1 | 9.6 | 6.1 | 6.3 | –0.1 | –0.4 | –0.8 | 7.9 | 7.3 | 7.3 |
| Paraguay | 4.1 | 3.9 | 4.0 | 4.1 | 3.5 | 4.0 | 1.7 | 1.1 | 0.4 | 6.0 | 6.5 | 6.2 |
| **Central America[6]** | **3.7** | **3.8** | **3.9** | **2.1** | **2.8** | **3.2** | **–2.9** | **–2.9** | **–2.8** | **. . .** | **. . .** | **. . .** |
| **Caribbean[7]** | **3.4** | **2.8** | **4.4** | **2.6** | **3.8** | **3.8** | **–4.1** | **–4.1** | **–4.3** | **. . .** | **. . .** | **. . .** |
| *Memorandum* | | | | | | | | | | | | |
| Latin America and the Caribbean[8] | –0.9 | 1.2 | 1.9 | 5.6 | 4.2 | 3.6 | –2.0 | –2.0 | –2.3 | . . . | . . . | . . . |
| East Caribbean Currency Union[9] | 2.6 | 2.6 | 2.8 | –0.7 | 1.3 | 1.4 | –5.4 | –6.6 | –7.4 | . . . | . . . | . . . |

Note: Data for some countries are based on fiscal years. Refer to Table F in the Statistical Appendix for a list of economies with exceptional reporting periods.
[1]Movements in consumer prices are shown as annual averages. Year-end to year-end changes can be found in Tables A6 and A7 in the Statistical Appendix.
[2]Percent of GDP.
[3]Percent. National definitions of unemployment may differ.
[4]Puerto Rico is a territory of the United States but its statistical data are maintained on a separate and independent basis.
[5]Includes Guyana and Suriname. Data for Argentina's and Venezuela's consumer prices are excluded. See country-specific notes for Argentina and Venezuela in the "Country Notes" section of the Statistical Appendix.
[6]Central America comprises Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama.
[7]The Caribbean comprises Antigua and Barbuda, The Bahamas, Barbados, Dominica, Dominican Republic, Grenada, Haiti, Jamaica, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, and Trinidad and Tobago.
[8]Latin America and the Caribbean comprises Mexico and economies from the Caribbean, Central America, and South America. Data for Argentina's and Venezuela's consumer prices are excluded. See country-specific notes for Argentina and Venezuela in the "Country Notes" section of the Statistical Appendix.
[9]Eastern Caribbean Currency Union comprises Antigua and Barbuda, Dominica, Grenada, St. Kitts and Nevis, St. Lucia, and St. Vincent and the Grenadines as well as Anguilla and Montserrat, which are not IMF members.

## Annex Table 1.1.4. Commonwealth of Independent States Economies: Real GDP, Consumer Prices, Current Account Balance, and Unemployment

*(Annual percent change, unless noted otherwise)*

| | Real GDP | | | Consumer Prices[1] | | | Current Account Balance[2] | | | Unemployment[3] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Projections | | | Projections | | | Projections | | | Projections | |
| | 2016 | 2017 | 2018 | 2016 | 2017 | 2018 | 2016 | 2017 | 2018 | 2016 | 2017 | 2018 |
| **Commonwealth of Independent States[4]** | **0.4** | **2.1** | **2.1** | **8.3** | **5.8** | **5.2** | **0.0** | **0.9** | **1.3** | **. . .** | **. . .** | **. . .** |
| **Net Energy Exporters** | **0.3** | **2.1** | **2.0** | **7.9** | **5.2** | **4.7** | **0.5** | **1.6** | **2.0** | **. . .** | **. . .** | **. . .** |
| Russia | –0.2 | 1.8 | 1.6 | 7.0 | 4.2 | 3.9 | 2.0 | 2.8 | 3.2 | 5.5 | 5.5 | 5.5 |
| Kazakhstan | 1.1 | 3.3 | 2.8 | 14.6 | 7.3 | 6.5 | –6.4 | –5.3 | –3.8 | 5.0 | 5.0 | 5.0 |
| Uzbekistan | 7.8 | 6.0 | 6.0 | 8.0 | 13.0 | 12.7 | 0.7 | 0.9 | 0.3 | . . . | . . . | . . . |
| Azerbaijan | –3.1 | –1.0 | 1.3 | 12.4 | 12.0 | 8.0 | –3.6 | 1.9 | 2.5 | 6.0 | 6.0 | 6.0 |
| Turkmenistan | 6.2 | 6.5 | 6.3 | 3.6 | 6.0 | 6.2 | –21.0 | –15.4 | –14.3 | . . . | . . . | . . . |
| **Net Energy Importers** | **1.2** | **2.1** | **2.7** | **11.0** | **10.0** | **8.3** | **–4.7** | **–4.9** | **–4.5** | **. . .** | **. . .** | **. . .** |
| Ukraine | 2.3 | 2.0 | 3.2 | 13.9 | 12.8 | 10.0 | –4.1 | –3.3 | –3.0 | 9.3 | 9.5 | 9.3 |
| Belarus | –2.6 | 0.7 | 0.7 | 11.8 | 8.0 | 7.5 | –3.6 | –5.3 | –4.6 | 1.0 | 1.0 | 1.0 |
| Georgia | 2.7 | 4.0 | 4.2 | 2.1 | 6.0 | 3.0 | –13.3 | –11.9 | –10.7 | 11.8 | . . . | . . . |
| Armenia | 0.2 | 3.5 | 2.9 | –1.4 | 1.9 | 3.5 | –2.3 | –3.6 | –3.2 | 18.8 | 18.9 | 18.9 |
| Tajikistan | 6.9 | 4.5 | 4.0 | 5.9 | 8.9 | 8.0 | –3.8 | –6.3 | –6.2 | . . . | . . . | . . . |
| Kyrgyz Republic | 3.8 | 3.5 | 3.8 | 0.4 | 3.8 | 5.1 | –9.7 | –11.6 | –12.0 | 7.5 | 7.4 | 7.3 |
| Moldova | 4.3 | 4.0 | 3.7 | 6.4 | 6.5 | 5.3 | –3.8 | –4.0 | –4.0 | 4.2 | 4.3 | 4.2 |
| *Memorandum* | | | | | | | | | | | | |
| Caucasus and Central Asia[5] | 2.5 | 3.6 | 3.7 | 10.4 | 8.8 | 7.8 | –6.4 | –4.9 | –4.2 | . . . | . . . | . . . |
| Low-Income CIS Countries[6] | 6.1 | 5.2 | 5.2 | 5.8 | 10.0 | 9.6 | –2.5 | –2.7 | –3.1 | . . . | . . . | . . . |
| Net Energy Exporters Excluding Russia | 2.4 | 3.5 | 3.7 | 11.6 | 9.3 | 8.2 | –6.2 | –4.4 | –3.6 | . . . | . . . | . . . |

Note: Data for some countries are based on fiscal years. Refer to Table F in the Statistical Appendix for a list of economies with exceptional reporting periods.
[1]Movements in consumer prices are shown as annual averages. Year-end to year-end changes can be found in Table A7 in the Statistical Appendix.
[2]Percent of GDP.
[3]Percent. National definitions of unemployment may differ.
[4]Georgia, Turkmenistan, and Ukraine, which are not members of the Commonwealth of Independent States (CIS), are included in this group for reasons of geography and similarity in economic structure.
[5]Caucasus and Central Asia comprises Armenia, Azerbaijan, Georgia, Kazakhstan, the Kyrgyz Republic, Tajikistan, Turkmenistan, and Uzbekistan.
[6]Low-Income CIS countries comprise Armenia, Georgia, the Kyrgyz Republic, Moldova, Tajikistan, and Uzbekistan.

**Annex Table 1.1.5. Middle East, North African Economies, Afghanistan, and Pakistan: Real GDP, Consumer Prices, Current Account Balance, and Unemployment**
*(Annual percent change, unless noted otherwise)*

| | Real GDP | | | Consumer Prices[1] | | | Current Account Balance[2] | | | Unemployment[3] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Projections | | | Projections | | | Projections | | | Projections | |
| | 2016 | 2017 | 2018 | 2016 | 2017 | 2018 | 2016 | 2017 | 2018 | 2016 | 2017 | 2018 |
| **Middle East, North Africa, Afghanistan, and Pakistan** | **5.0** | **2.6** | **3.5** | **5.1** | **6.8** | **7.7** | **–4.1** | **–1.9** | **–1.6** | **. . .** | **. . .** | **. . .** |
| **Oil Exporters[4]** | **5.6** | **1.7** | **3.0** | **4.6** | **4.3** | **6.0** | **–3.6** | **–0.4** | **–0.2** | **. . .** | **. . .** | **. . .** |
| Saudi Arabia | 1.7 | 0.1 | 1.1 | 3.5 | –0.2 | 5.0 | –4.3 | 0.6 | 0.4 | 5.6 | . . . | . . . |
| Iran | 12.5 | 3.5 | 3.8 | 9.0 | 10.5 | 10.1 | 4.1 | 5.1 | 5.9 | 12.5 | 12.4 | 12.4 |
| United Arab Emirates | 3.0 | 1.3 | 3.4 | 1.8 | 2.1 | 2.9 | 2.4 | 2.1 | 2.1 | . . . | . . . | . . . |
| Algeria | 3.3 | 1.5 | 0.8 | 6.4 | 5.5 | 4.4 | –16.5 | –13.0 | –10.8 | 10.5 | 11.7 | 13.2 |
| Iraq | 11.0 | –0.4 | 2.9 | 0.4 | 2.0 | 2.0 | –8.7 | –6.3 | –6.7 | . . . | . . . | . . . |
| Qatar | 2.2 | 2.5 | 3.1 | 2.7 | 0.9 | 4.8 | –4.9 | 2.3 | 1.0 | . . . | . . . | . . . |
| Kuwait | 2.5 | –2.1 | 4.1 | 3.5 | 2.5 | 2.7 | –4.5 | –0.6 | –1.4 | 2.1 | 2.1 | 2.1 |
| **Oil Importers[5]** | **3.6** | **4.3** | **4.4** | **6.2** | **12.1** | **11.2** | **–5.3** | **–5.3** | **–4.8** | **. . .** | **. . .** | **. . .** |
| Egypt | 4.3 | 4.1 | 4.5 | 10.2 | 23.5 | 21.3 | –6.0 | –5.9 | –3.8 | 12.7 | 12.2 | 11.5 |
| Pakistan | 4.5 | 5.3 | 5.6 | 2.9 | 4.1 | 4.8 | –1.7 | –4.0 | –4.9 | 6.0 | 6.0 | 6.1 |
| Morocco | 1.2 | 4.8 | 3.0 | 1.6 | 0.9 | 1.6 | –4.4 | –4.0 | –2.9 | 9.4 | 9.3 | 9.5 |
| Sudan | 3.0 | 3.7 | 3.6 | 17.8 | 26.9 | 19.0 | –5.6 | –1.9 | –2.0 | 20.6 | 19.6 | 18.6 |
| Tunisia | 1.0 | 2.3 | 3.0 | 3.7 | 4.5 | 4.4 | –9.0 | –8.7 | –8.4 | 14.0 | 13.0 | 12.0 |
| Lebanon | 1.0 | 1.5 | 2.0 | –0.8 | 3.1 | 2.5 | –18.6 | –18.0 | –16.8 | . . . | . . . | . . . |
| Jordan | 2.0 | 2.3 | 2.5 | –0.8 | 3.3 | 1.5 | –9.3 | –8.4 | –8.3 | 15.3 | . . . | . . . |
| *Memorandum* | | | | | | | | | | | | |
| Middle East and North Africa | 5.1 | 2.2 | 3.2 | 5.4 | 7.1 | 8.1 | –4.4 | –1.7 | –1.3 | . . . | . . . | . . . |
| Israel[6] | 4.0 | 3.1 | 3.4 | –0.5 | 0.2 | 0.5 | 3.6 | 4.1 | 3.1 | 4.8 | 4.3 | 4.5 |
| Maghreb[7] | 2.2 | 5.4 | 3.8 | 5.4 | 5.4 | 5.4 | –12.1 | –8.5 | –5.6 | . . . | . . . | . . . |
| Mashreq[8] | 3.9 | 3.8 | 4.2 | 8.7 | 20.7 | 18.7 | –7.8 | –8.2 | –6.4 | . . . | . . . | . . . |

Note: Data for some countries are based on fiscal years. Refer to Table F in the Statistical Appendix for a list of economies with exceptional reporting periods.
[1]Movements in consumer prices are shown as annual averages. Year-end to year-end changes can be found in Tables A6 and A7 in the Statistical Appendix.
[2]Percent of GDP.
[3]Percent. National definitions of unemployment may differ.
[4]Includes Bahrain, Libya, Oman, and Yemen.
[5]Includes Afghanistan, Djibouti, Mauritania, and Somalia. Excludes Syria because of the uncertain political situation.
[6]Israel, which is not a member of the economic region, is included for reasons of geography but is not included in the regional aggregates.
[7]The Maghreb comprises Algeria, Libya, Mauritania, Morocco, and Tunisia.
[8]The Mashreq comprises Egypt, Jordan, and Lebanon. Syria is excluded because of the uncertain political situation.

## Annex Table 1.1.6. Sub-Saharan African Economies: Real GDP, Consumer Prices, Current Account Balance, and Unemployment

*(Annual percent change, unless noted otherwise)*

| | Real GDP | | | Consumer Prices[1] | | | Current Account Balance[2] | | | Unemployment[3] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Projections | | | Projections | | | Projections | | | Projections | |
| | 2016 | 2017 | 2018 | 2016 | 2017 | 2018 | 2016 | 2017 | 2018 | 2016 | 2017 | 2018 |
| **Sub-Saharan Africa** | **1.4** | **2.6** | **3.4** | **11.3** | **11.0** | **9.5** | **–4.2** | **–3.4** | **–3.6** | **. . .** | **. . .** | **. . .** |
| **Oil Exporters[4]** | **–1.9** | **0.6** | **1.6** | **18.8** | **18.1** | **14.7** | **–2.0** | **–0.3** | **–0.6** | **. . .** | **. . .** | **. . .** |
| Nigeria | –1.6 | 0.8 | 1.9 | 15.7 | 16.3 | 14.8 | 0.7 | 1.9 | 1.0 | 13.4 | . . . | . . . |
| Angola | –0.7 | 1.5 | 1.6 | 32.4 | 30.9 | 20.6 | –5.1 | –4.8 | –4.5 | . . . | . . . | . . . |
| Gabon | 2.1 | 1.0 | 2.7 | 2.1 | 2.5 | 2.5 | –10.2 | –9.3 | –6.7 | . . . | . . . | . . . |
| Chad | –6.4 | 0.6 | 2.4 | –1.1 | 0.2 | 1.9 | –9.2 | –2.0 | –2.8 | . . . | . . . | . . . |
| Republic of Congo | –2.8 | –3.6 | 2.8 | 3.6 | –0.4 | –1.1 | –70.1 | –15.9 | 2.5 | . . . | . . . | . . . |
| **Middle-Income Countries[5]** | **2.0** | **2.5** | **3.2** | **6.8** | **5.3** | **5.1** | **–3.4** | **–3.2** | **–3.5** | **. . .** | **. . .** | **. . .** |
| South Africa | 0.3 | 0.7 | 1.1 | 6.3 | 5.4 | 5.3 | –3.3 | –2.9 | –3.3 | 26.7 | 27.6 | 28.3 |
| Ghana | 3.5 | 5.9 | 8.9 | 17.5 | 11.8 | 9.0 | –6.7 | –5.8 | –5.4 | . . . | . . . | . . . |
| Côte d'Ivoire | 7.7 | 7.6 | 7.3 | 0.7 | 1.0 | 2.0 | –1.1 | –2.9 | –2.8 | . . . | . . . | . . . |
| Cameroon | 4.7 | 4.0 | 4.6 | 0.9 | 0.7 | 1.1 | –3.6 | –3.6 | –3.5 | . . . | . . . | . . . |
| Zambia | 3.4 | 4.0 | 4.5 | 17.9 | 6.8 | 7.4 | –4.4 | –3.6 | –2.8 | . . . | . . . | . . . |
| Senegal | 6.7 | 6.8 | 7.0 | 0.9 | 2.1 | 2.2 | –5.3 | –5.1 | –5.2 | . . . | . . . | . . . |
| **Low-Income Countries[6]** | **5.3** | **5.6** | **5.9** | **6.6** | **8.8** | **8.2** | **–8.3** | **–7.9** | **–8.3** | **. . .** | **. . .** | **. . .** |
| Ethiopia | 8.0 | 8.5 | 8.5 | 7.3 | 8.1 | 8.0 | –9.9 | –8.3 | –7.4 | . . . | . . . | . . . |
| Kenya | 5.8 | 5.0 | 5.5 | 6.3 | 8.0 | 5.2 | –5.2 | –6.1 | –7.0 | . . . | . . . | . . . |
| Tanzania | 7.0 | 6.5 | 6.8 | 5.2 | 5.4 | 5.0 | –5.6 | –5.6 | –6.5 | . . . | . . . | . . . |
| Uganda | 2.3 | 4.4 | 5.2 | 5.5 | 5.8 | 5.6 | –4.3 | –5.6 | –7.2 | . . . | . . . | . . . |
| Madagascar | 4.2 | 4.3 | 5.3 | 6.7 | 7.8 | 6.8 | 0.8 | –4.7 | –5.3 | . . . | . . . | . . . |
| Democratic Republic of the Congo | 2.4 | 2.8 | 3.0 | 18.2 | 41.7 | 44.0 | –3.4 | –4.6 | –2.1 | . . . | . . . | . . . |
| *Memorandum* | | | | | | | | | | | | |
| Sub-Saharan Africa Excluding South Sudan | 1.5 | 2.7 | 3.4 | 10.4 | 10.5 | 9.3 | –4.2 | –3.4 | –3.6 | . . . | . . . | . . . |

Note: Data for some countries are based on fiscal years. Refer to Table F in the Statistical Appendix for a list of economies with exceptional reporting periods.
[1]Movements in consumer prices are shown as annual averages. Year-end to year-end changes can be found in Table A7 in the Statistical Appendix.
[2]Percent of GDP.
[3]Percent. National definitions of unemployment may differ.
[4]Includes Equatorial Guinea and South Sudan.
[5]Includes Botswana, Cabo Verde, Lesotho, Mauritius, Namibia, Seychelles, and Swaziland.
[6]Includes Benin, Burkina Faso, Burundi, the Central African Republic, Comoros, Eritrea, The Gambia, Guinea, Guinea-Bissau, Liberia, Malawi, Mali, Mozambique, Niger, Rwanda, São Tomé and Príncipe, Sierra Leone, Togo, and Zimbabwe.

**Annex Table 1.1.7. Summary of World Real per Capita Output**
*(Annual percent change; purchasing power parity)*

| | Average 1999–2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | Projections 2017 | 2018 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **World Output** | **2.7** | **–1.6** | **4.0** | **3.0** | **2.0** | **2.2** | **2.3** | **2.1** | **1.9** | **2.3** | **2.5** | **2.5** |
| **Advanced Economies** | **1.8** | **–4.0** | **2.5** | **1.1** | **0.7** | **0.8** | **1.6** | **1.7** | **1.1** | **1.7** | **1.6** | **1.3** |
| United States | 1.5 | –3.6 | 1.7 | 0.9 | 1.5 | 1.0 | 1.8 | 2.1 | 0.8 | 1.5 | 1.7 | 1.1 |
| Euro Area[1] | 1.7 | –4.9 | 1.8 | 1.3 | –1.1 | –0.5 | 1.1 | 1.6 | 1.4 | 2.0 | 1.8 | 1.4 |
| Germany | 1.7 | –5.2 | 4.2 | 3.7 | 0.5 | 0.3 | 1.5 | 0.6 | 0.9 | 1.9 | 1.7 | 1.3 |
| France | 1.4 | –3.5 | 1.5 | 1.6 | –0.3 | 0.1 | 0.4 | 0.6 | 0.8 | 1.1 | 1.3 | 1.4 |
| Italy | 0.9 | –6.1 | 1.2 | 0.2 | –3.2 | –2.3 | –0.3 | 0.8 | 1.1 | 1.3 | 1.1 | 0.9 |
| Spain | 2.1 | –4.4 | –0.4 | –1.4 | –3.0 | –1.3 | 1.7 | 3.3 | 3.3 | 3.2 | 2.7 | 1.8 |
| Japan | 0.9 | –5.3 | 4.2 | –0.3 | 1.7 | 2.2 | 0.5 | 1.2 | 1.0 | 1.7 | 0.9 | 1.0 |
| United Kingdom | 2.0 | –5.0 | 1.1 | 0.7 | 0.6 | 1.3 | 2.3 | 1.4 | 1.0 | 1.1 | 0.8 | 1.1 |
| Canada | 1.9 | –4.1 | 1.9 | 2.1 | 0.6 | 1.3 | 1.4 | 0.0 | 0.3 | 1.9 | 1.1 | 0.7 |
| Other Advanced Economies[2] | 3.3 | –1.9 | 5.0 | 2.5 | 1.2 | 1.6 | 2.1 | 1.2 | 1.4 | 1.7 | 1.7 | 1.7 |
| **Emerging Market and Developing Economies** | **4.5** | **1.1** | **5.9** | **4.9** | **3.7** | **3.7** | **3.2** | **2.8** | **2.8** | **3.2** | **3.5** | **3.6** |
| Commonwealth of Independent States | 7.2 | –6.9 | 4.3 | 4.9 | 3.2 | 2.0 | 1.5 | –2.6 | 0.0 | 1.8 | 1.8 | 2.1 |
| Russia | 7.2 | –7.8 | 4.5 | 5.0 | 3.6 | 1.7 | 0.7 | –2.8 | –0.2 | 1.8 | 1.7 | 1.7 |
| Excluding Russia | 7.6 | –3.9 | 4.4 | 5.1 | 2.6 | 3.4 | 2.7 | –1.6 | 1.2 | 2.2 | 2.6 | 3.6 |
| Emerging and Developing Asia | 6.7 | 6.4 | 8.5 | 6.7 | 5.9 | 5.9 | 5.8 | 5.7 | 5.4 | 5.4 | 5.4 | 5.2 |
| China | 9.4 | 8.7 | 10.1 | 9.0 | 7.4 | 7.3 | 6.7 | 6.4 | 6.1 | 6.1 | 5.9 | 5.1 |
| India[3] | 5.2 | 6.9 | 8.7 | 5.2 | 4.1 | 5.0 | 6.1 | 6.6 | 5.7 | 5.3 | 6.0 | 6.8 |
| ASEAN-5[4] | 3.6 | 1.0 | 5.5 | 3.2 | 4.7 | 3.7 | 3.2 | 3.5 | 3.6 | 3.9 | 3.9 | 4.0 |
| Emerging and Developing Europe | 3.8 | –3.5 | 4.0 | 6.0 | 2.0 | 4.3 | 3.4 | 4.2 | 2.7 | 4.1 | 3.1 | 2.8 |
| Latin America and the Caribbean | 1.9 | –3.1 | 4.7 | 3.4 | 1.8 | 1.8 | 0.1 | –1.1 | –2.1 | 0.1 | 0.8 | 1.7 |
| Brazil | 2.1 | –1.2 | 6.5 | 3.0 | 1.0 | 2.1 | –0.4 | –4.6 | –4.4 | 0.0 | 0.7 | 1.4 |
| Mexico | 1.4 | –6.0 | 3.8 | 2.8 | 2.8 | 0.2 | 1.1 | 1.6 | 1.2 | 1.1 | 0.9 | 1.8 |
| Middle East, North Africa, Afghanistan, and Pakistan | 1.9 | –1.2 | 2.4 | 4.0 | 1.0 | 0.3 | 0.1 | 0.5 | 2.7 | 0.0 | 1.5 | 1.9 |
| Saudi Arabia | 0.4 | –5.3 | 1.3 | 7.1 | 2.5 | –0.1 | 1.1 | 3.3 | –0.6 | –1.8 | –0.9 | 0.0 |
| Sub-Saharan Africa | 2.6 | 1.1 | 4.2 | 2.5 | 1.2 | 2.6 | 2.4 | 0.7 | –1.3 | 0.0 | 0.7 | 1.2 |
| Nigeria | 4.6 | 5.5 | 8.3 | 2.1 | 1.5 | 2.6 | 3.5 | –0.1 | –4.2 | –1.9 | –0.8 | –1.0 |
| South Africa | 2.7 | –2.9 | 1.6 | 1.8 | 0.7 | 1.0 | 0.2 | –0.3 | –1.3 | –0.9 | –0.5 | 0.6 |
| *Memorandum* | | | | | | | | | | | | |
| European Union | 2.1 | –4.6 | 1.9 | 1.5 | –0.6 | 0.1 | 1.5 | 1.9 | 1.6 | 2.1 | 1.9 | 1.5 |
| Low-Income Developing Countries | 3.4 | 3.5 | 5.2 | 3.7 | 2.4 | 3.8 | 3.7 | 2.2 | 1.2 | 2.2 | 3.0 | 3.1 |

Note: Data for some countries are based on fiscal years. Refer to Table F in the Statistical Appendix for a list of economies with exceptional reporting periods.
[1]Data calculated as the sum of individual euro area countries.
[2]Excludes the G7 (Canada, France, Germany, Italy, Japan, United Kingdom, United States) and euro area countries.
[3]See country-specific notes for India in the "Country Notes" section of the Statistical Appendix.
[4]Indonesia, Malaysia, Philippines, Thailand, Vietnam.

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CHAPTER 2

# RECENT WAGE DYNAMICS IN ADVANCED ECONOMIES: DRIVERS AND IMPLICATIONS

*Nominal wage growth in most advanced economies remains markedly lower than it was before the Great Recession of 2008–09. This chapter finds that the bulk of the wage slowdown can be explained by labor market slack (both headline unemployment and underutilization of labor in the form of involuntary part-time employment), inflation expectations, and trend productivity growth. While involuntary part-time employment may have helped support labor force participation and facilitated stronger engagement with the workplace than the alternative of unemployment, it also appears to have weakened wage growth. This is the case even in economies where measured slack appears low (that is, headline unemployment rates are now at, or below, their averages in the years leading up to the recession). Common factors—beyond slack, productivity, and price inflation—have also exerted downward pressure on wages in recent years, suggesting that the synchronized nature of excess capacity across countries may have amplified its effects. While accommodative policies can help lift demand and lower headline unemployment rates, wage growth may continue to remain subdued until involuntary part-time employment diminishes or trend productivity growth picks up. Inflation rates will also likely remain low unless wage growth accelerates beyond productivity growth in a sustained manner. Assessing the true degree of slack beyond measured headline unemployment rates will be important when judging the appropriate pace of exit from accommodative monetary policies.*

## Introduction

Close to a decade after the Great Recession of 2008–09, nominal wage growth in most advanced economies remains markedly lower than it was before the recession. This is the case even in countries where unemployment rates are now at, or even below, their averages in the years leading up to the recession. In some instances, recent wage dynamics may reflect a correction from unsustainably high wage growth prior to the Great Recession. The pattern, however, is more widespread.

Nominal wage dynamics, in general, are related to underlying changes in a "real" component—physical output created by labor together with other inputs into production—as well as inflation pressure in the economy. Viewed through this lens, subdued nominal wage growth is, in principle, consistent with a widely recognized slowdown in labor productivity, which can weigh on underlying real wage dynamics, and generally low inflation across advanced economies.[1]

Subdued nominal wage growth has also generally coincided with a reduction in hours per worker and, in some cases, a higher rate of involuntary part-time employment and an increased share of temporary employment contracts. Headline unemployment measures are therefore not as indicative of labor market slack, given this increase in part-time employment and temporary contracts. These developments may also point to persistent changes in the nature of employment relationships between firms and workers in response to technological change and remaining labor market rigidities in some countries that deter employers from hiring on standard, full-time contracts.[2]

From a macroeconomic perspective, shedding light on the forces shaping nominal wage developments could inform the debate on the extent of slack in the economy and the appropriate pace of exit from accommodative monetary policies. As noted in Chapter 1, core inflation rates in most advanced economies remain below targets and have not shown a steady upswing even as growth has generally picked up over the past year. With wages being the largest component of most firms' production costs, the upswing in wages in response to falling unemployment is the main reason core inflation typically picks up as aggregate demand strengthens and excess capacity in the econ-

The authors of this chapter are Gee Hee Hong, Zsóka Kóczán, Weicheng Lian, and Malhar Nabar (team leader), with support from Benjamin Hilgenstock and Jungjin Lee.

[1]On the productivity slowdown, see Fernald (2014); Byrne, Fernald, and Reinsdorf (2016); and Adler and others (2017). On weak inflation rates in advanced economies, see Chapter 3 of the October 2016 *World Economic Outlook* (WEO).

[2]See Bentolila and others (2012) for a discussion of labor market rigidities and the use of temporary contracts.

omy shrinks.[3] Core inflation in advanced economies is thus unlikely to recover in a sustained manner before labor market tightening spurs higher wage inflation. In sum, a better understanding of the forces that weigh on wage growth is important for assessing the appropriate course of monetary policy.

Insights into the drivers of wage dynamics and the role of part-time employment and temporary contracts may also offer perspective on prospects for income inequality and possible policy actions to address the income security of workers with part-time jobs or temporary contracts. The latter could include tackling slack, supporting retraining and reskilling, addressing remaining labor market and structural rigidities, and ensuring fairness of treatment across employees under various types of contracts.

Accordingly, the chapter addresses the following main questions:

- *Drivers:* How well do aggregate macroeconomic factors such as labor market slack, inflation expectations, and trend labor productivity growth account for nominal wage dynamics observed across advanced economies since the Great Recession? How has the evolving mix of full-time versus involuntary part-time employment and open-ended versus temporary work contracts affected labor market slack and hence wage dynamics?
- *Underlying changes:* How have changes in firms' incentives and constraints in recent years (for example, related to changing expectations about medium-term growth prospects, technology, and global production processes) affected nominal wage setting and part-time employment? What impact have shifts in bargaining power (arising, for example, from changes in employment regulations, unionization, and degree of import competition) had on wages and part-time employment?

These are the main findings of the chapter:

- Macroeconomic factors such as labor market slack (both headline unemployment and underutilization of labor in the form of involuntary part-time employment), inflation expectations, and trend productivity growth can account for the bulk of the variation in nominal wage growth at the country level in recent years. The analysis also suggests that common factors have been exerting increasing downward pressure on wage inflation in the aftermath of the global financial crisis and especially during 2014–16. For a number of euro area economies with large precrisis current account deficits, this may reflect policy measures to slow wage growth and improve competitiveness in the aftermath of the global financial crisis and euro area sovereign debt crisis.[4] More broadly, the finding of sizable common factors behind wage weakness could indicate the growing effect on wage setting in any given economy of labor market conditions in other countries (in the context of stronger cross-border economic integration). It could also point to the role of broad-based and synchronized demand weakness across many countries and heightened concern about job losses, which may have hindered wage growth in the aftermath of the global financial crisis and the euro area sovereign debt crisis.
- The relative roles of labor market slack and productivity growth vary across countries. In economies where unemployment rates are still appreciably above their averages before the Great Recession, conventional measures of labor market slack can explain about half of the slowdown in nominal wage growth since 2007, with involuntary part-time employment acting as a further significant drag on wages. Productivity growth is in turn relatively less important because these economies had generally lower productivity growth to begin with, and less of a slowdown.
- In economies where unemployment rates are below their averages before the Great Recession, slow productivity growth can account for most—about two-thirds—of the slowdown in nominal wage growth since 2007. However, even here, involuntary part-time employment appears to be weighing on wage growth, suggesting greater slack in the labor market than captured by headline unemployment rates.
- Involuntary part-time employment has risen more in countries where output is estimated to fall short of its potential. Once the influence of slack is taken into account, involuntary part-time employment has increased more where medium-term growth expectations have fallen more, automation has progressed faster, and the importance of services in the economy has increased.

[3]As noted in Chapter 1, the part of the wage-inflation weakening attributable to lower productivity growth would not translate into weaker price inflation, given that the changes would have no net effect on cost pressures (proxied by unit labor costs).

[4]Also see Kang and Shambaugh (2014).

- The analysis suggests that while accommodative policies can help lift demand and lower headline unemployment rates, wage growth may continue to remain subdued until involuntary part-time employment diminishes or trend productivity growth picks up. Inflation rates will also likely remain low unless wage growth accelerates beyond productivity growth in a sustained manner. Assessing the true degree of slack beyond measured headline unemployment rates will be important when judging the appropriate pace of exit from accommodative monetary policies.

The next section presents a primer on the determinants of wage growth to help set the stage for the empirical analysis. The chapter then takes stock of changes in the labor markets of advanced economies over recent years. In subsequent sections, the forces shaping nominal wage dynamics and employment outcomes at the aggregate level are assessed. The chapter concludes with a discussion of the main policy implications to be drawn from the analysis.

## Wage Determination—A Primer

Nominal wages are determined by the interaction between labor demand and supply, which are both subject to multiple, interrelated influences. It is useful to categorize these as influences related to the business cycle and forces that are slower moving (secular).

Over the business cycle, aggregate demand for final output translates into labor demand. In the expansionary phase, employers increase labor input to meet rising final demand. Rising demand for labor can result in a combination of more hours (including overtime), a decline in involuntary part-time employment, and an increase in the number of employed workers. Eventually, as demand continues to rise, the pool of jobseekers (a combination of unemployed plus currently employed workers who are searching for more attractive employment) shrinks relative to vacancies, and employers pay more to attract workers or to retain those on the payroll. To the extent that nominal wages are indexed to consumer price inflation and influenced by the expected path of inflation, rising price pressures in the expansionary phase of the cycle can also boost average nominal wage growth. The opposite happens when final demand weakens and the business cycle turns. Firms may initially hoard labor and, once the slump deepens, lay off workers. Average wage growth would then also weaken, and weakening inflation pressure would transmit back to weaker nominal wage growth. Thus, two key cyclical factors associated with wages are the degree of slack in the economy and inflation expectations.

During the past decade—with a deep and prolonged recession, and fewer and fewer workers working full-time—other dimensions of labor underutilization beyond the standard slack measure of the unemployment rate also appear to have had a bearing on wages.[5] Recent studies have found, for example, evidence of a negative impact of discouraged workers, or a rising share of part-time employment, on wages (Blanchflower and Posen 2014; Smith 2014).[6]

In addition to the business cycle, a key force shaping average wage growth is trend labor productivity growth—increases in the output produced by each hour of labor input in combination with other factors of production. From a firm's perspective, as trend labor productivity growth accelerates, the value of hiring additional workers increases relative to the cost of expanding the payroll.[7] Greater demand for labor translates into rising vacancies relative to jobseekers, and therefore rising pressure on wages. Conversely, as productivity growth weakens, all else equal, profitability declines, along with firms' ability to accommodate wage increases for their existing workers or their willingness to attract new workers with high wages. Thus, wage growth tends to weaken as productivity growth slows. Wage rigidities

[5]See Trigari (2014).

[6]Altig and Higgins (2014) note the negative impact on wages of people working part-time for economic reasons. Other studies look at whether the long-term unemployed affect wage dynamics as much as the short-term unemployed (Stock 2011; Gordon 2013; Council of Economic Advisers 2014; Krueger, Cramer, and Cho 2014; Rudebusch and Williams 2014; Watson 2014), partly motivated by the fact that both price and wage inflation rates in the early aftermath of the Great Recession appeared more robust than would be predicted based on conventional price and wage Phillips curves. These studies have generally noted a greater impact of short-term than of long-term unemployment. Others have noted, however, that in the United States, for example, the long- and short-term unemployment rates evolved closely together in the few decades preceding the Great Recession, and hence it can be difficult to disentangle their impacts (Kiley 2014; Smith 2014).

[7]The acceleration in labor productivity growth can occur through a combination of capital deepening (or an increase in the machinery and equipment each worker operates), improvements in human capital and the average skill composition of the workforce, and a faster pace of technology diffusion that complements the skills of a typical worker. The effects on particular types of workers may vary, depending on the complementarity of technological change with their skills and the tasks they perform, as discussed further below.

(Hall 2005; Taylor 2016) mean that changes in labor productivity may not translate one-for-one into wages immediately; wage growth is thus linked more to the trend of productivity growth (Dew-Becker and Gordon 2005; Yellen 2005).[8,9]

As long as workers are able to bargain for a stable share of the economy's value added, wage growth is generally in line with trend labor productivity growth (Mortensen and Pissarides 1999; Hall 2005). But the strength of the association may waver.[10] When workers' bargaining power improves over the medium term, more trend productivity growth increments are transmitted to wage growth.

Workers' bargaining power is a function of interrelated drivers.[11] These include institutional factors, such as union density, the coverage of collective bargaining agreements, and the degree of centralization of such agreements (for example, sectoral versus firm-level). Labor laws and employment regulations that circumscribe firms' flexibility in laying off workers can have an impact on hiring, wage setting, and terms of employment.[12]

As mentioned earlier, technological changes can also have varying impacts on bargaining power, depending on the complementarity between new technologies and the mix of tasks performed on the job and workers' skills. At one extreme, automation can substitute for some low- or middle-skilled workers whose jobs mostly call for routine inputs implemented under precise instructions (Autor and Dorn 2013; Goos, Manning, and Salomons 2014). This would weaken the bargaining power of such workers and lead to less attractive terms of employment, possibly in lower-skill occupations (for example, weaker wage growth, fewer hours, or an increase in the share of part-time employment). At the other extreme, advances in design technology can be highly complementary for high-skilled workers, such as engineers and architects whose jobs call for complex problem solving, boosting their productivity and ability to command higher wages. Workers' bargaining power can also be influenced by exposure to international competition. This may arise through trade and firms' participation in global supply chains, but it could also stem from the threat of production facilities relocating to economies where costs overall are lower. Automation and increased competition can in turn weaken unionization.

From a firm's perspective, uncertainty about growth over the medium term can also influence hiring decisions and the resulting wage dynamics. At times of greater optimism and certainty about future revenue, firms may be more willing to hire full-time workers, create jobs with open-ended contracts, and pay better wages to retain workers or improve the quality of the match in the labor market. During times of diminished growth expectations, perceptions of downside risks, or uncertainty about the future, firms may be less willing to lock themselves into potentially costly employment arrangements and prefer instead to hire labor part time, or on temporary contracts, with less favorable wages and benefits. Such growth expectations could incorporate both demand and supply components, including future demand and expected productivity growth.

The next section examines the evolution of key labor market indicators in recent years.

## Advanced Economy Labor Markets: Surface Healing Masks Deeper Changes

### Headline Employment and Wages

#### *Employment*

As shown in panel 1 of Figure 2.1, unemployment rates have been generally declining since 2013, but remain elevated in about three-quarters of advanced economies relative to their 2007 levels. These declines are mostly reflective of job creation, not artifacts of working-age members of the population dropping out of the labor force. In fact, as panel 2 of Figure 2.1

[8]A one-for-one relationship between real wages and average labor productivity over the long term would require an elasticity of substitution between capital and labor of one. The elasticity of substitution between capital and labor is important in determining how the labor share in national income responds to changes in the relative costs of labor and capital.

[9]Of course, this link between wages and productivity may not strictly hold at the sectoral level (as illustrated by the Balassa-Samuelson effect).

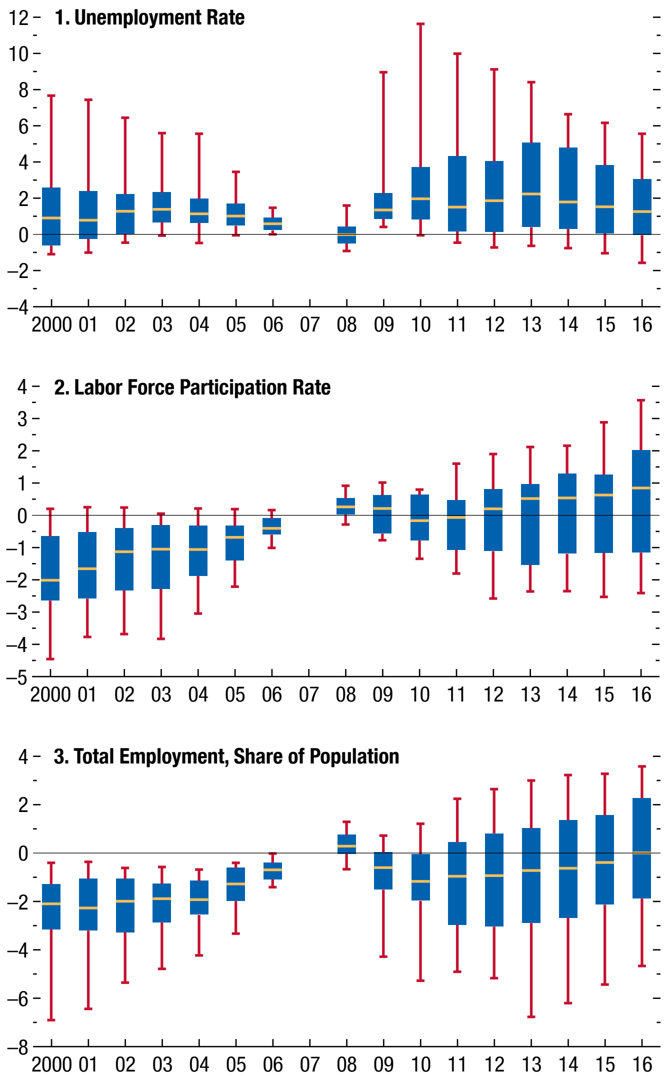
[10]During the two decades before the Great Recession, for example, the share of value added going to workers had been trending down across advanced economies (Chapter 3 of the April 2017 WEO).

[11]The interrelated nature of these drivers is examined, for example, by Kramarz (2017), who studies the relationship between union strength, offshoring, wages, and employment.

[12]Previous studies show that deregulation of the labor market may temporarily cause an increase in unemployment, but eventually translate into long-term welfare gains (Blanchard and Giavazzi 2003). Chapter 3 of the April 2016 WEO and OECD (2017) show that labor market deregulation has positive effects on employment and output in good times, but can become contractionary in periods of slack.

**Figure 2.1. Distribution of Labor Market Indicators**
*(Percentage-point difference relative to 2007)*

Unemployment rates have been generally declining since 2013 but remain elevated in about three-quarters of advanced economies relative to their 2007 levels. These declines are mostly reflective of job creation and not a result of working-age members of the population dropping out of the labor force. In fact, labor force participation has risen in more than half of advanced economies.




Sources: Organisation for Economic Co-operation and Development; and IMF staff calculations.
Note: The horizontal line inside each box represents the median, the upper and lower edges of the box show the top and bottom quartiles, and the red markers denote the top and bottom deciles.

shows, labor force participation has risen in more than half of advanced economies relative to 2007 levels, generally reflecting higher participation by workers older than 54 and women in these countries (analyzed in detail in Box 1.1).[13,14] Higher unemployment rates, combined with higher labor force participation rates, leave employment ratios (employed workers as a share of the age 15+ population) very close to or above their pre–Great Recession peak (2007) in about half of advanced economies.[15]

### *Wages*

Panel 1 of Figure 2.2 shows that for virtually all advanced economies, nominal wage growth (measured as nominal compensation per hour, and comparable across countries) remains below pre–Great Recession ranges.[16] This is particularly notable for economies where unemployment rates have declined relatively rapidly and are now close to or below pre–Great Recession averages (Figure 2.2, panel 2). Even in economies where nominal wage growth in 2016 was higher than before the Great Recession, such as Germany and Japan, the gains have been from low bases: a period of wage moderation in Germany intensified by the Hartz labor market reforms and in the midst of Japan's decade-long deflation and shrinking nominal wages.[17]

[13]As noted in Box 1.1, the decline in the population-weighted average labor force participation rate in advanced economies since 2007 is driven by a large decline in the United States.

[14]As highlighted in Chapter 1 of the October 2015 and October 2016 WEO, forecasts in the postcrisis period have generally underpredicted employment growth.

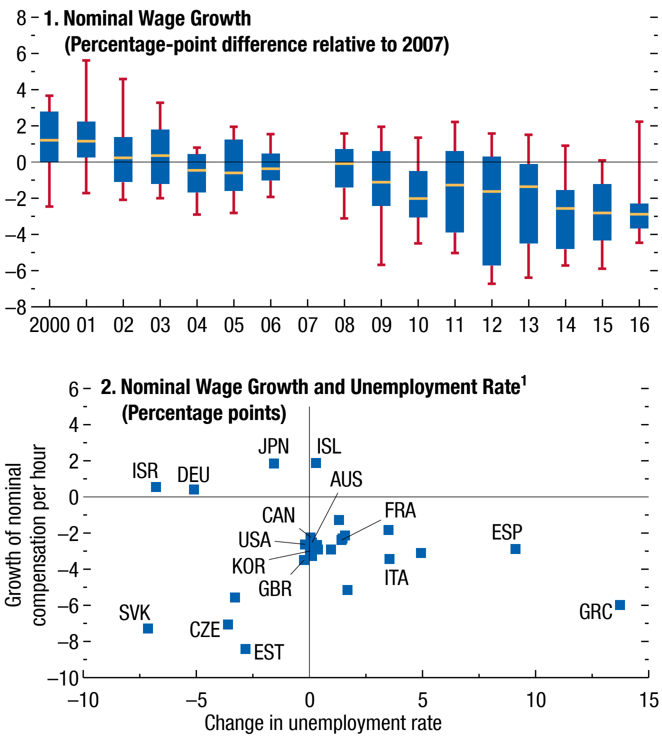
[15]The United States is a notable exception, where a decline of 3 percentage points in the participation rate since 2007 has resulted in a lower employment ratio than before the crisis, despite the decline in the unemployment rate to below its precrisis average.

[16]Growth rates for real wages in about three-quarters of advanced economies are below what they were before the Great Recession, whether viewed as "consumption real wages" (that is, nominal wages deflated by headline consumer price inflation, which influences living standards and labor supply decisions) or as "product real wages" (that is, nominal wages deflated by the GDP deflator, which influences firms' profitability and hiring decisions). See Annex 2.1 for more details on the wage measures and Annex Figure 2.2.1 on the dynamics of real wages.

[17]See Burda and Seele (2016) for a discussion of the effects of the Hartz reforms on the German labor market and Aoyagi and Ganelli (2015) on Japan's labor market outcomes during the 2000s.

**Figure 2.2. Distribution of Nominal Wage Growth and Correlation with Changes in the Unemployment Rate**

Despite improved headline employment indicators, nominal wages in virtually all advanced economies are growing at a slower pace than before the Great Recession. This is particularly notable for economies where unemployment rates are now close to or below pre-Great Recession averages.




Sources: Eurostat; national authorities; Organisation for Economic Co-operation and Development; and IMF staff calculations.
Note: The sample in panel 1 excludes Baltic countries. The wage variable used is compensation per hour of workers excluding the self-employed. The horizontal line inside each box represents the median, the upper and lower edges of the box show the top and bottom quartiles, and the red markers denote the top and bottom deciles. Data labels in panel 2 use International Organization for Standardization (ISO) country codes. Outliers and the 10 largest advanced economies (by 2016 nominal GDP in US dollars) are labeled.
[1]Changes shown are 2016 values relative to the 2000–07 average.

## Involuntary Part-Time Employment, Temporary Contracts, Hours

A more complete picture of the labor market emerges by considering additional indicators that suggest greater slack in the labor market than captured by headline unemployment rates, and possibly weaker job security than prior to the Great Recession.

### *Involuntary Part-Time Employment*

Panel 1 of Figure 2.3 documents that involuntary part-time employment (workers employed fewer than 30 hours a week who report they would like longer hours) increased across virtually the entire sample in 2009 and remains above the 2007 level in more than three-quarters of countries. In the United States, the share increased from 0.8 percent in 2007 to 1.3 percent in 2016, while in the United Kingdom it rose from 2.4 percent to 3.9 percent, and in France from 5.3 percent to 7.8 percent. Germany is an exception, although its 2016 involuntary part-time employment share (3.1 percent) was above the 2.7 percent average for 2000–07.

As panel 2 of Figure 2.3 shows, the largest increases in involuntary part-time employment occurred in economies with unemployment rates above their 2000–07 averages. But even for economies with rates now close to their 2000–07 averages (points clustered around the vertical axis), the involuntary part-time share of employment is higher than it was before the crisis.

### *Temporary Contracts*

Along with involuntary part-time employment, the incidence of temporary contractual arrangements has attracted attention in recent years (see Aoyagi and Ganelli 2015; Brainard 2016). These contracts can help reduce unemployment spells, allow workers to avoid gaps in their employment history, and maintain their engagement in the labor force. However, they typically offer briefer employment than do open-ended contracts, less opportunity for workers to develop skills and expand responsibilities, and sometimes weaker benefits. By 2016, in just over half the economies, the temporary contract share was higher than in 2007 (Figure 2.4, panel 1). Temporary contracts are more common now than in 2000–07 for most advanced economies (Figure 2.4, panel 2).[18]

### *Hours*

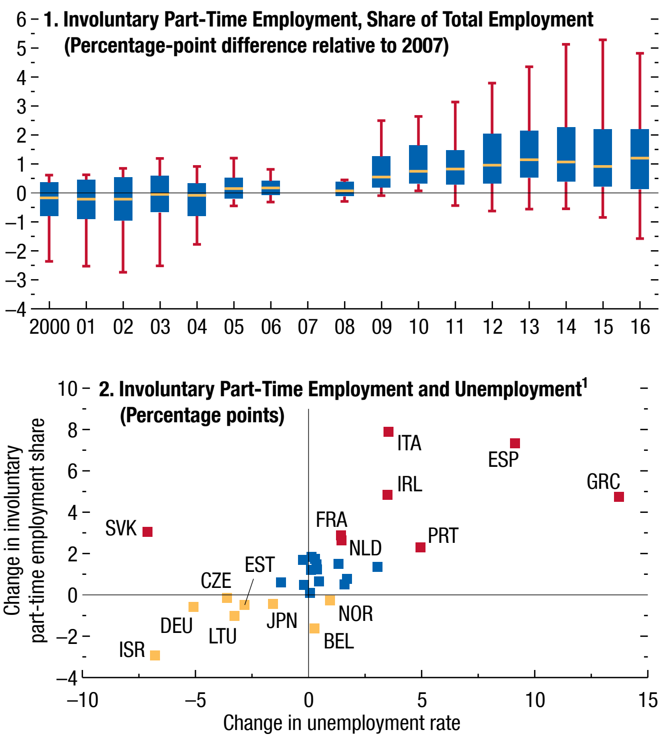
A third category of job attributes, which in part reflects worker preferences, is hours worked per worker. In more than half of the economies, hours per worker are at least 2 percent below 2007 levels (Figure 2.5, panel 1). However, hours had been declining before that, and the pattern has continued.[19]

[18]In the case of Japan, the figure shows that the share of temporary contract workers has dropped by close to 6 percentage points compared with the 2000–07 average. But as noted in IMF (2016), the wider category of "nonregular" workers—those who either (1) are not hired directly by the employer, (2) work part-time, or (3) do not have an open-ended contract—actually increased as a share of overall employment during this period. See also Aoyagi and Ganelli (2015). There are no comparable cross-country data on regular versus nonregular workers.

[19]The measure may understate the decline in hours per job if an individual now accumulates hours across multiple jobs more often than in the past.

**Figure 2.3. Job Attributes: Involuntary Part-Time Employment**

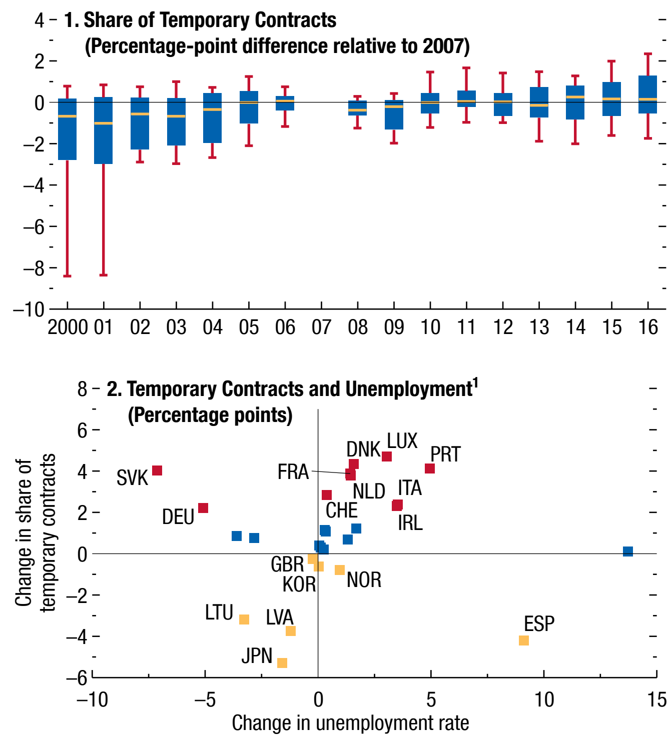
Involuntary part-time employment shares increased across virtually the entire sample in 2009 and remain above the 2007 level in more than three-quarters of the economies. The largest increases occurred in economies with unemployment rates above their 2000–07 averages.




Sources: National authorities; Organisation for Economic Co-operation and Development; and IMF staff calculations.
Note: Involuntary part-time workers are those working less than 30 hours a week because they could not find a full-time position. The involuntary part-time employment share is calculated as the total number of involuntary part-time workers divided by total employment. In panel 1, the horizontal line inside each box represents the median, the upper and lower edges of the box show the top and bottom quartiles, and the red markers denote the top and bottom deciles. In panel 2, countries in gold are those with decreases in the involuntary part-time employment share; countries in red are those with pronounced increases. Data labels in the figure use International Organization for Standardization (ISO) country codes.
[1]Changes shown are 2016 values relative to the 2000–07 average.

**Figure 2.4. Job Attributes: Temporary Contracts**

The temporary contract share in 2016 is above its 2007 level in over half of advanced economies. Temporary contracts are more common now than in 2000–07, primarily in economies where the unemployment rate remains above its pre-Great Recession average.



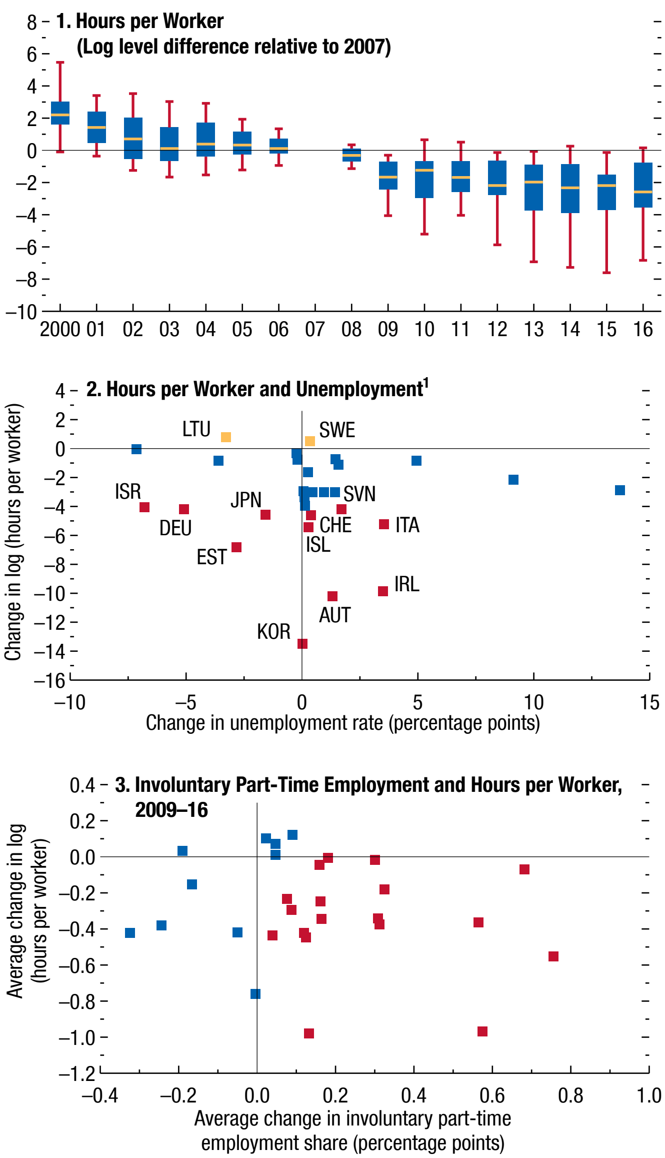

Sources: National authorities; Organisation for Economic Co-operation and Development; and IMF staff calculations.
Note: Temporary workers are those with work contracts of limited duration; thresholds are country specific. The share of temporary contracts is calculated as the number of temporary workers divided by total employment. In panel 1, the horizontal line inside each box represents the median, the upper and lower edges of the box show the top and bottom quartiles, and the red markers denote the top and bottom deciles. In panel 2, countries in gold are those with decreases in the share of temporary contracts; countries in red are those with pronounced increases. Data labels in the figure use International Organization for Standardization (ISO) country codes.
[1]Changes shown are 2016 values relative to the 2000–07 average.

The decline in hours could reflect worker preferences for greater flexibility and willingness to work fewer hours (for example for elderly workers or students who previously may not have been in the labor force). But it could also reflect firms' preference for hiring workers for fewer hours or on an as-needed basis. These just-in-time matches are often governed by agreements between firms and workers. The firm need not guarantee minimum hours, and workers are not obligated to accept an offer made by the firm. These contracts are referred to as "zero-hours contracts" in the United Kingdom; similar agreements govern employment relationships elsewhere, including in Australia and Canada.[20] As Box 2.1 documents, hours declined more in sectors with higher shares of low- and middle-skilled workers, suggesting that factors beyond worker pref-

[20]In the United Kingdom for example, workers on zero-hours contracts as a share of employed workers rose from 0.6 percent in 2010 to 3 percent in 2016 (Haldane 2017).

**Figure 2.5. Job Attributes: Hours per Worker**

In more than half of advanced economies in 2016, hours per worker were at least 2 percent below 2007 levels. However, this appears to be a continuation of the pre-2007 pattern. Hours per worker have fallen from their 2000–07 averages, regardless of whether unemployment rates are now higher or lower than before the Great Recession. Declining hours also tend to be associated with higher shares of involuntary part-time employment.




Sources: National authorities; Organisation for Economic Co-operation and Development; and IMF staff calculations.
Note: In panel 1, the horizontal line inside each box represents the median, the upper and lower edges of the box show the top and bottom quartiles, and the red markers denote the top and bottom deciles. In panel 2, countries in gold are those with increases in hours per worker; countries in red are those with pronounced decreases. In panel 3, countries in red display (on average) falling hours per worker and (on average) an increase in the involuntary part-time employment share for 2009–16. Data labels in the figure use International Organization for Standardization (ISO) country codes.
[1]Changes shown are 2016 values relative to the 2000–07 average.

erences were at play. A concurrent rise in involuntary part-time employment also suggests that the decline in hours per worker was driven by reduced demand for hours of work by firms, rather than reduced supply of hours by workers. However, it is still difficult to separate workers' preferences that shape labor supply from the binding constraints of weak labor demand.

Hours per worker have fallen from their 2000–07 averages, regardless of whether unemployment rates are higher or lower than they were (Figure 2.5, panel 2). Declining hours also tend to be associated with higher shares of involuntary part-time employment (panel 3).

## Separating Compositional Shifts from Common Patterns across Sectors

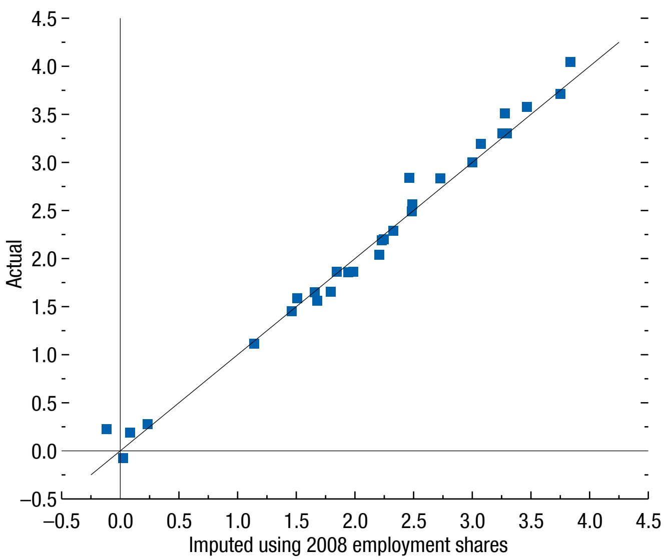
The previous sections point to a widespread change in labor market outcomes (subdued wage growth, larger involuntary part-time employment, higher incidence of temporary contracts, declining hours per worker) compared with the period before the Great Recession. To what extent do these developments mostly reflect common patterns across sectors, or compositional shifts in employment toward sectors where the change in labor market outcomes is more pronounced? Data for 21 sectors across 31 advanced economies since 2000 allow for a deeper look at the underlying role of compositional effects.

Figures 2.6 and 2.7 compare the average change in a job attribute during 2009–16 with the imputed change if employment shares across sectors had remained as they were in 2008. Points on the 45-degree line indicate that the actual change and the imputed change are identical; it is therefore within-sector developments, rather than compositional change across sectors, that drive aggregate dynamics. Conversely, points off the 45-degree line indicate that compositional change contributed to the overall development. Points marked in red are those for which the indicator deteriorated during 2009–16 and compositional change in sectoral employment shares made a quantitatively important contribution to that decline (that is, a shift in employment toward sectors where the deterioration was deeper). The figures indicate that compositional changes seem to play greater roles for part-time employment shares, temporary contracts, and hours per worker than for growth in nominal wages.[21]

[21]Labor mobility across sectors could cause wage growth to be broadly synchronized across sectors such that aggregate wage developments appear to reflect mostly within-sector developments.

**Figure 2.6. Average Nominal Wage Growth, 2009–16, Actual versus Imputed Using 2008 Sectoral Employment Shares**
*(Percent)*

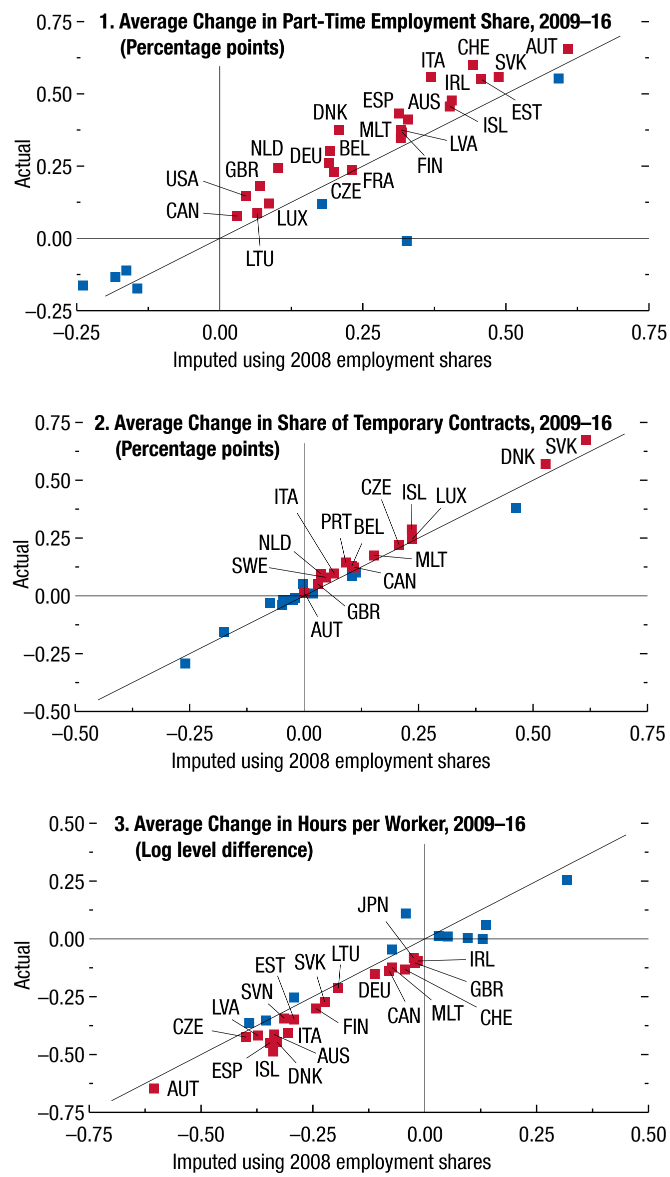
Compositional changes do not appear to have an important role in recent nominal wage growth dynamics. All advanced economies are close to the 45-degree line, indicating that aggregate wage growth is driven by within-sector developments.




Sources: Eurostat; national authorities; and IMF staff calculations.
Note: The wage variable used is annual wage per worker excluding the self-employed.

**Figure 2.7. Changes in Labor Market Indicators, Actual versus Imputed Using 2008 Sectoral Employment Shares**

Compositional change played an important role for changes in job attributes. Shifts in employment shares across sectors can explain about 22 percent of the increase in the part-time employment share, 18 percent of the increase in the share of temporary contracts, and 23 percent of the reduction in hours per worker.



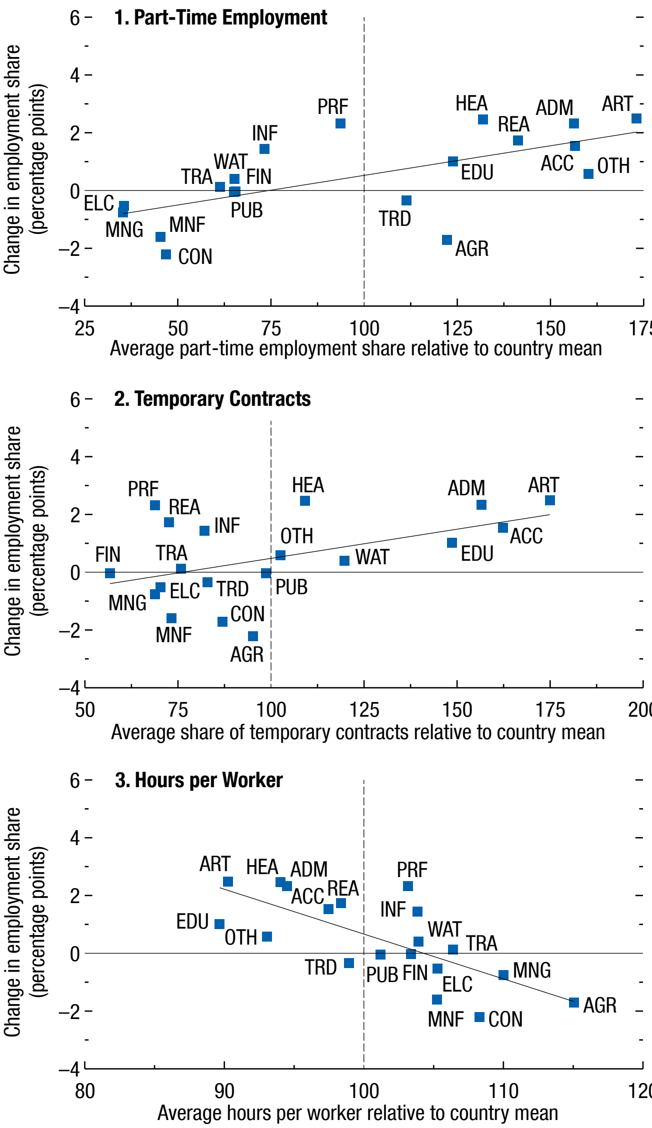

Sources: Eurostat; national authorities; and IMF staff calculations.
Note: The part-time employment share is calculated as the number of part-time workers in a sector divided by total employment in the sector. Temporary workers are people with work contracts of limited duration; thresholds are country specific. The share of temporary contracts is calculated as the number of temporary workers in a sector divided by total employment in the sector. Countries in red represent cases in which compositional changes amplified within-sector increases (panels 1 and 2) or decreases (panel 3). Data labels in the figure use International Organization for Standardization (ISO) country codes.

- In the case of part-time employment, 26 countries in the sample experienced an increased share of part-time workers. In 12 of the 26 countries, compositional change accounted for more than 25 percent of the increase (and more than half the increase in four countries).
- Regarding the temporary contract share of employment, 19 of the 26 countries experienced an increase. Compositional change accounted for more than 25 percent of the increase in seven of those countries (and more than half in three countries).
- Declines in hours per worker were seen in 25 countries, with compositional change accounting for more than 25 percent of this decrease in 10 countries (and more than half in five countries).

Panels 1 and 2 of Figure 2.8 show that, during 2008–16, declining employment shares in sectors with low part-time employment and temporary contracts (mining and manufacturing), together with faster increases in employment in sectors with higher shares

## Figure 2.8. Job Attributes and Changes in Sectoral Employment Shares, 2008–16

Compositional shifts in employment toward sectors with relatively high shares of part-time employment and temporary employment and relatively low hours per worker contributed to the overall changes in these job attributes.




Sources: Eurostat; national authorities; Organisation for Economic Co-operation and Development; and IMF staff calculations.
Note: Markers to the right of 100 represent sectors with relatively high values (relative to country mean); markers to the left of 100 represent sectors with relatively low values. ACC = accommodation and food service activities; ADM = administrative and support service activities; AGR = agriculture, forestry, and fishing; ART = arts, entertainment, and recreation; CON = construction; EDU = education; ELC = electricity, gas, steam, and air-conditioning supply; FIN = financial and insurance activities; HEA = human health and social work activities; INF = information and communication; MNF = manufacturing; MNG = mining and quarrying; OTH = other services; PRF = professional, scientific, and technical activities; PUB = public administration and defense; REA = real estate activities; TRA = transportation and storage; TRD = wholesale and retail trade; WAT = water supply, sewerage, waste management, and remediation activities.

of these attributes (services), contributed to rising overall shares of part-time employment and temporary contracts. Panel 3 of Figure 2.8 shows that shifts in employment toward sectors with relatively low hours per worker contributed to the aggregate change in this job attribute.

In sum, sectors that tend to have traditional employment arrangements (smaller shares of temporary contracts and part-time employment, longer hours per worker) have seen outright declines or weaker growth in employment than sectors where arrangements are more flexible. All in all, shifts in employment shares across sectors can explain about 22 percent of the increase in part-time employment, 18 percent of the increase in temporary contracts, and 23 percent of the reduction in hours per worker.

## Drivers of Recent Wage Dynamics

As documented in the section "Surface Healing Masks Deeper Changes," nominal wage growth remains lower than before the Great Recession in most advanced economies. Furthermore, rising involuntary part-time employment, a higher incidence of temporary contracts, and a decline in hours per worker suggest broader changes in the labor market in many advanced economies since 2007, and notably even in those where unemployment rates are now below their precrisis averages.

This section studies the determinants of wage growth across advanced economies in recent years. The empirical approach is guided by the sequence outlined in the primer on wage determination. It first explores the role of cyclical factors, such as headline unemployment and inflation expectations and medium-term factors (trend productivity growth), before examining how the changing nature of employment affects wage dynamics. Finally, it explores the influence of slower-moving factors on wage dynamics and involuntary part-time employment.

### Aggregate Analysis—Cross-Country Evidence

The baseline approach is a panel variant of the wage Phillips curve estimated in Gali (2011), in which wage growth is regressed on expected inflation, lagged inflation, and the unemployment rate.[22] The analysis

[22]The baseline wage measure is compensation per hour, excluding self-employment income. Because the data are insufficient to accu-

focuses on nominal wage growth, examining the influence of past inflation and inflation expectations explicitly, alongside drivers that could be acting through real wage dynamics.

These cyclical drivers can be rationalized as follows. Nominal wage growth depends on expected inflation (if wage setting is forward looking) or on lagged inflation (if backward indexation occurs); in aggregate, it is likely to depend on a combination of the two. Given that the benchmark model assumes a constant natural rate of unemployment and constant hours per worker, the unemployment rate proxies for labor market slack. In other models (described in Annexes 2.2 and 2.3), the output gap is used as an alternative measure of labor market slack. Greater slack in the labor market is expected to slow wage growth. Furthermore, at any given labor market slack and inflation expectations, wage growth can vary, depending on whether the economy is entering or exiting recession. The wage Phillips curves therefore also control for changes in unemployment (Manning 1993; Gali 2011). As described in the primer on wage determination, a key influence on wage growth is trend labor productivity growth. The benchmark model controls for this factor as well.[23]

The panel structure allows for the examination of wage dynamics across advanced economies, exploiting variation in the determinants of wage growth over time and across countries. Robustness tests are conducted by allowing the relationships between wage growth and labor market slack, changes in the unemployment rate, and inflation expectations to be country specific. Allowing coefficients to be country specific can help capture particular features of individual contexts—for instance, the hypothesis that nominal wage growth in the United States has been subdued in recent years in part because employers did not cut wages immediately after the financial crisis (Yellen 2014; Daly and Hobijn 2015), or the idea that wage growth may have been inhibited by a decline in the entry of new firms, a reduction in labor market "churn," and fewer job-to-job transitions—and thus fewer discrete increases in wages that often occur with these transitions.[24] While testing these country-specific hypotheses in detail is beyond the scope of this chapter, two boxes supplement the cross-country analysis by shedding light on particular mechanisms that apply in certain advanced economy contexts. Box 2.2 examines the incidence of nominal wage freezes and cuts using firm-level data from Europe. Box 2.3 studies how wage growth in a broad sample of advanced economies may have been affected by firm-level balance sheet health after the financial crisis.

### *Slack and Inflation*

The analysis indicates that slack and past inflation are statistically significantly associated with nominal wage growth, with expected signs (Annex Table 2.3.1, column 1). A 1 percentage point increase in the unemployment rate is associated with a 0.3 to 0.4 percentage point decline in nominal wage growth, while a 1 percentage point increase in lagged inflation is associated with a 0.2 percentage point increase in nominal wage growth.

### *Trend Labor Productivity Growth*

Firms' profitability and ability to accommodate wage increases are linked to changes in trend labor productivity growth, as discussed in the primer on wage determination. The empirical evidence suggests that nominal wage growth indeed appears to move broadly in line with trend productivity growth (Annex Table 2.3.1, column 2). A 1 percentage point increase in trend productivity growth is associated with a 0.7 percentage point increase in nominal wage growth.[25]

rately determine the shares of value added captured by labor versus capital for the self-employed, the baseline measure does not consider the wages of the self-employed. Results are broadly robust to using alternative wage measures.

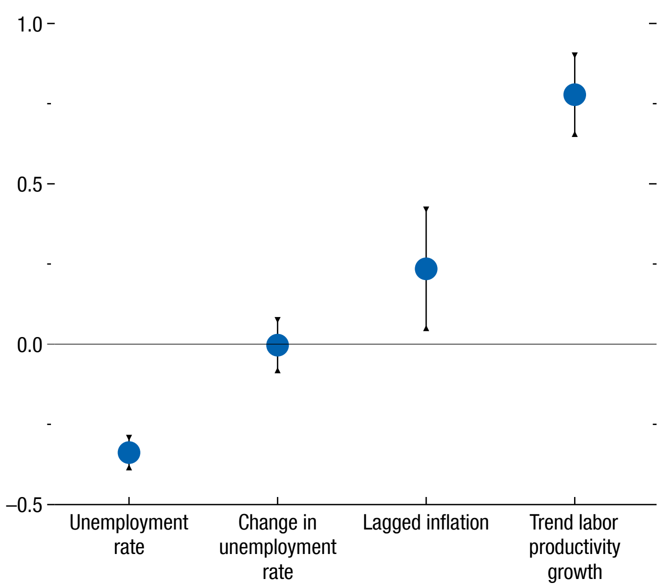
[23]The inclusion of trend productivity growth in wage equations that examine the role of cyclical factors, such as slack and inflation expectations, is argued for by Ball and Moffitt (2001), Dew-Becker and Gordon (2005), Hall (2005), and Yellen (2005). The theoretical motivation for including productivity growth in wage Phillips curves is shown, for example, in Blanchard and Katz (1997), although the authors note that the empirical estimates for US Phillips curves estimated up to the time of writing do not strongly argue for its inclusion in the specification. The pass-through from labor productivity to real wages depends on the bargaining power of workers and the elasticity of substitution between capital and labor (Chapter 3 of the April 2017 WEO). Annex Figure 2.2.3 illustrates the dynamics of trend productivity growth.

[24]Danninger (2016), for example, finds that job-to-job transitions in the United States have slowed for all skill and age groups in recent years. These developments are not necessarily a legacy of the Great Recession. Davis and Haltiwanger (2014) show that worker reallocation rates declined by 25 percent after 2000, suggesting that the labor market had begun to turn less fluid before the Great Recession.

[25]The impact of trend productivity growth on wage growth is consistent with other studies. These results suggest that a 1 percentage point increase in trend productivity growth rate is associated with 0.4 to 0.9 percentage point higher wage growth, a range that includes the impact of about 0.8 percentage point implied in

**Figure 2.9. Effects on Growth of Compensation per Hour: Panel Estimation**
*(Percentage points)*

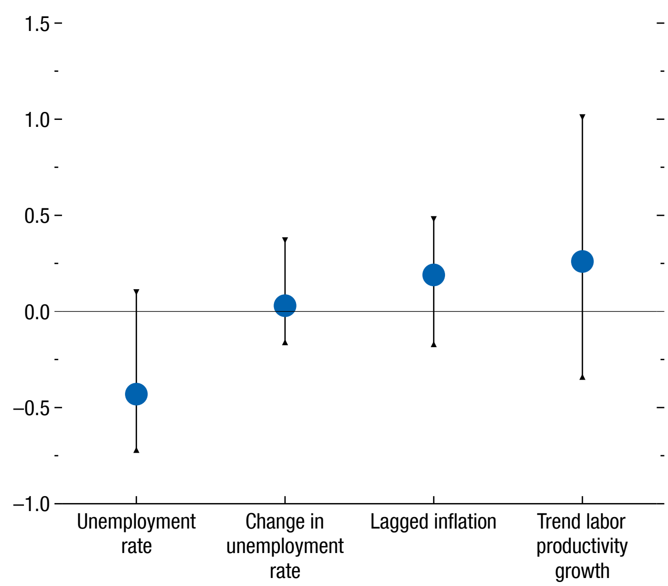
Slack, past inflation, and trend labor productivity growth are statistically significantly associated with nominal wage growth, with expected signs.




Source: IMF staff calculations.
Note: The wage variable used is compensation per hour of workers excluding the self-employed. Markers show estimated coefficients, and lines display 90 percent confidence intervals. Sample excludes Baltic countries. Oil price is used as an instrument for lagged inflation. Figure is based on column (7) of Annex Table 2.3.1.

**Figure 2.10. Effects on Growth of Compensation per Hour: Country-by-Country Estimation, Cross-Country Dispersion**
*(Percentage points)*

A country-by-country exploration of the influences of slack, past inflation, and trend labor productivity growth points to country-specific estimates that are broadly consistent with the coefficients obtained from the country panel estimation.




Source: IMF staff calculations.
Note: The wage variable used is compensation per hour of workers excluding the self-employed. Markers show means of country-by-country estimation coefficients, and lines display corresponding interquartile ranges. Sample excludes Baltic countries. Figure is based on column (8) of Annex Table 2.3.1.

Similar patterns emerge through approaches that attempt to reduce concerns about reverse causality from wage growth to inflation (Annex Table 2.3.1, column 3) and by focusing on a sample that excludes smaller advanced economies to ensure that they are not driving the results (Annex Table 2.3.1, columns 5–7). Figure 2.9 shows coefficient estimates for the preferred specification, based on the sample excluding the smaller economies and using instrumental variables to account for possible endogeneity of inflation in the wage equation (Annex Table 2.3.1, column 7). Furthermore, a country-by-country exploration of the influences of slack, past inflation, and trend productivity growth illustrates that the underlying dispersion of country-specific estimates (Figure 2.10; Annex Table 2.3.1, columns 4 and 8) is broadly consistent with the coefficients obtained from the cross-country panel.[26]

The findings also hold when using the aggregate output gap as a measure of slack (which allows for changes over time in the natural rate of unemployment and cyclical variations in hours per worker), as well as alternative measures of inflation expectations and trend productivity growth (Annex Table 2.3.2).

Karabarbounis and Neiman (2014). A coefficient smaller than 1 implies a less than one-for-one association between increments to productivity growth and wage growth, and indicates that some of the gains from higher productivity growth translate into higher capital income (including rent, interest, dividends and retained corporate earnings). See Chapter 3 of the April 2017 WEO for a more extensive discussion.

[26]The coefficients from the country-by-country specifications are, however, less precisely estimated than the panel coefficients due to smaller samples.

### *The Changing Nature of Employment and Latent Slack*

Recent studies have argued that measured unemployment rates may not accurately capture slack in the United States (with a resulting focus on U-6 as a broader measure of slack) and some parts of the euro area (ECB 2017).[27,28] Furthermore, to the extent that declining unemployment rates partly reflect workers forced into part-time jobs, increases in such types of employment may overstate the tightening of the labor market. Specifically, these workers may be willing to accept slower increases in wages and, at the same time, may continue to seek full-time employment and open-ended contracts. By doing so, they compete with workers employed under more traditional arrangements and, so, weigh on their wage growth as well. True labor market slack may therefore be larger than suggested by headline unemployment rates.[29]

Extensions of the baseline approach examine whether the changing nature of employment (as documented in the section "Surface Healing Masks Deeper Changes") may have contributed to latent slack in the economy that is not picked up in headline unemployment numbers (Annex Tables 2.3.3–2.3.7). The analysis augments the baseline approach by including the shares of involuntary part-time employment and temporary contracts.[30]

A higher share of involuntary part-time employment is associated with lower wage growth, even after controlling for the influence of the variables discussed previously. Across all countries, on average, a 1 percentage point increase in the involuntary part-time employment share is associated with a 0.3 percentage point decline in nominal wage growth. To allow for the possibility that coefficients might vary across countries that have had different degrees of labor market tightening since the crisis, the regressions are also estimated separately for three subgroups. The coefficient is larger for the sample of countries where the unemployment rate is below pre–Great Recession averages. Within this group of countries, a 1 percentage point increase in the involuntary part-time employment share is associated with a 0.7 percentage point decline in wage growth. The estimated effect is only 0.2 percentage point for countries with unemployment appreciably above the pre–Great Recession averages. Though the point estimates are different for these subsamples, these differences are not statistically significant (Figure 2.11 depicts the coefficients shown in Annex Table 2.3.3, columns 5–8).

In contrast to the finding that involuntary part-time employment has weighed on nominal wage growth, the analysis does not detect a role for temporary contracts in affecting wage dynamics. In general, the temporary contract share of employment does not have a statistically significant effect on aggregate wages for the whole sample or different subgroups (Annex Tables 2.3.6 and 2.3.7).[31]

### *Contributions to Changes in Nominal Wage Growth*

Putting the influences of slack, past inflation, and trend productivity growth together, Figure 2.12 examines the contributions of these factors to changes in average nominal wage growth since 2008 relative to 2000–07. For countries with unemployment rates below 2000–07 averages, about two-thirds of the observed decline in nominal wage growth can be explained by slower trend productivity growth—an effect that is larger in 2015–16 than in previous years (given the recent decline in trend productivity growth for this group). Lower slack (captured here using the conventional labor market indicators—that is, the unemployment rate and its change) would have acted to increase nominal wage growth since 2014. However, involuntary part-time employment continues to weigh on nominal

[27]U-6 includes the total unemployed, plus all marginally attached workers and total employed part-time for economic reasons as a percent of the civilian labor force plus all marginally attached workers.

[28]The evidence for the United States appears mixed. Krueger (2015) argues that the measured unemployment rate *overstates* the degree of slack in the United States because long-term unemployed workers have a negligible impact on wage setting. But as the same paper notes, other studies—Aaronson and Jordan (2014), Altig and Higgins (2014), Smith (2014), and Kumar and Orrenius (2016)—do find some evidence on the impact of the long-term-unemployment rate on wage growth, including at the state level.

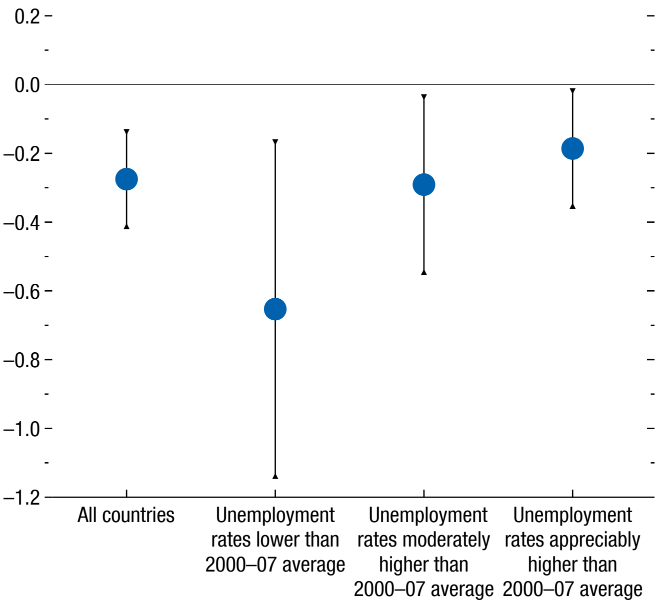
[29]Aoyagi and Ganelli (2015) study the growing importance of nonregular employment in Japan in recent years. Katz and Krueger (2016) discuss the rise of alternative, flexible work arrangements—temping, contracting, freelancing through short-term gigs—in the United States. They estimate that workers in such arrangements now comprise 16 percent of the US workforce. See also Brainard (2016).

[30]These could be seen as signs of binding constraints on workers (possibly stemming from weak labor demand since the Great Recession), reflecting in part structural developments, though with an important cyclical component. Given that hours per worker also reflect worker preferences, this attribute is not considered here as a measure of latent slack.

[31]This could in part reflect measurement problems for this variable; to ensure cross-country comparability, the analysis uses a measure that does not contain information on regular versus nonregular contracts, but rather one that adheres to a legal definition of temporariness. See also note 18.

**Figure 2.11. Effects of Involuntary Part-Time Employment on Growth of Compensation per Hour, 2000–16**
*(Percentage points)*

A higher share of involuntary part-time employment is associated with lower wage growth, even after controlling for the influence of other variables. The effect is more pronounced in countries where the unemployment rate is below pre-Great Recession averages.

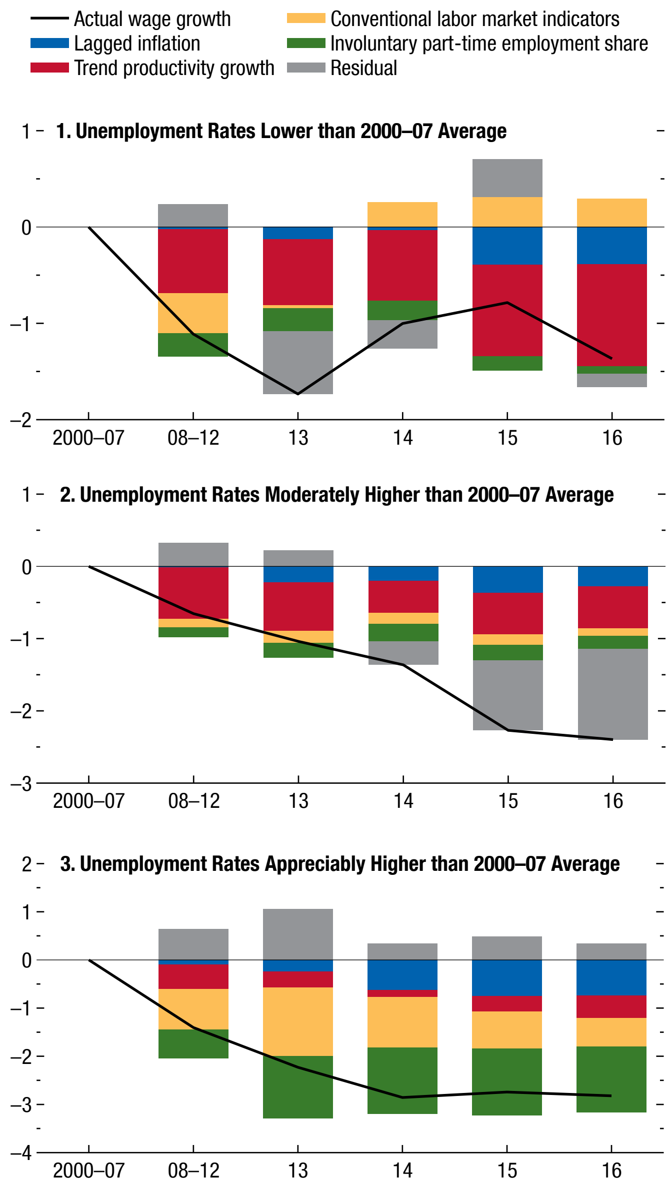



Source: IMF staff calculations.
Note: The wage variable used is compensation per hour of workers excluding the self-employed. Markers show estimated coefficients, and lines display 90 percent confidence intervals. Involuntary part-time workers are those working less than 30 hours a week because they could not find a full-time position. The involuntary part-time employment share is calculated as the total number of involuntary part-time workers divided by total employment. Countries with unemployment rates lower than the 2000–07 average are CZE, DEU, GBR, ISR, JPN, SVK, and USA; countries with unemployment rates moderately higher than the 2000–07 average are those with increases below the median of all countries with unemployment rate increases and comprise AUS, AUT, BEL, CAN, CHE, FIN, ISL, NOR, and SWE; countries with unemployment rates appreciably higher than the 2000–07 average are those with increases above the median of all countries with unemployment rate increases and comprise DNK, ESP, FRA, GRC, IRL, ITA, NLD, PRT, and SVN. Abbreviations in note use International Organization for Standardization (ISO) country codes. Figure is based on columns (5) to (8) of Annex Table 2.3.3.

wage growth (Figure 2.12, panel 1). In contrast, in countries with unemployment rates still above what they were before the crisis, conventional measures of labor market slack can explain about half of the slowdown in nominal wage growth since 2007, with involuntary part-time employment further weighing on wages (although part-time employment, even if involuntary, may have supported labor force participation and facilitated stronger engagement with the workplace than the alternative of unemployment). Productivity growth plays

**Figure 2.12. Decomposition of Wage Dynamics, 2000–16**
*(Percentage-point change relative to 2000–07 average)*

For countries with unemployment rates below 2000–07 averages, a large part of the decline in nominal wage growth can be explained by slower trend labor productivity growth, while lower slack would have acted to increase nominal wage growth. In contrast, in countries with unemployment rates still above what they were before the crisis, both conventional labor market slack measures and involuntary part-time employment weigh on nominal wage growth.




Source: IMF staff calculations.
Note: The wage variable used is compensation per hour of workers excluding the self-employed. Involuntary part-time workers are those working less than 30 hours a week because they could not find a full-time position. The involuntary part-time employment share is calculated as the total number of involuntary part-time workers divided by total employment. Groups are as defined in Figure 2.11. The decomposition is based on the coefficients reported in column (5) of Annex Table 2.3.3 and is weighted by GDP at market exchange rates across countries.

a smaller role, possibly as it was already slow in the years before the crisis (Figure 2.12, panels 2 and 3).

The domestic conditions driving wages (such as unemployment) could have a significant common component, given economic linkages between countries as well as the common influence of global factors. In addition, domestic conditions in one country could have direct spillover effects on wage setting in others. For instance, relative wage weakness in one country could put downward pressure on wages in other countries, given the threat of production relocation toward lower-cost destinations. These common factors would be picked up by statistically significant time effects in the regressions. The estimated year fixed effects tend to be correlated with advanced economy averages of lagged inflation, trend productivity growth, unemployment, and involuntary part-time employment. These forces together can explain over 70 percent of the total variation in the estimated year fixed effects. However, as illustrated in Figure 2.13, even beyond these factors, there is a negative residual after 2009, and especially during 2014–16. The residual could be picking up the effects of increased integration that make external conditions matter more and, in general, weigh on wage growth. Its increasing importance after the Great Recession and after the euro area sovereign debt crisis could point to downward pressure on wage demands as a result of synchronized recessions, and, in some cases, policy measures to slow wage growth and improve competitiveness. These findings thus corroborate the earlier findings on the importance of slack and lagged inflation on wage growth and also point to the effects of additional common external factors.[32]

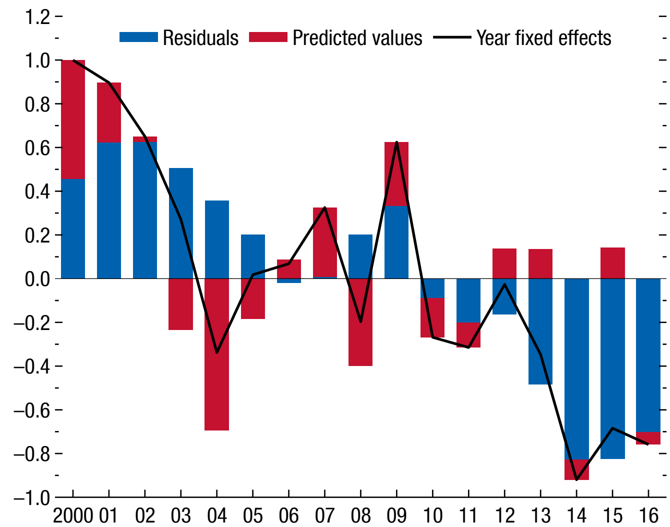
### *Underlying Drivers*

Subdued nominal wage growth and changes in the nature of employment have taken place in an environment of declining potential growth, changes to global production processes related to automation and trade integration, and changes in labor market institutions (Figures 2.14 and 2.15). Further extensions of the baseline approach to include these slower-moving factors show that a proxy for automation (the relative price of investment goods) and diminished medium-term growth expectations appear to weigh on wage growth alongside the influence of the forces discussed above.[33]

While other results are robust to whether the years of the Great Recession are included or not, some coefficients are sensitive to the choice of period, as shown in Annex Tables 2.3.8 and 2.3.9. Automation—as proxied by a decline in the relative price of investment goods—and diminished medium-term growth expectations consistently weigh on nominal wage growth, regardless of whether the Great Recession years are included. However, the coefficient on the change in union density is sensitive to both the choice of sample years and the inclusion of its level as an additional control.

**Figure 2.13. Year Fixed Effects and Common Drivers, 2000–16**
*(Index)*

The estimated year fixed effects tend to be correlated with advanced economy averages of lagged inflation, trend productivity growth, unemployment, and involuntary part-time employment. However, even beyond these factors, there is a negative residual after 2009, and especially during 2014–16. This could be picking up the effects of increased integration as well as downward pressure on wage demands as a result of synchronized recessions.



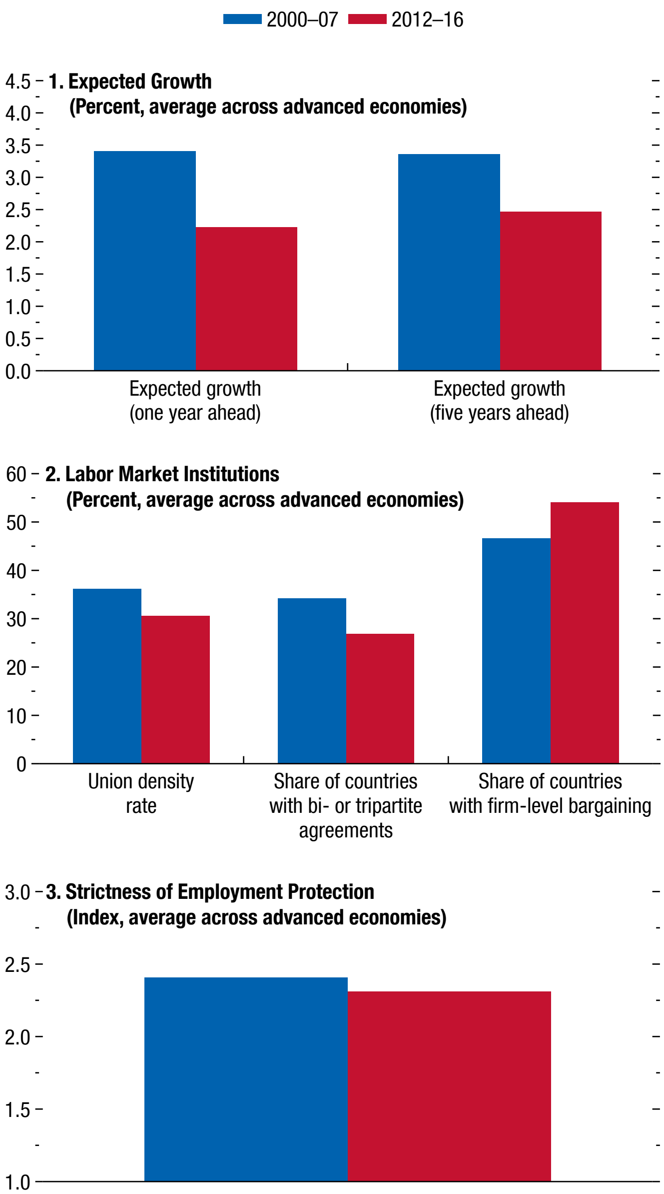

Source: IMF staff calculations.
Note: Year fixed effects are based on the panel ordinary least squares regression in column (1) of Annex Table 2.3.3. Residuals are from a regression of these year fixed effects on advanced economy averages of the drivers shown in Figure 2.12 and a constant. Year fixed effects and predicted values are subsequently renormalized such that year fixed effects over 2000–16 average to zero.

[32]Annex Figure 2.3.1 shows a decomposition similar to that in Figure 2.12, based on a regression with year fixed effects. The relative importance of the different drivers (slack versus productivity) shown in Figure 2.12 remains valid when year fixed effects are included.

[33]A decline in the relative price of investment goods can lower the cost of automating routine tasks (Autor and Dorn, 2013). However, this proxy may not fully capture the impact of automation on wages—for example, advances in artificial intelligence that allow for automation may not be perfectly measured in the relative price of investment goods.

**Figure 2.14. Changes in Growth Expectations and Labor Market Institutions**

Subdued nominal wage growth and changes to the nature of employment have taken place in an environment of declining potential growth and weakening worker bargaining power.




Sources: Institutional Characteristics of Trade Unions, Wage Setting, State Intervention, and Social Pacts database; Organisation for Economic Co-operation and Development; and IMF staff calculations.
Note: Union density rate refers to net union membership as a proportion of wage earners in employment (simple average across countries); bi- or tripartite agreements refers to the existence of a bipartite council of a central union and employers and/or the existence of a tripartite council with government participation. Firm-level bargaining denotes whether bargaining takes place predominantly at the local/company level. Strictness of employment protection refers to individual and collective dismissals (regular contracts). The sample consists of 26–33 advanced economies.

Changes in regulations related to individual and collective dismissals (a measure of employment protection; see Annex 2.3.1 for details) do not have a statistically significant effect on nominal wage growth. Because these factors may be interrelated (an increase in global value chain participation and offshoring of production can, for example, contribute to lower unionization), ascribing precise contributions to each factor's influence on recent wage dynamics is inherently difficult. Nevertheless, as seen in Figure 2.15, the limited decline in the relative price of investment goods in recent years compared with the earlier downward trend suggests that automation (as proxied by this measure) may not have made a large contribution to the subdued wage dynamics following the Great Recession.[34]

Such slower-moving forces may have also played a role in the increase in involuntary part-time employment, beyond the influence of cyclical factors (Annex Table 2.3.10). While a more negative output gap (shortfall of actual output relative to the economy's potential) is associated with an increase in the involuntary part-time employment share, other factors, such as medium-term growth expectations and automation, also appear to have had an influence (Figure 2.16). With declining medium-term growth expectations, firms may have preferred to hire workers part-time. Automation of work processes could have also led to structurally lower demand for labor. A higher services sector share of employment is also associated with an increase in involuntary part-time employment, consistent with the compositional shifts documented in the section on how surface healing masks deeper changes in advanced economy labor markets.

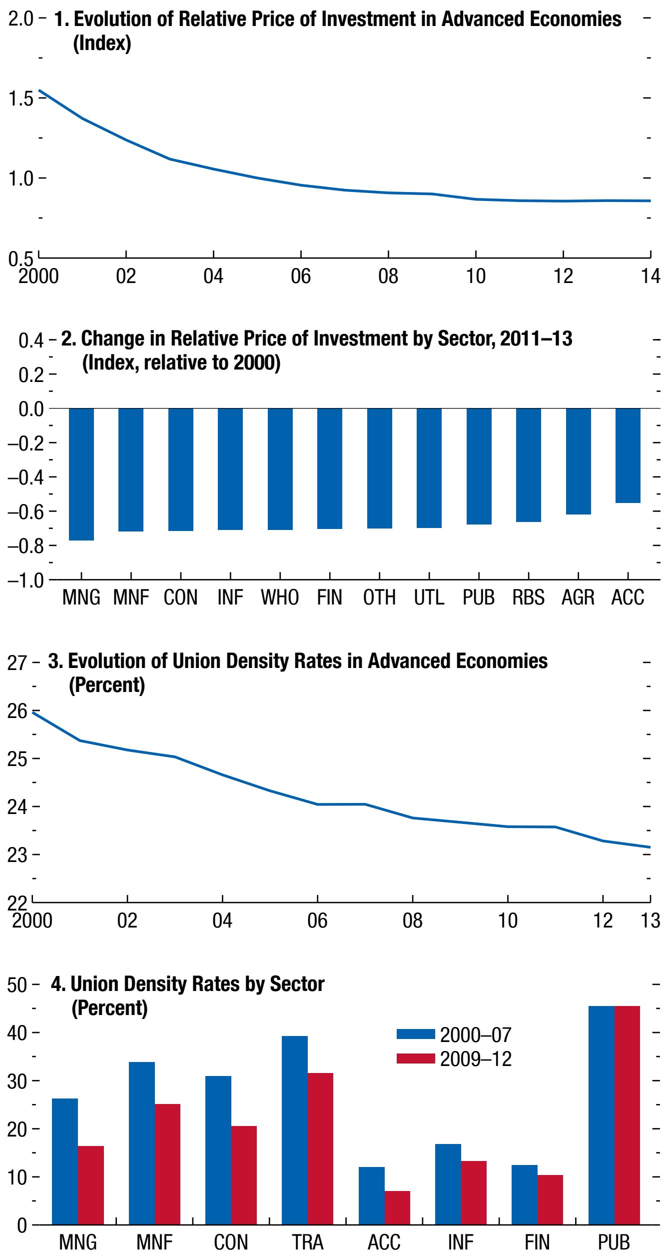
## Summary and Policy Implications

Recent labor market developments in advanced economies point to a possible disconnect between unemployment and wages. Whereas in many economies headline unemployment is approaching ratios seen before the Great Recession, or has even dipped below those levels, nominal wage growth rates continue to grow at a distinctly slower pace. For some economies, this may reflect policy measures to slow wage growth and improve competitiveness in the

[34]Studies focusing on long-term effects of automation tend to find larger effects on the wages of particular groups, for example middle-skilled workers (see Autor and Dorn 2013 and Chapter 3 of the April 2017 WEO).

### Figure 2.15. Long-Term Drivers of Labor Market Dynamics

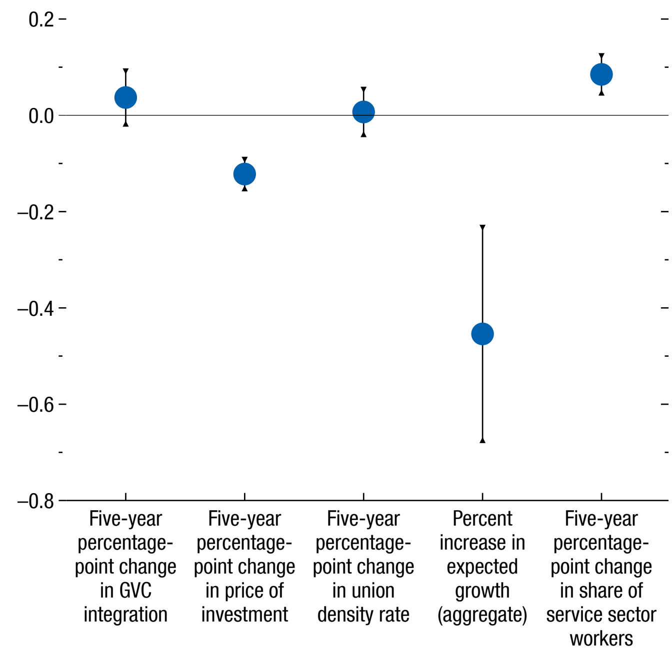
Technological advancements, captured by a declining relative price of investment, and falling union density rates could act as additional drivers of labor market dynamics.




Sources: Institutional Characteristics of Trade Unions, Wage Setting, State Intervention, and Social Pacts database; Penn World Tables Capital Detail; World Bank, World Development Indicators database; and IMF staff calculations.
Note: Numbers for advanced economies are calculated by first aggregating over sectors to the country level using sectoral value added as weight, and subsequently aggregating over countries using nominal GDP as weight. Sectoral numbers are calculated by aggregating over countries using sectoral value added as weight. Sector abbreviations are as defined in Figure 2.8.

### Figure 2.16. Effects on Involuntary Part-Time Employment Share, Aggregate Analysis
*(Percentage points)*

Larger declines in the relative price of investment, lower expected growth, and a higher share of service workers are associated with a higher share of involuntary part-time employment.




Source: IMF staff calculations.
Note: Markers show estimated coefficients, and lines display 90 percent confidence intervals. Figure is based on columns (2) to (6) of Annex Table 2.3.10. GVC = global value chain.

aftermath of the global financial crisis and euro area sovereign debt crisis. Moreover, wage weakness appears to have a common component across advanced economies, which could reflect larger cross-border spillovers of weak labor market conditions since the Great Recession. Subdued nominal wage growth has also occurred in a context of a higher rate of involuntary part-time employment, an increased share of temporary employment contracts, and a reduction in hours per worker.

The analysis finds that aggregate developments in part-time employment, temporary contracts, and hours, in part, reflect compositional shifts in employment away from sectors that tend to have traditional employment arrangements (smaller shares of part-time employment, a smaller proportion of temporary contracts, longer hours per worker) toward sectors where more flexible arrangements dominate.

However, there is less evidence that sectoral shifts in employment account for subdued wage growth. Rather, the analysis finds that, at the country level, labor market slack, together with weak productivity growth and low inflation expectations, are the main forces weighing on wage growth. Automation (proxied by the relative price of investment goods) appears to have made a small contribution to subdued wage dynamics following the Great Recession due to a limited decline in the relative price of investment goods in recent years compared with the previous downward trend. The analysis suggests that automation could weigh on wage growth more substantially in the future if the decline in the relative price of investment goods were to pick up again. However, inferences about the impact of automation are not straightforward given that, as noted previously, the relative price of investment goods is just one channel through which its influence on wage growth may play out.

Comparing the years since 2008 with 2000–07, the chapter finds that in economies where unemployment rates are still appreciably above their averages before the Great Recession, conventional measures of labor market slack can account for about half of the slowdown, with involuntary part-time employment acting as a further significant drag on wages. In these economies, wage growth is unlikely to pick up unless slack diminishes meaningfully—an outcome that will require continued accommodative policies to boost aggregate demand.

In economies where unemployment rates are now below their averages before the Great Recession and measured slack appears low, slow productivity growth can account for about two-thirds of the slowdown in nominal wage growth since 2007. Even in these economies, involuntary part-time employment, while it may have helped labor force participation and continued engagement with the workplace, appears to be weighing on wage growth, alongside slower-moving drivers.

The evidence further indicates that countries experiencing a slowdown in trend productivity will face headwinds to wage growth, even if unemployment rates decline. Inflation rates will also remain low unless wage growth accelerates beyond productivity growth in a sustained manner. In such cases, accommodative policies can help stimulate demand and lower headline unemployment rates, but overall wage growth (and hence inflation) may continue to remain subdued until involuntary part-time employment diminishes or trend productivity growth picks up. Assessing the true degree of slack beyond measured headline unemployment rates will be important when determining the appropriate pace of exit from accommodative monetary policies.

The evidence also suggests that involuntary part-time employment is in turn associated with both cyclical factors and slower-moving drivers, such as automation, diminished medium-term growth expectations, and the growing importance of the services sector. Some of these developments point to a persistent shift in the nature of work and employment relations. Policymakers may therefore need to enhance efforts to address the vulnerabilities that part-time workers face. Examples of possible initiatives in that regard include strengthening secondary and tertiary education to upgrade skills over the longer term; broadening minimum wage coverage where it does not currently include part-time workers; offering prorated paid annual, family, and sick leave to secure parity with full-time workers; and providing subsidized training for part-time workers for reskilling and retooling (see also the October 2017 *Fiscal Monitor* and Golden 2016 for a summary of measures taken by various cities in the United States, for example). However, any policy actions to address the income security of workers that hold part-time jobs or temporary contracts should be designed to minimize possible adverse impacts on the flexibility of labor markets and job creation.

More generally, the rise of part-time employment and temporary contracts challenges the current structure of social insurance systems—instituted in many advanced economies in the aftermath of the Great Depression and World War II—which may be better equipped to handle "binary" employment status (people in the labor force are either employed full-time or unemployed). To the extent that changes in the nature of employment are not purely cyclical, but also related to longer-term shifts in structural factors, a broader rethinking of the nature of social insurance may be needed.

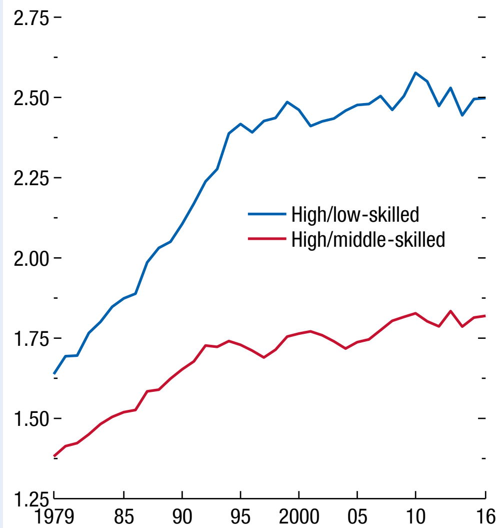
## Box 2.1. Labor Market Dynamics by Skill Level

The skill premium—the ratio of the wages of skilled to unskilled workers—has been the focus of a wide body of research in recent years. Several studies look at the flattening in the skill premium in the United States since 2000 (Figure 2.1.1) and attribute it to: (1) the maturation of the information technology revolution slowing the demand for highly educated labor (Beaudry, Green, and Sand 2014, 2016), (2) a leveling off of the complementarity between highly educated labor and new production technologies (especially those that rely on computers and related organizational capital), and (3) rising competition between education groups for increasingly scarce well-paid jobs (Valletta 2016; Autor 2017).[1]

Few studies, however, have analyzed the recent evolution of the skill premium in European economies.[2] This box focuses on the evolution of labor market indicators by skill level in European economies during the most recent decade, using three cross-sections of data for 2006, 2010, and 2014.[3]

The results suggest that while low- and middle-skilled workers in Europe were hurt on the extensive margin (hours and employment, respectively), the past decade brought relative gains for these groups in terms of hourly wages.

**Figure 2.1.1. Evolution of Skill Premiums in the United States**




Sources: US Bureau of Labor Statistics; and IMF staff calculations.
Note: Low-skilled refers to workers with less than a high school diploma; middle-skilled refers to high school graduates with no college education; high-skilled refers to those with at least a bachelor's degree.

### *Shrinking Wage Dispersion*

The skill premium declined in European economies between 2006 and 2014 (Figure 2.1.2); this is true in the case of the ratio of wages for high- to low-skilled workers as well as for high- to middle-skilled workers. In the United States, the former also declined over this period, however, the latter showed a small increase, pointing to relative wage losses of middle-skilled workers.

Examining variation across sectors reveals that sectors with a higher share of low-skilled workers saw higher nominal wage growth. Naturally (given that the shares add up to 1) the opposite is the case for sectors with a higher share of high-skilled workers (Figure 2.1.3).

### *Hollowing Out of Employment*

Changes in employment point to hollowing out in European economies as well—in line with the liter-

The author of this box is Zsóka Kóczán.

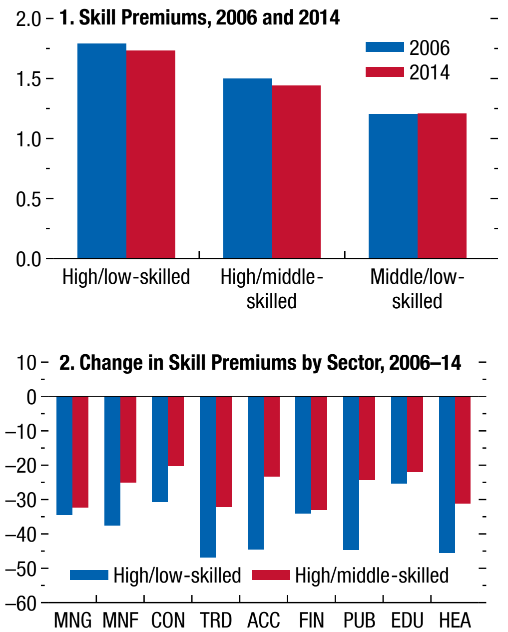
[1]Earlier studies link the widening wage dispersion in some advanced economies (in particular the United States and the United Kingdom) in the 1980s, and to a lesser extent the 1990s, to trade liberalization (Wood 1991, 1994, 1995; Leamer 1992, 1996; Burtless 1995), more intensive trade and migration (Borjas and Ramey 1995), outsourcing (Feenstra and Hanson 1996, 2001), or skill-biased technological change (Katz and Murphy 1992; Berman, Bound, and Griliches 1994; Autor, Katz, and Krueger 1998; Katz and Autor 1999; DiNardo and Card 2002; Autor, Katz, and Kearney 2008). Autor and Dorn (2013) analyze the polarization of employment and earnings in the United States between 1980 and 2005 and emphasized the role of automation of routine tasks.

[2]Parteka (2010) notes the increasing wage gap for low-skilled workers in the EU15 (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom) during 1995–2005 in most sectors, and EU (2015) finds that earnings inequality increased from 2006 to 2011 in two-thirds of the members of the European Union. Cho and Díaz (2016), however, note that the skill premium fell in 2000–08 in the Baltic countries.

[3]Low-skilled workers are defined as those with up to lower-secondary education, middle-skilled as those with upper-secondary or postsecondary nontertiary education, and high-skilled as those with tertiary education.

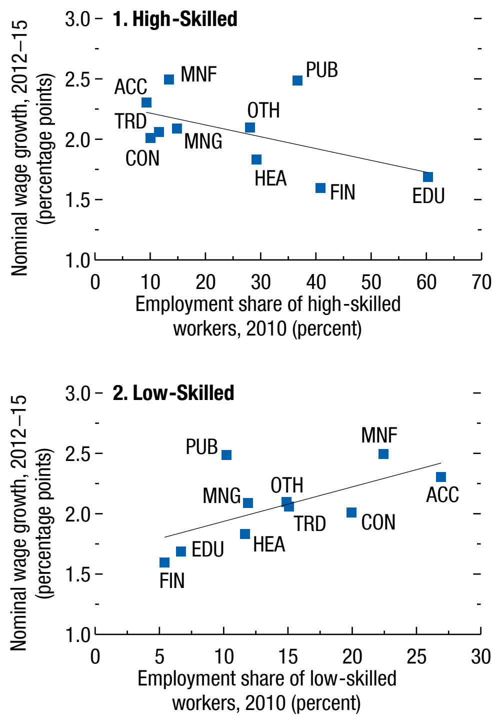
## Box 2.1 *(continued)*

### Figure 2.1.2. Skill Premiums and Changes in Skill Premiums in European Economies




Sources: Eurostat; and IMF staff calculations.
Note: Low-skilled refers to workers with less than a high school diploma; middle-skilled refers to high school graduates with no college education; high-skilled refers to those with at least a bachelor's degree. The figure shows simple averages across sectors and economies. ACC = accommodation and food service activities; CON = construction; EDU = education; FIN = financial and insurance activities; HEA = human health and social work activities; MNF = manufacturing; MNG = mining and quarrying; PUB = public administration and defense; TRD = wholesale and retail trade.

### Figure 2.1.3. Nominal Wage Growth by Sector and Skill Group




Sources: Eurostat; and IMF staff calculations.
Note: Low-skilled refers to workers with less than a high school diploma; high-skilled refers to those with at least a bachelor's degree. ACC = accommodation and food service activities; CON = construction; EDU = education; FIN = financial and insurance activities; HEA = human health and social work activities; MNF = manufacturing; MNG = mining and quarrying; OTH = other services; PUB = public administration and defense; TRD = wholesale and retail

ature on the United States.[4] The employment shares of middle-skilled workers fell, while those of low- and high-skilled workers increased (Figure 2.1.4). This pattern can be observed in all sectors, however, during this period it was starkest in services (finance, public administration, health, education). While sectoral data on the price of investment is limited, there are some evidence that sectors more exposed to technological change (that experienced larger declines in their price of investment goods) also saw more pronounced hollowing out declines in the employment shares of middle-skilled labor.[5]

### *Falling Hours among Low-Skilled Workers*

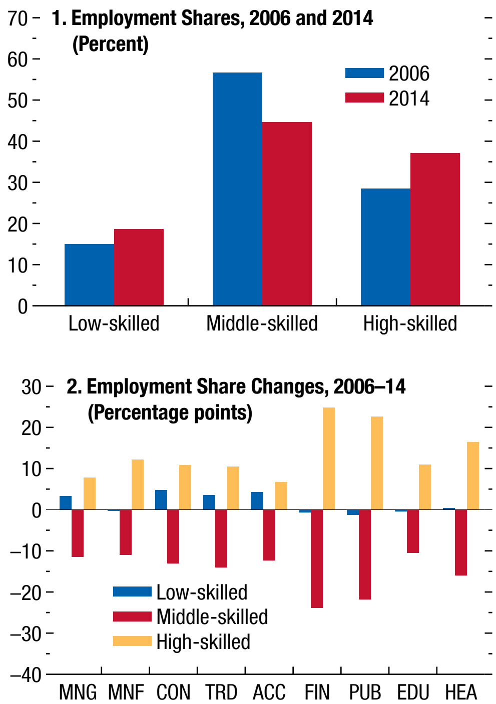
Middle-skilled workers lost out in terms of employment shares, but low-skilled workers appear to have experienced a larger decline in hours than other skill groups. Country-sector-level data on hours by skill level are unfortunately not readily available. However,

[4]See also Das and Hilgenstock (forthcoming) for a larger sample of advanced as well as emerging market economies.

[5]Chapter 3 of the April 2017 *World Economic Outlook* highlights a particularly large impact of technology (declining price of investment and exposure to routinization) on the labor share of middle-skilled workers.

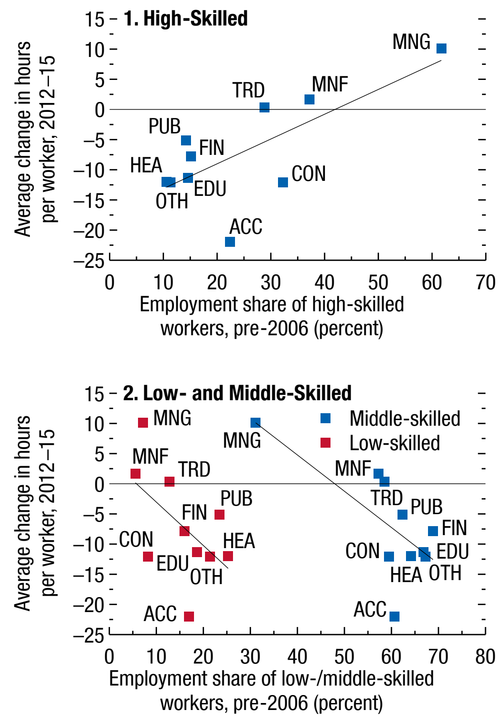
## Box 2.1 *(continued)*

### Figure 2.1.4. Employment Shares by Skill




Sources: Eurostat; and IMF staff calculations.
Note: Low-skilled refers to workers with less than a high school diploma; middle-skilled refers to high school graduates with no college education; high-skilled refers to those with at least a bachelor's degree. ACC = accommodation and food service activities; CON = construction; EDU = education; FIN = financial and insurance activities; HEA = human health and social work activities; MNF = manufacturing; MNG = mining and quarrying; PUB = public administration and defense; TRD = wholesale and retail trade.

### Figure 2.1.5. Employment Shares by Skill and Changes in Hours per Worker




Sources: Eurostat; and IMF staff calculations.
Note: Low-skilled refers to workers with less than a high school diploma; middle-skilled refers to high school graduates with no college education; high-skilled refers to those with at least a bachelor's degree. ACC = accommodation and food service activities; CON = construction; EDU = education; FIN = financial and insurance activities; HEA = human health and social work activities; MNF = manufacturing; MNG = mining and quarrying; OTH = other services; PUB = public administration and defense; TRD = wholesale and retail trade.

sectors with larger shares of low-skilled workers have seen larger declines in hours (Figure 2.1.5). This agrees with the findings of EU (2015), which highlights significantly higher inequality levels for annual earnings than inequality measures for monthly and hourly wages. Number of months and, to a lesser extent, hours worked in the year appear to be significant sources of variation.

## Box 2.2. Worker Contracts and Nominal Wage Rigidities in Europe: Firm-Level Evidence

This box examines the evolving nature of worker contract types and their potential implications for wage dynamics in Europe during the postcrisis period. The data set used in the analysis is from the Wage Dynamics Network (WDN), constructed to capture determinants of nominal wage dynamics for a large sample of European firms (see Izquierdo and others 2017 for further details on the data set).[1] The data set is generated by three waves of surveys conducted in 2007, 2010, and 2014.

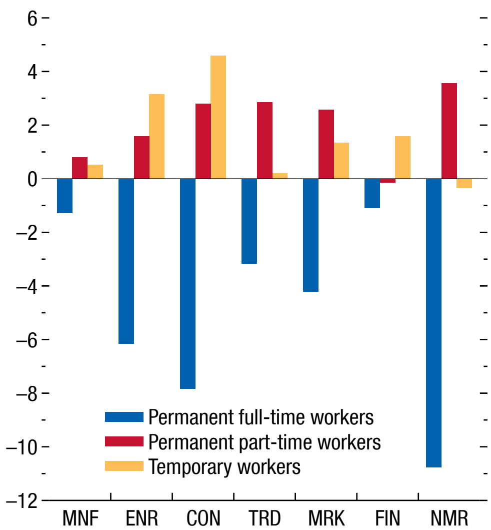
### *Changes in Worker Contract Type*

Worker contract type in the firm-level survey falls into one of three categories: permanent full-time, permanent part-time, and temporary. Examining these three categories of contracts by sector during 2007–14, the patterns seen in nonmanufacturing sectors appear to diverge from those registered in the manufacturing sector.

Most nonmanufacturing sectors appear to have experienced a sharp decline in the permanent full-time worker share and increases in more flexible contracts, such as permanent part-time hires and workers on temporary contracts (Figure 2.2.1). In particular:

- *Permanent full-time worker share:* The permanent full-time worker share, averaged across nonmanufacturing sectors, declined from 81.8 percent in 2007 to 77.3 percent in 2014; in contrast, the share of permanent full-time workers stayed relatively stable for the manufacturing sector: 87.2 percent in 2007 and 85.9 percent in 2014.
- *More flexible contracts:* The flip side of the above development is that the nonmanufacturing sectors experienced a higher increase in both the permanent part-time worker and temporary worker share of employment compared with the manufacturing sector. The share of permanent part-time workers increased by over 2 percentage points from 9.5 percent in 2007 to 11.8 percent in 2014 for nonmanufacturing sectors, whereas the manufacturing sector experienced a mild increase in this category of less than a percentage point, from 5.6 percent to 6.4 percent over the same period. Similarly, the share of temporary workers in nonmanufacturing sectors rose from 8.6 percent in 2007 to 10.3 percent in 2014, while the share remained broadly unchanged for the manufacturing sector in these two periods (7.1 percent in 2007 and 7.6 percent in 2014).

**Figure 2.2.1. Changes in Employment Shares**
*(Percentage points)*




Sources: Wage Dynamics Network, 2007, 2009, and 2014 waves; and IMF staff calculations.
Note: CON = construction; ENR = energy; FIN = financial intermediation; MNF = manufacturing; MRK = market services; NMR = nonmarket services; TRD = trade.

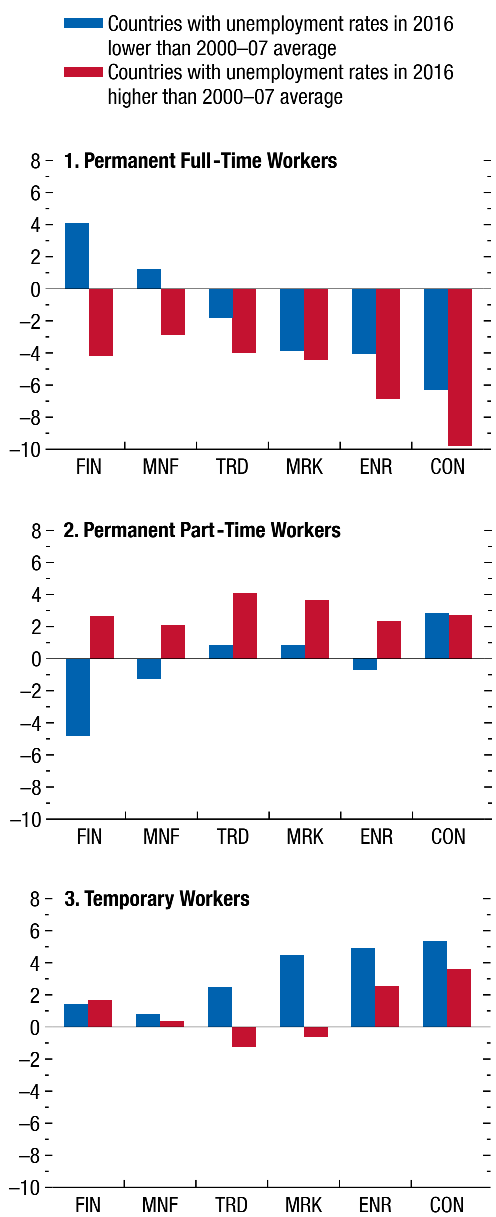
The magnitude of the decline in the permanent full-time worker share also varies across countries and appears related to the extent of healing in headline unemployment following the Great Recession (Figure 2.2.2). Countries whose unemployment rate is now below the 2000–07 average (blue bars) experienced a smaller decline in the share of permanent full-time workers than those where unemployment rate remains above the 2000–07 average (red bars).[2] Although the increase in the temporary contract share is more pronounced for most of the nonmanufacturing sectors for countries in the first group, countries in the second group show a higher increase in the share of permanent part-time workers in some sectors, such as trade and energy.

The author of this box is Gee Hee Hong.
[1]The author would like to thank the European Central Bank for making the WDN data sets available for this analysis.

[2]Countries with relatively high unemployment rates are those where the unemployment rate in 2016 was higher than their respective average unemployment rate between 2000 and 2007. These include Austria, Belgium, Cyprus, France, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Slovenia, Spain, and Switzerland. Countries with relatively low unemployment rates are those where the unemployment rate in 2016 was lower than their respective average unemployment rate between 2000 and 2007. These include the Czech Republic, Estonia, Germany, Malta, the Slovak Republic, and the United Kingdom.

## Box 2.2 *(continued)*

### Figure 2.2.2. Changes in Employment Shares, 2007–14
*(Percentage points)*

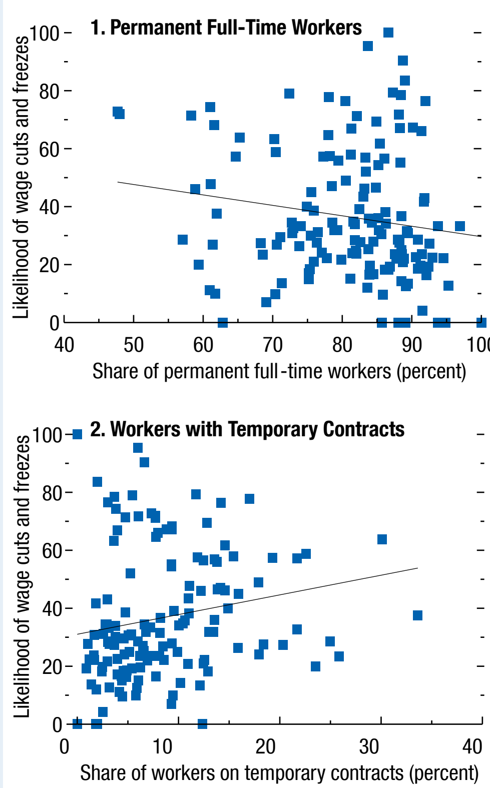



Sources: Wage Dynamics Network, 2007, 2009, and 2014 waves; and IMF staff calculations.
Note: CON = construction; ENR = energy; FIN = financial intermediation; MNF = manufacturing; MRK = market services; TRD = trade.

*Wage Dynamics*

Across the sample of 20,000 firms surveyed in 2014, sectors with a higher share of workers on temporary contracts also tend to have higher wage cuts and freezes. Figure 2.2.3 shows a positive relationship across sectors between the share of workers on temporary contracts and the fraction of firms within the sector reporting wage cuts and freezes. In contrast, there is a negative relationship between the share of permanent full-time workers and the fraction of firms with wage cuts and freezes. The patterns thus suggest an association between worker contract type and wage setting: sectors with a larger share of workers on more traditional contracts (permanent full-time) tend to experience fewer wage cuts and freezes as well.

### Figure 2.2.3. Wage Cuts and Freezes, 2014
*(Percent)*




Sources: Wage Dynamics Network, 2007, 2009, and 2014 waves; and IMF staff calculations.
Note: Each marker in the figure represents a country sector.

## Box 2.3. Wage and Employment Adjustment after the Global Financial Crisis: Firm-Level Evidence

How have revenue growth performance and volatility affected firms' labor-related decisions in the postcrisis period? What role has firm-level financial vulnerability at the outset of the crisis played when it comes to postcrisis firm-level labor market choices?

This box looks at these questions using the ORBIS data set compiled by Bureau van Dijk. It is a rich, cross-country, firm-level data set that contains firms' balance sheet variables as well as total wage bill and total employment information.[1] The box first explores the association between recent growth (which arguably influences firm-level growth expectations) and uncertainty, and firms' wages and employment growth following the global financial crisis. To assess the potential effect of financial-crisis-related factors on firms' wage and employment decisions, the box further explores whether firms with different degrees of ex ante financial vulnerability exhibit different wage and/or employment adjustment patterns in the postcrisis period.

The evidence suggests that firms with stronger recent growth performance (and thus arguably more optimistic growth expectations) and low volatility exhibit higher wage and employment growth. Moreover, firms with weaker balance sheets before the crisis experience lower growth in wages and employment following the crisis, which highlights the potential role of crisis-related legacies in firms' labor-related decisions in the postcrisis period.

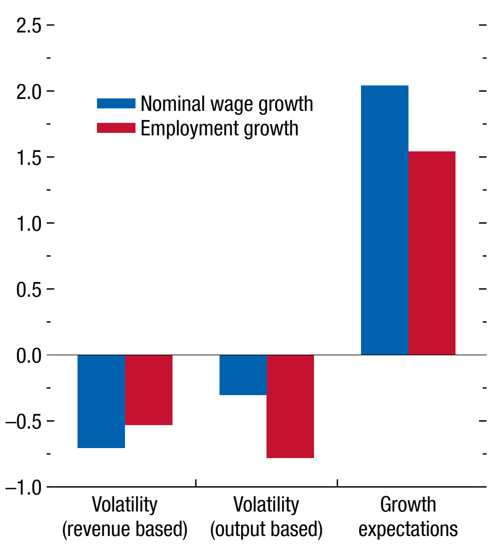
### *Growth Expectations and Uncertainty as Determinants of Wage and Employment Growth*

To the extent that recent growth influences expectations about future growth (for example, if firms form adaptive expectations), trailing five-year average revenue growth can be considered a proxy for firm-level medium-term growth expectations. Moreover, the standard deviation of

The author of this box is Gee Hee Hong.

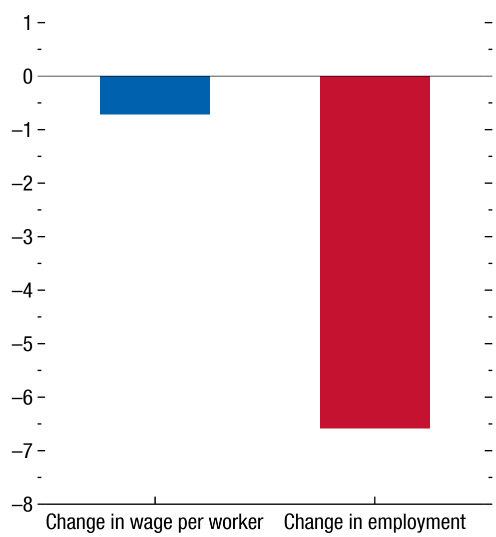
[1]Comparability of the variables across countries and over time is ensured as described in Duval, Hong, and Timmer (2017), following the methodology of Gal and Hijzen (2016).

**Figure 2.3.1. Estimated Nominal Wage Growth and Employment Growth Differences Based on Uncertainty and Growth Expectations**
*(Percentage points)*




Sources: ORBIS; and IMF staff calculations.
Note: Wage is defined as total wage bill divided by total employment for each firm. The blue bars show the estimated wage growth differences between firms with high uncertainty/growth expectations (75th percentile) and those with low uncertainty/growth expectations (25th percentile). The red bars show the corresponding employment growth differences.

**Figure 2.3.2. Wage and Employment Growth by Debt Maturity in 2008**
*(Percentage points)*




Sources: ORBIS; and IMF staff calculations.
Note: The left bar represents the estimated difference in postcrisis wage growth minus precrisis wage growth between a firm with a high ratio of debt maturing in 2008 (75th percentile) and a firm with a low ratio of debt maturing in 2008 (25th percentile). The right bar represents the estimated difference in postcrisis employment growth minus precrisis employment growth between the two types of firms.

**Box 2.3 *(continued)***

revenue growth (volatility)—or its ratio to average revenue growth over the trailing five-year interval (coefficient of variation)—can be considered a proxy for firm-level uncertainty about the operating environment.

The evidence suggests that firms with more optimistic growth expectations or lower volatility show stronger wage and employment growth in the postcrisis period.[2] Figure 2.3.1 compares the differences in average wage and employment growth rates since 2008 between firms whose volatility and growth expectations are in the 25th and 75th percentiles. Wage growth is 0.3 to 0.6 percentage point lower for firms with higher volatility than for their counterparts with lower volatility (depending on the measure used to construct volatility). In addition, firms whose growth expectations are more optimistic show 2 percentage points stronger wage growth than their less optimistic counterparts. Similarly, for employment growth, firms with higher volatility experience 0.5 to 0.8 percentage point lower employment growth than those with lower volatility. Optimism in growth expectations contributes positively to employment growth as well: firms with more optimistic expectations experience nearly 1.5 percentage points higher employment growth than those that are less optimistic.

[2]The two main dependent variables are the annual growth rate of total employment for each firm and the annual growth rate of wage per employee, in which the wage per employee is calculated as the total wage bill divided by the total number of employees for each firm.

### *Financial Frictions and Labor-Related Decisions*

Firms whose financial vulnerability was higher before the crisis appear to exhibit weaker wage and employment growth in its aftermath, which highlights the potential role of financial frictions or crisis-related legacies in wage and employment adjustments following the crisis.

Adopting the difference-in-differences methodology that compares the averages of precrisis and postcrisis wage and employment growth following Duval, Hong, and Timmer (2017), firms with ex ante more vulnerable balance sheets—higher leverage and rollover risk entering the financial crisis—exhibit lower wage and employment growth in the postcrisis years. The results are robust to controlling for labor productivity and multifactor productivity, following Wooldridge (2009).[3]

Table 2.3.1 reports the results. Controlling for different measures of productivity, a 10 percentage point higher leverage ratio before the crisis is associated with 0.1 percentage point weaker growth in wages and employment after the crisis. Similarly, firms with higher precrisis rollover risk show about 0.3 to 0.4 percentage point weaker growth in wages and employment.

[3]Rollover risk, measured as the ratio of current liabilities (that is, debt maturing within a year) to total sales in the 2007 balance sheet, allows for a causal interpretation. Firms' debt structure in 2007 is unlikely to be associated with other unobserved firm characteristics affecting wage and employment decisions given that the timing of the global financial crisis was not foreseen from the vantage point in 2007 (Almeida and others 2012; Duval, Hong, and Timmer 2017).

**Table 2.3.1. Precrisis Financial Vulnerabilities and Postcrisis Labor Adjustments**

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | Changes in Log(average wage/worker) | | Changes in Log(employment) | |
| Leverage Precrisis[1] | –0.0130*** | 0.005 | –0.011*** | –0.010*** |
| | (0.003) | (0.005) | (0.003) | (0.003) |
| Debt Maturing 2008[2] | –0.038*** | –0.036*** | –0.034*** | –0.032*** |
| | (0.005) | (0.004) | (0.005) | (0.004) |
| Productivity (multifactor productivity)[3] | 0.790*** | | 0.464*** | |
| | (0.145) | | (0.119) | |
| Productivity (labor productivity)[4] | | 0.540*** | | 0.343*** |
| | | (0.123) | | (0.111) |
| Country Fixed Effects | yes | yes | yes | yes |
| Sector Fixed Effects | yes | yes | yes | yes |
| Number of Observations | 82,162 | 98,386 | 82,204 | 98,420 |
| $R^2$ | 0.0253 | 0.0280 | 0.0269 | 0.0268 |

Source: IMF staff calculations.
Note: Changes in log(average wage/worker) is the difference between average wage per worker between the postcrisis and precrisis periods. Changes in log(employment) is the difference between log of average employment between the postcrisis and precrisis period. Standard errors in parentheses are clustered at the country-sector level. * $p < .10$; ** $p < .05$; *** $p < .01$.
[1]Average precrisis debt-to-assets ratio.
[2]Amount of debt maturing in 2008 divided by average total precrisis sales.
[3]Calculated using the methodology introduced by Wooldridge (2009).
[4]Calculated as the ratio of value-added output to total employment at the firm level.

**Annex Table 2.1.1. Country Coverage**

| | |
|---|---|
| Aggregate Analysis | Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Japan, Korea, Lithuania, Netherlands, New Zealand, Norway, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, United Kingdom, United States |
| Sectoral Analysis | Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Slovak Republic, Slovenia, Sweden, United Kingdom, United States |

**Annex Table 2.1.2. Data Sources**

| Indicator | Source |
|---|---|
| Compensation, Wages | Eurostat; national authorities; Organisation for Economic Co-operation and Development |
| Employment | Eurostat; national authorities; Organisation for Economic Co-operation and Development |
| Part-Time Employment | Eurostat; national authorities; Organisation for Economic Co-operation and Development |
| Involuntary Part-Time Employment | Eurostat; national authorities; Organisation for Economic Co-operation and Development |
| Temporary Employment | Eurostat; national authorities; Organisation for Economic Co-operation and Development |
| Hours per Worker, Total Hours | Eurostat; national authorities; Organisation for Economic Co-operation and Development |
| Output Gap | IMF, World Economic Outlook database |
| Inflation, Expected Inflation | Consensus Forecast database; IMF, World Economic Outlook database |
| Unemployment Rate | IMF, World Economic Outlook database |
| Productivity | Eora Multi-Region Input-Output table; Eurostat; national authorities; Organisation for Economic Co-operation and Development |
| Indicators of Employment Protection | Organisation for Economic Co-operation and Development |
| Expected Growth (aggregate) | IMF, World Economic Outlook database |
| Gross Output (sectoral) | Eora Multi-Region Input-Output database |
| Relative Price of Investment Goods (aggregate) | World Bank, World Development Indicators |
| Price of Investment (sectoral) | Penn World Tables Capital Detail |
| Capital Intensity | Penn World Tables |
| Exports, Final Exports, Final Imports | World Input-Output Database |
| Foreign Value Added Share of Exports | Eora Multi-Region Input-Output database |
| Labor Market Policies | Database on Institutional Characteristics of Trade Unions, Wage Setting, State Intervention, and Social Pacts |

Source: IMF staff compilation.

## Annex 2.1. Country Coverage and Data

The aggregate analysis is based on both quarterly and annual data for 29 advanced economies during 2000:Q1–16:Q4. Sectoral regressions are based on annual data for 20 advanced economies during 2000–15.

The primary data sources for labor market variables are Eurostat, the Organisation for Economic Co-operation and Development (OECD), and national authorities. Key sources for other variables used in this chapter are the Eora Multi-Region Input-Output database; Database on Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts (ICTWSS); IMF World Economic Outlook database; and the OECD.

## Annex 2.2. Empirical Methodologies

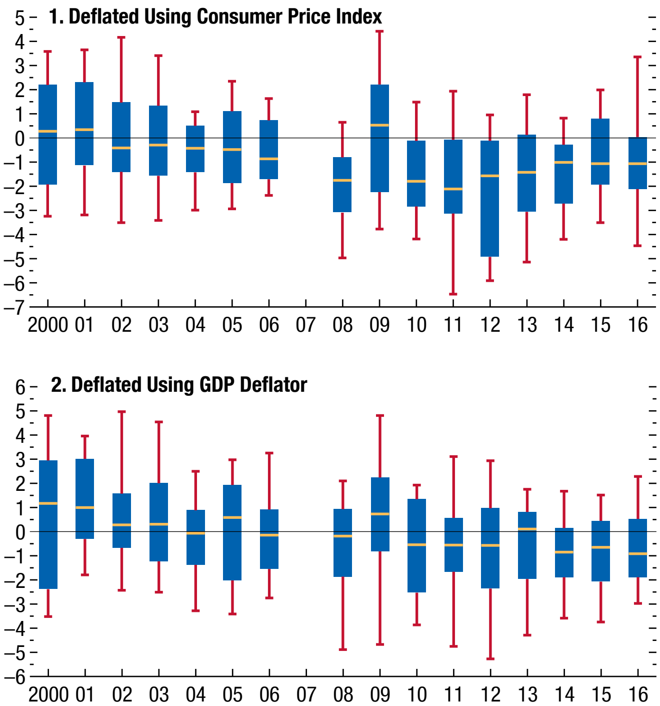
### Aggregate Analysis

The aggregate analysis uses a wage Phillips curve framework proposed by Gali (2011). The original equation used by Gali (2011) is similar to equation (2.1):[35]

[35]Gali's wage Phillips curve includes both the current and previous periods' unemployment rate given that the unemployment rate in the United States follows an autoregressive (2) process, in which the expected unemployment rate is a function of current and previous unemployment rates. The analysis in this chapter uses a similar argument for controlling for the change in unemployment rate: it captures the expectation of the evolution of unemployment rates beyond the current rate. Intuitively, this captures the importance of whether a country is entering a recession (rising unemployment rates) or recovering from one (falling unemployment rates).

### Annex Figure 2.2.1. Distribution of Real Compensation Growth Measures

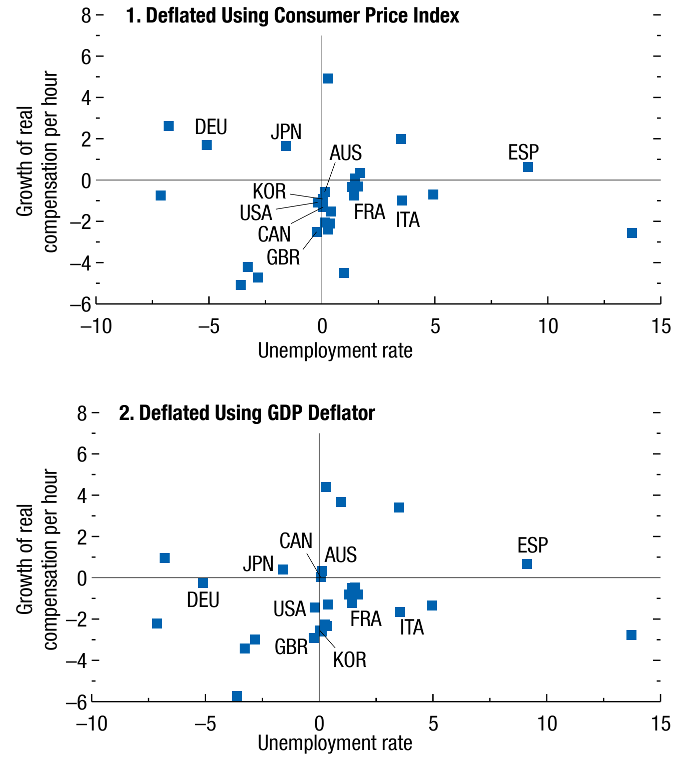
*(Percentage-point difference relative to 2007)*




Sources: Eurostat; national authorities; Organisation for Economic Co-operation and Development; and IMF staff calculations.
Note: The sample excludes Baltic countries. The wage variable used is compensation per hour of workers excluding the self-employed. The horizontal line inside each box represents the median, the upper and lower edges of the box show the top and bottom quartiles, and the red markers denote the top and bottom deciles.

### Annex Figure 2.2.2. Growth of Real Compensation per Hour and Unemployment Rates

*(Percentage-point change, 2016 relative to 2000–07 average)*




Sources: National authorities; Organisation for Economic Co-operation and Development; and IMF staff calculations.
Note: The wage variable used is compensation per hour of workers excluding the self-employed. Data labels in the figure use International Organization for Standardization (ISO) country codes. The 10 largest advanced economies (by 2016 nominal GDP in US dollars) are labeled.

$$\pi^w_{i,t} = \alpha_i + \theta\pi_{i,t-1} + \beta_1 u_{i,t} + \beta_2 \Delta u_{i,t} + \varepsilon_{i,t}, \qquad (2.1)$$

in which, for country $i$ and time $t$, $\pi^w_{i,t}$ is the nominal wage growth, $\pi_{i,t-1}$ is lagged year-over-year inflation, $u_{i,t}$ is the unemployment rate, and $\Delta u_{i,t}$ is the change in the unemployment rate.

To explore how productivity growth and labor underutilization may affect aggregate wage growth, equation (2.1) is augmented with two sets of variables: trend productivity growth and labor market underutilization measures. Equation (2.2) is estimated:

$$\pi^w_{i,t} = \alpha_i + \theta\pi_{i,t-1} + \beta_1 u_{i,t} + \beta_2 \Delta u_{i,t} + \gamma \bar{g}^{Y/H}_{i,t} + \varphi \vec{Z}_{i,t} + \varepsilon_{i,t}, \qquad (2.2)$$

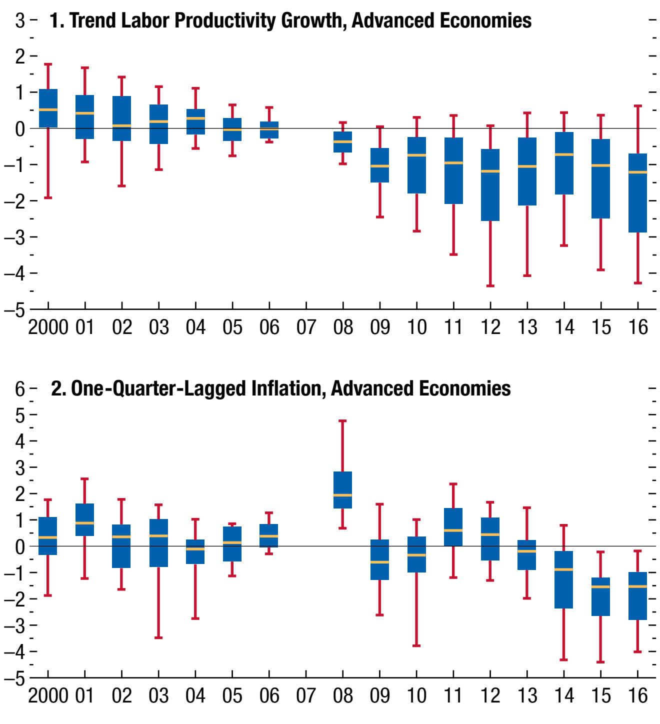
in which $\bar{g}^{Y/H}_{i,t}$ is the trend of the growth rate of real output per hour, and $\vec{Z}_{i,t}$ are labor underutilization measures. These measures include the share of employed workers who take part-time jobs involuntarily, with part-time jobs defined as less than 30 hours a week, and the share of employed workers who have temporary work contracts. The primer earlier in this chapter explains why these drivers matter for wage growth. As noted there, the analysis focuses on nominal wage growth; Annex Figures 2.2.1 and 2.2.2 illustrate real wage dynamics for reference.

Annex Figure 2.2.3 shows the dynamics of two key drivers in equation (2.2): trend productivity growth and lagged inflation (a proxy for inflation indexation).

The analysis examines several robustness tests:

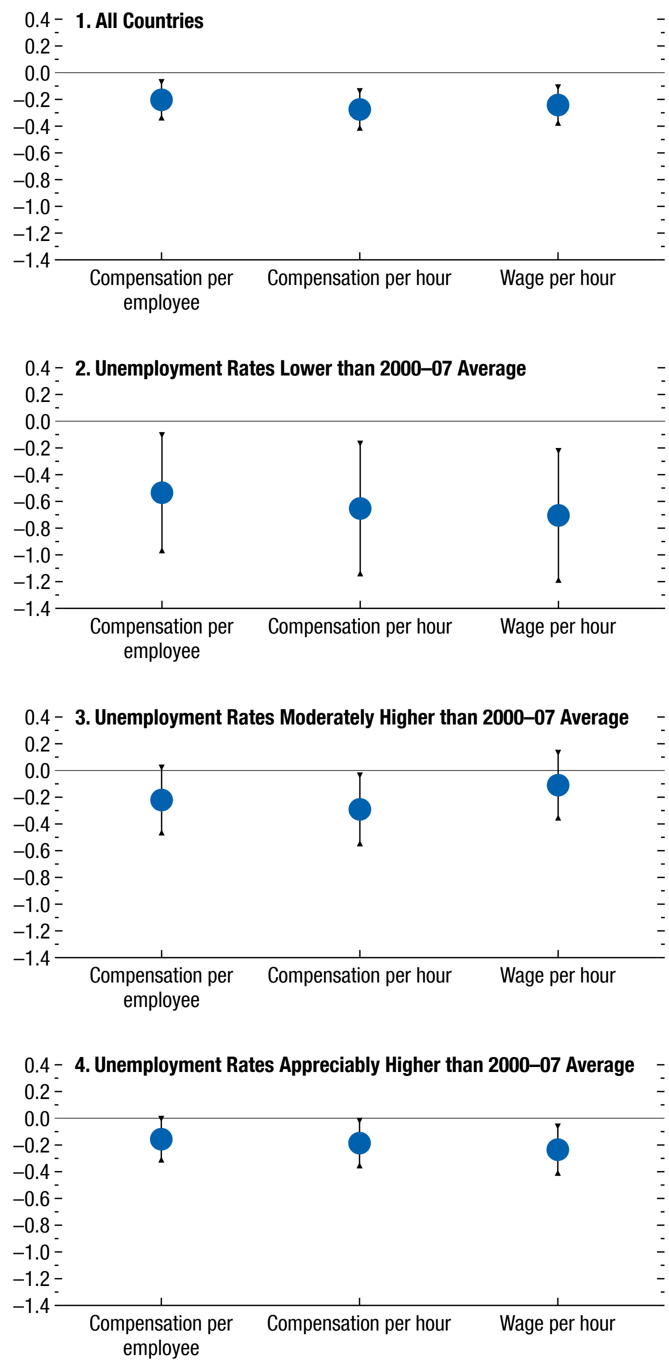
- *Data frequency:* The labor market underutilization measures (involuntary part-time and temporary contract employment shares) are not available at quarterly frequency—hence the analysis of their impact on aggregate wage growth in Annex

**Annnex Figure 2.2.3. Factors Associated with Nominal Wage Growth**
*(Percentage point difference relative to 2007)*




Sources: Organisation for Economic Co-operation and Development; and IMF staff calculations.
Note: Trend labor productivity growth is calculated as five-year trailing averages. Annual averages over four quarters are shown in panel 2. The horizontal line inside each box represents the median, the upper and lower edges of the box show the top and bottom quartiles, and the red markers denote the top and bottom deciles.

**Annex Figure 2.2.4. Effects of Involuntary Part-Time Employment on Compensation and Wages, 2000–16**
*(Percentage points)*




Source: IMF staff calculations.
Note: Markers show estimated coefficients, and lines display 90 percent confidence intervals. Involuntary part-time workers are those working less than 30 hours a week because they could not find a full-time position. The involuntary part-time employment share is calculated as the total number of involuntary part-time workers divided by total employment. Groups are as defined in Figure 2.11. Figure is based on Annex Tables 2.3.4 and 2.3.5.

Tables 2.3.3–2.3.9 uses data at annual frequency.[36] Robustness tests suggest that interpolation to quarterly series (uniform values across quarters or linear interpolation) does not significantly affect the results.

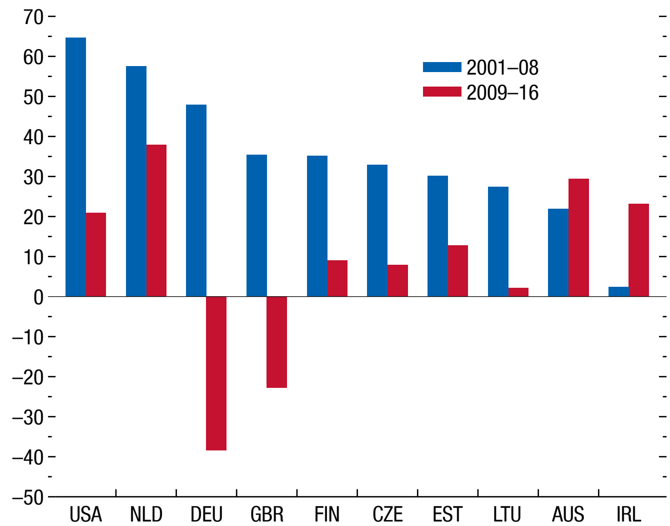
- *Alternative wage measures* (Annex Table 2.3.5; Annex Figure 2.2.4): Robustness tests examine different choices of wage measures as the dependent variable in equation (2.2)—aggregate compensa-

[36]The unemployment rate and its change and trend productivity growth are defined using annual data; lagged inflation is based on the year-over-year change in the consumer price index lagged by one quarter (wage contracts may not be set in a synchronized way, hence inflationary shocks may affect aggregate wages with a short lag). Results are broadly robust to, instead, using annual inflation with a one-year lag. In some specification (for example, Annex Table 2.3.3, column 5), this can lead to more plausible lagged inflation coefficients.

tion divided by total employees (compensation per employee), aggregate wage bill divided by total employees (wage per employee), aggregate compensation divided by total hours (compensation per hour), and aggregate wage bill divided by total hours (wage per hour, which includes aggregate social contributions of employers). Annex Figure 2.2.5 further illustrates that public sector wages are unlikely to have been an important driver of aggregate wages during 2009–16.

- *Alternative measures of explanatory variables:* The magnitude and significance of the coefficients are, in general, robust to alternative measures of slack, inflation expectations, and trend productivity growth (Annex Table 2.3.2).
- *Country-by-country regressions:* The significance and the magnitude of the coefficients of trend productivity growth and the involuntary part-time employment share are broadly similar when relying on country-by-country regressions (Annex Table 2.3.1, columns 4 and 8).
- *Instrumental variables:* Reverse causality from wage growth to price inflation may occur if firms pass faster growth in labor costs on in the prices they charge. This is alleviated by instrumenting lagged inflation with past changes in oil prices, which is critical in helping identify the degree of inflation indexation.[37] There are two possible concerns regarding the validity of oil price changes as the instrumental variable for lagged inflation: first, global demand shocks may drive both oil prices and wage growth. This is partly alleviated by the current wage Phillips curve equation already controlling for several channels through which global demand shocks could influence wages—slack and change in slack. The second concern is whether there could be reverse causality from wage growth to other inflation drivers. However, this too is unlikely to drive the main results—lower wage growth should cause lower labor market slack, which would bias the ordinary least squares estimates of the impact of slack on wage growth downward rather than upward. Similar logic applies to the labor underutilization measure. The main result—that involuntary part-time employment weighs on wage growth—is not sensitive to using ordinary least squares or instrumental variables estimation.[38]

**Annex Figure 2.2.5. Correlations between Aggregate Wage Growth and Two-Quarter-Lagged Public Wage Growth**
*(Percent)*




Sources: Eurostat; national authorities; and IMF staff calculations.
Note: Data labels in the figure use International Organization for Standardization (ISO) country codes.

The effects of secular drivers on job attributes are examined using a cross-country panel regression of 36 countries from 2000 to 2016, including country and year fixed effects, and controlling for the output gap. In this analysis, the share of involuntary part-time workers at the country level is the main dependent variable. Potential secular drivers include measures of worker bargaining power (proxied by the five-year change in the union density rate), the five-year change in the share of employment in the services sector, technological change (proxied by the five-year change

[37]Addressing this reverse causality could be expected to reduce the coefficient of lagged inflation. Annex Table 2.3.3 suggests that this is indeed the case for groups A and C. There could be some idiosyncratic reasons biasing the ordinary least squares estimate of lagged inflation downward for group B (the coefficient is negative and insignificant).

[38]Reverse causality from wage growth to trend productivity growth may cause upward bias in the effect of trend productivity growth through employment growth. However, estimated coefficients of the labor productivity trend are often lower than what is implied from other studies in the literature (for instance, Karabarbounis and Neiman 2014), especially if the sample is restricted to the post–Great Recession period. Together, these suggest that downward attenuation bias may dominate reverse causality, causing an underestimation of the role of trend productivity growth. Results are broadly unchanged when imposing the coefficient of trend productivity growth to be 1 or the value implied from other studies.

**Annex Table 2.2.1. Aggregate Forces and Sectoral Exposures**

| | Measure | Aggregate Variable | Sectoral Variation |
|---|---|---|---|
| Near-Term Factors | Slack inflation | Aggregate output gap, inflation | Interaction with sectoral correlation |
| Medium-Term Factors | Trend productivity growth | | Five-year trailing average of productivity growth |
| Long-Term Factors | Expected growth | Expected growth (one and five years ahead) | Interaction with sectoral correlation; sectoral expected growth (adaptive) |
| | Trade openness | | Exports, intermediate exports, global value chain participation, final imports |
| | Technological progress | Change in relative price of investment | Interaction with sectoral capital intensity; change in sectoral price of investment |
| | Worker bargaining power | Union density rate, bi- or tripartite agreement, level of bargaining | Interactions with sectoral characteristics: high expected growth, high volatility |
| | Ease of hiring and firing | Ease of hiring and firing | Interactions with sectoral characteristics: high expected growth, high volatility |

Source: IMF staff compilation.
Note: Sample comprises 20 advanced economies: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Slovak Republic, Slovenia, Sweden, United Kingdom, and United States.

in the relative price of investment), growth expectations, and global value chain integration (proxied by the five-year change in foreign value added as a percent of exports).

## Sectoral Analysis

As a complement to the aggregate analysis, drivers of nominal wage growth and part-time employment shares are examined at the sectoral level.[39] Following the structure of the aggregate analysis, sector-level regressions explore the roles of slack, medium-term growth expectations, technological progress, increased trade integration, and changes in labor market institutions.[40] These are examined as possible drivers of nominal wage growth and part-time employment to determine their effect on different margins of adjustment. The analysis exploits variation in sectoral exposure to aggregate forces to shed light on mechanisms that operate within countries.[41]

As noted earlier, across several advanced economies, a rise in involuntary part-time employment has accompanied subdued wage growth, even as headline employment has fallen. These developments have occurred in the context of falling growth expectations and declines in worker bargaining power, as shown in Figures 2.14 and 2.15.[42]

The sectoral analysis examines the effects of increasing trade openness, automation (captured by the declining relative price of investment), and slowing sectoral growth rates (used to construct a measure of adaptive growth expectations at the sectoral level) on nominal wage growth and part-time employment as a share of total employment.[43] It does so by exploiting sectoral variations in exposure to aggregate forces (Annex Table 2.2.1). For instance, country-level slack could be expected to matter more for labor market dynamics in sectors that are more correlated with the aggregate economy, and the effects of a decline in the aggregate relative price of investment could vary by the initial capital intensity of the sector.

The analysis relies on annual data for a sample of 20 advanced economies starting in 2000, and relates changes in nominal wage growth to the same cyclical and secular drivers used in the aggregate analysis, controlling for country, sector, and year fixed effects:

[39]Estimates of involuntary part-time employment are not available at the sectoral level, so the focus here is on total part-time employment, including both voluntary and involuntary.

[40]Control variables are in line with those used in ECB (2009) and EC (2003), as well as in the literature on interindustry wage differentials and wage dispersion (for example, Erdil and Yetkiner 2001; Koeniger, Leonardi, and Nunziata 2007; and Du Caju and others 2010). Wage regressions also control for inflation and (sectoral) trend productivity growth.

[41]The regressions also control for country, sector, and year fixed effects.

[42]Panel 4 of Figure 2.15 shows the decline in union density rates occurring in most sectors, with the notable exception of public administration; coverage of sectoral union density rates is unfortunately too limited to be included in the regression analysis.

[43]Sectoral expected growth is measured as the five-year trailing average of sectoral gross output growth rates. As noted above, this could be capturing expected productivity growth as well as demand conditions.

$$y_{ijt} = \alpha_i + \mu_j + \tau_t + \beta X_{ijt} + \gamma Z_{jt}, \quad (2.3)$$

in which $y_{ijt}$ is nominal wage growth, $X_{ijt}$ includes measures that vary at the country-sector level, such as the share of part-time employment, how correlated a sector's gross output growth is with the overall economy, sectoral trend productivity growth (measured again using a five-year trailing average), sectoral expected growth (an adaptive measure based on a five-year trailing average of sectoral gross output growth), and the five-year change in final imports as a share of gross output.

$Z_{jt}$ includes measures that vary only at the country level, such as the aggregate output gap and (lagged) inflation, the change in the relative price of investment, and measures of worker bargaining power (proxied again using the five-year change in the union density rate). To exploit sectoral variation in exposure to aggregate forces, these are interacted with sectoral characteristics, looking at the interaction of the aggregate output gap with the correlation of the sector and the aggregate economy and the interaction of the change in the relative price of investment with sectoral capital intensity.

As in the aggregate regressions, the sectoral analysis relates the share of part-time employment to slack (captured using the output gap and how correlated a sector is with the aggregate economy and the interaction between these two variables) and to secular drivers: expected growth, change in final imports as a share of gross output, change in the relative price of investment (also interacted with capital intensity), and change in the union density rate.

## Annex 2.3. Empirical Results

### Aggregate Analysis

Annex Tables 2.3.1 and 2.3.2 show estimates of wage Phillips curves using ordinary least squares and instrumental variables estimations, for the full sample as well as a sample excluding the Baltic countries, and for alternative measures of the dependent and explanatory variables.

**Annex Table 2.3.1. Estimates of Wage Phillips Curves**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| | All Advanced Economies | | | | All Advanced Economies Excluding Baltic Countries | | | |
| | OLS | OLS | IV[1] | Country-by-Country OLS[2] | OLS | OLS | IV[1] | Country-by-Country OLS[2] |
| Unemployment Rate | −0.332*** | −0.366*** | −0.394*** | −0.464 | −0.261*** | −0.281*** | −0.338*** | −0.428 |
| | (0.0261) | (0.0257) | (0.0284) | | (0.0249) | (0.0249) | (0.0279) | |
| Change in Unemployment Rate | −0.114*** | −0.0836** | −0.124*** | 0.00042 | −0.0386 | −0.0111 | −0.00301 | 0.0313 |
| | (0.0381) | (0.0373) | (0.0419) | | (0.0427) | (0.0425) | (0.0474) | |
| Lagged Inflation | 0.215*** | 0.161*** | 0.291*** | 0.177 | 0.216*** | 0.190*** | 0.235** | 0.187 |
| | (0.0438) | (0.0431) | (0.110) | | (0.0435) | (0.0432) | (0.112) | |
| Trend Productivity Growth Rate[3] | | 0.697*** | 0.922*** | 0.344 | | 0.446*** | 0.778*** | 0.261 |
| | | (0.0725) | (0.0732) | | | (0.0729) | (0.0742) | |
| First-Stage F-statistics above 10 | | | yes | | | | yes | |
| Country Fixed Effects | yes | yes | yes | | yes | yes | yes | |
| Year Fixed Effects | yes | yes | no | | yes | yes | no | |
| Number of Observations | 1,889 | 1,889 | 1,857 | | 1,766 | 1,766 | 1,736 | |
| $R^2$ | 0.472 | 0.498 | 0.478 | | 0.438 | 0.450 | 0.419 | |
| *Memorandum:* | | | | | | | | |
| The coefficient of trend productivity growth rate implied from other studies: 0.781.[4] | | | | | | | | |

Source: IMF staff calculations.
Note: Dependent variable = year-over-year growth rate of compensation per hour of workers excluding the self-employed. Sample is of quarterly frequency from the first quarter of 2000 to the fourth quarter of 2016. See Annex Table 2.1.1 for countries in the sample. IV = instrumental variable. OLS = ordinary least squares. Standard errors in parentheses. * $p < .10$; ** $p < .05$; *** $p < .01$.
[1]The instrumental variable for lagged inflation is the two-quarter-lagged change in oil price.
[2]Averages of the estimates of country-specific wage Phillips curves.
[3]Five-year trailing average of the labor productivity growth rate.
[4]Karabarbounis and Neiman (2014).

## Annex Table 2.3.2. Estimates of Wage Phillips Curves with Alternative Measures

| | (1) Benchmark[1] | (2) Alternative Measure of Labor Market Slack[3] | (3) Alternative Measure of Inflation Expectations[4] | (4) Alternative Measure of Trend Productivity Growth[5] | (5) Restricting the Coefficient of Trend Productivity Growth[6] |
|---|---|---|---|---|---|
| | IV[2] | IV[2] | IV[2] | IV[2] | IV[2] |
| Unemployment Rate | –0.339*** | | –0.220*** | –0.347*** | –0.339*** |
| | (0.0291) | | (0.0236) | (0.0296) | (0.0287) |
| Output Gap | | 0.291*** | | | |
| | | (0.0331) | | | |
| Change in Unemployment Rate | 0.0244 | 0.0279 | –0.0935*** | –0.00512 | 0.0240 |
| | (0.0480) | (0.0502) | (0.0397) | (0.0479) | (0.0447) |
| Lagged Inflation | 0.195 | 0.149 | 0.735*** | 0.302*** | 0.196* |
| | (0.120) | (0.128) | (0.0594) | (0.117) | (0.108) |
| Ten-Year Inflation Expectation | | | 0.265*** | | |
| | | | (0.0594) | | |
| Trend Productivity Growth Rate: Five-year[7] | 0.783*** | 0.645*** | 0.553*** | | 0.781 |
| | (0.0720) | (0.0727) | (0.0634) | | |
| Trend Productivity Growth Rate: Three-year[8] | | | | 0.410*** | |
| | | | | (0.0692) | |
| First-Stage F-statistics above 10 | yes | yes | yes | yes | yes |
| Country Fixed Effects | yes | yes | yes | yes | yes |
| Year Fixed Effects | no | no | no | no | no |
| Number of Observations | 1,656 | 1,656 | 1,656 | 1,656 | 1,656 |
| $R^2$ | 0.406 | 0.369 | 0.379 | 0.396 | 0.284 |

Source: IMF staff calculations.
Note: Dependent variable = year-over-year growth rate of compensation per hour of workers excluding the self-employed. Sample is of quarterly frequency from the first quarter of 2000 to the fourth quarter of 2016. See Annex Table 2.1.1 for countries in the sample. IV = instrumental variable. Standard errors in parentheses. * $p < .10$; ** $p < .05$; *** $p < .01$.
[1]The sample size is slightly smaller than that in Annex Table 2.3.1, as this table ensures the sample size consistency for columns (1) to (5).
[2]The instrumental variable for lagged inflation is the two-quarter-lagged change in oil price.
[3]Output gap replaces unemployment rate as the measure of the labor market slack.
[4]Lagged inflation is replaced by lagged inflation and 10-year inflation expectation, with the sum of the two coefficients assumed to be 1.
[5]Three-year trailing average of productivity growth replaces five-year trailing average of productivity growth.
[6]The coefficient of trend productivity growth is imposed to be 0.781, to address the reverse causality from wage growth to trend productivity growth.
[7]Five-year trailing average of labor productivity growth rate.
[8]Three-year trailing average of labor productivity growth rate.

Oil price changes are common across countries, so instrumental variables results do not control for year fixed effects. The main results are not sensitive to the choice of estimation method—ordinary least squares including year fixed effects or instrumental variables without year fixed effects (Annex Figure 2.3.1 compared with Figure 2.12). The share of variation in wage growth explained by inflation drivers is broadly similar across the two approaches.[44]

Annex Tables 2.3.3–2.3.5 augment the wage Phillips curve specification in Annex Table 2.3.1 further with the share of involuntary part-time employment, and examine robustness to using different measures of wages, as well as exploring differences across countries with unemployment rates below, moderately above, and appreciably above 2000–07 averages.

Annex Tables 2.3.6 and 2.3.7 conduct a similar exercise for the temporary contract employment share instead of involuntary part-time employment share. Results are very similar if both the involuntary part-time employment share and temporary contract employment share are controlled for simultaneously. These labor market underutilization measures do not appear to affect the sensitivity of wage growth to unemployment rates—they are thus included additively.

As described above, Annex Table 2.3.8 augments the wage Phillips curve with secular drivers. Because wage

[44]Further analysis relating the residuals from the wage Phillips curve analysis to the global output gap (weighted by dollar GDP) suggests that the global output gap is not significant in explaining such residuals.

growth rates were volatile during the Great Recession, Annex Table 2.3.9 examines robustness to excluding the years 2008 and 2009.

Annex Table 2.3.10 zooms in on the determinants of job attributes and examines the drivers of involuntary part-time employment, linking it to the output gap and the secular drivers explored above.

## Sectoral Analysis

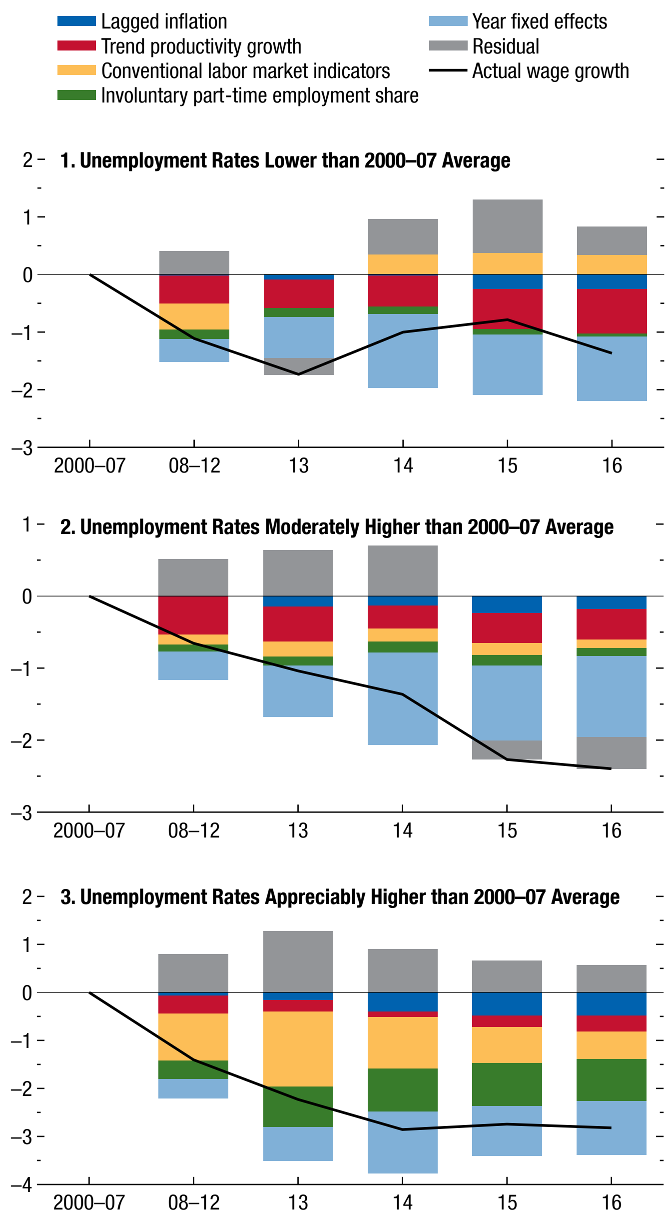
Sectoral data have many more missing observations than country-level data, resulting in an unbalanced panel, and sectoral measurements are likely noisier. Although the results of the sectoral regressions are not as conclusive as those based on the country panel regressions presented earlier, they tend to be consistent.

Annex Tables 2.3.11 and 2.3.12 report the results of the sectoral analysis, linking growth in nominal wages and part-time employment to cyclical and secular drivers. These include country, sector, and year fixed effects—results are robust to including interacted sector-year fixed effects instead, which would pick up common sectoral developments across countries. Diminished sector-specific slack is associated with higher nominal wage growth in countries where unemployment in 2016 was below 2000–07 averages (as captured by the sum of the impacts of the aggregate output gap, the correlation between the sector and the aggregate economy, and their interaction; see Figure 2.3.2, panel 1). Automation and medium-term growth expectations have been generally associated with lower wage growth in these economies. Where unemployment rates are still appreciably above 2000–07 averages, slack and past inflation are the largest drags on nominal wage growth (Figure 2.3.2, panel 3). For countries with unemployment rates only moderately above their former averages, structural factors—automation and medium-term growth expectations—play a role (Figure 2.3.2, panel 2). Although sectoral productivity growth does not have a significant effect in the sectoral analysis, this finding could result from spillovers of wage pressures across sectors and cross-sector labor mobility. These spillovers tend to weaken links between sector-level drivers and sectoral nominal wage growth.

Automation and lower sectoral medium-term growth expectations are also associated with higher shares of part-time employment across sectors,

**Annex Figure 2.3.1. Decomposition of Wage Dynamics, 2000–16**

*(Percentage-point change relative to 2000–07 average)*




Source: IMF staff calculations.
Note: The wage variable used is compensation per hour of workers excluding the self-employed. Involuntary part-time workers are those working less than 30 hours a week because they could not find a full-time position. The involuntary part-time employment share is calculated as the total number of involuntary part-time workers divided by total employment. Groups are as defined in Figure 2.11. The decomposition is based on the coefficients reported in column (1) of Annex Table 2.3.3 and is weighted by GDP at market exchange rates across countries.

### Annex Table 2.3.3. Estimation of Wage Phillips Curve Augmented with Involuntary Part-Time Employment Share by Country Group

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| | Full Sample | Group A | Group B | Group C | Full Sample | Group A | Group B | Group C |
| | OLS | OLS | OLS | OLS | IV[1] | IV[1] | IV[1] | IV[1] |
| Involuntary Part-Time Employment Share | –0.177** | –0.503* | –0.336** | 0.0159 | –0.275*** | –0.653** | –0.291* | –0.186* |
| | (0.0830) | (0.274) | (0.139) | (0.124) | (0.0829) | (0.294) | (0.154) | (0.101) |
| Unemployment Rate | –0.187*** | –0.0178 | –0.00699 | –0.280*** | –0.182*** | 0.0855 | –0.284 | –0.395*** |
| | (0.0445) | (0.128) | (0.186) | (0.0686) | (0.0438) | (0.146) | (0.186) | (0.0722) |
| Change in Unemployment Rate | –0.349*** | –0.690*** | –0.609** | –0.128 | –0.263*** | –0.449** | –0.830*** | 0.0821 |
| | (0.0960) | (0.244) | (0.271) | (0.129) | (0.0887) | (0.181) | (0.247) | (0.117) |
| Lagged Inflation | 0.193*** | 0.378*** | –0.183 | 0.156 | 0.300* | 0.287 | 0.397 | –0.279 |
| | (0.0728) | (0.129) | (0.124) | (0.206) | (0.164) | (0.282) | (0.248) | (0.292) |
| Trend Productivity Growth Rate[2] | 0.456*** | 0.634* | –0.131 | 0.699*** | 0.624*** | 0.763*** | 0.00955 | 0.986*** |
| | (0.112) | (0.348) | (0.189) | (0.170) | (0.106) | (0.223) | (0.176) | (0.170) |
| First-Stage F-statistics above 10 | yes | yes | yes | yes | yes | yes | yes | yes |
| Country Fixed Effects | yes | yes | yes | yes | yes | yes | yes | yes |
| Year Fixed Effects | yes | yes | yes | yes | no | no | no | no |
| Number of Observations | 411 | 117 | 146 | 148 | 411 | 117 | 146 | 148 |
| $R^2$ | 0.610 | 0.709 | 0.649 | 0.723 | 0.577 | 0.652 | 0.458 | 0.660 |

Source: IMF staff calculations.
Note: Dependent variable = annual growth rates of compensation per hour of workers excluding the self-employed. Sample is of annual frequency from 2000 to 2016. See Annex Table 2.1.1. for countries in the full sample. A few countries are not in the sample due to missing data on involuntary part-time employment share. Country groups are divided by comparing unemployment rate in 2016 with 2000–07 average. Group A (2016 unemployment lower than 2000–07): Czech Republic, Germany, Japan, Israel, Slovak Republic, United Kingdom, and United States. Group B (2016 unemployment moderately higher than 2000–07): Australia, Austria, Belgium, Canada, Switzerland, Finland, Iceland, Norway, and Sweden. Group C (2016 unemployment appreciably higher than 2000–07): Denmark, Spain, France, Greece, Ireland, Italy, Netherlands, Portugal, and Slovenia. IV = instrumental variable. OLS = ordinary least squares. Standard errors in parentheses. * $p < .10$; ** $p < .05$; *** $p < .01$.
[1]The instrumental variable for lagged inflation is the two-quarter-lagged change in oil price.
[2]Five-year trailing average of the labor productivity growth rate.

### Annex Table 2.3.4. Estimation of Wage Phillips Curve Augmented with Involuntary Part-Time Employment Share: Full Sample and Countries with Unemployment Rates Lower than 2000–07 Average

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | Full Sample | | | Countries with Unemployment Rate Lower than 2000–07 Average (Group A) | | |
| | Compensation per Employee[1] | Compensation per Hour[1] | Wage per Hour[1] | Compensation per Employee[1] | Compensation per Hour[1] | Wage per Hour[1] |
| | IV[2] | IV[2] | IV[2] | IV[2] | IV[2] | IV[2] |
| Involuntary Part-Time Employment Share | –0.203** | –0.275*** | –0.242*** | –0.535** | –0.653** | –0.705** |
| | (0.0803) | (0.0829) | (0.0805) | (0.261) | (0.294) | (0.292) |
| Unemployment Rate | –0.167*** | –0.182*** | –0.177*** | –0.0174 | 0.0855 | 0.103 |
| | (0.0424) | (0.0438) | (0.0422) | (0.130) | (0.146) | (0.145) |
| Change in Unemployment Rate | –0.473*** | –0.263*** | –0.321*** | –0.574*** | –0.449** | –0.567*** |
| | (0.0859) | (0.0887) | (0.0853) | (0.161) | (0.181) | (0.180) |
| Lagged Inflation | 0.509*** | 0.300* | 0.309* | 0.491* | 0.287 | 0.253 |
| | (0.159) | (0.164) | (0.162) | (0.250) | (0.282) | (0.279) |
| Trend Productivity Growth Rate[3] | 0.413*** | 0.624*** | 0.701*** | 0.659*** | 0.763*** | 0.760*** |
| | (0.103) | (0.106) | (0.102) | (0.198) | (0.223) | (0.222) |
| First-Stage F-statistics above 10 | yes | yes | yes | yes | yes | yes |
| Country Fixed Effects | yes | yes | yes | yes | yes | yes |
| Year Fixed Effects | no | no | no | no | no | no |
| Number of Observations | 411 | 411 | 410 | 117 | 117 | 117 |
| $R^2$ | 0.570 | 0.577 | 0.603 | 0.705 | 0.652 | 0.663 |

Source: IMF staff calculations.
Note: Sample is of annual frequency from 2000 to 2016. See the notes in Annex Table 2.3.3 for countries in the full sample and group A. IV = instrumental variable. Standard errors in parentheses. * $p < .10$; ** $p < .05$; *** $p < .01$.
[1]The dependent variable of the regression, defined as annual growth rates.
[2]The instrumental variable for lagged inflation is the two-quarter-lagged change in oil price.
[3]Five-year trailing average of the labor productivity growth rate.

**Annex Table 2.3.5. Estimation of Wage Phillips Curve Augmented with Involuntary Part-Time Employment Share: Countries with Unemployment Rates Moderately Higher and Appreciably Higher than 2000–07 Average**

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | Countries with Unemployment Rates Moderately Higher than 2000–07 Average (Group B) | | | Countries with Unemployment Rates Appreciably Higher than 2000–07 Average (Group C) | | |
| | Compensation per Employee[1] | Compensation per Hour[1] | Wage per Hour[1] | Compensation per Employee[1] | Compensation per Hour[1] | Wage per Hour[1] |
| | IV[2] | IV[2] | IV[2] | IV[2] | IV[2] | IV[2] |
| Involuntary Part-Time Employment Share | –0.221 | –0.291* | –0.110 | –0.157* | –0.186* | –0.235** |
| | (0.147) | (0.154) | (0.147) | (0.0923) | (0.101) | (0.105) |
| Unemployment Rate | –0.203 | –0.284 | –0.147 | –0.358*** | –0.395*** | –0.375*** |
| | (0.177) | (0.186) | (0.187) | (0.0663) | (0.0722) | (0.0751) |
| Change in Unemployment Rate | –1.429*** | –0.830*** | –0.743*** | –0.0369 | 0.0821 | –0.0381 |
| | (0.235) | (0.247) | (0.241) | (0.107) | (0.117) | (0.121) |
| Lagged Inflation | 0.522** | 0.397 | 0.780*** | –0.126 | –0.279 | –0.369 |
| | (0.236) | (0.248) | (0.259) | (0.268) | (0.292) | (0.304) |
| Trend Productivity Growth Rate[3] | –0.183 | 0.00955 | 0.0518 | 0.834*** | 0.986*** | 1.082*** |
| | (0.168) | (0.176) | (0.167) | (0.156) | (0.170) | (0.177) |
| First-Stage F-statistics above 10 | yes | yes | yes | yes | yes | yes |
| Country Fixed Effects | yes | yes | yes | yes | yes | yes |
| Year Fixed Effects | no | no | no | no | no | no |
| Number of Observations | 146 | 146 | 145 | 148 | 148 | 148 |
| $R^2$ | 0.487 | 0.458 | 0.389 | 0.681 | 0.660 | 0.652 |

Source: IMF staff calculations.
Note: Sample is of annual frequency from 2000 to 2016. See the notes in Annex Table 2.3.3 for countries in groups B and C. IV = instrumental variable. Standard errors in parentheses. * $p < .10$; ** $p < .05$; *** $p < .01$.
[1]The dependent variable of the regression, defined as annual growth rates.
[2]The instrumental variable for lagged inflation is the two-quarter-lagged change in oil price.
[3]Five-year trailing average of the labor productivity growth rate.

**Annex Table 2.3.6. Estimation of Wage Phillips Curve Augmented with Temporary Contract Employment Share: Full Sample and Countries with Unemployment Rates Lower than 2000–07 Average**

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | Full Sample | | | Countries with Unemployment Rate Lower than 2000–07 Average (Group A) | | |
| | Compensation per Employee[1] | Compensation per Hour[1] | Wage per Hour[1] | Compensation per Employee[1] | Compensation per Hour[1] | Wage per Hour[1] |
| | IV[2] | IV[2] | IV[2] | IV[2] | IV[2] | IV[2] |
| Temporary Contract Employment Share | –0.0274 | –0.0866 | –0.0861 | 0.0498 | –0.115 | –0.146 |
| | (0.0566) | (0.0584) | (0.0561) | (0.135) | (0.174) | (0.176) |
| Unemployment Rate | –0.244*** | –0.297*** | –0.277*** | –0.0666 | 0.262 | 0.308 |
| | (0.0428) | (0.0441) | (0.0427) | (0.219) | (0.281) | (0.285) |
| Change in Unemployment Rate | –0.428*** | –0.181* | –0.249*** | –0.392* | –0.291 | –0.375 |
| | (0.0974) | (0.100) | (0.0960) | (0.203) | (0.261) | (0.265) |
| Lagged Inflation | 0.556*** | 0.259 | 0.281 | 0.431 | –0.167 | –0.249 |
| | (0.182) | (0.188) | (0.183) | (0.430) | (0.553) | (0.561) |
| Trend Productivity Growth Rate[3] | 0.503*** | 0.736*** | 0.806*** | 0.987*** | 1.130*** | 1.133*** |
| | (0.118) | (0.122) | (0.116) | (0.195) | (0.251) | (0.254) |
| First-Stage F-statistics above 10 | yes | yes | yes | yes | yes | yes |
| Country Fixed Effects | yes | yes | yes | yes | yes | yes |
| Year Fixed Effects | no | no | no | no | no | no |
| Number of Observations | 388 | 388 | 387 | 88 | 88 | 88 |
| $R^2$ | 0.617 | 0.616 | 0.648 | 0.732 | 0.591 | 0.575 |

Source: IMF staff calculations.
Note: Sample is of annual frequency from 2000 to 2016. See the notes in Annex Table 2.3.3 for countries in the full sample and group A. IV = instrumental variable. Standard errors in parentheses. * $p < .10$; ** $p < .05$; *** $p < .01$.
[1]The dependent variable of the regression, defined as annual growth rates.
[2]The instrumental variable for lagged inflation is the two-quarter-lagged change in oil price.
[3]Five-year trailing average of the labor productivity growth rate.

**Annex Table 2.3.7. Estimation of Wage Phillips Curve Augmented with Temporary Contract Employment Share: Countries with Unemployment Rates Moderately Higher and Appreciably Higher than 2000–07 Average**

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | Countries with Unemployment Rate Moderately Higher than 2000–07 Average (Group B) | | | Countries with Unemployment Rate Appreciably Higher than 2000–07 Average (Group C) | | |
| | Compensation per Employee[1] | Compensation per Hour[1] | Wage per Hour[1] | Compensation per Employee[1] | Compensation per Hour[1] | Wage per Hour[1] |
| | IV[2] | IV[2] | IV[2] | IV[2] | IV[2] | IV[2] |
| Temporary Contract Employment Share | –0.0416 | –0.158 | –0.138 | –0.106 | –0.107 | –0.101 |
| | (0.0987) | (0.102) | (0.0975) | (0.0818) | (0.0875) | (0.0919) |
| Unemployment Rate | –0.489*** | –0.446*** | –0.383** | –0.383*** | –0.426*** | –0.411*** |
| | (0.153) | (0.158) | (0.153) | (0.0699) | (0.0748) | (0.0786) |
| Change in Unemployment Rate | –1.227*** | –0.636** | –0.610** | –0.0615 | 0.0538 | –0.0717 |
| | (0.249) | (0.257) | (0.250) | (0.117) | (0.126) | (0.132) |
| Lagged Inflation | 0.384 | 0.128 | 0.563* | 0.0161 | –0.104 | –0.132 |
| | (0.274) | (0.283) | (0.293) | (0.272) | (0.291) | (0.306) |
| Trend Productivity Growth Rate[3] | 0.0832 | 0.303* | 0.277* | 0.862*** | 1.000*** | 1.097*** |
| | (0.158) | (0.163) | (0.155) | (0.190) | (0.204) | (0.214) |
| First-Stage F-statistics above 10 | yes | yes | yes | yes | yes | yes |
| Country Fixed Effects | yes | yes | yes | yes | yes | yes |
| Year Fixed Effects | no | no | no | no | no | no |
| Number of Observations | 147 | 147 | 146 | 153 | 153 | 153 |
| $R^2$ | 0.607 | 0.582 | 0.564 | 0.667 | 0.647 | 0.637 |

Source: IMF staff calculations.
Note: Sample is of annual frequency from 2000 to 2016. See the notes of Annex Table 2.3.3 for countries in groups B and C. IV = instrumental variable. Standard errors in parentheses. * $p < .10$; ** $p < .05$; *** $p < .01$.
[1]The dependent variable of the regression, defined as annual growth rates.
[2]The instrumental variable for lagged inflation is the two-quarter-lagged change in oil price.
[3]Five-year trailing average of the labor productivity growth rate.

and the associations are broadly similar in size to those found in the aggregate analysis for involuntary part-time employment (Figure 2.3.3; Annex Table 2.3.12).

Annex Table 2.3.13 reports the robustness test in which growth in nominal wages, employment, and part-time employment are treated as jointly determined and estimates the system using three-stage least squares, which treats the dependent variables as endogenous, instruments them using the exogenous variables, and allows them to be correlated with disturbances in the system's equations.

The results are also robust to looking at three-year nonoverlapping averages of the dependent and explanatory variables instead of annual data. Furthermore, as in the aggregate analysis, results are robust to omitting smaller advanced economies (the Baltic countries). While skill composition is not included in the baseline specifications due to data limitations, the results are robust to including it as an additional control.

Further robustness tests have explored alternative trade measures, such as exports and intermediate exports as a share of gross output and global value chain participation, aggregate expected growth (one and five years ahead) interacted with sectoral correlation instead of sectoral expected growth, and further measures of worker bargaining power. Such further measures include whether the country has a bi- or tripartite agreement, whether bargaining is done predominantly by firms (as opposed to at the sector or country level), the ease of hiring and firing, and the strictness of employment protection regulation. Results on other variables are broadly comparable to those in the baseline regressions.

**Annex Table 2.3.8. Estimation of Wage Phillips Curve Augmented with Structural Variables**

| | (1) IV[1] | (2) IV[1] | (3) IV[1] | (4) IV[1] | (5) IV[1] | (6) IV[1] | (7) IV[1] | (8) IV[1] | (9) IV[1] |
|---|---|---|---|---|---|---|---|---|---|
| Involuntary Part-Time Employment Share | –0.275*** | –0.306*** | –0.192** | –0.200** | –0.166* | –0.225*** | –0.272*** | –0.0840 | –0.0570 |
| | (0.0829) | (0.0947) | (0.0845) | (0.0976) | (0.0977) | (0.0794) | (0.0830) | (0.133) | (0.125) |
| Unemployment Rate | –0.182*** | –0.226*** | –0.211*** | –0.293*** | –0.365*** | –0.199*** | –0.177*** | –0.333*** | –0.362*** |
| | (0.0438) | (0.0556) | (0.0492) | (0.0688) | (0.0590) | (0.0444) | (0.0446) | (0.0948) | (0.0902) |
| Change in Unemployment Rate | –0.263*** | –0.225** | –0.137 | –0.284*** | –0.0325 | –0.247*** | –0.267*** | –0.295** | –0.334*** |
| | (0.0887) | (0.0969) | (0.0833) | (0.109) | (0.0887) | (0.0893) | (0.0887) | (0.130) | (0.123) |
| Lagged Inflation | 0.300* | –0.0452 | 0.00644 | –0.380 | –0.236 | 0.199 | 0.308* | –0.432 | –0.540 |
| | (0.164) | (0.280) | (0.197) | (0.311) | (0.206) | (0.186) | (0.164) | (0.332) | (0.327) |
| Trend Productivity Growth Rate | 0.624*** | 0.720*** | 0.845*** | 0.497*** | 0.594*** | 0.570*** | 0.628*** | 0.231 | 0.325** |
| | (0.106) | (0.118) | (0.109) | (0.123) | (0.117) | (0.101) | (0.107) | (0.168) | (0.156) |
| Change in Foreign Value Added as a Share of Exports[2] | | 0.0944** | | | | | | | |
| | | (0.0424) | | | | | | | |
| Change in the Relative Price of Investment[2] | | | 0.114*** | | | | | | |
| | | | (0.0302) | | | | | | |
| Change in the Union Density Rate[2] | | | | –0.330*** | | | | | –0.340*** |
| | | | | (0.0774) | | | | | (0.0774) |
| Change in Individual and Collective Dismissal Regulation[2] | | | | | –0.259 | | | | |
| | | | | | (0.918) | | | | |
| Expected Growth | | | | | | 0.459** | | | |
| | | | | | | (0.180) | | | |
| Change in the Share of Service Sector Workers[2] | | | | | | | –0.0194 | | |
| | | | | | | | (0.0327) | | |
| Union Density Rate (Level) | | | | | | | | 0.322*** | 0.186*** |
| | | | | | | | | (0.0836) | (0.0678) |
| First-Stage F-statistics above 10 | yes | yes | yes | yes | yes | yes | yes | yes | yes |
| Country Fixed Effects | yes | yes | yes | yes | yes | yes | yes | yes | yes |
| Year Fixed Effects | no | no | no | no | no | no | no | no | no |
| Number of Observations | 411 | 361 | 316 | 288 | 247 | 411 | 411 | 267 | 264 |
| $R^2$ | 0.577 | 0.561 | 0.596 | 0.590 | 0.603 | 0.589 | 0.578 | 0.501 | 0.567 |

Source: IMF staff calculations.
Note: Dependent variable = annual growth rates of compensation per hour of workers excluding the self-employed. Sample is of annual frequency from 2000 to 2016. See Annex Table 2.1.1 for countries in the sample. IV = instrumental variable. Standard errors in parentheses. * $p < .10$; ** $p < .05$; *** $p < .01$.
[1]The instrumental variable for lagged inflation is the two-quarter-lagged change in oil price.
[2]Relative to five years ago.

### Annex Table 2.3.9. Estimation of Wage Phillips Curve Augmented with Structural Variables: Excluding 2008 and 2009

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| | IV[1] | IV[1] | IV[1] | IV[1] | IV[1] | IV[1] | IV[1] | IV[1] | IV[1] |
| Involuntary Part-Time Employment Share | –0.213** | –0.227 | –0.168* | –0.215* | –0.193 | –0.173** | –0.205** | –0.212 | –0.169 |
| | (0.0912) | (0.139) | (0.102) | (0.123) | (0.131) | (0.0862) | (0.0913) | (0.198) | (0.178) |
| Unemployment Rate | –0.174*** | –0.205*** | –0.186*** | –0.301*** | –0.319*** | –0.196*** | –0.162*** | –0.367 | –0.380* |
| | (0.0428) | (0.0657) | (0.0549) | (0.105) | (0.0768) | (0.0446) | (0.0435) | (0.230) | (0.227) |
| Change in Unemployment Rate | –0.400*** | –0.321* | –0.280** | –0.308* | –0.129 | –0.352*** | –0.406*** | –0.495** | –0.507** |
| | (0.118) | (0.183) | (0.131) | (0.168) | (0.152) | (0.127) | (0.118) | (0.229) | (0.213) |
| Lagged Inflation | 0.502** | 0.351 | 0.180 | –0.583 | –0.254 | 0.354 | 0.520** | –1.289 | –1.417 |
| | (0.208) | (0.598) | (0.346) | (1.107) | (0.677) | (0.251) | (0.207) | (2.101) | (2.053) |
| Trend Productivity Growth Rate | 0.768*** | 0.826*** | 0.891*** | 0.471*** | 0.662*** | 0.721*** | 0.779*** | –0.0674 | 0.151 |
| | (0.101) | (0.118) | (0.120) | (0.154) | (0.130) | (0.0968) | (0.101) | (0.662) | (0.466) |
| Change in Foreign Value Added as a Share of Exports[2] | | 0.0262 | | | | | | | |
| | | (0.0452) | | | | | | | |
| Change in Relative Price of Investment[2] | | | 0.0911*** | | | | | | |
| | | | (0.0338) | | | | | | |
| Change in Union Density Rate[2] | | | | –0.390* | | | | | –0.483 |
| | | | | (0.234) | | | | | (0.373) |
| Change in Individual and Collective Dismissal Regulation[2] | | | | | –0.390 | | | | |
| | | | | | (1.653) | | | | |
| Expected Growth | | | | | | 0.414** | | | |
| | | | | | | (0.197) | | | |
| Change in Share of Service Sector Workers[2] | | | | | | | –0.0424 | | |
| | | | | | | | (0.0308) | | |
| Union Density Rate (Level) | | | | | | | | 0.542 | 0.302 |
| | | | | | | | | (0.510) | (0.302) |
| First-Stage F-statistics above 10 | yes | yes | yes | yes | yes | yes | yes | yes | yes |
| Country Fixed Effects | yes | yes | yes | yes | yes | yes | yes | yes | yes |
| Year Fixed Effects | no | no | no | no | no | no | no | no | no |
| Number of Observations | 361 | 311 | 274 | 241 | 203 | 361 | 361 | 221 | 219 |
| $R^2$ | 0.678 | 0.676 | 0.654 | 0.612 | 0.632 | 0.682 | 0.680 | 0.264 | 0.369 |

Source: IMF staff calculations.
Note: Dependent variable = annual growth rates of compensation per hour of workers excluding the self-employed. Sample is of annual frequency from 2000 to 2016. See Annex Table 2.1.1 for countries in the sample. IV = instrumental variable. Standard errors in parentheses. * $p < .10$; ** $p < .05$; *** $p < .01$.
[1]The instrumental variable for lagged inflation is the two-quarter-lagged change in oil price.
[2]Relative to five years ago.

### Annex Table 2.3.10. Drivers of Involuntary Part-Time Employment Share, Aggregate Analysis

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Output Gap | –0.265*** | –0.263*** | –0.172*** | –0.238*** | –0.172*** | –0.245*** |
| | (0.030) | (0.029) | (0.029) | (0.031) | (0.033) | (0.030) |
| Expected Growth | | –0.454*** | | | | |
| | | (0.134) | | | | |
| Change in Relative Price of Investment[1] | | | –0.122*** | | | |
| | | | (0.018) | | | |
| Change in Foreign Value Added as a Share of Exports[1] | | | | 0.037 | | |
| | | | | (0.033) | | |
| Change in Union Density Rate[1] | | | | | 0.007 | |
| | | | | | (0.028) | |
| Change in Share of Service Sector Workers[1] | | | | | | 0.085*** |
| | | | | | | (0.023) |
| Country Fixed Effects | yes | yes | yes | yes | yes | yes |
| Year Fixed Effects | yes | yes | yes | yes | yes | yes |
| Number of Observations | 386 | 386 | 357 | 361 | 288 | 386 |
| $R^2$ | 0.447 | 0.465 | 0.548 | 0.447 | 0.474 | 0.467 |

Source: IMF staff calculations.
Note: Dependent variable = involuntary part-time employment share in logs. Sample is of annual frequency from 2000 to 2016. See Annex Table 2.1.1 for countries in the sample. Standard errors in parentheses. * $p < .10$; ** $p < .05$; *** $p < .01$.
[1]Relative to five years ago.

### Annex Table 2.3.11. Drivers of Sectoral Nominal Wage Growth

| | (1) Group A | (2) Group B | (3) Group C |
|---|---|---|---|
| Aggregate Output Gap | –0.221** | 0.0417 | 0.177* |
| | (0.0750) | (0.119) | (0.0867) |
| Correlation of Sectoral and Aggregate Output Growth | 0.321 | –0.599 | 0.179 |
| | (1.077) | (0.606) | (0.310) |
| Aggregate Output Gap × Correlation | –0.183 | –0.123 | 0.319* |
| | (0.138) | (0.102) | (0.158) |
| Lagged Inflation | 0.182 | 0.304 | 0.492** |
| | (0.295) | (0.216) | (0.195) |
| Trend Productivity Growth Rate[1] | –0.0229 | –0.0387 | –0.00741 |
| | (0.0889) | (0.0286) | (0.0306) |
| Part-Time Employment Share | 0.0215 | –0.00107 | 0.00870 |
| | (0.0254) | (0.0193) | (0.00999) |
| Expected Growth (Sectoral) | 0.189* | 0.134** | 0.0135 |
| | (0.0716) | (0.0483) | (0.0256) |
| Change in Final Imports as a Share of Gross Output[2] | 0.0943 | 0.0213 | 0.0209 |
| | (0.0494) | (0.0384) | (0.0262) |
| Change in Relative Price of Investment[2] | 0.256** | 0.0701 | –0.0215 |
| | (0.0861) | (0.0369) | (0.0427) |
| Country Fixed Effects | yes | yes | yes |
| Sector Fixed Effects | yes | yes | yes |
| Year Fixed Effects | yes | yes | yes |
| Number of Observations | 349 | 447 | 493 |
| $R^2$ | 0.400 | 0.111 | 0.355 |

Source: IMF staff calculations.
Note: Dependent variable = year-over-year percent change in nominal wages and salaries per worker (excludes self-employment and employers' social contributions) for NACE revision 2 sectors. NACE = Statistical Classification of Economic Activities in the European Community. Sample is of annual frequency from 2000 to 2015. See notes for Annex Table 2.3.3 for countries in different groups. The following countries are absent in respective groups due to data constraints: Japan (A), Israel (A), Iceland (B), Switzerland (B), and Greece (C). Standard errors in parentheses. * $p < .10$; ** $p < .05$; *** $p < .01$.
[1]Five-year trailing average of the labor productivity growth rate.
[2]Relative to five years ago.

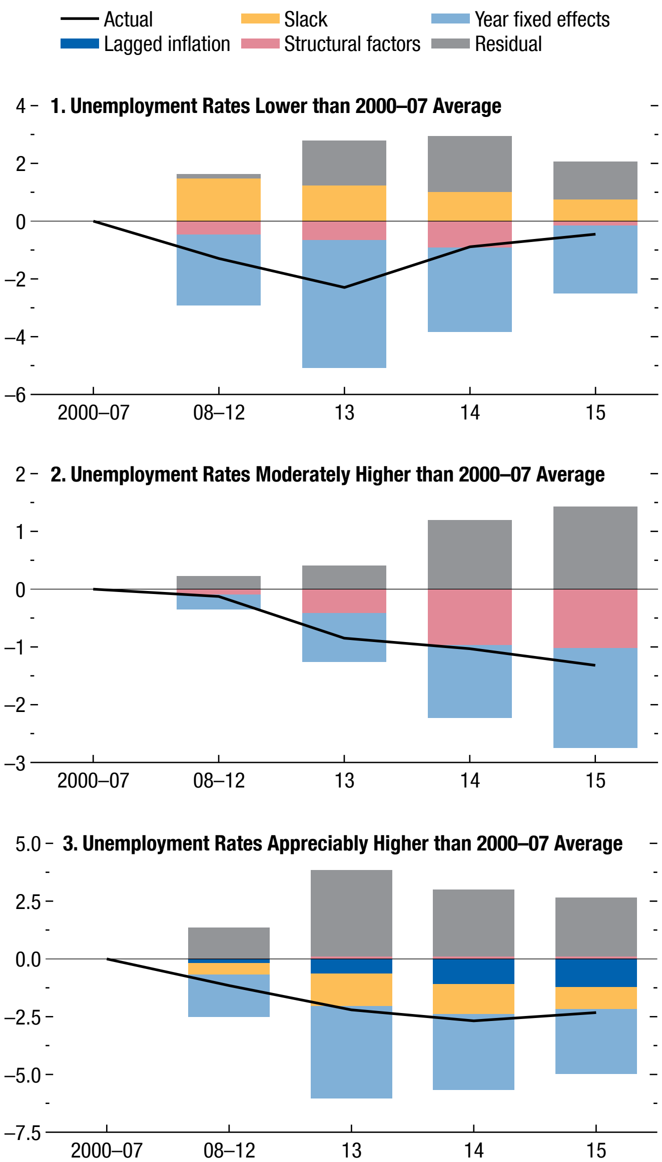
### Annex Table 2.3.12. Drivers of Sectoral Part-Time Employment Shares

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Aggregate Output Gap | –0.0273 | –0.00807 | 0.0237 | 0.00105 | 0.0124 | –0.00168 |
| | (0.0710) | (0.0685) | (0.0736) | (0.0781) | (0.0595) | (0.0830) |
| Correlation of Sectoral and Aggregate Output Growth | –0.318 | –0.355 | –0.321 | –0.290 | 0.254 | –0.441 |
| | (0.512) | (0.514) | (0.454) | (0.478) | (0.479) | (0.773) |
| Aggregate Output Gap × Correlation | –0.0703 | –0.0779 | –0.115 | –0.0297 | –0.0204 | 0.0285 |
| | (0.0739) | (0.0727) | (0.0788) | (0.0686) | (0.0924) | (0.0831) |
| Expected Growth (Aggregate) | | –0.615* | | | | |
| | | (0.322) | | | | |
| Expected Growth (Sectoral) | | | –0.137** | | | |
| | | | (0.0573) | | | |
| Change in Final Imports as a Share of Gross Output[1] | | | | –0.0577 | | |
| | | | | (0.0367) | | |
| Change in Relative Price of Investment[1] | | | | | –0.147*** | |
| | | | | | (0.0464) | |
| Change in Relative Price of Investment × Capital Intensity | | | | | 0.00118** | |
| | | | | | (0.000419) | |
| Capital Intensity | | | | | 5.052 | |
| | | | | | (4.032) | |
| Change in Union Density Rate[1] | | | | | | 0.106 |
| | | | | | | (0.0749) |
| Country Fixed Effects | yes | yes | yes | yes | yes | yes |
| Sector Fixed Effects | yes | yes | yes | yes | yes | yes |
| Year Fixed Effects | yes | yes | yes | yes | yes | yes |
| Number of Observations | 2,103 | 2,103 | 2,103 | 1,687 | 1,710 | 1,562 |
| $R^2$ | 0.806 | 0.806 | 0.807 | 0.811 | 0.810 | 0.824 |

Source: IMF staff calculations.
Note: Dependent variable = part-time employment shares for NACE revision 2 sectors. NACE = Statistical Classification of Economic Activities in the European Community. Sample is of annual frequency from 2000 to 2015. See Annex Table 2.1.1 for countries in the sample. Standard errors in parentheses.
* $p < .10$; ** $p < .05$; *** $p < .01$.
[1]Relative to five years ago.

**Annex Figure 2.3.2. Decomposition of Sectoral Wage Dynamics, 2000–15**

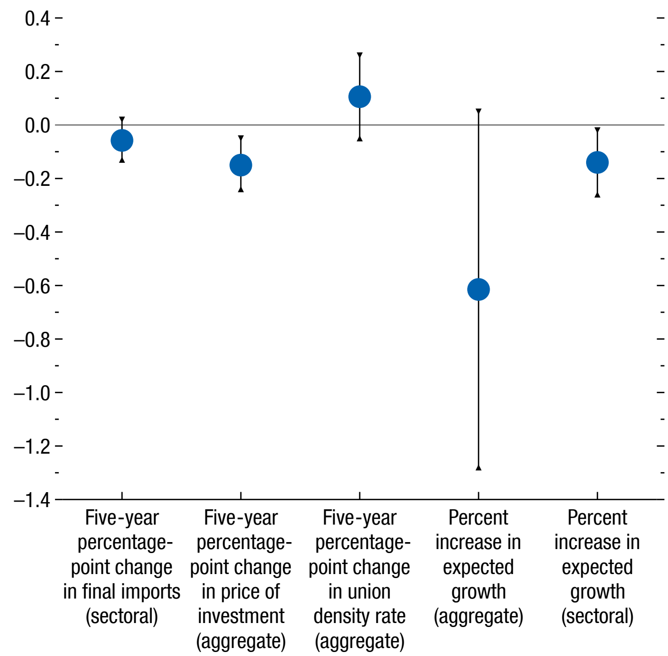
*(Percentage-point change relative to 2000–07 average)*




Source: IMF staff calculations.
Note: Groups are as defined in Figure 2.11. Structural factors include automation (proxied by the relative price of investment), trade, and expected growth. Regressions also control for trend labor productivity growth, the share of part-time employment, as well as country and sector fixed effects. The decomposition is based on the coefficients reported in Annex Table 2.3.11 and is weighted by GDP at market exchange rates across countries. Only statistically significant coefficients are shown.

**Annex Figure 2.3.3. Effects on Part-Time Employment Share, Sectoral Analysis**

*(Percentage points)*




Source: IMF staff calculations.
Note: Markers show estimated coefficients, and lines display 90 percent confidence intervals. Figure is based on columns (2) to (6) of Annex Table 2.3.12.

**Annex Table 2.3.13. Drivers of Nominal Wage Growth, Employment Growth, and Part-Time Employment**

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | Nominal Wage Growth[1] | | Employment Growth[1] | | Part-Time Employment[1] |
| | 3SLS[2] | 3SLS[3] | 3SLS[2] | 3SLS[3] | 3SLS[3] |
| Aggregate Output gap | 0.284*** | 0.241*** | –0.0682 | –0.0513 | –0.0907 |
| | (0.0334) | (0.0322) | (0.0786) | (0.0641) | (0.0816) |
| Correlation of Sectoral and Aggregate Output Growth | –0.388** | –0.412** | –1.001** | –0.226 | –0.698* |
| | (0.172) | (0.163) | (0.404) | (0.324) | (0.413) |
| Aggregate Output Gap × Correlation | 0.321*** | 0.269*** | 0.606*** | 0.644*** | 0.000166 |
| | (0.0548) | (0.0531) | (0.129) | (0.106) | (0.135) |
| Lagged Inflation | 0.207*** | 0.210*** | 0.0552 | –0.0967 | 0.131 |
| | (0.0573) | (0.0578) | (0.135) | (0.115) | (0.147) |
| Expected Growth (Sectoral) | 0.0205 | 0.0226* | –0.0700** | –0.0337 | –0.106*** |
| | (0.0138) | (0.0137) | (0.0324) | (0.0272) | (0.0347) |
| Change in Final Imports as a Share of Gross Output[4] | –0.0103 | –0.00520 | 0.0280 | 0.0218 | 0.0588** |
| | (0.0110) | (0.00973) | (0.0258) | (0.0194) | (0.0247) |
| Change in the Relative Price of Investment[4] | 0.102*** | 0.115*** | 0.0294 | 0.0133 | –0.0683 |
| | (0.0228) | (0.0213) | (0.0537) | (0.0424) | (0.0540) |
| Country Fixed Effects | yes | yes | yes | yes | yes |
| Sector Fixed Effects | yes | yes | yes | yes | yes |
| Year Fixed Effects | no | no | no | no | no |
| Number of Observations | 1,833 | 1,526 | | | |

Source: IMF staff calculations.
Note: Sample is of annual frequency from 2000 to 2015. See Annex Table 2.1.1 for countries in the sample. 3SLS = three-stage least squares. Standard errors in parentheses. * $p < .10$; ** $p < .05$; *** $p < .01$.
[1]The dependent variable of the regression, defined as annual growth rates and share of total employment.
[2]System estimated using 3SLS for nominal wage growth and employment growth as the endogenous dependent variables.
[3]System estimated using 3SLS for nominal wage growth, employment growth, and the share of part-time employment as the endogenous dependent variables.
[4]Relative to five years ago.

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CHAPTER 3

# THE EFFECTS OF WEATHER SHOCKS ON ECONOMIC ACTIVITY: HOW CAN LOW-INCOME COUNTRIES COPE?

*Global temperatures have increased at an unprecedented pace over the past 40 years, and significant further warming could occur, depending on our ability to restrain greenhouse gas emissions. This chapter finds that increases in temperature have uneven macroeconomic effects, with adverse consequences concentrated in countries with relatively hot climates, such as most low-income countries. In these countries, a rise in temperature lowers per capita output, in both the short and medium term, by reducing agricultural output, suppressing the productivity of workers exposed to heat, slowing investment, and damaging health. To some extent, sound domestic policies and development, in general, alongside investment in specific adaptation strategies, could help reduce the adverse consequences of weather shocks. But given the constraints faced by low-income countries, the international community must play a key role in supporting these countries' efforts to cope with climate change—a global threat to which they have contributed little. And while the analysis of the chapter focuses on the impact of weather shocks in low-income countries, most countries will increasingly feel direct negative effects from unmitigated climate change through warming above optimal levels in currently cooler countries, more frequent natural disasters, rising sea levels, loss of biodiversity, and adverse spillovers from vulnerable countries. Looking ahead, only continued international cooperation and a concerted effort to stem the man-made causes of global warming can limit the long-term risks of climate change.*

## Introduction

Since the turn of the 20th century, the Earth's average surface temperature has increased significantly. Sizable swings in global temperatures used to happen over long periods, such as fluctuations in and out of the Ice Ages. However, the speed at which the climate has changed over the past 30–40 years appears to be unprecedented in the past 20,000 years (Figure 3.1).[1] Most scientists agree that global temperatures are set to rise further, at a scale and pace very much dependent on our ability to restrain greenhouse gas emissions, the central cause of global warming (IPCC 2013). Extreme weather events, such as heat waves, droughts, and floods, are likely to become more frequent, and sea levels will rise. Although considerable uncertainty surrounds temperature projections, the scientific consensus predicts that without further action to tackle climate change, average temperatures could rise by 4°C or more by the end of the 21st century. Very substantial cuts to current emissions will be needed to limit warming to less than 2°C. Will climate change have significant macroeconomic consequences, especially in low-income developing countries that tend to be more exposed to the vagaries of the weather? And how can these countries cope with the rises in temperature they are set to experience over the coming decades?

Pinning down the economic consequences of climate change is difficult. Temperature increases of the magnitude that could potentially occur over the next century—and many other aspects of climate change, such as rapid rise in sea levels, ocean acidification, and the like—sit well outside recent (and relevant) historical experience and could affect a large number of countries. Extrapolating from the historically observed relationship between activity and weather patterns could also be problematic as populations adapt to persistent changes in climate. Yet studying the macroeconomic effects of annual variation in weather patterns

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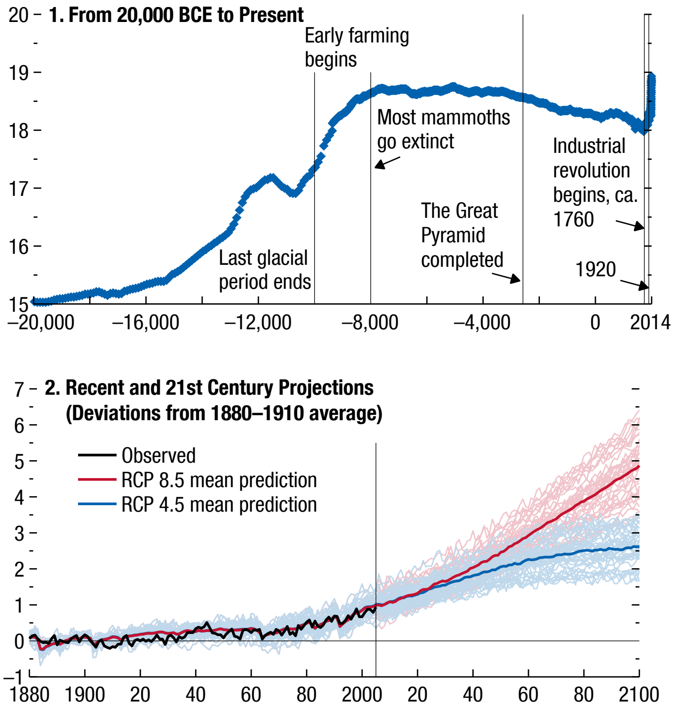
[1]Climate refers to a distribution of weather outcomes for a given location, while weather refers to a realization from that distribution. Climate change typically implies that the whole distribution of outcomes shifts, with a possible increase in the likelihood of extreme outcomes. As argued by Weitzman (2011), the fattening of the tails—the increase in the probability of potentially irreversible and catastrophic damages—justifies aggressive policy actions to stabilize greenhouse gas concentrations in the atmosphere ("climate change mitigation") and adjust to the changing climate ("adaptation").

**Figure 3.1. Average Global Temperature**
*(Degrees Celsius)*

The average global temperature has risen at an extraordinary pace over the past century, and significant further warming could occur.




Sources: Intergovernmental Panel on Climate Change (IPCC) Coupled Model Intercomparison Project Phase Five AR5 Atlas subset; Marcott and others (2013); Matsuura and Willmott (2007); National Aeronautics and Space Administration (NASA) Goddard Institute for Space Studies; Royal Netherlands Meteorological Institute Climate Change Atlas; Shakun and others (2012); and IMF staff calculations.
Note: In panel 2, the thin lines represent each of the 40 models in the IPCC WG1 AR5 Annex I Atlas, where a model with different parametrization is treated as a separate model. The thick lines represent the multimodel mean. Representative Concentration Pathways (RCP) are scenarios of greenhouse gas concentrations, constructed by the IPCC. RCP 4.5 is an intermediate scenario, which assumes increased attention to the environment, with emissions peaking around 2050 and declining thereafter. RCP 8.5 is an unmitigated scenario in which emissions continue to rise throughout the 21st century.

could produce useful insights.[2] In an influential study, Dell, Jones, and Olken (2012) find that higher temperatures significantly reduce economic growth in low-income countries. Burke, Hsiang, and Miguel (2015a) provide evidence that productivity peaks at about 13°C and declines strongly at higher temperatures. Since low-income countries are concentrated in geographic areas with hotter climates, the Burke, Hsiang, and Miguel (2015a) findings suggest that a rise in temperature would be particularly harmful for this set of economies.

Countries negatively affected by climate change will need to increase their resilience to rising temperatures and extreme weather events, both by enhancing their ability to smooth out shocks, which could become more frequent, and by investing in adaptation strategies, such as activity diversification, infrastructure investment, and technology innovation, that reduce the harm they do. Populations may also respond to changing climatic conditions by relocating geographically, which could have important cross-border ramifications. But the evidence on which policies may help countries and individuals cope with weather shocks is limited.

Understanding the macroeconomic effects of weather shocks and the scope for policy actions to moderate them will be crucial for low-income developing countries to achieve durable growth in the long term—a precondition for convergence and implementation of the United Nations Sustainable Development Goals.

Drawing from and building on the existing literature, this chapter contributes to the policy debate by examining the following questions:

- What has been the historical relationship between temperature and precipitation shocks and economic activity in both the short and the medium term? Are low-income countries particularly vulnerable? Through what channels do weather fluctuations affect the economy? And has the sensitivity of growth to weather shocks changed over time?
- How can countries, particularly low-income ones, cope with weather shocks? Can policies and other country characteristics mitigate the macroeconomic response to weather fluctuations?
- Given the projected path of temperature by the end of the 21st century, what might be the impact of climate change on low-income countries?

To address these questions, the chapter starts by documenting the historical evolution and projected change in temperature and precipitation patterns across broad country groups according to leading climate change models, as well as these groups' contributions to greenhouse gas emissions. It then examines the historical evidence on the macroeconomic effects of annual variation in temperature and precipitation

[2]Dell, Jones, and Olken (2014); Carleton and Hsiang (2016); and Heal and Park (2016) provide surveys of the new climate literature, which explores the impact of weather fluctuations on a broad range of economic variables.

across a large sample of economies, highlighting the channels through which climatic conditions affect the macroeconomy. The chapter offers evidence on how various policies and country characteristics influence the sensitivity of growth to weather variations, using both empirical analysis and model simulations, and presents case studies of various climate change adaptation strategies. Finally, the chapter incorporates the empirical estimates of economic loss from weather shocks and projected changes in temperature into a dynamic general equilibrium model to trace the potential long-term effects of climate change.

The chapter's main findings are as follows:

- The rise in temperature over the past century has been broad based. No country has been spared from the warming of the Earth's surface, and no country is projected to be spared further temperature increases, with the largest increases in temperature expected in countries with relatively colder climates. The contribution of low-income developing countries—which tend to be situated in some of the hottest geographic areas on the planet—to atmospheric greenhouse gas concentrations is negligible, both in absolute terms and on a per capita basis.
- The macroeconomic effect of temperature shocks is uneven across countries. Confirming the global nonlinear relationship between annual temperature and growth uncovered by Burke, Hsiang, and Miguel (2015a) using an expanded data set, the empirical analysis suggests that rising temperatures lower per capita output in countries with relatively high annual average temperature, such as most low-income countries. In these economies, the adverse effect is long-lasting and operates through several channels: lower agricultural output, depressed labor productivity in sectors more exposed to the weather, reduced capital accumulation, and poorer human health. Moreover, data indicate that macroeconomic outcomes have not become any less sensitive to temperature shocks in recent years, pointing to significant adaptation constraints.
- To some extent, sound policies and institutional frameworks, investment in infrastructure, and other adaptation strategies can reduce the damage from temperature shocks in hot countries. Although causal interpretation is difficult, empirical evidence suggests that countries with better-regulated capital markets, higher availability of infrastructure, flexible exchange rates, and more democratic institutions recover somewhat faster from the negative impacts of temperature shocks. Higher temperatures also constrain growth in hot regions of emerging market and developing economies significantly more than in hot regions of advanced economies, which corroborates the importance of development in reducing vulnerability.
- The temperature increase projected by 2100 under a scenario of unmitigated climate change implies significant economic losses for most low-income countries. Under the conservative assumption that weather shocks have permanent effects on the level, rather than the growth rate, of per capita output, model simulations suggest that the per capita GDP of a representative low-income country would be 9 percent lower in 2100 than it would have been in the absence of temperature increases, with the present value of output losses amounting to more than 100 percent of current GDP when discounted at the growth-adjusted rate of 1.4 percent.

Taken together, these findings paint a worrisome picture. Rising temperatures would have vastly unequal effects across the world, with the brunt of adverse consequences borne by those who can least afford it. In all likelihood, most countries will increasingly feel the direct impact of unmitigated climate change, through warming above optimal temperatures, more frequent (and more damaging) natural disasters, rising sea levels, loss of biodiversity, and many other hard-to-quantify effects. In addition, climate change is likely to create economic winners and losers at both individual and sectoral levels, even in countries where the effect might be moderate or positive on average. However, low-income countries will suffer disproportionately from further temperature increases—a global threat to which they have contributed little. And within low-income countries, the poor would likely be the most heavily affected by climate change (Hallegatte and Rozenberg 2017). Having little influence on the future course of climate, how can these countries cope with the challenges they face as temperatures rise?

The findings of this chapter suggest that domestic policies can partially dampen the adverse effects of weather shocks. Improving buffers and strengthening well-targeted social safety nets that can deliver support when needed would help countries smooth some of the instantaneous effects of weather shocks, while policies and institutions that make capital and labor markets more flexible and foster structural economic transformation could help countries recover somewhat faster and reduce their vulnerability to future shocks. Adaptation strategies that reduce specific climate change effects and risks, such as targeted infrastructure projects, adoption of appropriate technologies, and mechanisms to transfer and share these risks through financial markets, could also be part of the toolkit for reducing the economic damage caused by climate change.

But putting in place the right policies will be particularly difficult in low-income countries, which have huge spending needs and limited ability to mobilize the resources necessary for adaptation in a challenging economic environment. In some cases, political uncertainty and security issues exacerbate the challenge. Moreover, even when in place, domestic policies alone cannot fully insulate low-income countries from the adverse consequences of climate change, as higher temperatures push the biophysical limits of these countries' ecosystems, potentially triggering more frequent epidemics, famines, and other natural disasters, along with armed conflict and refugee flows. The international spillovers from these difficult-to-predict effects of climate change could be very considerable.

Climate change is a negative global externality of potentially catastrophic proportions, and only collective action and multilateral cooperation can effectively address its causes and consequences. Mitigating climate change requires radically transforming the global energy system, including through the use of fiscal instruments to better reflect environmental costs in energy prices and promote cleaner technologies as discussed in Box 3.6. Adapting to the consequences of climate change necessitates vast investments, including in boosting infrastructure, reinforcing coastal zones, and strengthening water supply and flood protection (Margulis and Narain 2010; UNEP 2016). The international community will have a key role to play in fostering and coordinating financial and other types of support for affected low-income countries. With advanced and emerging market economies contributing the lion's share to the warming that has occurred so far and is projected to continue, helping low-income countries cope with its consequences is a humanitarian imperative and sound global economic policy. In the future, only continued international cooperation and a concerted effort to stem the man-made causes of global warming can limit the long-term risks of climate change (IPCC 2014; IMF 2015; Stern 2015; Farid and others 2016; Hallegatte and others 2016).

It is important to highlight from the outset the inherent difficulty of quantifying the potential macroeconomic consequences of climate change. Extrapolating from historically observed weather responses of GDP to the long-term effect of global warming is challenging for several reasons.[3] On one hand, such an extrapolation may overstate the impact as governments and other economic agents take ameliorative actions, make investments, or develop new technologies that help populations adapt to persistent changes in climate. On the other hand, the actual impact could be larger if there are nonlinearities in the response as the climate shifts to conditions beyond recent experience.[4] Moreover, the chapter does not separately quantify the effects of natural disasters, whose higher projected frequency may amplify the damages they cause; it does not analyze distributional impacts across sectors and households within countries, which may be quite sizable; nor does it shed light on the consequences of many aspects of climate change, such as a rapid rise in sea levels, ocean acidification, and the like, that have no historical precedent but could have very large macroeconomic consequences.[5] Nevertheless, as long as the Earth continues to warm over the rest of the 21st century in the same pattern as over the past 50 years—a stochastic series of annual shocks along an upward trend—this chapter may provide valuable guidance on climate change vulnerabilities and adaptation needs under the current production technologies and geographic distribution of populations (Dell, Jones, and Olken 2012).

[3]Dell, Jones, and Olken (2014); Carleton and Hsiang (2016); Hsiang (2016); and Lemoine (2017) provide discussions of the conditions under which empirical estimates of the effect of weather shocks based on historical data can shed light on the consequences of climate change.

[4]For example, the historically observed natural year-to-year temperature variability for countries located in the tropics is roughly 0.5°C. The projected increase in temperature for these countries between 2005 and 2100 under the extreme unmitigated climate change scenario is 4.1°C—in other words, more than 8.5 times larger than the current natural variability, implying a totally new climatic regime (see also World Bank 2013).

[5]A large body of literature studies the macroeconomic impact of natural disasters (see, for example, Noy 2009; Cavallo and others 2013; Acevedo 2014; Felbermayr and Gröschl 2014; Cabezon and others 2015; IMF 2016a; IMF 2016b; Gerling, forthcoming; and Gerling, Moreno Badia, and Toffano, forthcoming). The chapter focuses on direct measures of the weather because natural disaster data may suffer from reporting and mismeasurement issues. Mismeasurement could be a particular problem in low-income countries, which typically have lower capacity to accurately evaluate, record, and report damage (Jennings 2011).

## Temperature and Precipitation: Historical Patterns and Projections

This section sets the context for the rest of the chapter by summarizing the scientific consensus on how climate and one of its key man-made drivers—greenhouse gas emissions—have evolved over the past century. The section then presents scientists' projected changes for the rest of the 21st century and discusses the link between temperature, precipitation, and weather-related disasters.

### Historical Patterns

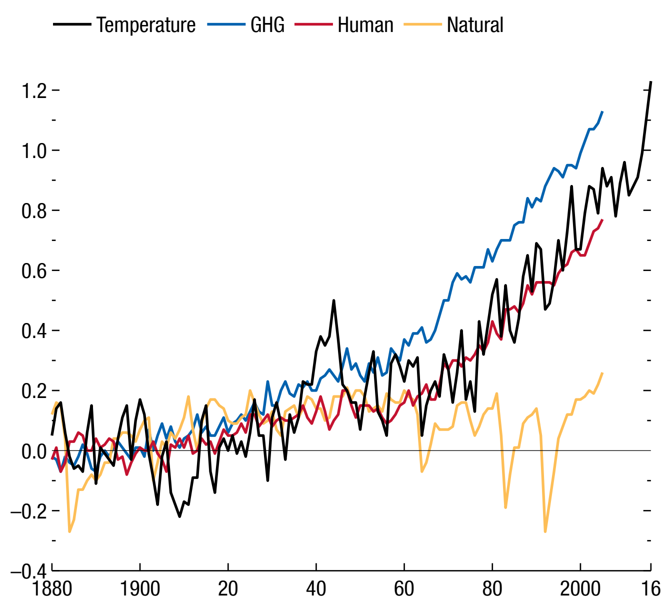
Global temperatures have increased by roughly 1°C compared with the 1880–1910 average (Figure 3.2). The rise started in earnest in the 1970s, following a large increase in carbon dioxide ($CO_2$) emissions.[6] Although natural factors explain some of the warming over the past century, according to the Intergovernmental Panel on Climate Change (IPCC), more than half of the temperature increase since 1950 can be attributed to human activity (IPCC 2014).

The increase in temperature has occurred in all regions, with the same accelerating trend, starting in the 1970s (Figure 3.3).[7] The median temperature over the first 15 years of this century, compared with the first 15 years of the past century, was 1.4°C higher in advanced economies, 1.3°C higher in emerging market economies, and 0.7°C higher in low-income developing countries. Even though most of the warming occurred in advanced economies, by 2015 the temperature in the median low-income developing country (25°C) was more than twice that of the median advanced economy (11°C).

Other aspects of the climate have also changed appreciably. Since 1900, the global mean sea level has risen by 17–21 centimeters. As with temperature, there has been an increase in the pace at which the sea level is rising: from 0.17 centimeter a year throughout most of the 20th century to 0.32 centimeter a year over the past 20 years (IPCC 2014).

**Figure 3.2. Increase in Average Global Temperature and Contributions of Key Factors**
*(Deviations from 1880–1910 average, degrees Celsius)*

According to the Intergovernmental Panel on Climate Change, most of the increase in temperature since 1950 can be attributed to human factors.




Sources: Carbon Dioxide Information Analysis Center; National Aeronautics and Space Administration (NASA) Goddard Institute for Space Studies; Roston and Migliozzi (2015); and IMF staff calculations.
Note: The lines present the actual increase in land and ocean surface air temperature relative to 1880–1910 and the increase predicted by different factors. Human factors include land use, ozone emissions, aerosol emissions, and GHG emissions. Natural factors include orbital changes, solar output, and volcanic activity. The contribution of each factor is estimated by "ModelE2" by NASA Goddard Institute for Space Studies. GHG = greenhouse gases.

$CO_2$ emissions have grown rapidly since the 1950s across all income groups, along with rising incomes and populations (Figure 3.4). However, emissions in low-income developing countries are still a fraction of those in advanced and emerging market economies, in both aggregate and per capita terms. And although advanced economies have managed to contain their overall emissions over the past decade, in per capita terms they still contribute vastly more than the rest of the world.

### Projections

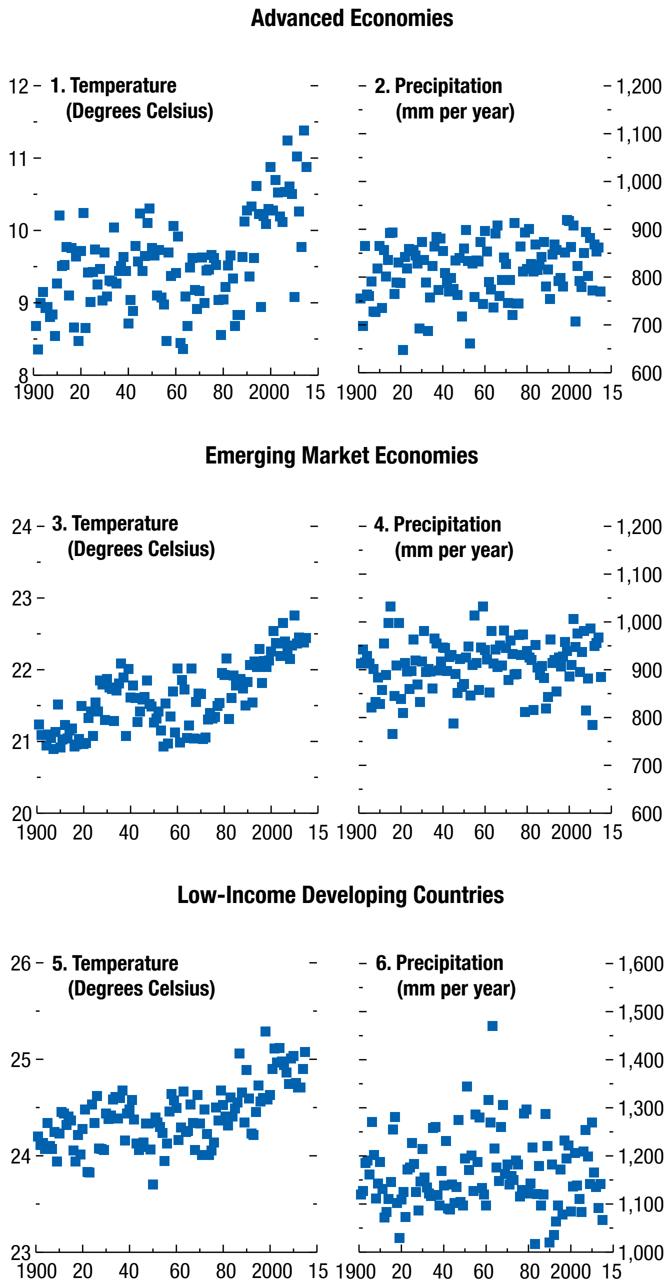
The overwhelming majority of scientists agree that future climate change depends largely on the path of $CO_2$ emissions, which in turn hinges on demo-

[6]The three most important greenhouse gases, which are regulated under the Kyoto Protocol, are carbon dioxide ($CO_2$), methane ($CH_4$), and nitrous oxide ($N_2O$). Among those, $CO_2$ has so far been the largest contributor to global warming.

[7]Trends in precipitation are generally less clear (Figure 3.3, panels 2, 4, and 6). Precipitation has increased somewhat in the northern hemisphere since the 1950s, and average precipitation in low-income developing countries has declined since the 1970s.

### Figure 3.3. Temperature and Precipitation across Broad Country Groups

Temperature has risen across all country groups, while precipitation does not exhibit a clear pattern.

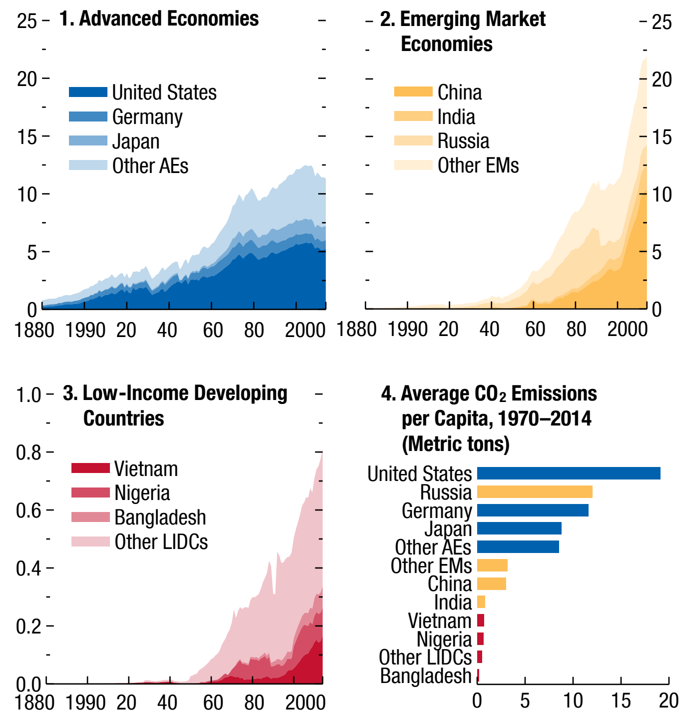



Sources: Climate Research Unit (v. 3.24); and IMF staff calculations.
Note: Terrestrial median annual temperature and precipitation data at grid level are aggregated to the country-year level using 1950 population weights. See Annex 3.1 for data sources and country groupings. mm = millimeter.

### Figure 3.4. Annual $CO_2$ Emissions across Broad Country Groups

*(Billion metric tons, unless noted otherwise)*

$CO_2$ emissions have grown rapidly since the 1950s across all income groups, but emissions by low-income developing countries are negligible in both absolute and per capita terms.




Sources: Carbon Dioxide Information Analysis Center; and IMF staff calculations.
Note: AEs= advanced economies; $CO_2$ = carbon dioxide; EMs = emerging markets; LIDCs = low-income developing countries.

graphic changes, economic development, technological advances, and the vigor with which countries implement mitigation measures.[8] Yet, given the significant buildup and persistence of greenhouse gas concentration in the atmosphere, even with immediate and substantial cuts to current greenhouse gas emissions, temperatures are projected to rise for some time, albeit at a slower pace. The IPCC constructed four possible scenarios, called Representative Concentration Pathways (RCP), using alternative greenhouse gas concentration assumptions to project likely ranges

[8]Surveying 12,000 peer-reviewed scientific papers on climate change, Cook and others (2013) find that 97 percent of the studies expressing a position on the reasons behind global warming agree that it is influenced by man-made causes. See also Cook and others (2016).

of temperatures over the 21st century. The rest of the chapter focuses on two of these scenarios: an intermediate path (RCP 4.5) and an unmitigated path (RCP 8.5), as shown in Figure 3.1, panel 2.[9]

Under the RCP 8.5 scenario of unmitigated climate change, the average global temperature by 2081–2100 could rise by 3.7°C (with a projected range of 2.6°C–4.8°C).[10] Warming would occur all over the globe, with larger increases over the northern hemisphere, where some regions could experience temperatures almost 12°C higher than in 2005 (Figure 3.5). Between 2005 and 2100, the increase for the median advanced economy is projected to be 4.4°C, and 4.5°C for the median emerging market economy and median low-income developing country. Increases are projected to be smaller in absolute terms closer to the equator, but are very significant when set against the historical year-to-year and intrayear variability in temperature observed in those locations. Change in precipitation will vary by region, with dry areas generally expected to become drier and wet regions expected to experience an increase in rainfall.

Under this scenario, the global mean sea level is projected to rise by almost 0.8 meter by the end of the 21st century, exposing coastal areas, including some large population centers, to higher risk of flooding and erosion. Sea level rise will not be uniform across regions—it is projected to be higher than the global mean closer to the equator and less than the global mean at high latitudes (IPCC 2014; World Bank 2013).

It is important once again to stress the large uncertainty surrounding climate change projections. Future emissions depend on many factors that are difficult to predict and, even for the same emission scenario, climate models differ widely in their temperature and precipitation projections (Figure 3.1, panel 2). However, it is precisely this uncertainty and the possibility of fat tails—the probability that catastrophic climate change can occur—that is behind calls for strong mitigation actions to reduce emissions and for adaptation to prepare for significant shocks (Weitzman 2011).

## Weather-Related Disasters

As temperatures rise, the risks of extreme weather events, such as floods, droughts, and heat waves, will increase (IPCC 2014). New statistical analysis suggests that projected climate change will likely bring more frequent weather-related disasters—events that cause great damage or loss of life.[11] This likelihood is particularly important for low-income developing countries and small states, which historically have been much more likely, relative to their land area, to experience natural disasters than advanced and emerging market economies (Figure 3.6, panel 1).[12]

Using monthly data from 1990 to 2014 on 8,000 weather-related disasters, a statistical analysis uncovers the historical relationship between the occurrence of a disaster and temperature and precipitation.[13] It then combines the estimated elasticities and the projected monthly temperature and precipitation in 2050 and 2100 under the RCP 8.5 scenario to forecast the likelihood of natural disasters. The results indicate that most disaster types will be more common by the end of the century, across all country income levels. As depicted in Figure 3.6, the frequency of disasters caused by heat waves or tropical cyclones will increase considerably (see Box 3.1, which explores the effect of tropical cyclones on economic activity).[14] Similarly,

[9]The Paris Agreement aims to contain the rise in temperature to less than 2°C (ideally to less than 1.5°C) relative to the preindustrial average, which would require policy efforts beyond those assumed under the RCP 4.5 scenario. Under the RCP 4.5 scenario, there is increased attention to the environment. $CO_2$ emissions peak around 2050 and decline thereafter, with a resulting temperature increase of 1.8°C by 2081–2100 relative to 1986–2005 (a likely range of 1.1°C to 2.6°C and a greater than 50 percent chance of an increase exceeding 2°C by 2100). Under the RCP 8.5 scenario, $CO_2$ emissions grow throughout the 21st century.

[10]Under this scenario, the average increase in population-weighted temperature between 2005 and 2100 across the countries in the sample is projected to be 4.4°C, with the median country experiencing warming of 4.5°C.

[11]The International Disaster Database (EM-DAT) defines a natural disaster as an event in which at least one of the following criteria is met: 10 or more people are reported killed, 100 or more people are reported affected, and either a declaration of a state of emergency or a call for international assistance is made (Guha-Sapir, Below, and Hoyois 2015).

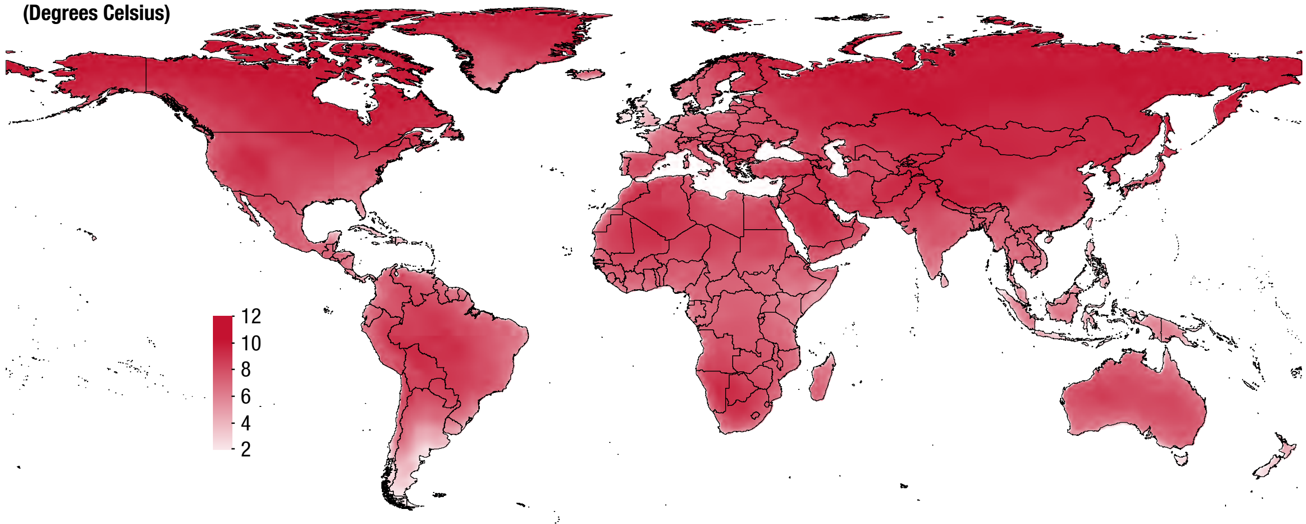
[12]Low-income developing countries and small states, respectively, are five and 200 times more likely to be hit by a weather-related natural disaster than the rest of the world, after controlling for country size.

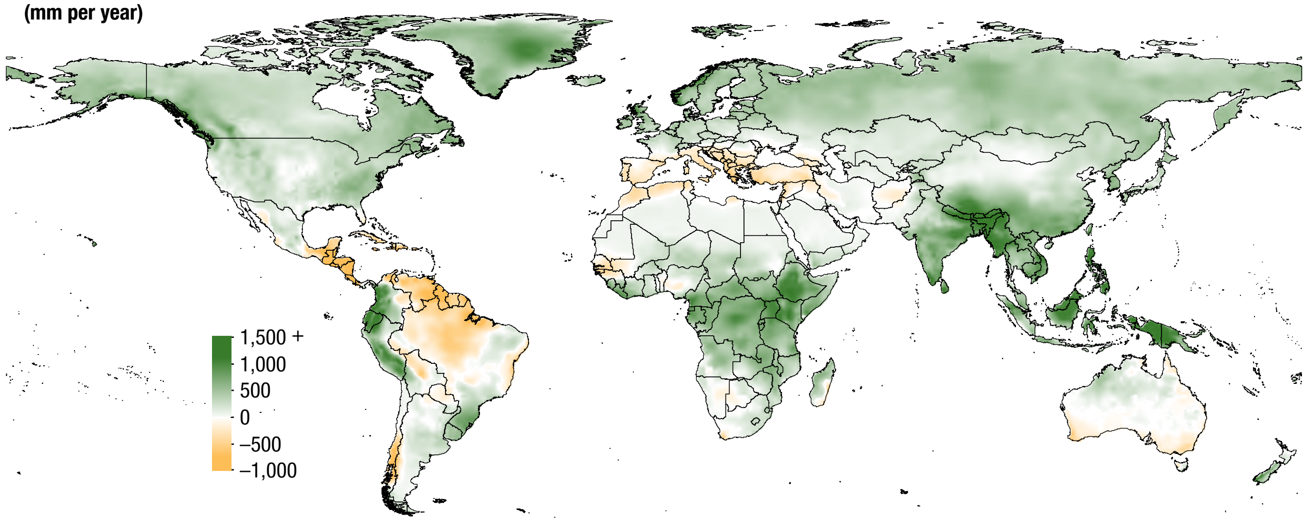
[13]The probability of each disaster type (flood, tropical cyclone, and so on) is estimated using a panel logit with country fixed effects, in which temperature and precipitation are the main explanatory variables. The analysis expands on Thomas and Lopez (2015) by modeling each disaster type separately and relying on monthly rather than annual data. See Annex 3.2 for further details.

[14]Scientists project that the frequency of tropical cyclone storms will decrease, but their strength and intensity will rise in a warmer world (Knutson and others 2010). This could lead to more natural disasters caused by more intense tropical cyclones despite the overall lower frequency of storms.

**Figure 3.5. Temperature and Precipitation Projections under the RCP 8.5 Scenario**

Under the scenario of continued increase in greenhouse gas emissions, temperatures across the globe are projected to rise significantly.

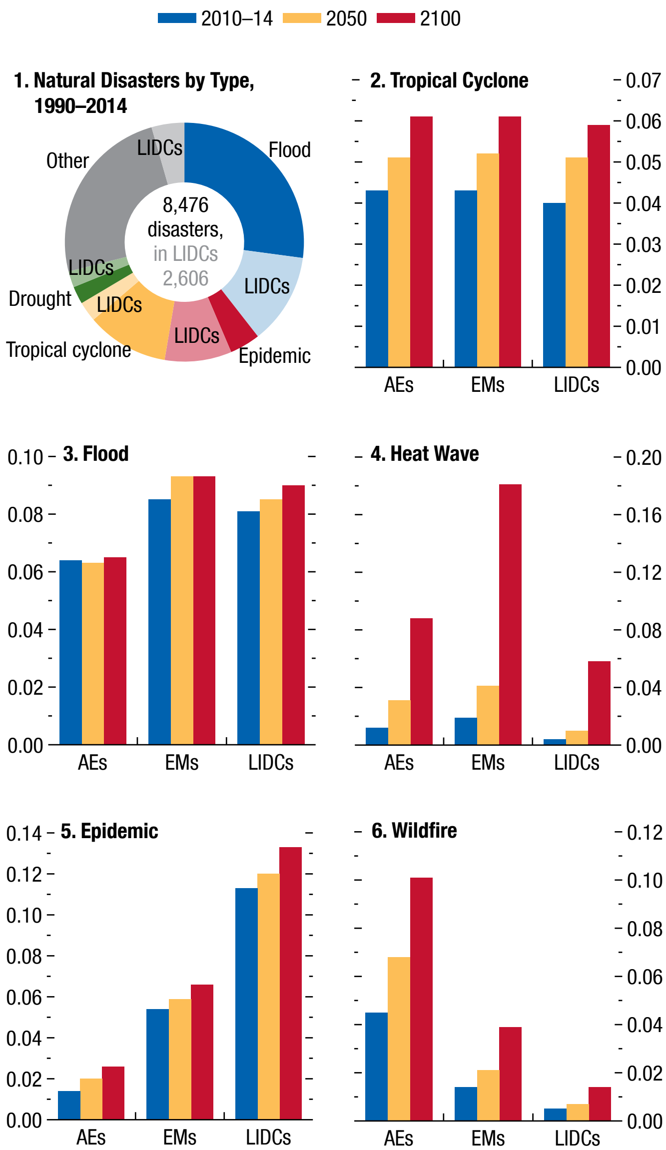



Sources: National Aeronautics and Space Administration (NASA) Earth Exchange Global Daily Downscaled Projections (NEX-GDDP); World Bank Group Cartography Unit; and IMF staff calculations.
Note: The NEX-GDDP data set comprises downscaled climate scenarios for the globe that are derived from the General Circulation Model (GCM) runs conducted under the Coupled Model Intercomparison Project Phase 5 (CMIP5) and for two Representative Concentration Pathways (RCP) greenhouse gas emissions scenarios (4.5 and 8.5). The CMIP5 GCM runs were developed for the Intergovernmental Panel on Climate Change Fifth Assessment Report. The data set includes downscaled projections from the 21 models and scenarios for daily maximum temperature, minimum temperature, and precipitation for 1950–2100. The spatial resolution of the data set is 0.25 degrees (~25 km x 25 km). mm = millimeter.

**Figure 3.6. Natural Disasters: Historical and Projected Monthly Probability of Occurrence**

Natural disasters, which have historically occurred with greater frequency in low-income developing countries relative to their land area, could become more common by the end of the 21st century under the scenario of continued increase in greenhouse gas emissions.




Sources: International Disaster Database (EM-DAT); and IMF staff calculations.
Note: In panel 1, the colors indicate the different types of natural disasters, with the lighter shades of each color specifying the portion that has occurred in low-income developing countries (LIDCs). Panels 2–6 show the predicted monthly probability of a disaster in 2050 and 2100, based on the Representative Concentration Pathways 8.5 scenario. Most of the predicted probabilities for individual months are not statistically significant, therefore the results should only be interpreted as indicative of the potential increase in the frequency of disasters with climate change. AEs = advanced economies; EMs = emerging markets; LIDCs = low-income developing countries.

floods and epidemics, which mainly affect low-income developing countries, will also become more common. More frequent weather-related disasters, without a corresponding increase in reconstruction capabilities, could amplify the damages they cause because economies may have insufficient time to recover between events (Hallegatte, Hourcade, and Dumas 2007).

## The Macroeconomic Impact of Weather Shocks

The design of appropriate policies to cope with climate change requires an understanding of its potential macroeconomic consequences. In the absence of historical experience with climate change that may be relevant for countries today, the analysis in this section builds on existing literature and identifies how annual fluctuations in temperature and precipitation affect macroeconomic performance in the short and medium term. The channels through which macroeconomic effects occur and the changes in the sensitivity of growth to weather shocks are explored, motivated by evidence that higher temperatures constrain per capita GDP growth in countries with hot climates.

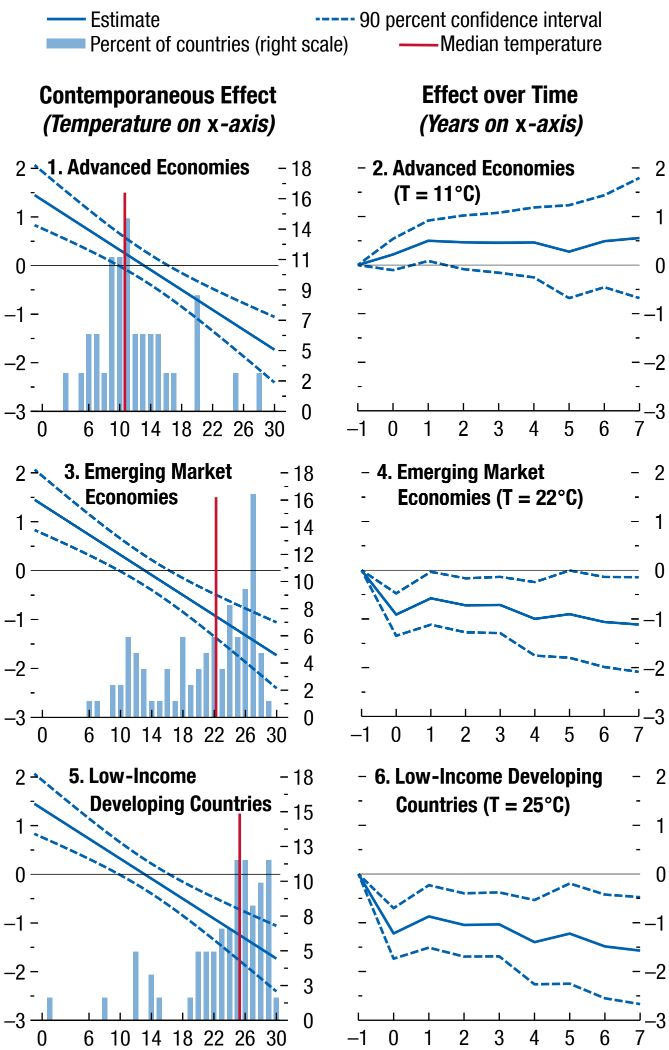
### Short- and Medium-Term Effects

To measure the impact of weather shocks, this section examines the historical relationship between weather patterns and economic activity, using the approach of Dell, Jones, and Olken (2012) and Burke, Hsiang, and Miguel (2015a). Similar to these studies, the analysis uses within-country and across-country year-to-year fluctuations in temperature and precipitation to identify the causal effect of weather on aggregate outcomes, both contemporaneously and over the medium term. It builds on these studies by expanding the geographic and temporal coverage of the analysis, examining the effects of weather shocks on a larger set of outcome variables and establishing the robustness of findings to different sources of weather data and alternative, more flexible empirical specifications.

The baseline analysis uses Jordà's (2005) local projection method to trace the impulse response function of real per capita GDP to a weather shock in a sample of more than 180 economies during 1950–2015. Weather is measured as the country's average annual temperature and precipitation, along with the squared terms of temperature and precipitation to account for the global nonlinear relationship between temperature

**Figure 3.7. Effect of Temperature Increase on Real per Capita Output**
*(Percent)*

In relatively hot countries, such as most low-income developing countries, an increase in temperature has a negative, statistically significant, and long-lasting effect on per capita output.




Source: IMF staff calculations.
Note: Left-hand-side panels superimpose the contemporaneous effect of a 1°C increase in temperature on per capita output at different temperature levels computed as per equation (3.3) over the distribution of average annual temperatures recorded in 2015 in advanced economies (panel 1), emerging markets (panel 3), and low-income developing countries (panel 5). The blue lines show the point estimates and 90 percent confidence intervals, while the light blue bars denote the percent of countries at each temperature level. The vertical red line is the median temperature for the country group. Right-hand-side panels depict the impulse response of per capita output to a 1°C increase in temperature estimated at the median temperature of advanced economies (panel 2), emerging markets (panel 4), and low-income developing countries (panel 6). Horizon 0 is the year of the shock. T = temperature.

and growth, as demonstrated by Burke, Hsiang, and Miguel (2015a).[15]

The analysis confirms the existence of a statistically significant nonlinear effect of temperature on per capita economic growth, first established by Burke, Hsiang, and Miguel (2015a), in this chapter's substantially larger sample. In countries with high average temperatures, an increase in temperature dampens economic activity, whereas it has the opposite effect in much colder climates. The threshold temperature is estimated to be about 13°C to 15°C (see Annex Table 3.3.1).[16] These results suggest highly uneven effects of warming across the globe (Figures 3.7 and 3.8).

Because most advanced economies are in colder locations, with annual average temperatures close to the threshold, a marginal temperature increase does not materially affect their contemporaneous growth (Figure 3.7, panel 1).[17] Emerging market economies and particularly low-income developing countries tend

[15]Average annual temperature and precipitation are constructed by aggregating weather data at the grid-cell level to the level of the country using the population in each cell as weights to account for differences in population density within countries and capture the average weather experienced by a person in the country (see Annexes 3.1 and 3.3). The empirical approach consists of regressing contemporaneous and future output growth on temperature and precipitation and the squared terms to estimate an impulse response function at various horizons, controlling for country fixed effects, region-year fixed effects, lags and forwards of weather shocks, and lagged growth. See Annex 3.3 for further details.

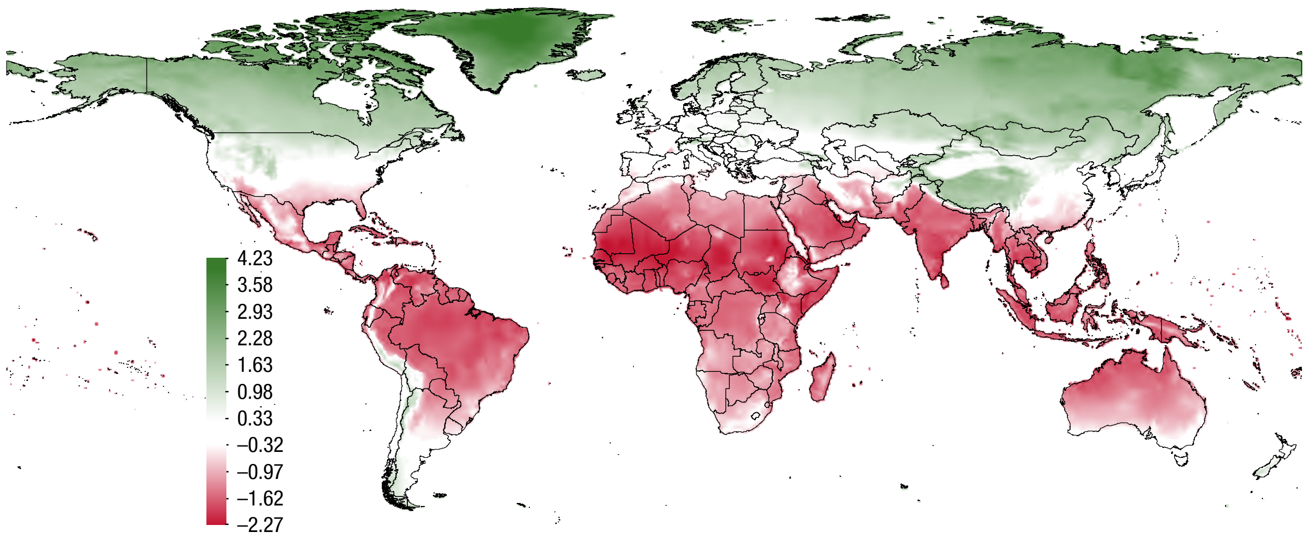
[16]The finding is robust to, among other things: (1) using alternative sources of raw grid-level weather data, (2) aggregating grid-level weather data to country averages with population weights from different decades, (3) estimation through an autoregressive distributive lag specification instead of a local projection method, (4) using country-specific linear and quadratic time trends as opposed to region-year fixed effects, and (5) controlling for the occurrence of natural disasters. The analysis does not find a consistently significant relationship between precipitation and per capita GDP growth, although it uncovers an effect of precipitation on agricultural output (Annex Tables 3.3.1 and 3.3.2).

[17]Even if the effects on overall GDP in these countries are negligible, this may mask large losses and gains, with some sectors facing large investment needs to cope with higher temperatures, rising sea levels, or more damaging disasters. Moreover, the analysis focuses on the macroeconomic effects of a limited set of weather characteristics, namely temperature and precipitation. The negative impact of other aspects of the climate, such as the rise in sea levels or the occurrence of extreme weather events, may be less unequal across broad income groups, as demonstrated in Box 3.1, which documents similar output losses from tropical cyclones across advanced and emerging market economies. The estimates also abstract from potential spillovers to advanced economies from famines, epidemics, social conflicts, and other difficult-to-predict effects of weather shocks in vulnerable economies. Moreover, under the scenario of unconstrained $CO_2$ emissions, most advanced economies will cross the threshold temperature and would start suffering the negative effects of higher temperatures on economic output (Annex Figure 3.6.1).

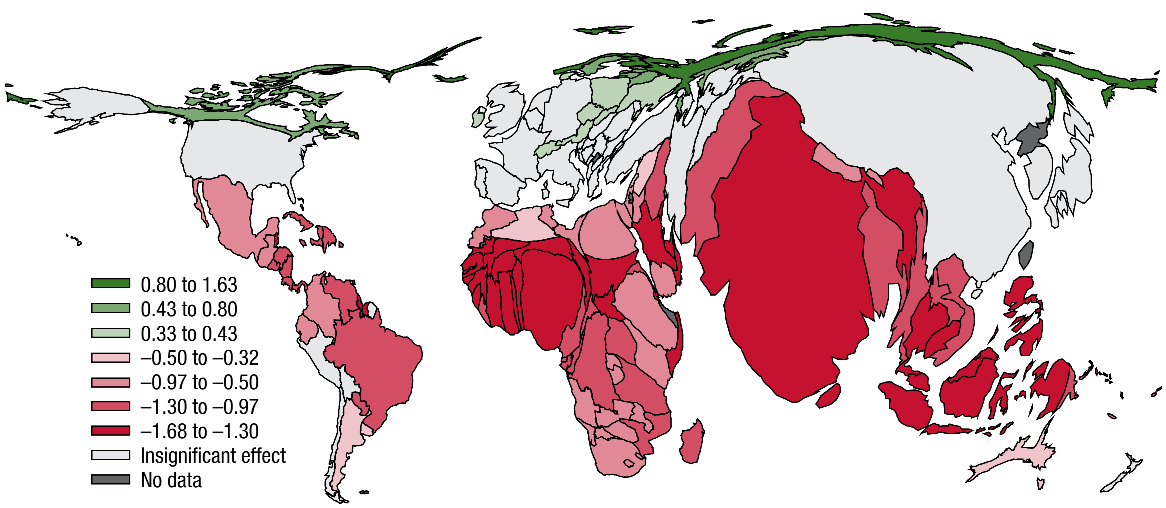
**Figure 3.8. Effect of Temperature Increase on Real per Capita Output across the Globe**
*(Percent)*

An increase in temperature has a highly uneven effect across the globe, with adverse consequences concentrated in the parts of the world where the majority of the world's population lives.

**1. Effect of a 1°C Increase in Temperature on Real per Capita Output at the Grid Level**




**2. Effect of a 1°C Increase in Temperature on Real per Capita Output at the Country Level, with Countries Rescaled in Proportion to Their Population**



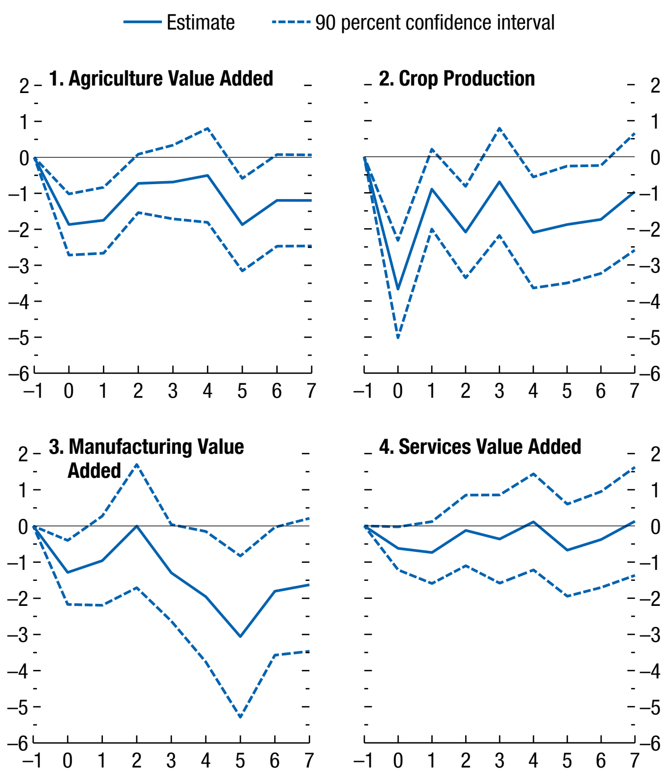

Sources: Natural Earth; ScapeToad; United Nations World Population Prospects Database: the 2015 Revision; World Bank Group Cartography Unit; and IMF staff calculations.
Note: The maps depict the contemporaneous effect of a 1°C increase in temperature on per capita output computed as per equation (3.3). Panel 1 uses 2005 grid-level temperature, while panel 2 uses the recent 10-year average country-level temperature together with estimated coefficients in Annex Table 3.3.1, column (5). In the cartogram in panel 2, each country is rescaled in proportion to its 2015 population. Gray areas indicate the estimated impact is not statistically significant.

to have much hotter climates, and a rise in temperature significantly lowers per capita GDP growth. For the median emerging market economy, a 1°C increase from a temperature of 22°C lowers growth in the same year by 0.9 percentage point. For the median low-income developing country, with a temperature of 25°C, the effect of a 1°C increase in temperature is even larger: growth falls by 1.2 percentage points (Figure 3.7, panels 3 and 5).[18] And even though countries projected to be significantly affected by an increase in temperature produced only about one-fifth of global GDP in 2016, they are home to close to 60 percent of current global population and more than 75 percent of the projected global population at the end of the century (Figure 3.8 and Annex Figure 3.3.1).

Does economic activity in countries with warmer climates recover quickly after a rise in temperature? The analysis suggests not. Even seven years after a weather shock, per capita output is 1 percent lower for the median emerging market economy and 1.5 percent lower for the median low-income country (Figure 3.7, panels 2, 4, and 6).[19] A deepening in the shape of the estimated impulse response of output to a temperature shock hints at the possibility of a growth effect (and consequently much larger economic losses from higher temperatures). However, statistically, it is not possible to reject the hypothesis that the contemporaneous and medium-term effects of a temperature shock on per capita output are identical.[20]

**Figure 3.9. Effect of Temperature Increase on Sectoral Output Estimated at the Temperature of the Median Low-Income Developing Country**
*(Percent; years on x-axis)*

An increase in temperature lowers agricultural output, but also has adverse effects on manufacturing value added in hot countries.




Source: IMF staff calculations.
Note: The panels depict the effect of a 1°C increase in temperature estimated at the median low-income developing country temperature (25°C). Horizon 0 is the year of the shock. Crop production is an index, produced by the Food and Agriculture Organization, of price-weighted quantities of agricultural commodities produced excluding production for seeds and fodder.

## Channels of Impact

The weather can influence economic activity through various channels. The most obvious one is agricultural output, given that temperature and precipitation are direct inputs in crop production. However, studies show evidence of broader impacts, including on labor productivity, mortality, health, and conflict.[21] The literature so far has often studied these effects within a specific country or through laboratory experiments; this chapter examines whether these channels are also at work in a cross-country setting. Box 3.1 extends the analysis in this section by examining the macroeconomic effects of another aspect of the weather—tropical cyclones.

The main analysis begins by studying whether weather shocks influence only agricultural production or also affect other economic sectors. As shown

[18]There are also substantial differences in the estimated effects of temperature increases within each broad country group, which reflect the wide distribution of average temperature across countries (Figure 3.7, panels 1, 3, and 5; Figure 3.8).

[19]The persistence of the estimated effects may reflect the relatively persistent nature of temperature shocks. Univariate time series regression analysis shows that temperature shocks decay slowly, especially in relatively hot locations. A 1°C degree increase in annual temperature leads to significantly higher temperatures over the subsequent eight years.

[20]Dell, Jones, and Olken (2012) and Burke, Hsiang, and Miguel (2015a) argue in favor of a growth effect, although it is difficult to pin down the precise channel through which weather shocks persistently influence economic growth.

[21]See Dell, Jones, and Olken (2014); Carleton and Hsiang (2016); and Heal and Park (2016) for literature reviews. Weather shocks can also indirectly affect economic activity through their impacts on third markets. See Cashin, Mohaddes, and Raissi (2017) for an analysis of the international macroeconomic transmission of El Niño within a dynamic multicountry framework.

in Figure 3.9, at the temperatures prevailing in the median low-income developing country, agricultural value added and crop production drop with higher temperatures, recover somewhat in subsequent years, and generally remain depressed over the medium term—much as expected and as documented in a large body of work.[22]

However, the analysis also confirms findings that industrial output is similarly hurt as temperatures rise in countries with hot climates, although the estimates are more imprecise (see also Dell, Jones, and Olken 2012; Burke, Hsiang, and Miguel 2015a). Only services sector output appears to be sheltered from the weather.

To shed light on the reasons weather shocks affect sectors besides agriculture, the analysis concentrates on how key elements of the aggregate production function—productivity and labor and capital inputs—respond to weather shocks. As in other studies, the analysis aims to capture the net reduced-form effects of weather on various outcomes rather than uncover the potentially complex structural relationships that may exist among these variables.

### *Productivity*

Evidence from surveys and other sources shows that exposure to heat above a certain point reduces people's performance on both cognitive and physical tasks.[23] The analysis therefore examines whether higher temperatures in parts of the world that are hot decrease labor productivity. If productivity is a channel through which weather shocks affect aggregate GDP, the effect should be significantly larger for sectors in which workers are directly exposed to the weather.[24]

Analysis of sectoral data on value added per worker reveals that, at the temperatures prevailing in the median low-income developing country, productivity of workers in heat-exposed industries falls significantly after a rise in temperature (Figure 3.10, panels 1 and 2). However, labor productivity is unaffected in industries in which work is performed mostly indoors.

Overall productivity may also decline if weather shocks provoke political instability, incite conflict, or undermine governing institutions in other ways. Although a more detailed analysis would be beyond the scope of this chapter, numerous studies document a strong link between weather shocks and these outcomes.[25] Since conflict is one of the key triggers of refugee flows, as discussed in Chapter 1 of the April 2017 *World Economic Outlook* (WEO), weather shocks could result in substantial spillovers to neighboring countries and ultimately to advanced economies through this channel.

### *Capital Accumulation*

Temperature increases are largely supply-side shocks, but they could lead to persistent output losses and affect growth if they influence the rate of factor accumulation.[26] Using national accounts data, the analysis examines the response of the main components of aggregate demand—gross capital formation, consumption, exports, and imports—to weather shocks within the empirical framework described above. At the tem-

[22]See, among others, Barrios, Bazoumana, and Strobl (2010); Barrios, Bertinelli, and Strobl (2006); Feng, Krueger, and Oppenheimer (2010); Schlenker and Lobell (2010); Lobell, Schlenker, and Costa-Roberts (2011); and Lanzafame (2014) for evidence from emerging market and developing economies, and Schlenker and Roberts (2009), Burke and Emerick (2016), and Wang and others (2017) for evidence from the United States. Unlike per capita output, agricultural value added and crop production respond to precipitation, in addition to temperature shocks, with more precipitation generally boosting production. See Annex Table 3.3.2.

[23]Seppänen, Fisk, and Faulkner (2003) report a productivity loss of about 2 percent for every 1°C increase in temperature above 25°C, based on a survey of laboratory experiments. See also Seppänen, Fisk, and Lei (2006) for a meta-analysis of the literature, Deryugina and Hsiang (2014) for evidence from the United States, and Somanathan and others (2017) for recent evidence on labor productivity from India. Heat stress may also reduce cognitive function, as captured in student performance (Wargocki and Wyon 2007; Graff Zivin, Hsiang, and Neidell 2015; Garg, Jagnani, and Taraz 2017; Park 2017).

[24]The analysis follows Graff Zivin and Neidell (2014) and uses the National Institute for Occupational Safety and Health definitions of heat-exposed industries. Heat-exposed industries include agriculture, forestry, fishing and hunting, construction, mining, transportation, and utilities, as well as manufacturing in facilities that may not be climate controlled in low-income countries and whose production processes often generate considerable heat.

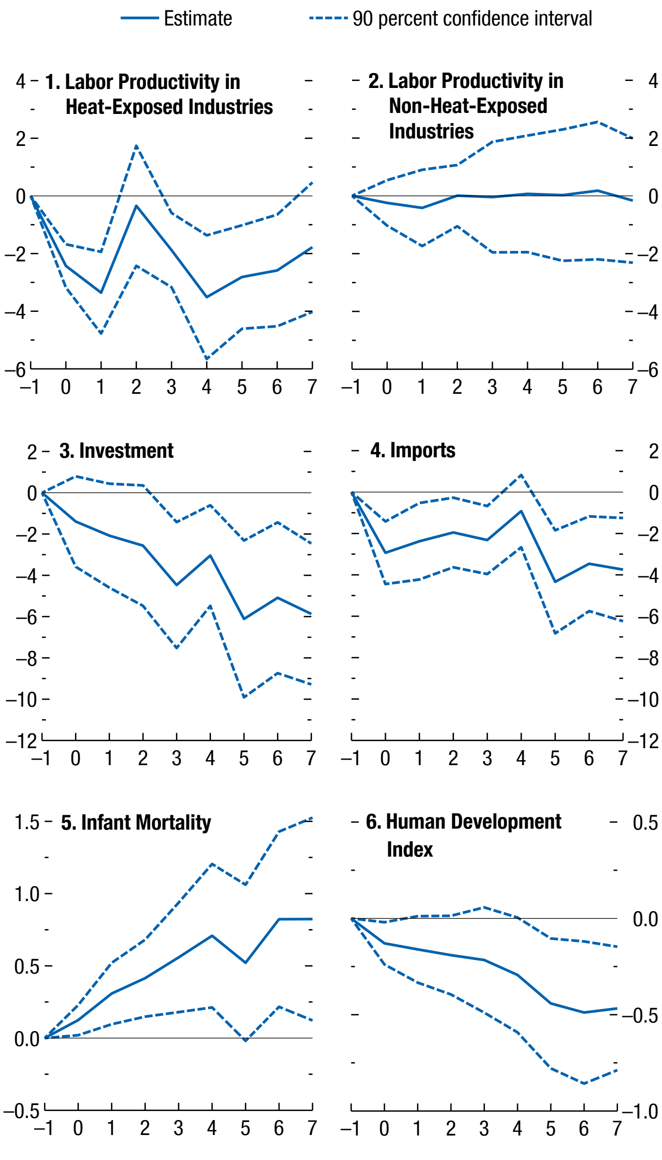
[25]Burke, Hsiang, and Miguel (2015b) review the literature that links climate to conflict. Forcible removal of rulers has also been linked to fluctuations in climate (Burke and Leigh 2010; Dell, Jones, and Olken 2012; Chaney 2013; Kim 2014), and several historical cases of societal collapse have been compellingly attributed to climate change (Cullen and others 2000; Haug and others 2003; Buckley and others 2010; Büntgen and others 2011).

[26]Investment may fall in response to temperature shocks because there are fewer resources to invest, because the rate of return on capital is lower, and/or because the temporary negative shock to income raises the cost of financing investment in an environment of imperfect capital markets (see, for example, Fankhauser and Tol 2005). When access to formal savings, credit, or insurance is limited, households may also sell productive assets to smooth consumption in response to weather shocks.

**Figure 3.10. Effect of Temperature Increase on Productivity, Capital, and Labor Input Estimated at the Temperature of the Median Low-Income Developing Country**

*(Percent; years on x-axis)*

In hot countries, an increase in temperature dampens labor productivity in heat-exposed industries, depresses investment and imports, and has damaging health effects.




Source: IMF staff calculations.
Note: The panels depict the effect of a 1°C increase in temperature estimated at the median low-income developing country temperature (25°C). Horizon 0 is the year of the shock. Heat-exposed industries include agriculture, forestry, fishing, and hunting, construction, mining, transportation, utilities, and manufacturing, following Graff Zivin and Neidell (2014).

perature of the median low-income country, all four components respond negatively to a 1°C increase in temperature. However, in the medium term, the effect is most pronounced for investment, which is estimated to be 6 percent lower seven years after the shock (Figure 3.10, panel 3). Imports, which are typically closely tied to investment, also exhibit a significant and long-lasting drop as temperature rises (Chapter 2 of the October 2016 WEO).[27]

### *Labor Supply*

The analysis also reveals that, in hot climates, higher temperatures may reduce (future) labor supply because of their influence on mortality rates (Figure 3.10, panel 5). A 1°C increase in temperature raises infant mortality by 0.12 percentage point in the year of the shock. The effect grows through the estimation period as weather-related lower income (and potential food insecurity) reinforces the direct physiological impact of higher temperatures in hot climates. This cross-country panel evidence corroborates findings of numerous studies of links between weather and mortality, prenatal health, and other health outcomes in various countries.[28] The adverse effects on the health and educational attainment of children could be one of the key reasons behind the long-lasting nature of weather's consequences.

## Effects over Time

As countries repeatedly face weather fluctuations, it is reasonable to expect them to take measures that lessen the impact of temperature shocks on the economy. However, the analysis does not find any obvious evidence of such adaptation over the past 60 years. Estimates of the response of per capita output

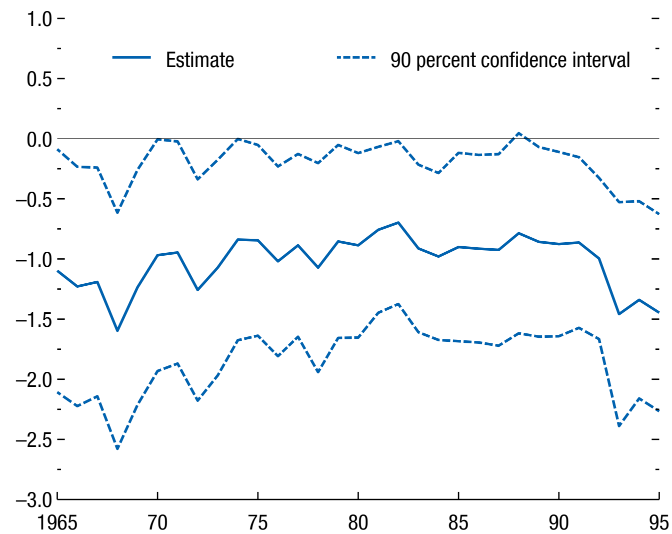
[27]The negative effect of temperature shocks on aggregate investment is consistent with evidence from household-level studies, which find that weather shocks could slow or even reverse capital accumulation as households try to smooth consumption or perceive investment as too risky (Hallegatte and others 2016).

[28]Deschênes (2012) and Guo and others (2014) provide comprehensive reviews of the literature on the link between temperature and mortality and health. See, for example, Deschênes and Greenstone (2011), Barreca (2012), and Barreca and others (2016) for evidence from the United States; Kudamatsu, Persson, and Strömberg (2012) for evidence from a subset of African countries; and Burgess and others (2014) for evidence from India. Carleton (2017) documents a significant increase in suicide rates when higher temperatures threaten agricultural yields in India. Deryugina and Hsiang (2014), Graff Zivin and Neidell (2014), Park (2016), and Somanathan and others (2017) find a direct effect of higher temperature on labor supply and productivity.

to temperature shocks over rolling 20-year periods suggest that the relationship between the two variables has remained constant (Figure 3.11).[29] The reasons behind this apparent lack of adaptation are not well understood, but high costs, limited access to credit for financing adaptation, insufficient information about the benefits of adaptation, limited rationality in planning for future risks, and inadequate access to technology are likely constraints, as discussed in Carleton and Hsiang (2016).

**Figure 3.11. Effect of Temperature Increase on Real per Capita Output Estimated at the Temperature of the Median Low-Income Developing Country over Time**
*(Percent; years on x-axis)*

The contemporaneous effect of temperature shocks on per capita output has remained relatively constant over time.




Source: IMF staff calculations.
Note: The figure depicts the effect of a 1°C increase in temperature at horizon 0 estimated at the median low-income developing country temperature (25°C), over a 20-year rolling window. Each point estimate is for a period ($t$, $t$ + 20).

## Coping with Weather Shocks and Climate Change

This section examines how policies, institutions, and other country characteristics can mitigate the adverse consequences of temperature shocks and climate change. It begins by discussing the toolkit available to policymakers and private agents with which to cope with weather shocks. It then presents illustrative evidence of the extent to which, historically, some policies (along with the overall level of development) have shaped the link between macroeconomic performance and temperature shocks. The empirical evidence is complemented in Box 3.2 by dynamic general equilibrium model scenarios of the response of macroeconomic aggregates to weather shocks under various proxies for relevant policies. Case studies of specific adaptation strategies occupy Boxes 3.3 and 3.4. The section also examines migration as a response to persistent changes in climate as adaptation strategies reach their limits. Finally, the role of international cooperation in supporting countries' efforts to cope with weather shocks and climate change is discussed.

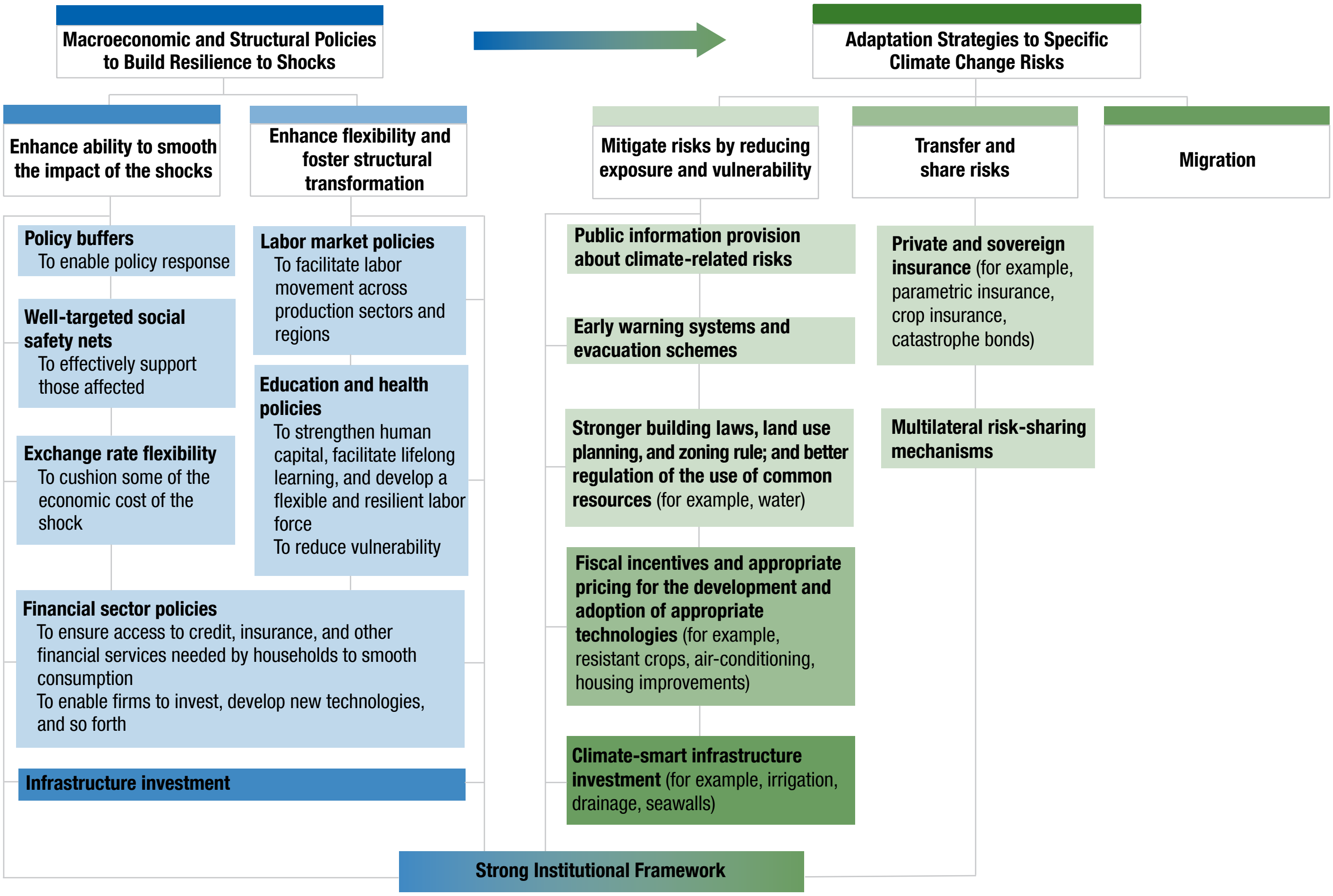
### A Toolkit

To structure the discussion, this subsection lays out a toolkit of possible domestic policy actions and private choices that may help insulate economic activity from weather shocks and from the risks that accompany climate change (Figure 3.12).

Fluctuations in weather can be viewed as one of many shocks that affect macroeconomic performance. As such, their consequences could be attenuated by general macroeconomic and structural policies and institutions that enhance countries' ex ante and ex post resilience to shocks. While priorities will vary depending on each country's specific circumstances and weather-related threats, policies may include those that seek to limit the short-term impact when shocks occur, help the economy recover faster, and reduce vulnerability to future shocks. Policies reinforce each other to achieve these goals. For example, countries with buffers (fiscal and monetary space, large international reserves, access to foreign aid) and well-targeted social safety nets may be better placed to deliver support to people affected by weather shocks, thus smoothing consumption in the short term. Adjusting to weather shocks and climate change will likely require reallocating people and capital across sectors and regions as production and trade patterns shift. Policies and institutions that

[29]Studies reveal large differences in the ability of individual sectors to adapt to specific weather shocks. For example, Hsiang and Narita (2012) and Hsiang and Jina (2014) find that countries more frequently exposed to tropical cyclones experience less damage, which suggests that they have learned to cope with these extreme events. Mortality caused by high temperatures has declined significantly over time with the introduction of air-conditioning in the United States (Barreca and others 2016). But there is little evidence of declining sensitivity of agricultural yields (Burke and Emerick 2016) or overall output (Dell, Jones, and Olken 2012; Deryugina and Hsiang 2014; Burke, Hsiang, and Miguel 2015a) to temperature fluctuations.

**Figure 3.12. Coping with Weather Shocks and Climate Change: A Toolkit**




Source: IMF staff compilation.

facilitate the needed reallocation, such as those that ensure access to finance, labor market flexibility, and investment in human capital and infrastructure, could speed up recovery and foster the structural transformation necessary to reduce vulnerability.[30]

Mitigating the risks associated with climate change will also require some very specific adaptation policies to help countries reduce their exposure and vulnerability to climatic events. Once the key climate change risks are identified for a particular location, both "soft" and "hard" adaptation measures can be applied (Hallegatte 2009). Soft measures may include strengthening public information provision, building codes, and land use and zoning laws, and devising warning and evacuation systems, along with targeted incentives for climate-related technologies (such as air-conditioning) and transferring and sharing risks related to weather events (such as natural disasters, which may increase in frequency) through financial markets. Hard measures may include investment in climate-smart infrastructure, such as retrofitting properties and building (or upgrading) irrigation or drainage systems, building seawalls, and the like.[31] Appropriate adaptation measures are highly specific to the climate-related risks in

[30]The classification of policies presented in Figure 3.12 is rather loose. Greater financial access could help farmers both smooth consumption when higher temperatures damage crops and invest in the technology needed to prevent future damage (such as buying heat-resistant seeds).

[31]See Hallegatte (2009); Hallegatte, Lecocq, and de Perthuis (2011); IPCC (2014); Cabezon and others (2015); OECD (2015a); Farid and others (2016); Hallegatte and others (2016); IMF (2016a); and IMF (2016b) for a comprehensive discussion of various climate change adaptation strategies.

each location and national circumstances; the infrastructure requirements for a flood-prone area would be vastly different from those of an area that is frequently exposed to droughts. This specificity, together with lack of comparable data on adaptation measures, precludes cross-country empirical analysis. Case studies of adaptation strategies, however, could prove insightful and are presented in Box 3.3. Box 3.4 discusses the role of financial markets in sharing and transferring weather-related risks.

Important synergies exist between general macroeconomic and structural policies and specific adaptation strategies: economic and institutional development will likely strengthen a country's capacity to cope with climate change and to invest in specific adaptation strategies. For example, stronger institutions will make enforcement of soft measures more effective, while fiscal space will enable the investment in needed infrastructure. Conversely, some adaptation strategies, such as efficient water use, climate-resilient housing, or activity diversification could facilitate development even in the absence of climate change (Farid and others 2016).

Finally, as adaptation strategies reach their limits, economic agents could respond to persistent changes in climate and the associated loss in income by relocating geographically.

## The Role of Domestic Policies and Institutions: Empirical Evidence

To study the extent to which macroeconomic and structural policies and country characteristics mute the effect of weather shocks, the analysis extends the empirical approach described above. It does so by allowing the response of per capita output to weather shocks to vary with various proxies for these policy and institutional settings, which are included one at a time in the analysis.[32] It is important to emphasize that, whereas fluctuations in temperature and precipitation are truly exogenous, which allows their causal impact to be identified, variations in policies and institutions across countries and over time are not. Accordingly, estimated correlations should be interpreted as being merely suggestive of causal impact.

The results suggest that having the right policies and institutions in place may help attenuate the effects of temperature shocks, to some extent. The instantaneous effect of a temperature shock is slightly smaller in countries with lower public debt, higher inflows of foreign aid, and greater exchange rate flexibility. The presence of monetary buffers (proxied by having below double-digit inflation) or international reserves makes no notable difference (Figure 3.13). However, the extent of attenuation that buffers provide is estimated to be small and short lived.

The evidence is somewhat more compelling for structural policies and country characteristics that are typically deemed important for easing sectoral reallocation of factors of production and structural transformation in general. Although the uncertainty surrounding the empirical estimates is often very large, the medium-term adverse effect of a temperature increase appears to fade when domestic and international financial markets are better regulated, the exchange rate is flexible, infrastructure is widely available, democratic institutions are strong, and the distribution of income is fairly even—that is, in more-developed economies (Figure 3.14).

Patterns uncovered in the data broadly mirror simulations of a dynamic structural general equilibrium model, which can properly isolate the causal effects of the availability of buffers, costs of capital adjustment, quality of institutions, and investment in adaptation strategies (Box 3.2). They are also in line with the empirical findings that show less damage from extreme weather events and natural disasters in countries where exchange rates are flexible, financial services are readily available, and institutions are strong.[33,34]

[32]More specifically, the estimated specification augments equation (3.2) to include an interaction term between the weather shock and the policy variable. For simplicity, the sample is restricted to countries with average temperature exceeding 15°C, in which an increase in temperature has a statistically significant linear negative impact on economic activity. See Annex 3.3 for further details.

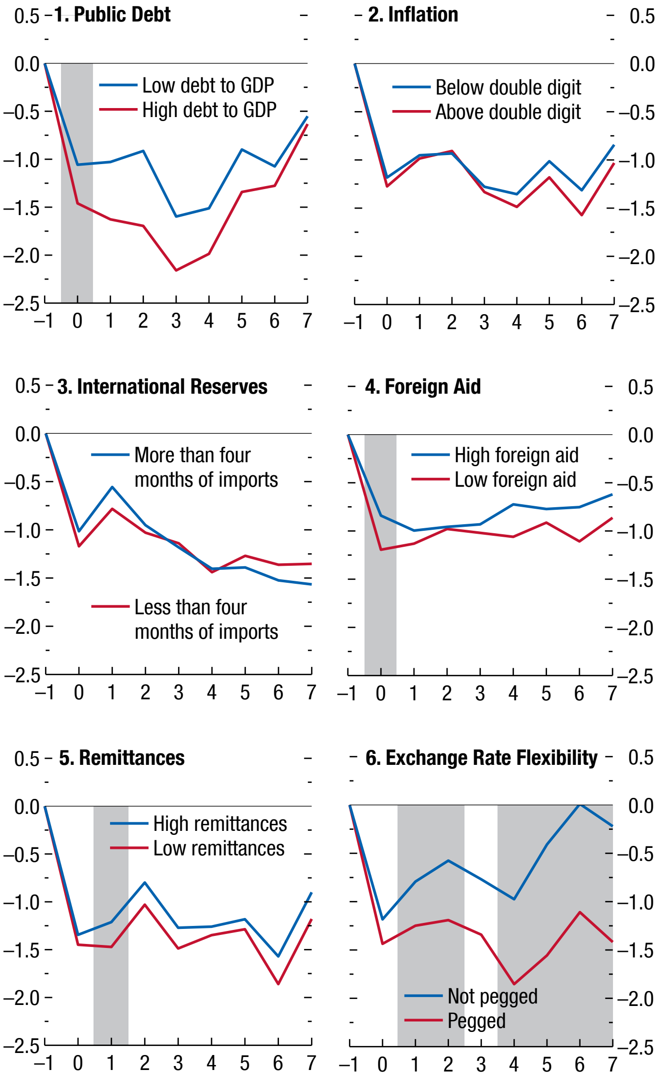
[33]See Kahn (2005); Noy (2009); McDermott, Barry, and Tol (2013); Burgess and others (2014); and Felbermayr and Gröschl (2014) for the role of financial development, and Von Peter, Dahlen, and Saxena (2012); Breckner and others (2016); and Lee, Villaruel, and Gaspar (2016) for the role of insurance penetration. Kahn (2005), Noy (2009), and Felbermayr and Gröschl (2014) find evidence for the role of institutions, and Ramcharan (2009) examines the role of exchange rates in reducing damage from extreme weather events and natural disasters.

[34]Two studies make a compelling case for the importance of sectoral reallocation in alleviating output losses from climate change. When quantifying the effects of climate change on agricultural markets using micro data from 1.7 million fields around the world, Costinot, Donaldson, and Smith (2016) find that the welfare losses would be three times larger if farmers were unable to switch production in response to changing climatic conditions and comparative advantage. In an empirical study, Colmer (2016) establishes that labor movements from agriculture into manufacturing in India can significantly offset the aggregate economic losses associated with weather-driven changes in agricultural productivity.

**Figure 3.13. Role of Policy Buffers**

*(Percent; years on x-axis)*

There is some suggestive evidence that the contemporaneous effect of temperature on per capita output is marginally lower in countries with lower public debt, greater foreign aid inflows, and flexible exchange rates.

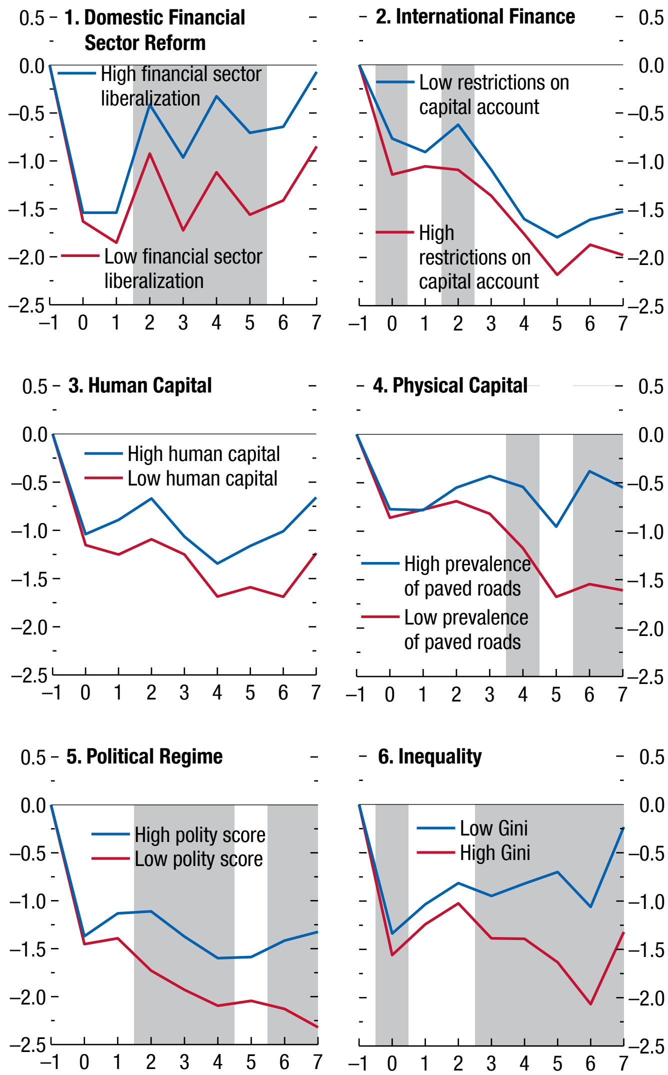



Source: IMF staff calculations.
Note: The panels depict how the effect of a 1°C increase in temperature on per capita output in the sample of countries with average temperature exceeding 15°C varies with the empirical proxy of a policy buffer. Horizon 0 is the year of the shock. Gray areas indicate that the blue and red lines are significantly different from each other at the 15 percent level. See Annex 3.3 for the exact definition of policy variables.

**Figure 3.14. Role of Structural Policies and Institutions**

*(Percent; years on x-axis)*

There is some suggestive evidence that the medium-term effect of an increase in temperature on per capita output is marginally lower in countries with better-regulated financial markets, greater physical capital, more democratic institutions, and lower income inequality.

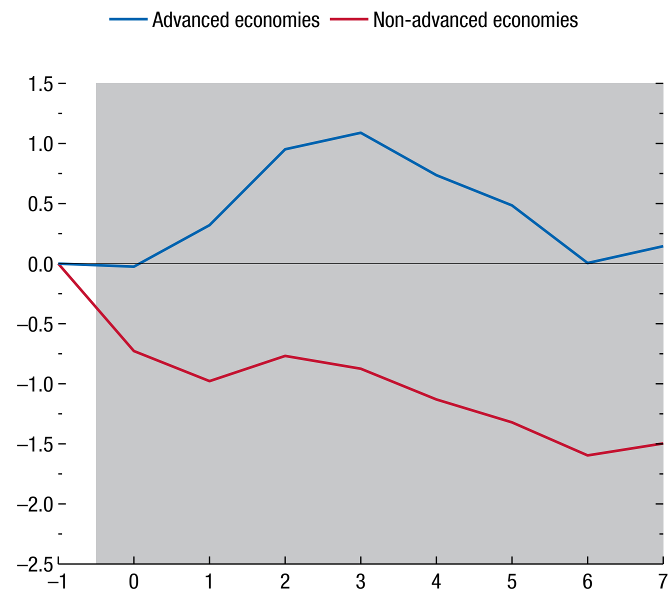



Source: IMF staff calculations.
Note: The panels depict how the effect of a 1°C increase in temperature on per capita output in the sample of countries with average temperature exceeding 15°C varies with the empirical proxies of structural policies and institutional settings. Horizon 0 is the year of the shock. Gray areas indicate that the blue and red lines are significantly different from each other at the 15 percent level. See Annex 3.3 for the exact definition of policy variables.

An alternative approach to assessing whether development more broadly reduces vulnerability to weather shocks takes advantage of subnational cross-country data. It is difficult to establish definitively whether advanced economies experience a smaller marginal effect of heat on macroeconomic performance, because so few of them have hot climates. However, some of the larger advanced economies, such as the United States, span several climate zones.[35] This within-country geographic heterogeneity makes it possible to compare whether economic activity in the "hot" states or provinces of advanced economies responds to a temperature increase in the same way as economic activity does in states or provinces of emerging market and developing economies with a similar average temperature. Indeed, analysis suggests that temperature shocks hurt hot areas in emerging market and developing economies significantly more than those in advanced economies (Figure 3.15). Thus, economic development seems, to some extent, to insulate countries from the vagaries of the weather.[36]

**Figure 3.15. Role of Development: Evidence from Subnational Data**
*(Percent; years on x-axis)*

The adverse effect of an increase in temperature on output is more pronounced in non-advanced economies.




Source: IMF staff calculations.
Note: The figure depicts how the effect of a 1°C increase in temperature in the sample of states or provinces with average temperature exceeding 15°C varies with an indicator of whether the state or province is located in an advanced economy. Horizon 0 is the year of the shock. Gray area indicates that the blue and red lines are significantly different from each other at the 15 percent level.

## The Role of Migration

Migration is another possible adaptation strategy for households hurt by weather shocks and persistent changes in climate—one with important cross-border spillovers. Theoretically, the impact of weather shocks on migration is ambiguous (see Dell, Jones, and Olken 2014). Although lower incomes, safety concerns, and physiological discomfort are powerful incentives to relocate, the adverse income effect of weather shocks may undermine households' ability to pay for transport and other relocation expenses (Bryan, Chowdhury, and Mobarak 2014; Carleton and Hsiang 2016).[37] Several empirical studies have documented adaptation to weather shocks and natural disasters through migration within country borders.[38] Evidence of international migration responses is scarcer and typically focuses on flows from individual countries.[39]

The analysis builds on Cattaneo and Peri (2016) and examines whether weather shocks and natural

[35]Average annual temperatures in the US states of Maine and Texas are about 7°C and 21°C, respectively.

[36]Data constraints prevent the identification of the precise channels through which development attenuates the link between weather and overall economic performance. Economic activity in hot areas in advanced economies may be more insulated from temperature shocks given that households exposed to these shocks have better access to ex post coping mechanisms (such as social protection) or have reduced their vulnerability to shocks through ex ante adaptation strategies (such as activity diversification, adoption of air-conditioning, and the like).

[37]Lack of knowledge and uncertainty about the risks caused by slowly changing climate conditions (Lee and others 2015) as well as the provision of government assistance to disaster-prone areas may also result in minimal behavioral change (Baez and others 2017).

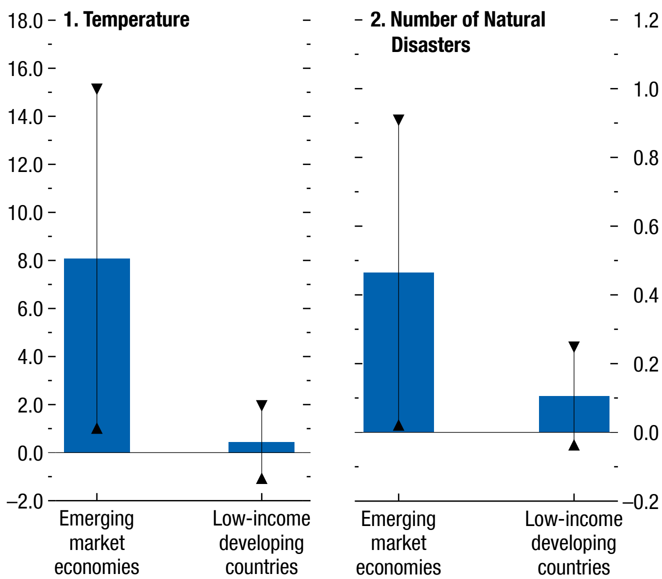
[38]See Gray and Mueller (2012b) for evidence from Bangladesh; and Boustan, Kahn, and Rhode (2012); Feng, Oppenheimer, and Schlenker (2012); Hornbeck (2012); and Hornbeck and Naidu (2014), among others, for evidence from the United States. Deryugina (2011), on the other hand, finds no population response in the 10 years following a hurricane landfall in the United States, but documents a substantial increase in government transfer payments.

[39]Munshi (2003), for example, finds that more migrants move from Mexico to the United States when rainfall is lower in a given Mexican community—a pattern also confirmed by Feng, Krueger, and Oppenheimer (2010). Country-specific evidence also includes Ethiopia (Gray and Mueller 2012a), Indonesia (Bohra-Mishra, Oppenheimer, and Hsiang 2014), Pakistan (Mueller, Gray, and Kosec 2014), and Syria (Kelley and others 2015). Barrios, Bertinelli, and Strobl (2006) and Marchiori, Maystadt, and Schumacher (2012) provide evidence from several countries in sub-Saharan Africa.

**Figure 3.16. Effect of Temperature and Natural Disasters on International Migration**

*(Percentage points of origin country's total population)*

Among the sample of countries with average temperature exceeding 15°C, an increase in temperature and greater incidence of natural disasters induce migration, but only from non-low-income developing countries.




Source: IMF staff calculations.
Note: Estimates from a panel regression of the effects of a 1°C increase in 10-year average temperature and number of natural disasters on the share of emigrants. See Annex 3.4 for further details on the data, specification, and estimation. Vertical lines denote 90 percent confidence intervals.

disasters trigger emigration.[40] The findings suggest that a rise in temperature and greater incidence of weather-related disasters induce emigration, but only from countries where people can generally afford to leave, which confirms Cattaneo and Peri's (2016) results (Figure 3.16; Annex Table 3.4.1). Households in low-income developing countries, which tend to have limited access to savings and credit, appear trapped by weather-induced income shocks (see Black and others 2011; Chen and others 2017). This interpretation is consistent with the findings of Hallegatte and others (2016) that the poorest households in low-income countries tend to be the most exposed and vulnerable to climate change. These are also precisely the households with the fewest resources available to finance relocation.

Substantial migration flows, potentially spilling across country borders, could arise if climate change leads to a significant rise in sea levels. Hundreds of millions of people in low-lying areas could become vulnerable to flooding, forcing them to abandon their homes and relocate (Usery, Choi, and Finn 2007, 2009). In the United States alone, more than 4 million people living in coastal areas could be affected if oceans rise the 80 centimeters the IPCC projects by 2100 under the unmitigated climate change scenario. If the rise in sea levels is twice as much, the affected population would exceed 13 million (Hauer, Evans, and Mishra 2016).

## International Support

Climate change is a global externality, and countries will not be able to deal with its causes or its consequences on their own. Both equity and efficiency arguments call for active support from the international community in helping low-income countries plan, fund, and implement adaptation measures to cope with the consequences of climate change without compromising developmental objectives. On equity grounds, low-income countries have contributed only marginally to greenhouse gas emissions, yet they are the most vulnerable to their harmful consequences, as this chapter demonstrates. On efficiency grounds, requiring countries that have and/or are currently contributing substantially to the atmospheric greenhouse gas concentration to bear some of the adaptation costs of low-income countries will help offset polluters' failure to fully internalize the cost of greenhouse gas emissions. And while the benefits of adaptation are largely domestic, successfully coping with weather shocks and climate change could avert significant cross-border spillovers, for example by stemming climate-induced population migration.

Support from the international community in the form of concessional climate finance will be crucial to mobilize the resources necessary to build resilience to climate change in low-income countries (see Box 3.6). The commitment by advanced economies to jointly contribute $100 billion a year by 2020 for mitigation and adaptation in developing economies, which was further strengthened by the 2015 Paris Agreement,

[40]Focusing on the sample of countries with average annual temperature of at least 15°C, as in the section titled "The Role of Domestic Policies and Institutions: Empirical Evidence," the analysis relates the share of emigrants from a country to its average temperature, precipitation, and incidence of natural disasters over a 10-year period, controlling for time-invariant country characteristics and global and region-specific decadal shocks. See Annex 3.4 for further details.

is an important step in that regard.[41] In addition to financial assistance, the transfer of appropriate adaptation and clean technologies to low-income countries can further enhance their efforts to cope with climate change by improving access to state-of-the-art technology, skills, and knowledge. Several initiatives under the United Nations Framework Convention on Climate Change have promoted the international exchange of knowledge related to good practices in adaptation (such as the Adaptation Learning Mechanism), which can be integrated into national and local plans. Multilateral risk-sharing mechanisms, such as the Caribbean Catastrophic Risk Insurance Facility and the African Risk Capacity, can also help countries with emergency response in the immediate aftermath of a disaster, as discussed in Boxes 3.3 and 3.4.

Cognizant of the challenges posed by climate change, the IMF, among other international financial institutions, offers direct technical and financial support to small states and other countries that are vulnerable to weather conditions. To foster adaptation, it provides policy advice and capacity building on how to enhance macroeconomic and risk management frameworks, determine the appropriate balance between self-insurance and risk transfer, and strengthen investment and growth to build resilience.[42] The IMF has also increased vulnerable countries' annual access limits under the Rapid Credit Facility and Rapid Financing Instrument to provide rapid assistance to countries with urgent payment needs, including as a result of natural disasters (IMF 2016b).

## Long-Term Effects of Temperature Increase—A Model-Based Approach

Empirical work in this chapter so far has assessed the macroeconomic effects of weather shocks in the short and medium term. This section incorporates these estimates into a dynamic general equilibrium model to shed light on the potential long-term effects of temperature increases on GDP, investment, and public debt for a representative small open low-income country. The model also highlights the role that structural transformation of low-income countries (that is, making the transition from agriculture to a more services-based economy) could play in attenuating the impact of climate change. Box 3.5 complements the analysis by reviewing the evidence on the long-term effects of historical climate on economic performance.

Simulations are based on the Debt, Investment, and Growth (DIG) model of Buffie and others (2012), which captures aspects pertinent to low-income countries—such as low public investment efficiency and high capital adjustment costs—and can be extended easily to incorporate the structural transformation process.[43] These aspects of the DIG model make it preferable for studying the impact of climate change in low-income countries relative to the Integrated Assessment Models (IAMs) more commonly used to assess climate change effects.[44]

In the DIG model, firms combine labor, private capital, and infrastructure to produce output. Consumers supply labor and derive utility from consuming traded and nontraded goods, while the government collects revenue, redistributes income, and invests in infrastructure, which it funds through domestic and external borrowing, grants, and remittances. Based on the empirical results, changes in the exogenously-given sector-specific total factor productivity (TFP) levels are modeled as quadratic functions of temperature, while all other parameters are calibrated broadly as in Buffie and others (2012).[45]

[41]Estimates vary, but there is general agreement that adaptation needs in developing economies are on the order of billions of dollars a year (Margulis and Narain 2010; UNEP 2016). The Paris Agreement reiterates and extends developed economies' commitment to jointly mobilize $100 billion a year by 2020: advanced economies are strongly urged to scale up their efforts with a concrete road map for achieving the goal and, by 2025, are expected to set a new collective, quantified goal from a floor of $100 billion a year (Farid and others 2016).

[42]The IMF completed its first Climate Change Policy Assessment in June 2017 in collaboration with the World Bank for Seychelles (IMF 2017).

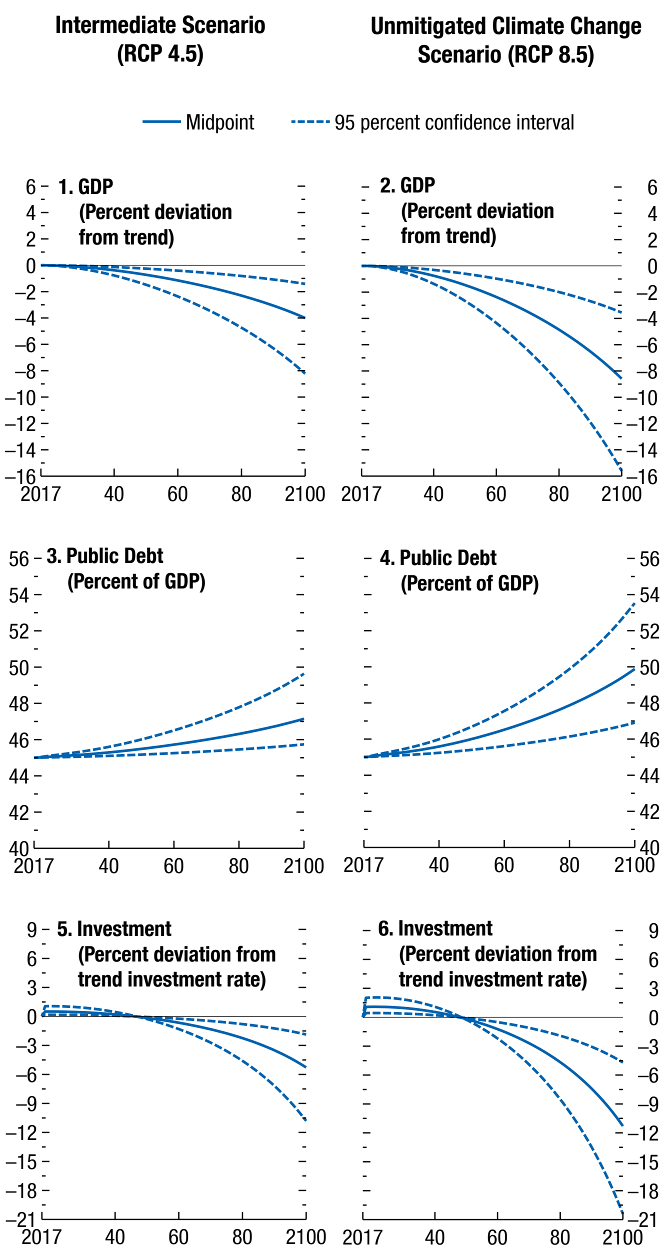
[43]For a detailed description of the model, see Buffie and others (2012) and Annex 3.5.

[44]The three best-known IAMs are the Dynamic Integrated Climate-Economy (DICE) model; the Climate Framework for Uncertainty, Negotiation, and Distribution model; and the Policy Analysis of the Greenhouse Effect model. RICE is a DICE model that includes regions and AD-DICE is a variant of DICE that includes adaptation. Anthoff and Tol (2010), Hope (2011), and Nordhaus and Sztorc (2013) provide descriptions of these models. Existing IAMs are typically not geographically granular enough, lumping together economies with different income levels and average temperatures. They include various feedback loops among emissions, growth, and climate that are less relevant for low-income countries. And they are typically not well suited to analyzing sectoral issues and structural economic transformation.

[45]In particular, $TFP_{t+1} - TFP_t = \beta_1^1(T_{t+1} - T_t) + 2\beta_2^1(T_{t+1} - T_t)T_t + \Delta TFP_t^*$, in which $\Delta TFP_t^*$ is the TFP growth rate that would prevail under no climate change, assumed to be 2.8 percent based on the WEO medium-term growth forecast for low-income countries. $\beta_1^1$ and $\beta_2^1$ are the estimated coefficients on the linear and squared temperature terms in equation (3.2), as reported in column (5) of Annex Table 3.3.1, rescaled to match the modeled decline of GDP when temperature increases by 1°C, and $T_t$ is the average annual temperature for the median low-income country at time $t$, where the initial temperature is set at 25°C.

**Figure 3.17. Long-Term Impact of Temperature Increase for a Representative Low-Income Developing Country: Model Simulations**

Model simulations suggest that the increase in temperature projected under the intermediate and the unmitigated climate change scenarios could have significant economic consequences for a representative low-income developing country, with sizable downside risks.




Source: IMF staff calculations.
Note: RCP = Representative Concentration Pathways.

The effects of climate change are examined through simulations of the macroeconomic response of output, the public-debt-to-GDP ratio, and private investment to the temperature increases projected under two of the scenarios prepared by the IPCC, as discussed in the "Projections" subsection of this chapter. The simulations suggest that under both scenarios, the representative low-income country will experience sizable economic losses relative to a baseline of no changes in temperature, with significant downside risks (Figure 3.17).

Under the milder scenario, the increase in temperature will lower output by 4 percent by 2100 and depress private investment by 5 percent as firms respond to lower productivity from rising temperatures by cutting back capital spending. The relative decline in output implies an increase in the public-debt-to-GDP ratio of 2 percentage points by 2100. Under the unmitigated climate change scenario, the macroeconomic effect would be much larger. Output would fall short by close to 9 percent relative to no climate change, private investment would fall by 11 percent, and the public-debt-to-GDP ratio would rise by 5 percentage points by 2100.[46]

Conversely, the adverse effect would be significantly smaller if the rise in temperature is successfully contained to less than 2°C, as stipulated in the 2015 Paris Agreement, underscoring the critical importance of mitigation efforts in limiting climate change damage. Box 3.6 discusses recent developments in climate mitigation efforts.

There is great uncertainty surrounding these central projections because empirical estimates of the effect of temperature shocks are imprecise and temperature projections are uncertain. As a result, wide confidence intervals surround this chapter's central projections.[47] There is a 2.5 percent chance of output declining more than 8 percent below the trend under the milder scenario and more than 16 percent under the unmitigated climate change scenario. In line with lower output, public debt would increase significantly relative to output (about 10 percent of GDP under the worst-case scenario), and the private-investment-to-GDP

[46]These results are broadly in line with other model-based estimates of the impact of climate change as discussed in Tol (2009). For a survey of estimates of climate change damage at the global level, see Tol (2014) and Nordhaus and Moffat (2017).

[47]The construction of confidence intervals is detailed in Annex 3.5. These intervals do not account for stochastic variations in the weather or fat-tail events.

ratio could plummet by as much as 20 percent below the trend.

An alternative way to quantify climate change damage for a representative low-income country is to compute the present value of the shortfall in economic output relative to the baseline of no climate change and to express this present value as a share of current output.[48] Using a moderate growth-adjusted discount rate of 1.4 percent, the present value of output losses is large, at 48 percent and 100 percent of current output under the RCP 4.5 and RCP 8.5 scenarios, respectively.

The above simulations assume a static economic structure. However, as seen in the "Channels of Impact" subsection, rising temperatures affect some economic sectors more than others. For example, compared with agriculture, the services sector is relatively sheltered from the adverse effects of higher temperature. Hence, structural economic transformation from a mostly agrarian to a more services-based economy could lower the economic cost of climate change. The analysis extends the baseline DIG model to include an exogenous process of reallocating labor from agriculture and manufacturing to services. The pace of structural transformation is assumed to be moderate and replicates past trends for low-income countries: in the absence of shocks, the employment share of the services sector rises by 2.5 percentage points a decade. Simulations in this extended model indicate that over the long term, for the median low-income country, structural transformation can reduce the cost of climate change by about 25 percent and 30 percent under the RCP 4.5 and RCP 8.5 scenarios, respectively.

The potential impact of climate change quantified in this section is subject to important caveats. First, extrapolating from the short- to medium-term causal effects of weather shocks estimated from historical data to the long-term impact of potential global warming may overstate the case if persistent changes in climate induce agents to adapt their economic activity to the new environment. Conversely, permanent changes in climate may have consequences that fluctuations in annual weather do not. Moreover, the model does not capture the effects of extreme weather events, which inflict long-lasting macroeconomic damage, as demonstrated in Box 3.1 in the case of tropical cyclones, and could increase in frequency, potentially amplifying the damage they cause. Certain expected or possible events (such as rising sea levels) have no historic precedents from which to draw inference but may have very significant economic consequences for many low-income countries, which are also not quantified in the simulations. Moreover, the long-term projections do not incorporate several of the channels through which temperature increases, and climate change in general, could affect economic activity, such as declining labor supply from higher mortality and migration.

Even abstracting from these difficulties, considerable uncertainty exists about how to incorporate the empirical estimates of economic losses into the dynamic general equilibrium model. The analysis in this chapter has taken a very conservative approach and assumes that weather shocks have a permanent effect on the *level* of output. However, several studies have argued that the empirical evidence is not inconsistent with a persistent effect on the *growth rate* of output (Dell, Jones, and Olken 2012; Burke, Hsiang, and Miguel 2015a). Because even a small growth effect would ultimately dwarf a level effect, the adverse consequence of temperature increases for the median low-income country would be many times larger if rising temperatures were incorporated into the model as affecting the growth path of output.[49]

## Summary and Policy Implications

Coping with climate change is one of the fundamental challenges of the 21st century, and this challenge looms particularly large for low-income developing economies. This chapter documents the extraordinarily fast rise in temperature over the past century across advanced, emerging market, and low-income developing economies and the significant warming that could occur by the end of this century, depending on the international community's ability

[48]In line with Nordhaus (2010), the real interest rate is assumed to be 4.25 percent, giving a growth-adjusted discount rate of 1.4 percent. A more extreme discount rate of 0.1 percent, proposed by Stern (2007), would increase the present value of damage by an order of magnitude.

[49]Burke, Hsiang, and Miguel (2015a) estimate much larger damages from climate change for hot countries: they model temperature increases as having a persistent effect on the growth rate, rather than the level of output. Permanent growth effects could arise if weather shocks scar productivity growth through their effects on institutions, innovation, or human capital accumulation. Several studies have found evidence of effects of weather shocks on outcomes that could plausibly shape productivity growth (for example, the link between weather and conflict or weather and educational attainment), but it is difficult to establish empirically how long the growth damage through this channel lasts.

to contain greenhouse gas emissions. Low-income developing countries, which tend to be in some of the hottest parts of the planet and are projected to experience sizable increases in temperature, have contributed very little to the atmospheric concentration of greenhouse gases.

Yet the analysis suggests that rising temperatures have highly uneven macroeconomic effects, with the adverse consequences borne disproportionately by countries with hot climates, such as most low-income developing countries. The chapter finds that a rise in temperature lowers per capita output in countries with high average temperatures, in both the short and medium term, through a wide array of channels. In areas with hot climates, higher temperatures reduce agricultural output, lower productivity of workers exposed to the heat, slow the rate of capital accumulation, and damage health. These findings reflect impacts of weather shocks on average country outcomes. But weather shocks could also have sizable unfavorable distributional consequences within a country. Poor households tend to be more vulnerable to weather fluctuations as a result of their heavy reliance on agricultural income, higher proportion of income devoted to food items, and limited access to savings and credit (Hallegatte and others 2016; Hallegatte and Rozenberg 2017; IMF 2016b). Despite the significant warming that has occurred over the past century, the sensitivity of per capita output to temperature shocks has not changed materially, pointing to significant constraints to adaptation.

The negative effects of projected climate change for low-income countries could be large. Focusing on one particular aspect of climate change—namely, the projected rise in temperature—and under the conservative assumption that temperature increases affect the level rather than the growth path of output, model simulations suggest that, absent efforts to reduce global emissions, the output of a representative low-income country could be 9 percent lower than without an increase in temperature, with considerable downside risks.[50] The significant uncertainty about the magnitude and effects of climate change—not only how much temperatures will rise, but also how the environment will react—calls for careful consideration of these downside risks.

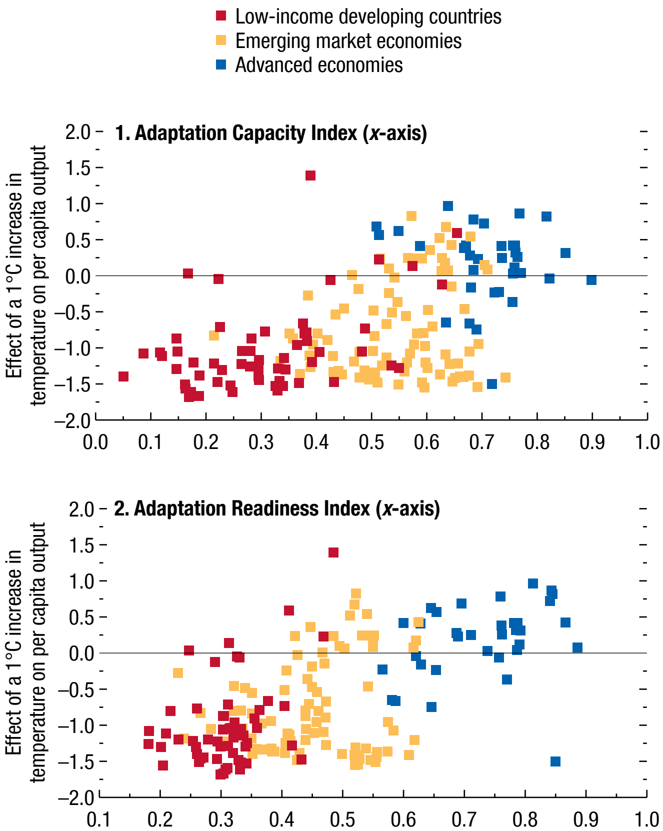
[50]Moreover, the negative welfare consequences of changing climate conditions will likely exceed output losses. Uncomfortably high temperatures could spur investment as households adapt, but the increase in economic activity may not improve welfare.

How can low-income countries cope with the rise in temperatures they are set to experience over the coming decades? Although causal interpretation is difficult, the chapter finds that the sensitivity of per capita output to temperature shocks varies with several mediating factors, and these factors are fundamental to teasing out the chapter's policy implications. Sound domestic policies and institutions, and development in general, could play a role in partially reducing the adverse effects of weather shocks. Having policy buffers in place can help cushion some of the negative effects of weather shocks by helping sustain public investment at adequate levels. Policies and institutional settings that facilitate the reallocation of factors of production across economic sectors and geographic regions and that foster development—such as better access to domestic and international financial markets, high-quality infrastructure, and stronger institutions—can increase resilience to weather shocks to some extent. These policies and institutional settings enable countries to recover faster from the negative consequences of temperature increases and reduce their exposure and vulnerability in the future. Investment in adaptation strategies and projects—such as, for example, well-targeted social safety nets that can promptly deliver support where needed, climate-smart infrastructure, and appropriate technology—could also reduce some of the damage from climate change, as illustrated by selected case studies.

But low-income countries have huge spending needs and scarce resources to undertake the investments necessary to cope with climate change. According to United Nations estimates, attaining the Sustainable Development Goals would require low-income countries to increase public spending by up to 30 percent of GDP—an amount that likely exceeds the fiscal space available in most countries (Baum and others 2017; Schmidt-Traub 2015). Low-income countries also often lack the institutional setting, administrative capacity, or political stability to implement appropriate macroeconomic policies or adaptation strategies (Figure 3.18). Moreover, domestic policies alone cannot fully insulate low-income countries from the consequences of climate change as higher temperatures push the biophysical limits of these countries' ecosystems, potentially triggering more frequent epidemics, famines, and other natural disasters, at the same time fueling migration pressure and conflict risk. The international spillovers from these impacts of climate change in vulnerable countries could be very sizable.

### Figure 3.18. Vulnerability to Temperature Increase and Adaptation Prospects

Low-income developing countries, where the effect of temperature increase is estimated to have the most pernicious effect, tend to have much lower climate change adaptation capacity and readiness.




Sources: Notre Dame Global Adaptation Index; and IMF staff calculations.
Note: The figure depicts the estimated effect of a 1°C increase in temperature on per capita output at horizon 0 against countries' score for adaptation readiness and adaptation capacity. A higher score indicates better adaptation capacity and more readiness.

Given that low-income countries' potential to address the climate change challenge by themselves is limited, the international community must play a key role in providing and coordinating financial and nonfinancial support to these countries (see Box 3.6). Advanced and emerging market economies have contributed the lion's share to actual and projected climate change. Hence, helping low-income developing countries cope with the consequences of climate change is both a humanitarian imperative and sound global economic policy that helps offset countries' failure to fully internalize the costs of greenhouse gas emissions.

While the analysis in this chapter focused on the impact of global warming in low-income countries, it is important to note that all countries will increasingly feel direct negative effects from unmitigated climate change, through more frequent (and more damaging) natural disasters (see Box 3.1), rising sea levels, loss of biodiversity, and many other difficult-to-quantify consequences. Warming will also begin to weigh on growth in many advanced economies as their temperatures rise above optimal levels (see Annex Figure 3.6.1). And even in countries where the effect might be moderate or positive on average, climate change will create winners and losers at both the individual and sectoral levels. Moreover, the international spillovers from the most vulnerable countries, through depressed economic activity and potentially higher conflict and migration flows, could be considerable. Going forward, only a global effort to contain carbon emissions to levels consistent with an acceptable increase in temperature can limit the long-term risks of climate change (Farid and others 2016; Hallegatte and others 2016; IMF 2015; Stern 2015; IPCC 2014).

## Box 3.1. The Growth Impact of Tropical Cyclones

Tropical cyclones, commonly known as hurricanes in the Atlantic and as typhoons in the northwest Pacific, are one of the most destructive forces of nature.[1] They caused damage of $548 billion (constant 2010 dollars) worldwide during 2000–14 (International Disasters Database [EM-DAT]; Guha-Sapir, Below, and Hoyois 2015), almost three-quarters of which occurred in advanced economies.[2] This box estimates the effect of tropical cyclones on economic activity and discusses the possible consequences of climate change through its effects on tropical cyclones under an unconstrained greenhouse gas emissions scenario (Representative Concentration Pathway 8.5).

### *Measuring Tropical Cyclones and Empirical Estimation*

Several studies have examined the macroeconomic impact of tropical cyclones, typically finding significant economic damage.[3] The analysis in this box combines detailed data on maximum sustained wind speed and settlements' population to construct a comprehensive database of tropical storms that took place near centers of economic activity.[4] Between 1950 and 2016, 4,597 storms passed within 100 miles of a city, affecting 3,113 cities in 132 countries or territories.

Tropical cyclones affect countries of different sizes, from small islands in the Caribbean and the Pacific to large countries such as China, Mexico, and the United States. When a storm strikes a small country, it generally affects a large portion of its territory and population, while the impact in larger countries can be contained to relatively smaller areas. To account for this difference, the wind variable—the maximum sustained wind in knots within 100 miles of a country ($Wind_{i,t}$)—is weighted by the share of the population exposed to all tropical cyclones in a year ($P_{i,t}$). Storms also differ in the speed at which they move, with slow-moving storms being potentially more destructive. Thus, the wind variable is also weighted by the share of a country's time endowment exposed to all storms within a year ($TE_{i,t}$), in which the time endowment is given as the product of the number of hours in a year and the number of cities in a country. Table 3.1.1 summarizes the key elements of the cyclone variables.

To estimate the effect of tropical cyclones on per capita output, the analysis extends the local projection empirical approach used in the chapter to include the

The author of this box is Sebastian Acevedo.

[1]A tropical cyclone is a rotating, organized system of clouds and thunderstorms that originates over tropical or subtropical waters and has a closed low-level circulation (NOAA 2017b). Hurricane-strength winds (greater than 64 knots) can extend beyond 200 miles for the largest storms.

[2]Storms cause more absolute damage in advanced economies because their capital stocks tend to be more valuable; however, as a percentage of GDP, damage is generally higher in small states and low-income developing countries. The EM-DAT reports damage for about half of the disasters caused by storms. Acevedo (2016) finds that, in the Caribbean, economic damage caused by tropical cyclones could be 1.6 to 3.6 times higher than reported.

[3]Raddatz (2009); Fomby, Ikeda, and Loayza (2013); and Acevedo (2014) use data from the EM-DAT to estimate the effects of different types of natural disasters (including storms) on growth, while a parallel body of literature (Strobl 2012; Bertinelli and Strobl 2013; Hsiang and Jina 2014) uses wind-field models to estimate the effects of storm winds on growth. Bakkensen and Barrage (2016) use maximum wind speed at landfall, which is closer to the approach used here.

[4]The International Best Track Archive for Climate Stewardship contains data on 7,140 tropical cyclones, with information on maximum sustained wind speed between 1950 and 2016 (Knapp, Applequist, and others 2010; Knapp, Kruk, and others 2010). These data are combined with the CIESIN (2016) settlements' population in 2000, which contains data for 67,682 cities that range in population from one person to 18.5 million people.

**Table 3.1.1. Characteristics of the Average Tropical Cyclone by Country Group**

| | MSW within 100 Miles (knots) | Exposed Population | Exposed Time Endowment | Distance (miles) |
|---|---|---|---|---|
| World | 51.30 | 0.34 | 0.0005 | 77.05 |
| Advanced Economies | 58.56 | 0.28 | 0.0004 | 77.78 |
| Emerging Market Economies | 49.84 | 0.28 | 0.0004 | 76.27 |
| Low-Income Developing Countries | 42.45 | 0.20 | 0.0003 | 79.66 |
| Small States | 47.02 | 0.58 | 0.0009 | 71.26 |
| Islands | 54.43 | 0.49 | 0.0007 | 75.69 |

Sources: CIESIN GRUMPv1 Settlement Points r01; Ibtracs v03r09; and IMF staff calculations.
Note: Maximum sustained winds (MSW) one minute average in knots per hour. Exposed population as a share of total population. Exposed time endowment as a share of the total hours available in each country (24 hours × 365 days × cities). Distance is the average distance from each city (within 100 miles of the storm) to the storm position where the wind was at its maximum.

## Box 3.1 *(continued)*

### Table 3.1.2. Effect of Weather and Wind Shocks on Economic Activity

| Real GDP per Capita Growth | (1) | (2) | (3) |
|---|---|---|---|
| Temperature | 1.347*** | 0.931*** | 0.920*** |
| | (0.357) | (0.222) | (0.223) |
| Temperature$^2$ | –0.051*** | –0.038*** | –0.037*** |
| | (0.011) | (0.010) | (0.010) |
| Precipitation | 0.110 | 0.051 | 0.047 |
| | (0.104) | (0.104) | (0.106) |
| Precipitation$^2$ | –0.003 | –0.002 | –0.001 |
| | (0.002) | (0.002) | (0.002) |
| Wind × Population × Time Endowment | | | –26.750** |
| | | | (12.912) |
| Adjusted $R^2$ | 0.14 | 0.18 | 0.18 |
| Number of Countries | 189 | 96 | 96 |
| Number of Observations | 8,815 | 4,696 | 4,696 |

Source: IMF staff calculations.
Note: All regressions control for country and region-year fixed effects; lags and forwards of temperature, precipitation, and their squared terms; and lag of growth. Column (3) also controls for the contemporaneous wind variable, as well as its lags and forwards. Column (1) replicates the chapter's baseline specification (column (5) in Annex Table 3.3.1). Columns (2) and (3) include only countries exposed to tropical cyclones. Standard errors clustered at the country level.
* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

wind variable weighted by the share of population and time exposed. The specification estimated is as follows:

$$\begin{aligned} y_{i,t+h} - y_{i,t-1} &= \alpha_1^h(\text{Wind}_{i,t}P_{i,t}TE_{i,t}) \\ &+ \alpha_2^h(\text{Wind}_{i,t-1}P_{i,t-1}TE_{i,t-1}) \\ &+ \textstyle\sum_{j=1}^{h-1}\alpha_3^h(\text{Wind}_{i,t+h-j}P_{i,t+h-j}TE_{i,t+h-j}) \\ &+ \beta_1^h c_{i,t} + \beta_2^h c_{i,t-1} + \textstyle\sum_{j=1}^{h-1}\beta_3^h c_{i,t+h-j} \\ &+ \varphi_1^h \Delta y_{i,t-1} + \mu_i^h + \theta_{r,t}^h + \varepsilon_{i,t}^h, \qquad (3.1.1) \end{aligned}$$

in which $h$ indexes the estimation horizon, $\mu_i^h$ are country fixed effects, $\theta_{r,t}^h$ are region-year fixed effects, $y_{i,t}$ is the log of GDP per capita, and $c_{i,t}$ refers to average annual temperature and precipitation and their squared terms.

The results presented in Table 3.1.2 indicate that if the wind speed increased by one knot throughout the entire country (that is, the entire population is exposed), and for an entire year, real GDP per capita would decline by 26.7 percent the year the storm strikes. This, of course, is not a very useful indicator of the effect of a typical storm on a country; a better measure is the marginal effect of increasing wind speed as captured by $\alpha P_{i,t} TE_{i,t}$.

### *Findings*

Tropical cyclones have a significant negative effect on output, with the biggest impact felt in small states and islands that are generally more exposed to this type of storm (Figure 3.1.1).[5] By income group, advanced economies are the hardest hit by tropical cyclones because they tend to be exposed to higher wind speeds.

The estimates are not only statistically, but also economically, significant. Seven years after an average storm strikes, per capita output is almost 1 percent lower than if the storm had not happened, with 2.5 times larger losses experienced by small states (Figure 3.1.2).[6] The effects of storms are very persistent: even after 20 years, the economy has not fully recovered from the shock.[7] Notably, the effect of tropical cyclones on economic activity is separate and in addition to the effects of temperature (Table 3.1.2). Introducing the wind variable does not materially change the coefficients on temperature and precipitation for the same sample of countries.

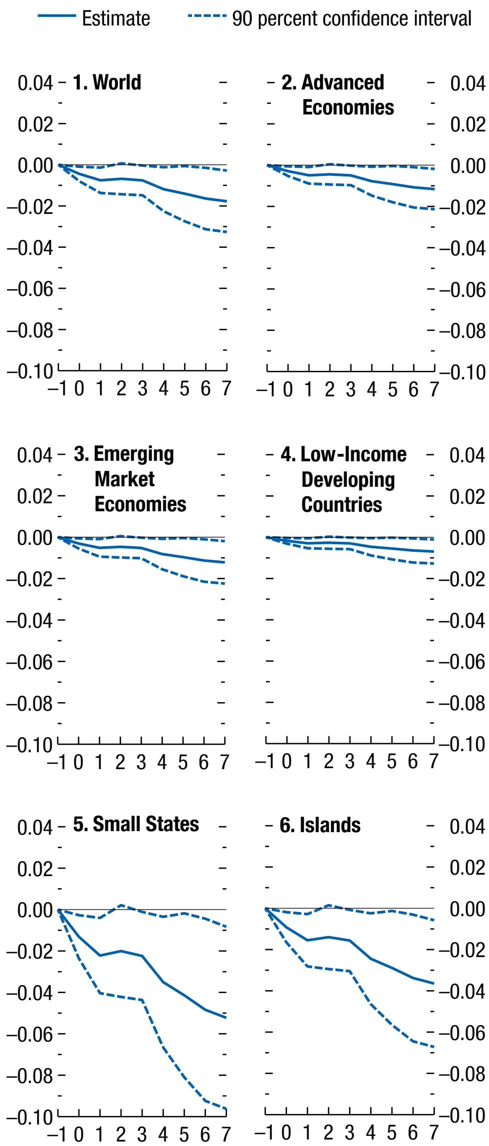
### *Climate Change and Tropical Cyclones*

Climate scientists predict that, with climate change, there will be fewer tropical cyclones that form, but the

[5]For a discussion of small states' vulnerability to natural disasters and climate change, see IMF (2016b).
[6]A storm strike includes any tropical cyclone that passed within 100 miles of a city in a country.
[7]Hsiang and Jina (2014) find a similar response; in their case, the decline in GDP is much larger, but the partial recovery starts after 15 years.

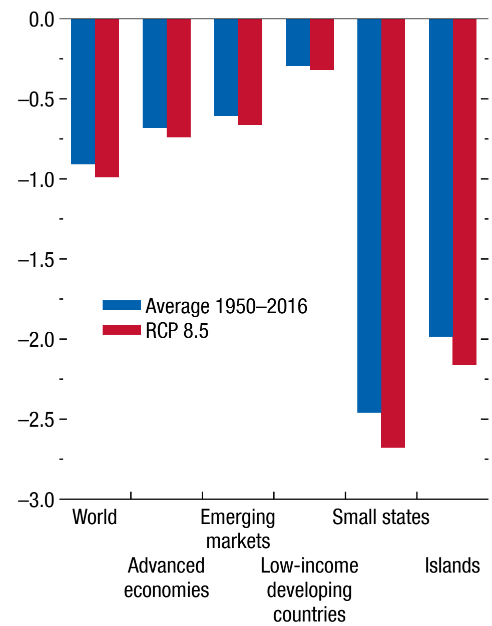
## Box 3.1 *(continued)*

### Figure 3.1.1. Effect of Tropical Cyclone Exposure on Real GDP per Capita
*(Percent; years on x-axis)*




Source: IMF staff calculations.
Note: Cumulative impact of a one-knot increase in tropical cyclone winds on real GDP per capita. Horizon 0 is the year of the shock.

### Figure 3.1.2. Cumulative Effect of Average Tropical Cyclone on Real GDP per Capita after Seven Years
*(Percent)*




Source: IMF staff calculations.
Note: Cumulative effect after seven years on real GDP per capita of the average tropical cyclone that each country group is exposed to in terms of maximum wind speed, exposed population, and exposed time endowment. RCP = Representative Concentration Pathways.

ones that do will be more intense and destructive (Knutson and others 2010). In the unmitigated climate change scenario (Representative Concentration Pathway 8.5), sea surface temperature in 2090–2100 is expected to increase by 2.6°C relative to 1995–2005, which suggests that the maximum wind speed of tropical cyclones could increase by 9 percent.[8] The analysis in this box suggests that the average country would suffer an additional 0.1 percent of per capita output loss every time it is hit by an average tropical cyclone, with smaller states experiencing 0.2 percent greater damage (Figure 3.1.2).

[8]Sea surface temperature is a key ingredient in the formation and development of tropical cyclones (Landsea 2004). A 1°C increase in sea surface temperature raises maximum wind speed by 3.5 percent (Knutson and Tuleya 2004).

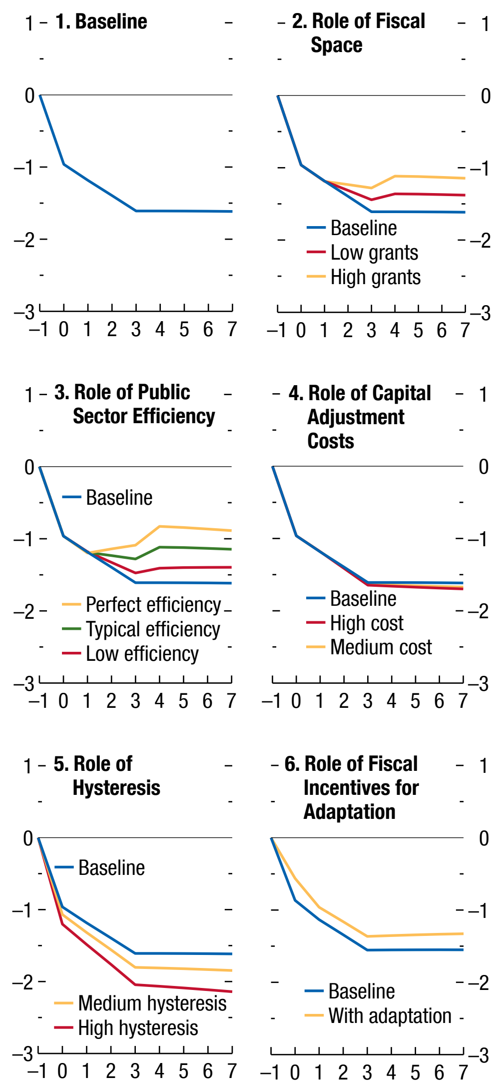
## Box 3.2. The Role of Policies in Coping with Weather Shocks: A Model-Based Analysis

To illustrate how policies can help moderate the consequences of weather shocks in low-income countries, this box uses the Debt, Investment, and Growth (DIG) model developed by Buffie and others (2012) and simulates the macroeconomic effects of temperature increases under various assumptions for key policy variables.[1] As demonstrated empirically in the chapter, in hot countries, an increase in temperature reduces productivity. Moreover, a temperature increase could precipitate the loss of productive land. Consequently, the analysis calibrates the weather damage to total factor productivity and private capital to broadly match the estimated response of GDP to a 1°C increase in temperature in a representative low-income country with a baseline temperature of 25°C and examines how this damage can be shaped by macroeconomic and structural policies (Figure 3.2.1).[2]

### *Policy Space and the Role of Institutions*

Weather shocks can weigh significantly on the public purse of low-income countries. Government revenues can be adversely affected by the reduction in agricultural and industry output at the same time that spending may need to be ramped up to deliver support to affected households if weather shocks compromise food security, to rebuild transport or communication infrastructure if they are damaged by natural disasters, and potentially to retrain the workforce. Because fiscal space is often tight in many low-income countries, expanding transfers from advanced economies—for instance, through the transfers agreed to under the Paris Agreement—could strengthen countries' ability to reduce the impact of weather shocks. Model simulations suggest that receiving additional transfers used to build up public investment for three years, starting a

**Figure 3.2.1. Role of Policies: A Model-Based Analysis**
*(Real GDP, deviation from steady state; years on x-axis)*




Source: IMF staff calculations.
Note: The baseline assumes no additional grants in panels 2 and 3, low adjustment cost in panel 4, no hysteresis in panel 5, and no adaptation in panel 6. In panel 2, additional grants amount to 0.5 percent of GDP in low grants scenario, and 1 percent of GDP in high grants scenario. In panel 3, all simulations, except the baseline, assume high additional grants.

The authors of this box are Manoj Atolia, Claudio Baccianti, Ricardo Marto, and Mico Mrkaic.

[1]The DIG model is a real, neoclassical, dynamic open economy framework with two production sectors that use public and private capital as input and many features that are pertinent to low-income countries, such as low public investment efficiency, limited fiscal space, and capital adjustment costs. The model is also used to simulate the long-term effects of climate change in the section of the chapter titled "Long-Term Effects of Temperature Increase—A Model-Based Approach."

[2]For simplicity, the traded and nontraded sectors are assumed to react equally to weather shocks. The findings are robust to this modeling choice. Most other parameters are calibrated as in Buffie and others (2012), except the real interest rate on public debt, which is lower than in the original paper because of the decline in global interest rates. See Annex 3.5 for further details.

## Box 3.2 *(continued)*

year after the weather shock, could limit the damage of weather shocks to output (Figure 3.2.1, panel 2). Additional transfers of 1 percent of the recipient country's GDP reduce the depth of the recession by about 0.5 percent throughout the simulation period. Encouragingly, because the transfers increase the stock of public infrastructure, thereby boosting productive capacity in both sectors, they increase output not only in the short term, but also in the long term.

Additional transfers benefit the recipient country, but the size of the benefit depends crucially on the efficiency of investment in public sector infrastructure, in particular, and on the quality of public sector governance in general. Efficiency of public investment is low in many low-income countries, with estimates of the share of expenditures on public infrastructure that truly increase the stock of public capital ranging from 20 percent to 60 percent (Hulten 1996; Pritchett 2000; Foster and Briceno-Garmendia 2010). The results of the simulations show that, in countries with high public investment efficiency, the receipt of additional transfers can effectively dampen the adverse consequences of a weather shock (Figure 3.2.1, panel 3). In countries with low public investment efficiency, however, there is little difference between receiving and not receiving additional transfers. In sum, the simulation shows convincingly that low-income countries must continue to improve the efficiency of public investment and strengthen their institutional frameworks to reap the full benefit of having buffers to counteract the effects of changing weather conditions.

### *Policies that Ease Factor Reallocation and Structural Transformation*

Weather shocks disrupt production, especially in certain sectors of the economy, and adjusting to these shocks would require reallocating workers and capital across and within sectors. The speed and cost at which these factors of production can be reallocated will influence how fast the economy can recover after adverse shocks to total factor productivity or the stock of capital.

In low-income countries, reallocation of capital (and factors of production in general) can be hampered by rigid economic environments and suboptimal policies, for example, limited access to financial markets, bureaucratic impediments (such as difficulties in obtaining building permits), and legal uncertainties.[3] Simulations indicate that higher costs of capital reallocation slow the recovery from weather shocks (Figure 3.2.1, panel 4).[4]

The speed at which affected workers can be reallocated to alternative productive activities also matters. Unemployment can cause hysteresis or permanent "scarring" of productivity, given that workers lose skills during long unemployment or underemployment episodes. This in turn could have long-lasting consequences for economic performance. In the DIG model, this channel is captured in the sensitivity of productivity to lagged negative output gaps.[5] The results from simulations that vary this sensitivity suggest that hysteresis could significantly prolong and deepen the effects of weather shocks. Hence, policies should aim to preserve human capital, including by instituting programs that provide incentives to the unemployed to participate in human-capital-preserving activities, such as public works projects, as in the Ethiopian Productive Safety Net Program, discussed in Box 3.3.

### *Investment in Adaptation Strategies*

In addition to the general macroeconomic and structural policies discussed above, governments, households, and firms engage in direct investments in adaptation strategies in response to changing weather conditions (for example, by planting more-heat-resistant crops or investing in green infrastructure). Many adaptation measures, however, have the nature of public goods. Setting up an early-warning system for extreme heat, instituting information campaigns about water conservation, or increasing vegetation in public areas and other green infrastructure investments all have nonrival

[3]In the DIG model, the ease of factor reallocation is captured in the cost of private capital adjustment parameter. The cost of capital adjustment is inversely proportional to elasticity of investment with respect to Tobin's q, in which higher elasticity implies lower capital adjustment costs.

[4]The quantitative impact appears small, but the simulation should be seen as a qualitative guide only. The size of the GDP decline depends on the cost of capital adjustment as well as on the shape and timing of the shock. If the climate shock results mostly in the destruction of private capital and, to a lesser extent in lowering total factor productivity, then the recovery is slower and damage to GDP larger because of slower rebuilding of capital.

[5]The size of the effect is calibrated by using the estimated elasticity of current wages to lagged hours worked by Altuğ and Miller (1998). Their estimated elasticity of 0.2 stands for the high degree of hysteresis in the model specification.

### Box 3.2 *(continued)*

and nonexcludable payoffs. Because households and firms are unable to internalize the full social benefits, government involvement may be needed to provide incentives to private agents to undertake adaptation efforts toward socially optimal levels. In an extension of the DIG model, the government introduces fiscal incentives for the adoption of resilience-improving technologies and finances the provision of public goods related to weather risks, which lowers the sensitivity of output to temperature increases. Assuming that private adaptation expenditure falls 20 percent short of the social optimum, and that government policy aims at restoring optimality, simulations suggest that over 20 years, each $1 spent on adaptation by the government reduces total weather damage by $2. The mechanism behind this finding is private investment's response to the reduced weather-related productivity losses, which boosts GDP in the medium and long term. The simulation illustrates a general principle that improving resilience through public adaptation spending can reduce weather-driven downturns and accelerate recoveries (Figure 3.2.1, panel 6).

## Box 3.3. Strategies for Coping with Weather Shocks and Climate Change: Selected Case Studies

Adverse effects of weather shocks and climate change have motivated local communities and countries to adapt and counter these unfavorable consequences. As demonstrated in Figure 3.12, a wide range of strategies could dampen the negative impacts of weather shocks and natural disasters by reducing exposure and vulnerability or by transferring and sharing weather-related risks. The purpose of this box is to showcase some examples of successful coping strategies.

### *Social Safety Nets*

Approximately 85 percent of the Ethiopian population is employed in agriculture, mostly on small family-owned farms. Climate change and associated droughts, delayed rains, and flooding weigh on agricultural productivity and food security. Furthermore, in some areas, the land has become degraded due to overuse. Consequently, approximately 10 percent of the rural population is chronically food insecure.

To assist the at-risk population, the Ethiopian government and international partners instituted the Productive Safety Net Program (PSNP) in 2006. The PSNP provides cash or food to households unable to feed themselves all year, particularly in the lean season (June–August). The aid is contingent on active participation in local productivity-enhancing or environmental programs—for example, land rehabilitation, improvement of water sources, and construction of infrastructure such as roads and hospitals. A complementary program, the Household Asset Building Program, which targets the same households as the PSNP, helps households diversify their income sources and increase productive assets, including by offering technical assistance, with the goal of achieving lasting food security.

With more than 7.6 million participants (or almost 8 percent of the Ethiopian population) and 47,000 small community projects every year, the PSNP is the largest climate change adaptation program in Africa. The community projects, which are mostly devoted to environmental restoration, are offering measurably positive results. The PSNP has reduced soil loss by more than 40 percent and improved the quality and quantity of available water. Studies suggest that land productivity has consequently increased by up to 400 percent. In addition, the PSNP has reduced the damage from seasonal flooding. The program has also improved the food security of vulnerable households—beneficiaries of the PNSP experienced a 25 percent smaller drop in consumption relative to those that were not covered by the program in the aftermath of droughts (Porter and White 2016). The PSNP has also reduced the number of people in need of humanitarian intervention and the cost of such intervention. Finally, the PSNP has increased savings of vulnerable households and has facilitated improved access to educational and health services.

### *Technology Adoption*

High temperatures significantly lower labor productivity and could lead to adverse health outcomes—such as increased incidence of hyperthermia and worsening chronic cardiovascular or respiratory diseases—and mortality, as demonstrated in a large body of work and the analysis in this chapter. Governments and individuals have various options for reducing these adverse economic and health impacts, such as green infrastructure (to increase the presence of vegetation in cities) and specific construction technologies (for example, roofs that are highly solar reflective). Among all options, modern air-conditioning, invented at the turn of the 20th century, is the most common solution adopted by households and firms to deal with excessive heat.

The benefits of climate control, both in the workplace and for health outcomes, are well documented. In a 1957 survey, 90 percent of American firms named cooled air as the single biggest boost to their productivity (Cooper 2002), and Singapore's founding father, Lee Kuan Yew, credited air-conditioning as the most important factor in his country's development success. The dramatic decline in heat-related mortality over the 20th century in the United States has also been attributed to the adoption of residential air conditioning (Barreca and others 2016).

Nevertheless, the negative effects of air-conditioning cannot be ignored. Increased adoption of indoor climate control increases energy consumption and greenhouse gas emissions. Exhaust from air-conditioning machines and facilities can give rise to local pockets of hot air, which can present significant negative externalities for nearby populations. High up-front costs and infrastructure requirements make this technology out of reach for poor and vulnerable populations, especially in low-income developing countries.[1]

The authors of this box are Claudio Baccianti and Mico Mrkaic.

[1]As of 2012, slightly more than one-third of households had access to electricity in the median low-income developing country.

## Box 3.3 *(continued)*

Intelligent planning and implementation of air-conditioning could reduce some of the negative spillovers of this otherwise effective strategy for adapting to rising temperatures. A case in point is district cooling—a centralized air-conditioning system—which has been adopted in major cities in advanced economies and is currently under construction in the Gujarat International Finance Tec-City, a new business district in Gujarat, India. With district cooling, chilled water is produced at a central source and is distributed to final consumers through underground pipes.

A centralized cooling system has clear environmental and economic advantages over decentralized air-conditioning. The centralized production of chilled water consumes 35 to 50 percent less energy than individual air cooling units, reducing cost and pollution. Higher energy efficiency, in turn, eases the pressure the diffusion of air-conditioning puts on the local electricity sector, which often lags the rapidly growing demand for energy in emerging market and developing economies. Finally, district cooling eliminates the up-front cost for final users, making indoor climate control more accessible.

As in the provision of other types of infrastructure, such as energy and water distribution, public sector involvement could speed up the development and expansion of district cooling systems, which could be held back by low energy prices, insufficient demand density, economic uncertainty, and other risks related to the substantial up-front investment. The government of Gujarat has taken direct control of the construction of the cooling distribution network, as have the governments of the Republic of Korea, Qatar, and Singapore.

### *Climate-Smart Public Infrastructure Investment*

Flash floods in Kuala Lumpur, Malaysia, have caused considerable property damage, impassable traffic congestion, contamination of the water supply, and loss of human life. To alleviate these problems, the authorities embarked on an ambitious dual-purpose infrastructure project that would help with both traffic and flood water management.

The Stormwater Management and Road Tunnel (SMART Tunnel) is a dual-purpose structure designed to combat flash floods. A three-level tunnel combines a two-level road tunnel and a storm drainage system underneath. Under normal conditions, the drainage level is closed and the tunnel is used as an ordinary road traffic tunnel. However, the tunnel is designed so that one or both traffic-carrying levels can be temporarily repurposed by being allowed to flood for use as storm drains.

During moderate storms, the system reallocates the lower traffic level to carry storm water, while the top level can still be used by motorists. If the rainfall is expected to be extreme, both traffic-carrying levels can be closed to traffic, evacuated, and used as drains.

Cost-benefit analysis has demonstrated the effectiveness of the tunnel system. At a cost of about $500 million, it is expected to prevent more than $1.5 billion in flood damage and reduce the costs of traffic congestion by more than $1 billion over the next 30 years.

### *Early-Warning Systems and Evacuation Programs*

Situated in the Ganges delta, Bangladesh is one of the countries most vulnerable to climate change. Annual floods typically inundate about one-fifth of the country, leading to loss of life and property damage.[2] Over the past 70 years, storms have caused thousands of deaths and millions of tons of crop damage, and, because of climate change, the problems are expected to worsen.

After the extraordinary damage caused by Cyclone Sidr, the authorities and international partners embarked on the Emergency Cyclone Recovery and Restoration Project (ECRRP).[3] The goals of the ECRRP are to improve agricultural infrastructure and long-term disaster preparedness, including by building and reconstructing cyclone shelters and reinforcing embankments. The program has meaningfully reduced the risk of cyclone exposure of the vulnerable population by rebuilding about 240 cyclone shelters and repairing more than 100 kilometers of embankments.

The ECRRP has also helped increase agricultural resilience to climate shocks and helped improve the livelihoods of the affected populations. In addition to providing farmers with agricultural equipment, saline-tolerant rice seeds, and training in crop diversification for better farm management, investments in grain silos and livestock protection have reduced the exposure of the agricultural production chain to weather-related shocks.

[2]In extreme years, floods can affect up to three-quarters of the land area in Bangladesh.

[3]The cyclone destroyed 1.5 million houses and damaged 1.3 million tons of crops.

## Box 3.3 *(continued)*

### *Multilateral Risk-Sharing Mechanisms*

#### Caribbean Catastrophic Risk Insurance Facility

Caribbean countries are regularly affected by tropical storms, extreme rainfall, earthquakes, and volcanic eruptions. Because these shocks are, at least in part, uncorrelated, risk sharing in the form of a regional insurance pool can offer welfare improvements relative to self-insurance or purchase of reinsurance by individual countries. The Caribbean Catastrophic Risk Insurance Facility (CCRIF) is the world's first regional risk-pooling financial institution, offering insurance for the most prevalent natural disasters in the region. It was formed in 2007 and currently includes 17 members.[4]

The CCRIF insures against tropical cyclones, excessive rainfall, and earthquakes. All 17 participating countries can purchase up to $100 million of coverage for each category of risk. The program is designed to finance emergency response, over the weeks and months after the disaster, rather than provide comprehensive insurance against asset losses or infrastructure damages. The insurance is parametric—payouts are based on parameterized models for each category of insured events: tropical cyclones, excessive rainfall, and earthquakes. For example, the payout after an earthquake is proportional to its intensity, location, and estimated losses. Predetermined payouts, based on publicly observable data, obviate the need for time-consuming and costly damage assessments and insurance adjustments. A downside of parametric insurance in response to the effects of basis risk; that is, calculated payouts might not match the actual damage.[5]

During 2007–15, the CCRIF made 13 payouts to eight members in the total amount of $38 million, most of which was in response to the effects of tropical cyclones. The payouts ranged from 0.1 to 0.3 percent of GDP for the recipient country. While the payouts do not cover all losses, they offer important support to insured countries, including from the rapid disbursement of funds—payouts have been disbursed, at the latest, two weeks after the insured event. In addition, CCRIF members are given complete freedom regarding the use of the funds received.

The CCRIF has proved to be an effective risk-pooling mechanism. Its effectiveness is recognized by both the insured countries, which can obtain coverage at a lower cost than they could individually from commercial insurers, and from the participants in the reinsurance market.

### *African Risk Capacity*

The African Risk Capacity (ARC) is a mutual insurance facility whose aim is to strengthen food security. The ARC, a Specialized Agency of the African Union, was established in 2012 to help African Union members insure against crop failure caused by extreme weather events, such as droughts and floods, by pooling climate-related risks. Initially, 18 African Union members signed the establishment agreement; since then, membership has grown to more than 35 countries.

The ARC provides parametric insurance. When an insured event occurs, the payout is based on models and satellite input data to predict the extent of crop failures and the associated costs. Using parametric instead of indemnity insurance accelerates the payouts, which is of particular importance to the most vulnerable populations. By pooling their risks, participating countries reduce the cost of insurance by about half, given that drought is very unlikely to affect the whole country pool.

Evidence points to the benefits of the ARC, but challenges remain. The ARC has reduced the volatility of food consumption for the most vulnerable households. Furthermore, it has helped reduce the need for fire sales of assets in distressed regions. However, the risk pool is still relatively small (for example, in comparison with the CCRIF) and could be expanded further to better diversify the risks. In addition, misallocation of insurance may decrease with accumulated experience.

[4]Anguilla, Antigua and Barbuda, The Bahamas, Barbados, Belize, Bermuda, the Cayman Islands, Dominica, Grenada, Haiti, Jamaica, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Trinidad and Tobago, and the Turks and Caicos Islands joined at the inception; Nicaragua joined in 2015. The CCRIF is contemplating expanding beyond the Caribbean.

[5]Indemnity insurance avoids this problem, but suffers from costly assessments and adjustments.

## Box 3.4. Coping with Weather Shocks: The Role of Financial Markets

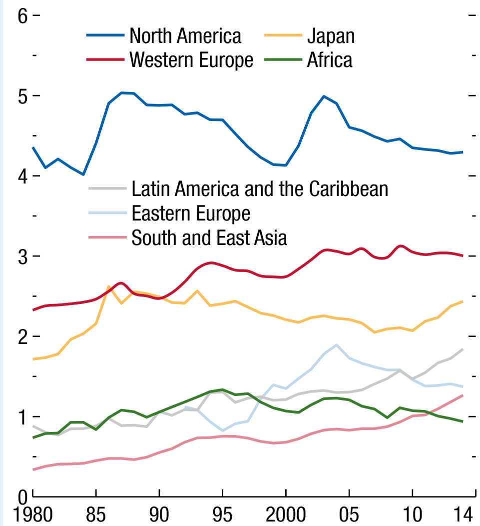
Financial markets can reduce the adverse consequences of weather shocks by reallocating the costs and risks of such shocks to those most willing and able to bear them. Insurance products, such as weather derivatives, can help households and firms vulnerable to short-term fluctuations in temperature and precipitation hedge their idiosyncratic weather exposure. Catastrophe (Cat) bonds can help disperse catastrophic weather risk to capital markets. However, the degree to which financial markets can mitigate the impacts of weather shocks hinges on the level of insurance penetration and on the capacity to correctly price weather-related risks. This box reviews recent developments in the market for weather-related financial products and provides new evidence on the extent to which stock markets efficiently price weather-related risks.

### *Insurance*

Recent studies highlight the important role that insurance markets could play in facilitating economic recovery in the aftermath of weather-related natural disasters. A higher degree of insurance penetration can limit the fiscal burden of natural disasters (Lloyd's 2012) and reduce their negative macroeconomic consequences (Von Peter, Dahlen, and Saxena 2012), especially in countries with strong institutions (Breckner and others 2016). Parametric insurance products, developed in the early 2000s, also hold promise for providing protection from various weather-related risks to households and firms in low-income countries.[1] Overcoming important barriers to the provision of traditional insurance to small farmers, these products minimize transaction costs, are easy to enforce, and limit potential adverse selection and moral hazard issues.

Yet, insurance penetration, as captured in non-life insurance premiums as a percentage of GDP, remains low, especially in developing economies (Figure 3.4.1). And despite its advantages, the take-up of parametric insurance has been disappointing (Hallegatte and others 2016). Many factors have likely contributed to the slow adoption of the novel financial instruments, including limited financial literacy or experience with similar financial products, insufficient understanding of the product, high cost, and residual basis risk (see, among others, Cole and others 2012, 2013; Karlan and others 2014).

**Figure 3.4.1. Insurance Penetration: Non-Life Insurance Premium**
*(Percent of GDP)*




Sources: Haver Analytics; Swiss Re, Sigma database; and IMF staff calculations.

### *Catastrophe Bonds*

The market for Cat bonds, a financial instrument that transfers catastrophe risk from the issuing primary insurers and reinsurance companies to the capital markets, has grown rapidly in recent years, reaching an outstanding volume of nearly $30 billion at the end of 2016 (Figure 3.4.2).[2] Cat bonds are attractive to investors because they have relatively higher yields and low correlation with the returns of most other financial assets. The low-interest-rate environment since

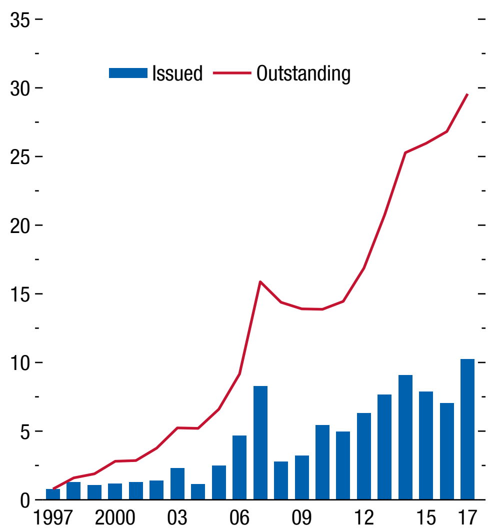
The author of the box is Alan Xiaochen Feng.

[1]Unlike traditional indemnity insurance for natural hazards, parametric insurance products offer payments that are based on a publicly observable index, such as rainfall or temperature. While their design offers numerous advantages over traditional products, parametric insurance can leave a fair amount of residual risk uncovered ("basis risk"), given that the actual loss may differ from the payment received by contract holders.

[2]Cat bonds pay interest, principal, or both during normal times, but absorb losses if a predefined catastrophe occurs. They were first introduced in the mid-1990s, in the aftermath of Hurricane Andrew.

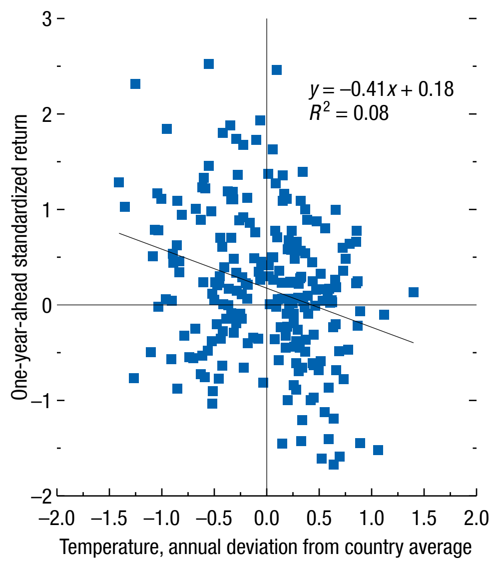
**Box 3.4 *(continued)***

**Figure 3.4.2. Catastrophe Bond Market**
*(Billions of US dollars)*




Source: Artemis Insurance-Linked Securities and Catastrophe Bond Market Report (www.artemis.bm).
Note: Years ending June 30.

**Figure 3.4.3. Temperature Shocks and Stock Price Predictability: Food and Beverages Sector**




Sources: Datastream; Peng and Feng (forthcoming); and IMF staff calculations.
Note: One-year-ahead food and beverages sector returns are regressed on annual average temperature (deviation from the country average, degrees Celsius). Sample is restricted to countries with an average annual temperature above 15°C.

the global financial crisis, as well as new regulations that recognize the relief of capital through Cat bond issuance, have potentially contributed to the growth of the Cat bond market. Cat bonds have become an increasingly popular tool for private insurance and reinsurance companies in Europe, Japan, and the United States to transfer away their risk exposures to earthquakes, storms, and hurricanes.

As discussed in the chapter, low-income developing countries and small states are especially vulnerable to catastrophic risks. Mexico, in 2006, was the first country to issue Cat bonds; since then, several low-income developing countries have issued Cat bonds covering hurricanes, earthquakes, and other extreme events. The World Bank issued its first-ever Cat bond in 2014 to provide reinsurance to the Caribbean Catastrophe Risk Insurance Facility, a risk-pooling facility designed to limit the financial impact on 16 Caribbean country governments after possible earthquakes and hurricanes (see also Box 3.3). A similar arrangement—the Extreme Climate Facility—is being developed by the African Risk Capacity (see Box 3.3) to allow for the issuance of Cat bonds to alleviate the impact of extreme weather conditions on member African countries.

### *Do Financial Markets Correctly Price Weather-Related Risks?*

The optimal level of insurance against abnormal weather conditions requires accurate assessments of weather-related risk. There is growing evidence that investors in financial markets do not fully understand, at least immediately, the impact of weather shocks on output and productivity. Hong, Li, and Xu (2016) show that the stock indices of the food industry in the United States and in a few other advanced economies respond to changes in drought indices only with a delay. This finding suggests that markets do not incorporate weather information into prices until several months later, perhaps after the losses incurred are reflected in food companies' annual reports. The

### Box 3.4 *(continued)*

initial underreaction to weather shocks may indicate the possibility of underinsurance, even in the presence of easily accessible insurance products.

The analysis in this box examines the response of investors to temperature variations. As demonstrated in the chapter, an increase in temperature in countries with relatively hot climates has a negative effect on output and productivity, especially in certain sectors of the economy. Using data on equity market returns across 17 sectors in 42 countries and annual fluctuation in temperature, the analysis studies whether financial markets correctly price in these adverse temperature effects. If markets are efficient, fluctuations in temperature should have no predictive power on equity returns because stock prices instantaneously reflect the impact of temperature shocks on firm performance. Empirical analysis suggests that this is not the case. Higher temperature can predict negative future (12-month-ahead) stock returns for the food and beverages sector, suggesting that investors respond to temperature shocks with a delay (Figure 3.4.3).[3] These effects are particularly strong for countries at lower latitudes (for example, those with average annual temperature greater than 15°C) and are insignificant for industrial, technology, utilities, and oil and gas sectors. The predictability of stock returns in the food and beverages sector suggests that the impact of temperature shocks on productivity is not well priced by investors until several months later (possibly only after earnings reports reflect these losses), consistent with the hypothesis of underreaction to these shocks.

[3]The one-year-ahead equity return for the food and beverages sector is regressed on current-year average temperature in the country, controlling for country-year fixed effects as well as the dividend yield of the sector. Equity returns are normalized by the standard deviation of yearly sector returns in each country. Results are robust to controlling for one-year-ahead average temperature in the country. Similar effects are found for retail and personal goods sectors (Peng and Feng forthcoming).

## Box 3.5. Historical Climate, Economic Development, and World Income Distribution

As argued in the chapter, climate change may have very long-lived effects on economic performance, although the exact magnitudes depend on many factors, including economic agents' adaptability and the ability of the economy to structurally adjust. Empirically, it is very difficult to disentangle whether weather shocks have permanent level or growth effects on output based on recent data (since 1950); if they reflect permanent growth rather than level effects, then the consequences may be many times larger than the initial effects, but this impact would manifest only over a very long time.

This box reviews a relatively new and growing literature that attempts to directly assess whether historical climate can have a large and permanent effect on economic performance. Enabled by the rising availability and granularity of historical data, the literature examines the relationship between modern outcomes and historical climate, starting from the hypothesis that historical events (potentially in the very deep past) interact with the physical environment and can have permanent effects on economic development and performance.[1]

Leveraging the exogeneity of historical climate, Bluedorn, Valentinyi, and Vlassopoulos (2009) estimate the reduced-form relationship between a country's temperature over different periods from 1730 to 2000 and its modern income per capita, uncovering some striking patterns. A simple bivariate regression confirms the strong negative correlation between income in 2000 and the average temperature during 1970–99 (Table 3.5.1, regression 1). However, after controlling for historical average temperature in the 18th and 19th centuries, a time-varying and nonmonotonic effect of temperature on current country incomes is revealed, with 18th century temperature exhibiting a positive and large effect while 19th century temperature shows an even larger negative effect (Table 3.5.1, regression 2). Interestingly, once historical climate is introduced, 20th century temperature no longer shows a strong, negative association with current income, suggesting that it may be serving as a proxy for the combined effects of historical climate, rather than capturing a direct impact of the current temperature level in the simple regression.

What might account for the estimated nonmonotonic relationship between temperature and income? Bluedorn, Valentinyi, and Vlassopoulos (2009) postulate that it could reflect interactions between temperature and historical events across centuries. For example, the large negative effect of 19th century temperature on current incomes could be linked to a slower diffusion of technologies from the United Kingdom and Europe, which were at the technological frontier then, and generally at the cooler end of the global temperature distribution. If the technologies these countries developed were more suitable for

The author of this box is John C. Bluedorn.

[1]Nunn (2014) provides an excellent exposition of the idea, which is central to recent empirical research on historical development.

### Table 3.5.1. Effect of Historical Climate on Current Real Output

| | Mean Temperature | | Mean Temperature | | | | |
|---|---|---|---|---|---|---|---|
| | 1970–99 | $R^2$ | 1970–99 | 1830–59 | 1730–59 | $R^2$ | N |
| Sample | (1) | | | (2) | | | |
| Full Sample | –0.061** | 0.16 | 0.177 | –2.100* | 1.864** | 0.27 | 167 |
| | (0.011) | | (0.073) | (0.315) | (0.301) | | |
| Visual Outliers Excluded | –0.058** | 0.15 | 0.179 | –2.591** | 2.353** | 0.24 | 162 |
| | (0.011) | | (0.180) | (0.484) | (0.446) | | |
| Sub-Saharan Africa Excluded | –0.026* | 0.04 | 0.126** | –1.660** | 1.505** | 0.16 | 128 |
| | (0.011) | | (0.047) | (0.262) | (0.257) | | |
| Neo-Europes Excluded | –0.057** | 0.14 | 0.169* | –2.652** | 2.423** | 0.25 | 163 |
| | (0.011) | | (0.068) | (0.461) | (0.453) | | |

Source: IMF staff calculations.
Note: Dependent variable is log real GDP per capita in 2000, purchasing power parity adjusted. Robust standard errors appear underneath coefficient estimates in parentheses. Visual outliers are Australia, Bolivia, Eritrea, Ethiopia, and the United States. Neo-Europes = Australia, Canada, New Zealand, and the United States. N = number of countries in the cross-sectional sample. See Bluedorn, Valentinyi, and Vlassopoulos (2009).
* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

## Box 3.5 *(continued)*

cooler climates, the negative correlation between 19th century temperature and current incomes could arise from historically slower technological adoption. Alternative interpretations are possible, such as a negative relationship between historical temperature and the quality of institutions adopted in European colonies in the 19th century (see Acemoglu, Johnson, and Robinson 2001).

The positive effect of 18th century temperature on current incomes is more difficult to interpret. Fenske and Kala (2015) provide a compelling hypothesis for Africa, where the level of a region's participation in the 18th century slave trade may have been shaped by climate conditions. Given the adverse effects higher temperatures have on agricultural productivity and mortality in hotter climates, as documented in the chapter, Fenske and Kala (2015) argue that a region's slave supply costs fell when temperatures were lower, leading to greater slave exports, which, in turn, is strongly associated with poorer incomes today (Nunn 2008).

Climate may have also affected the timing of transitions along the economic development path. Ashraf and Michalopoulos (2015) argue that climatic volatility thousands of years ago affected the willingness of human societies to experiment with farming as a solution to unpredictable foraged food sources. They find a statistically significant and robust hump-shaped relationship between the standard deviation of historically experienced temperatures in a region and the timing of the adoption of agriculture—areas with more volatile climate (assuming that the volatility was not so large as to precipitate social collapse) tended to make the transition to farming earlier, partly accounting for differences in income today.

Andersen, Dalgaard, and Selaya (2016) consider another characteristic of climate—the historical intensity of ultraviolet radiation (UV-R) experienced in a location. They argue that higher UV-R intensity affects mortality and thereby the willingness to engage in human capital investment. This, in turn, affected the time at which a society experienced the fertility transition (the decline of fertility associated with a rise in incomes; see Galor 2011). A slower fertility transition is associated with lower incomes at the country level today. In a mix of empirical and theoretical work, they find a positive relationship between UV-R and the transition timing, consistent with the link they hypothesize.

As shown by these studies, historical climate can have very long-lived effects on economic development through its interaction with historical events.

## Box 3.6. Mitigating Climate Change

Although the primary focus of the chapter is the macroeconomic consequences of climate change and potential for adaptation in low-income countries, only a concerted global effort to cut greenhouse gas emissions and slow the pace of rising temperatures can limit the long-term threat of climate change. This box reviews recent developments in climate change mitigation efforts and describes the crucial role fiscal policies could play in abating climate change and mobilizing financing for mitigation and adaptation, drawing on recent IMF work.[1]

### *The 2015 Paris Agreement*

In December 2015 parties to the United Nations Framework Convention on Climate Change agreed to the aspirational goal of containing global warming to 2°C above preindustrial levels (and to strive to keep warming to 1.5°C), thus laying the foundation for meaningful progress on addressing climate change at the global level. Mitigation pledges were submitted by 195 countries in their Nationally Determined Contributions (NDCs) under the 2015 Paris Agreement, with many pledges aiming to reduce emissions in 2030 by about 30 percent relative to emissions in some baseline year. Starting in 2018 parties are required to report progress on meeting mitigation pledges every two years, and to submit updated (and preferably more stringent) NDCs every five years. The pledges are not legally binding, however, and there is some risk of backtracking, given that the United States is withdrawing from the agreement.

The Paris Agreement strengthens previous commitments by developed economies to jointly mobilize $100 billion a year by 2020 for adaptation and mitigation in developing economies. By 2025 the parties to the agreement are expected to set a new collective quantifiable goal from a floor of $100 billion a year—many developing countries' more ambitious mitigation commitments are contingent on receiving external finance.

### *The Role of Fiscal Instruments in Climate Change Mitigation*

It is widely accepted that carbon pricing—charging for the carbon emissions from fossil fuels—should be front and center in implementing mitigation pledges in both advanced and emerging market economies. Charging for carbon emissions increases the price of energy from fossil fuels (especially carbon-intensive coal) and provides incentives for mitigation, including replacing coal with less-carbon-intensive natural gas as well as carbon-free renewables and nuclear energy. In addition, carbon pricing stimulates improvements in energy efficiency, reduces the demand for energy-consuming products, and promotes innovation (for example, in the areas of carbon capture and storage technologies).

Carbon pricing can be implemented through carbon taxes or emissions trading systems. Carbon taxes are imposed on fossil fuels in proportion to the fuel's carbon content. Implementing carbon taxes is a straightforward extension of already-established taxes on fossil fuels and can be easily administered in most countries. Emissions trading systems put an upper limit on emissions by issuing emissions allowances. Firms are required to obtain allowances to cover their emissions, and the trading of allowances among emitters establishes the price of emissions. Emissions trading systems are typically implemented downstream on power generators and large industrial firms and need to be accompanied by other measures to cover smaller sources of emissions, for example, from vehicles and buildings.

### *China*

China, the largest emitter of carbon dioxide ($CO_2$), accounted for 29 percent of global emissions in 2013. According to IMF estimates, phasing in an emissions tax of $70 a ton of $CO_2$ in China by 2030 would raise the prices of coal, electricity, and road fuels by about 70 percent, 15 percent, and 7 percent, respectively, and reduce 2030 emissions by about 30 percent, relative to the no-tax scenario (Figure 3.6.1, panel 1). An alternative with almost equal effectiveness would simply involve the addition of a carbon charge to existing taxes on domestic and imported coal. An emissions trading system would be about 40 percent less effective than a carbon tax. Given that China is moving ahead with an emissions trading system in any case, combining it with an up-front coal charge (perhaps with rebates for entities covered by the emissions trading system) would ensure more comprehensive pricing. Despite being less effective than carbon taxes, an emissions trading

The author of this box is Ian Parry.

[1]See, for example, Chapter 4 of the October 2008 *World Economic Outlook*; Parry, de Mooij, and Keen (2012); Parry, Morris, and Williams (2015); Farid and others (2016); and Parry and others (2016).

## Box 3.6 *(continued)*

system is nonetheless much more effective than a variety of other mitigation policies, such as incentives for energy efficiency or renewables and taxes on road fuels and electricity.

Coal and carbon taxes, if phased in between 2017 and 2030, would also substantially reduce air pollution in China and save almost 4 million lives. The emissions trading system is about half as effective in this regard, with about 2 million lives saved (Figure 3.6.1, panel 2). The carbon tax would also raise substantial revenues of about 3 percent of GDP in 2030. In other countries, typically less coal intensive than China, reduced $CO_2$ emissions, lower domestic air pollution, and increased fiscal revenues would be less striking (in proportionate terms). However, the key policy lessons would remain unchanged: carbon taxes are the most effective mitigation instrument. Furthermore, carbon taxes—because of their domestic environmental and fiscal benefits—can be (up to a point) in countries' own interests.

### *Easing the Transition to Carbon Pricing*

At the domestic level, undesirable effects of carbon pricing need to be mitigated to ease its adoption. Some carbon-intensive industries might become uneconomical as a result of carbon pricing, and their employees will require help with retraining and reallocation to other sectors. Using a fraction of revenues from carbon pricing to enhance social safety nets and to offer other forms of fiscal relief to low-income households would smooth the transition as well.[2]

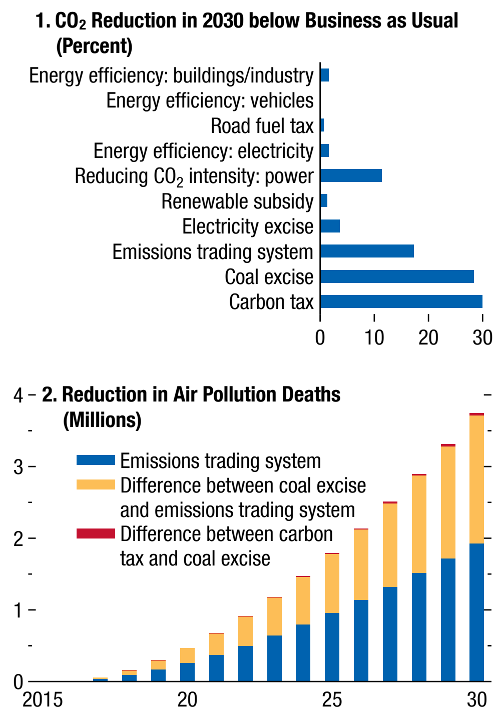
At the international level, policymakers might consider imposing carbon price floor requirements for large emitters to reinforce the Paris Agreement and provide some reassurance against losses in competitiveness. Countries could elect to set carbon prices above the floor for fiscal or domestic environmental reasons, thus becoming environmental leaders—a prototype for this type of arrangement is the recently announced requirement that Canadian provinces phase in a price of Can$50 a ton of $CO_2$ by 2022.

### *Progress on Climate Mitigation*

Carbon pricing mechanisms have proliferated—about 40 national governments and more than 20 subnational governments have implemented, or are implementing, some form of carbon pricing. Much more remains to be done, however. Only 12 percent of global greenhouse gases are currently priced (although China's emissions trading system will double this figure). Current prices are also too low. $CO_2$ prices for emissions trading systems are less than $15 a ton of $CO_2$, and carbon taxes are mostly less than $25 a ton, with the notable exceptions of Canada and the Scandinavian countries (World Bank, Ecofys, and Vivid Economics 2016). In contrast, average global prices of about $40–$80 a ton by 2020 would be consistent with limiting projected warming to 2°C (Stern and Stiglitz 2017). This shortfall in appropriate pricing could result in large-scale future climate change and underscores the pressing need for adaptation investment.

[2]For example, Parry and others (2016) and Parry, Mylonas, and Vernon (2017) show that, at least initially, this assistance will require about 10 percent or less of the carbon pricing revenues.

**Figure 3.6.1. Effectiveness of Mitigation Policies in China**




Source: Parry and others (2016).
Note: The price is $70 per ton of $CO_2$ for emissions trading system, coal excise, and carbon tax. $CO_2$ = carbon dioxide.

## Box 3.6 *(continued)*

### *The Role of Fiscal Instruments in Climate Finance*

Financing needs for climate adaptation investment in developing economies have been estimated at upward of $80 billion a year until 2050 (Margulis and Narain 2010), which greatly exceeds current finance from advanced economies. The volume of public and private climate finance mobilized by developed economies for developing economies reached $62 billion in 2014 (of which only 15 percent was for adaptation), compared with the $100 billion goal set in 2009 and reiterated in the Paris Agreement (OECD 2015b). On equity grounds, there is some appeal in linking climate finance donations from advanced economies to their contribution to climate change. If the Group of Twenty economies, excluding the five members with lowest per capita income, donated $5 for each ton of projected $CO_2$ emissions, an additional $70 billion for climate finance could be raised in 2020.[3] Funding these contributions from national budgets would provide a more robust source of finance than apportioning a fraction of revenues from future (and highly uncertain) carbon pricing. The onus, however, is on recipient countries to carefully cost and prioritize adaption projects and to attract finance through resilient macro-fiscal frameworks and strong governance.

[3]IMF staff calculations, assuming emissions are reduced linearly over time to meet countries' Paris Agreement mitigation pledges. Carbon charges for international aviation and maritime fuels are another promising source of climate finance—a $30 a ton $CO_2$ charge on these fuels could raise revenues of $25 billion in 2020, even with full compensation for developing economies (Farid and others 2016).

## Annex 3.1. Data Sources and Country Groupings

### Data Sources

The primary data sources for this chapter are the IMF World Economic Outlook database and the World Bank World Development Indicators database. The main data sources on temperature and precipitation are the University of East Anglia's Climate Research Unit (historical data, 1901–2015) and National Aeronautics and Space Administration (NASA) Earth Exchange Global Daily Downscaled Projections data set (forecast, present–2100). All data sources used in the chapter's analysis are listed in Annex Table 3.1.1.

For real GDP per capita, investment, and imports, the sources are listed in the order in which they are spliced (which entails extending the level of a primary series using the growth rate of a secondary series).

### Data Definitions

The main historical temperature and precipitation series used in the chapter's analysis are constructed by aggregating grid cell data at 0.5 × 0.5 degree resolution (approximately 56 kilometers × 56 kilometers at the equator) to the level of individual countries or subnational regions at annual or monthly frequency.

### Annex Table 3.1.1. Data Sources

| Indicator | Source |
|---|---|
| Temperature, Historical | Intergovernmental Panel on Climate Change (IPCC) Coupled Model Intercomparison Project Phase Five AR5 Atlas subset; Marcott and others (2013); Matsuura and Willmott (2007); National Aeronautics and Space Administration (NASA) Goddard Institute for Space Studies (GISS); Royal Netherlands Meteorological Institute (KNMI) Climate Change Atlas; Shakun and others (2012) |
| Temperature and Precipitation, Forecast (Grid level) | NASA Earth Exchange Global Daily Downscaled Projections data set (NEX-GDDP) |
| Temperature and Precipitation, Historical (Grid level) | University of East Anglia, Climate Research Unit (CRU TS v.3.24); University of Delaware (UDEL v.4.01) |
| Population 2010, 1990, 1950 (Grid level) | Center for International Earth Science Information Network (CIESIN v.3 and v.4); History Database of the Global Environment (HYDE v3.2); Klein and others (2016) |
| Population 2015 and Projected Population 2100 | United Nations World Population Prospects database, 2015 Revision |
| $CO_2$ Emissions | Carbon Dioxide Information Analysis Center |
| Temperature Forcings | Carbon Dioxide Information Analysis Center; NASA GISS; Roston and Migliozzi (2015) |
| Natural Disasters | Centre for Research on the Epidemiology of Disasters, International Disaster Database (EM-DAT) |
| Global Ocean Temperature | NOAA (2017a) |
| Migration | Global Bilateral Migration Database, World Bank Group; Özden and others (2011) |
| Real GDP per Capita | IMF, World Economic Outlook database; World Bank, World Development Indicators database |
| Subnational GDP per Capita | Gennaioli and others (2014) |
| Crop Production Index | Food and Agriculture Organization; World Bank, World Development Indicators database |
| Sectoral Real Value Added (Agriculture, manufacturing, services) | World Bank, World Development Indicators database |
| Sectoral Labor Productivity | Groningen Growth and Development Centre 10-Sector Database; Timmer, de Vries, and de Vries (2015) |
| Real Gross Capital Formation | IMF, World Economic Outlook database; World Bank, World Development Indicators database |
| Real Imports of Goods and Services | IMF, World Economic Outlook database; World Bank, World Development Indicators database |
| Infant Mortality Rate | World Bank, World Development Indicators database |
| Human Development Index | United Nations Development Programme, Human Development Report database |
| Consumer Price Index | IMF, World Economic Outlook database |
| Debt-to-GDP Ratio | IMF, Historical Public Debt database |
| Reserves Minus Gold | Lane and Milesi-Ferretti (2017); External Wealth of Nations database, updated to 2015 |
| Net Official Development Assistance and Official Aid Received | World Bank, World Development Indicators database |
| Personal Remittances Received | World Bank, World Development Indicators database |
| Exchange Rate Regime Indicator | Reinhart and Rogoff (2004); Ilzetzki, Reinhart, and Rogoff (2008), updated to 2015 |
| Adaptation Readiness and Capacity | Notre Dame Global Adaptation Initiative; Chen and others (2015) |
| Domestic Financial Sector Liberalization Index | Abiad, Detragiache, and Tressel (2008) |
| Quinn-Toyoda Capital Control Index | Quinn (1997); Quinn and Toyoda (2008) |
| Human Capital Index | Penn World Tables 9.0 |
| Paved Roads Kilometers per Capita | Calderón, Moral-Benito, and Servén (2015); World Bank, World Development Indicators database; Chapter 3 of the October 2014 *World Economic Outlook* |
| Revised Combined Polity Score (Polity2) | Polity IV Project |
| Gini Coefficient | Standardized World Income Inequality Database |

Source: IMF staff compilation.

The estimates are weighted by grid-level population (exploring three alternatives: population distribution as of 1950, 1990, and 2010) to account for differences in population density (Dell, Jones, and Olken 2014).

Temperature and precipitation projections are from two of the four scenarios, called Representative Concentration Pathways (RCP), constructed by the Intergovernmental Panel on Climate Change. The RCP 4.5 scenario assumes increased attention to the environment with slow growth of carbon dioxide ($CO_2$) emissions until 2050 and a decline of emissions thereafter, resulting in a mean temperature increase of 1.8°C by 2081–2100 relative to 1986–2005 (in a range of 1.1°C–2.6°C, with a greater than 50 percent chance of an increase exceeding 2°C by 2100). In the RCP 8.5 scenario, $CO_2$ emissions continue to grow unconstrained, and the average 2081–2100 temperature is expected to be 3.7°C higher (in a range of 2.6°C–4.8°C) relative to 1986–2005. The chapter uses the average of the maximum and minimum daily temperature and total daily precipitation data from 2005 and projections for 2050 and 2100 at the 0.25 x 0.25 degree resolution, averaged across the 21 models of the Coupled Model Intercomparison Project Phase 5 for each scenario. Annual temperatures are computed as the average of the daily temperature; annual precipitation is the sum of daily precipitation.

## Country Groupings

### Annex Table 3.1.2. Country and Territory Groups

| | |
|---|---|
| Advanced Economies | Australia, Austria, Belgium, Canada, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong SAR,* Iceland, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Macao SAR,* Malta, Netherlands, New Zealand, Norway, Portugal, Puerto Rico, San Marino,* Singapore, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Taiwan Province of China,* United Kingdom, United States |
| Emerging Market Economies | Albania, Algeria, Angola, Antigua and Barbuda, Argentina, Armenia, Azerbaijan, The Bahamas,* Bahrain, Barbados, Belarus, Belize, Bosnia and Herzegovina, Botswana, Brazil, Brunei Darussalam, Bulgaria, Cabo Verde, Chile, China, Colombia, Costa Rica, Croatia, Dominica, Dominican Republic, Ecuador, Egypt, El Salvador, Equatorial Guinea, Fiji, Gabon, Georgia, Grenada, Guatemala, Guyana, Hungary, India, Indonesia, Iran, Iraq, Jamaica, Jordan, Kazakhstan, Kosovo,* Kuwait, Lebanon, Libya, Macedonia FYR, Malaysia, Maldives,* Marshall Islands,* Mauritius, Mexico, Micronesia,* Montenegro, Morocco, Namibia, Nauru,* Oman, Pakistan, Palau,* Panama, Paraguay, Peru, Philippines, Poland, Qatar, Romania, Russia, Samoa, Saudi Arabia, Serbia, Seychelles,* South Africa, Sri Lanka, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname, Swaziland, Syria, Thailand, Timor-Leste, Tonga, Trinidad and Tobago, Tunisia, Turkey, Turkmenistan, Tuvalu,* Ukraine, United Arab Emirates, Uruguay, Vanuatu, Venezuela |
| Low-Income Developing Countries | Afghanistan, Bangladesh, Benin, Bhutan, Bolivia, Burkina Faso, Burundi, Cambodia, Cameroon, Central African Republic, Chad, Comoros, Democratic Republic of the Congo, Republic of Congo, Côte d'Ivoire, Djibouti, Eritrea, Ethiopia, The Gambia, Ghana, Guinea, Guinea-Bissau, Haiti, Honduras, Kenya, Kiribati,* Kyrgyz Republic, Lao P.D.R., Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Moldova, Mongolia, Mozambique, Myanmar, Nepal, Nicaragua, Niger, Nigeria, Papua New Guinea, Rwanda, Senegal, Sierra Leone, Solomon Islands, Somalia,* South Sudan, Sudan, São Tomé and Príncipe, Tajikistan, Tanzania, Togo, Uganda, Uzbekistan, Vietnam, Yemen, Zambia, Zimbabwe |
| Countries and Territories with Average Annual Temperature above 15°C | Algeria, American Samoa, Angola, Anguilla, Antigua and Barbuda, Argentina, Australia, Bahrain, Bangladesh, Barbados, Belize, Benin, Bhutan, Botswana, Brazil, Brunei Darussalam, Burkina Faso, Burundi, Cabo Verde, Cambodia, Cameroon, Central African Republic, Chad, Colombia, Comoros, Democratic Republic of the Congo, Republic of Congo, Costa Rica, Cuba, Curaçao,* Cyprus, Côte d'Ivoire, Djibouti, Dominica, Dominican Republic, Ecuador, Egypt, El Salvador, Equatorial Guinea, Eritrea, Ethiopia, Fiji, Gabon, The Gambia, Ghana, Grenada, Guadeloupe,* Guatemala, French Guiana,* Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, India, Indonesia, Iraq, Israel, Jamaica, Jordan, Kenya, Kuwait, Lao P.D.R., Lebanon, Liberia, Libya, Madagascar, Malawi, Malaysia, Mali, Malta, Martinique,* Mauritania, Mauritius, Mexico, Montserrat, Morocco, Mozambique, Myanmar, Namibia, Nepal, New Caledonia, Nicaragua, Niger, Nigeria, Oman, Pakistan, Panama, Papua New Guinea, Paraguay, Philippines, Puerto Rico, Qatar, Reunion,* Rwanda, Samoa, Saudi Arabia, Senegal, Sierra Leone, Singapore, Solomon Islands, Somalia, South Africa, South Sudan, Sri Lanka, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Sudan, Suriname, Swaziland, Syria, São Tomé and Príncipe, Tanzania, Thailand, Timor-Leste, Togo, Tonga, Trinidad and Tobago, Tunisia, Turkmenistan, Turks and Caicos,* Uganda, United Arab Emirates, Uruguay, Vanuatu, Venezuela, Vietnam, Virgin Islands (US), West Bank and Gaza, Yemen, Zambia, Zimbabwe |
| Countries with Province-Level Data | Albania, Argentina, Australia, Austria, Bangladesh, Belgium, Benin, Bolivia, Bosnia and Herzegovina, Brazil, Bulgaria, Canada, Chile, China, Colombia, Croatia, Czech Republic, Denmark, Ecuador, Egypt, El Salvador, Estonia, Finland, France, Germany, Greece, Guatemala, Honduras, Hungary, India, Indonesia, Iran, Ireland, Italy, Japan, Jordan, Kazakhstan, Kenya, Korea, Kyrgyz Republic, Latvia, Lesotho, Lithuania, Macedonia FYR, Malaysia, Mexico, Mongolia, Morocco, Mozambique, Nepal, Netherlands, Nicaragua, Nigeria, Norway, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Portugal, Romania, Russia, Serbia, Slovak Republic, Slovenia, South Africa, Spain, Sri Lanka, Sweden, Switzerland, Tanzania, Thailand, Turkey, Ukraine, United Arab Emirates, United Kingdom, United States, Uruguay, Uzbekistan, Venezuela, Vietnam |
| Countries with Sectoral-Level Data | Argentina, Bolivia, Botswana, Brazil, Chile, China, Colombia, Costa Rica, Denmark, Egypt, Ethiopia, France, Germany, Ghana, Hong Kong SAR,* India, Indonesia, Italy, Japan, Kenya, Korea, Malawi, Malaysia, Mauritius, Mexico, Morocco, Netherlands, Nigeria, Peru, Philippines, Senegal, Singapore, South Africa, Spain, Sweden, Taiwan Province of China,* Tanzania, Thailand, United Kingdom, United States, Venezuela, Zambia |

Source: IMF staff compilation.
* Not included in the main regression analysis.

## Annex 3.2. Weather Shocks and Natural Disasters

Although there is a clear link between weather conditions and the occurrence of extreme weather events, the relationship between weather shocks and natural disasters—extreme events associated with significant economic damage and loss of life—has not been studied in detail. The analysis in this section examines how weather conditions influence the frequency of various types of weather-related natural disasters.

A logit panel specification with country fixed effects is used to estimate the effect of the weather variables $c_{i,t}$ (temperature and precipitation) on the probability of a natural disaster taking place in country $i$ in a given month $t$.

$$\Pr\left(\text{disaster}_{i,t} = 1\right) = \Phi\,(\beta_1 c_{i,t} + \beta_2 c_{i,t}^2 + \gamma_1 Dev_{i,t}^T + \gamma_2 Dev_{i,t}^P + \gamma_3 Dev_{i,t}^{Ocean} + \delta_1 \ln(GDP)_{i,t-12} + \delta_2 \ln(Pop)_{i,t-12} + \mu_i + \varepsilon_{i,t}), \quad (3.1)$$

in which the nonlinear function $\Phi(\cdot) = \exp(\cdot)/(1+\exp(\cdot))$ captures the effect of the regressors on the probability of a natural disaster. Country fixed effects ($\mu_i$) capture time-invariant country characteristics, such as the size and geographic location of the country and its topology, that may influence the exposure and vulnerability of countries to different types of disasters.[51] The specification controls for the level of real GDP per capita and population, as well as for global weather conditions—specifically the deviation in global ocean surface temperature from the 1901–2000 average—that might affect the incidence of disasters. The sample includes monthly data during 1990–2014 for 228 countries and territories on more than 8,000 weather-related disasters. Equation (3.1) is estimated separately for each type of natural disaster, improving on Thomas and Lopez (2015), who perform a similar exercise on annual data, but group together all disasters.

Annex Table 3.2.1 presents the estimation results for each disaster type. Weather conditions have a very strong impact on the occurrence of disasters. More precipitation reduces the occurrence of disasters caused by droughts, wildfires, and heat waves, but increases the probability of disasters triggered by floods, landslides, cold waves, tropical cyclones, and other storms. The effects of temperature are also as expected, with higher temperatures resulting in more disasters caused by droughts, wildfires, heat waves, tropical cyclones, and other storms, but reducing the probability of cold waves. The results also show that precipitation has nonlinear effects on the probability of most disasters.

Interestingly, the estimations suggest that the weather conditions over the preceding 12 months have a significant effect on the occurrence of most types of disasters. Weather anomalies during the previous year, as captured in the cumulative deviation of temperature and precipitation from its monthly 10-year average, are important determinants of all types of disasters, except those caused by landslides or tropical cyclones, which are entirely a function of short-term weather patterns. Epidemics, however, are not affected by short-term weather conditions, but respond to temperature deviations in the year before the event is triggered.

To quantify the likely impact of climate change, the analysis combines the estimation results and projected temperature and precipitation in 2050 and 2100 under Representative Concentration Pathway 8.5 to predict the likelihood of each type of natural disaster. These predicted probabilities in 2050 and 2100 are compared with the predicted incidence of natural disasters over 2010–14 in Figure 3.6.

## Annex 3.3. Empirical Analysis of the Macroeconomic Effects of Weather Shocks and the Role of Policies

This annex provides further details on the empirical model used to quantify short- and medium-term effects of weather on economic activity to identify the channels through which these effects occur, investigate evidence or lack thereof of adaptation over time, and study the role of various policy measures in attenuating the effects of temperature shocks.

The baseline analysis uses Jordà's (2005) local projection method to trace out the impulse response functions of various outcomes to weather shocks based on the following equation:

[51] Given the large time dimension of the sample (each country has about 300 observations), a panel logit specification is preferred to conditional logit models because it allows for the estimation of predicted and marginal effects accounting for country fixed effects. The results are robust to the use of conditional logit regression models developed by Chamberlain (1980) to avoid the incidental parameters problem that may arise from estimating fixed effects with a small time sample.

## Annex Table 3.2.1. Effect of Weather Shocks on Natural Disasters, 1990–2014

| Dependent Variable | Drought (1) | Epidemic (2) | Flood (3) | Landslide (4) | Wildfire (5) | Cold Wave (6) | Heat Wave (7) | Tropical Cyclone (8) | Other Storms (9) |
|---|---|---|---|---|---|---|---|---|---|
| Precipitation | –0.002*** | 0.000 | 0.022*** | 0.018*** | –0.023*** | 0.014*** | –0.009*** | 0.012*** | 0.012*** |
| | (0.001) | (0.001) | (0.002) | (0.003) | (0.004) | (0.005) | (0.003) | (0.003) | (0.004) |
| Precipitation$^2$ | 0.000*** | 0.000 | –0.000*** | –0.000*** | 0.000*** | –0.000** | 0.000*** | –0.000* | –0.000** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Temperature | 0.024* | 0.009 | 0.051*** | –0.010 | 0.109*** | –0.286*** | 0.282* | 0.168*** | –0.063*** |
| | (0.013) | (0.012) | (0.020) | (0.025) | (0.012) | (0.049) | (0.144) | (0.039) | (0.014) |
| Temperature$^2$ | –0.000 | 0.000 | –0.001 | –0.000 | 0.001 | –0.007*** | 0.005 | –0.001 | 0.000 |
| | (0.000) | (0.000) | (0.001) | (0.001) | (0.001) | (0.002) | (0.005) | (0.001) | (0.001) |
| Precipitation Deviations (12 months) | –0.005*** | –0.000 | 0.001*** | 0.001 | –0.001* | –0.001* | –0.003*** | 0.000 | 0.000 |
| | (0.001) | (0.000) | (0.000) | (0.000) | (0.001) | (0.000) | (0.001) | (0.000) | (0.000) |
| Temperature Deviations (12 months) | 0.037* | 0.024** | –0.008 | –0.013 | 0.022 | –0.042*** | 0.026 | 0.003 | 0.033*** |
| | (0.019) | (0.012) | (0.006) | (0.013) | (0.020) | (0.015) | (0.019) | (0.009) | (0.007) |
| Global Ocean Temperature Deviations | –0.127 | 1.014** | 0.274 | 0.028 | 1.566* | 1.098 | 0.861 | –1.441*** | 0.395 |
| | (1.002) | (0.486) | (0.298) | (0.578) | (0.870) | (0.781) | (1.025) | (0.549) | (0.370) |
| Log GDP per Capita$_{t-12}$ | –0.975* | –0.589** | –0.059 | 0.033 | –1.029 | 2.486*** | 0.045 | –0.076 | –0.303 |
| | (0.500) | (0.267) | (0.158) | (0.383) | (0.711) | (0.627) | (0.382) | (0.302) | (0.279) |
| Log Population$_{t-12}$ | 0.869 | 2.361*** | 2.575*** | 0.650 | 0.821 | –1.026 | 0.273 | 2.617*** | 0.058 |
| | (0.878) | (0.364) | (0.318) | (0.662) | (1.211) | (1.392) | (1.267) | (0.582) | (0.575) |
| Constant | 10.481* | 5.529* | 1.646 | –5.050 | 9.982 | –31.876*** | –9.242** | 0.504 | 3.519 |
| | (6.145) | (3.087) | (1.896) | (4.746) | (8.525) | (7.772) | (4.416) | (3.683) | (3.352) |
| Number of Observations | 29,976 | 35,772 | 43,632 | 19,620 | 18,732 | 17,844 | 12,924 | 20,652 | 33,684 |
| Number of Countries | 101 | 120 | 147 | 66 | 63 | 61 | 44 | 69 | 114 |

Source: IMF staff calculations.
Note: The dependent variable is an indicator that takes the value of 1 if a natural disaster of a particular type is taking place. All specifications control for country fixed effects. Standard errors are clustered at the country level.
* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

$$y_{i,t+h} - y_{i,t-1} = \beta_1^h c_{i,t} + \beta_2^h c_{i,t}^2 + \gamma_1^h c_{i,t-1} + \gamma_2^h c_{i,t-1}^2 + \sum_{j=1}^{h-1} \delta_1^h c_{i,t+h-j} + \sum_{j=1}^{h-1} \delta_2^h c_{i,t+h-j}^2 + \varphi_1^h \Delta y_{i,t-1} + \mu_i^h + \theta_{r,t}^h + \varepsilon_{i,t}^h, \tag{3.2}$$

in which $i$ indexes countries, $t$ indexes years, and $h$ indexes the estimation horizon (from horizon 0, which represents the contemporaneous regression, up to horizon 7). Regressions for each horizon are estimated separately. The dependent variable is the cumulative growth rate of the outcome of interest between horizons $t - 1$ and $t + h$, measured as difference in the natural logarithms ($y_{i,t}$). Following Burke, Hsiang, and Miguel (2015a), the estimated regression has a quadratic specification in the weather variables $c_{i,t}$, which comprise average annual temperature (T) and precipitation (P). The regressions control for one lag of the dependent and weather variables and for forwards of the weather variables, as suggested by Teulings and Zubanov (2014). Country fixed effects ($\mu_i^h$) control for all time-invariant country differences, such as latitude, initial macroeconomic conditions, and average growth rates, while time fixed effects interacted with region dummies ($\theta_{r,t}^h$) control for the common effect of all annual shocks across countries within a region. The analysis also explores an alternative fixed-effects structure proposed by Burke, Hsiang, and Miguel (2015a), which includes time fixed effects ($\tau_i^h$) and country-specific linear and quadratic time trends ($\theta_i^h t + \theta_i^h t^2$) to account for within-country changes over time, such as demographic shifts, instead of the region-year fixed effects ($\theta_{r,t}^h$) of the baseline specification. Standard errors are clustered at the country level. To avoid bias associated with "bad controls" (or overcontrolling), the specification is purposefully parsimonious: many of the determinants of growth, typically included in standard growth regressions (for example, institutional quality, educational achievement, policies, and so forth), may themselves be shaped by weather shocks, as documented below, and are thus not part of the baseline estimation.

Within this estimation framework, the effect of a 1°C increase in temperature on the level of output at horizon $h$ can be obtained by differentiating equation (3.2) with respect to temperature:

$$\frac{\partial(y_{i,t+h} - y_{i,t-1})}{\partial T_{i,t}} = \beta_1^h + 2\beta_2^h T_{i,t}. \tag{3.3}$$

Evaluating equation (3.3) for each horizon separately and using the 2015 annual average temperature $T_{i,2015}$ allows us to obtain the impulse response functions of per capita GDP to a temperature shock for each country. The marginal effect of an increase in precipitation is computed analogously. The threshold temperature at which the effect on the outcome variable switches from positive to negative can be obtained by setting equation (3.3) to zero.

## The Effect of Weather Shocks on Economic Activity

Annex Table 3.3.1 presents the key results for the effect of weather shocks on per capita output, along with numerous robustness checks. Panel A contains the estimated coefficients for the weather variables at horizon 0 (that is, the contemporaneous effects of weather shocks); panel B shows the effect of a 1°C increase in temperature estimated at the median 2015 temperature for advanced economies (median T = 11°C), emerging market economies (median T = 22°C), and low-income developing countries (median T = 25°C) on impact and after seven years. Similarly, panel C shows the effect of a 100 millimeter increase in precipitation estimated at the median 2015 precipitation for advanced economies, emerging market economies, and low-income developing countries on impact and after seven years.

Annex Table 3.3.1 begins by replicating Burke, Hsiang, and Miguel's (2015a) specification and establishes its robustness to using alternative sources of weather data; alternative population weights that are used to aggregate gridded weather data at the country level; alternative sets of fixed effects; and alternative samples, controls, and estimation approaches. Column (1) estimates the specification used in Burke, Hsiang, and Miguel (2015a) and includes country-specific linear and quadratic time trends, University of Delaware weather data, and 1990 population weights in the chapter's substantially larger sample (the chapter expands the sample both geographically and temporally by about 25 percent). Column (2) uses an alternative source of weather data, the University of East Anglia Climate Research Unit instead of the University of Delaware, and obtains similar coefficients on the temperature and precipitation variables.

The choice of population weights used to aggregate gridded weather data to the country level could play an important role given that migration within and across country borders is one of the potential strategies for coping with adverse weather conditions. Given that historical data show an increase in average annual temperatures starting in the 1970s (Figure 3.3), column (3) presents results with 1950 population weights to account for migration responses that could have already taken place.

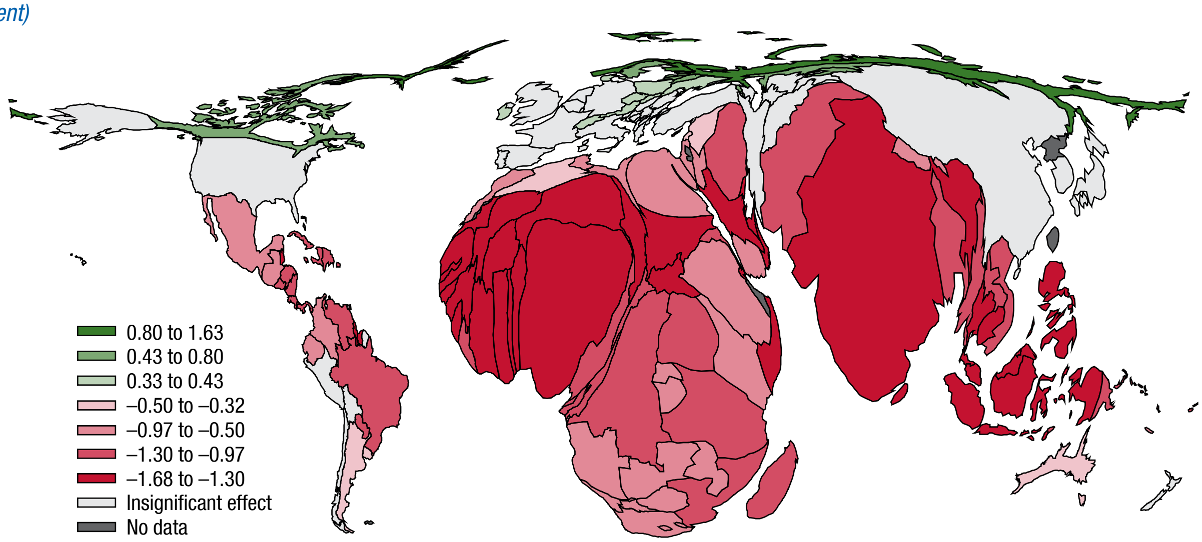
Following Dell, Jones, and Olken (2012), column (4) and column (5) (main specification for the chapter)

## Annex Table 3.3.1. Effect of Weather Shocks on Output

| A. Real Output per Capita Growth | (1) | (2) | (3) | (4) | **(5)** | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| Temperature | 1.399*** | 1.443*** | 1.428*** | 1.343*** | **1.347*** ** | 1.248*** | 1.342*** | 1.249*** | –1.154*** |
| | (0.359) | (0.367) | (0.366) | (0.355) | **(0.357)** | (0.339) | (0.355) | (0.380) | (0.320) |
| Temperature$^2$ | –0.049*** | –0.049*** | –0.048*** | –0.052*** | **–0.051*** ** | –0.044*** | –0.051*** | –0.044*** | |
| | (0.012) | (0.011) | (0.011) | (0.011) | **(0.011)** | (0.010) | (0.011) | (0.011) | |
| Precipitation | 0.056 | 0.103* | 0.163* | 0.045 | **0.110** | 0.127 | 0.119 | 0.082 | 0.005 |
| | (0.097) | (0.061) | (0.085) | (0.058) | **(0.104)** | (0.103) | (0.104) | (0.112) | (0.034) |
| Precipitation$^2$ | –0.002 | –0.002** | –0.004** | –0.001 | **–0.003** | –0.003 | –0.003 | –0.002 | |
| | (0.002) | (0.001) | (0.002) | (0.001) | **(0.002)** | (0.002) | (0.002) | (0.002) | |
| Any Disaster | | | | | | | –0.406** | | |
| | | | | | | | (0.180) | | |
| Threshold Temperature (°C) | 14 | 15 | 15 | 13 | **13** | 14 | 13 | 14 | |
| Weather Source | UDEL | CRU | CRU | CRU | **CRU** | CRU | CRU | CRU | CRU |
| Population Weight | 2010 | 2010 | 1950 | 2010 | **1950** | 1950 | 1950 | 1950 | 1950 |
| Year Fixed Effects | Y | Y | Y | N | **N** | N | N | N | N |
| Region x Year Fixed Effects | N | N | N | Y | **Y** | Y | Y | Y | Y |
| Country Time Trends | Y | Y | Y | N | **N** | N | N | N | N |
| At Least 20 Years of Data | N | N | N | N | **N** | Y | N | N | N |
| Adjusted $R^2$ | 0.15 | 0.15 | 0.15 | 0.14 | **0.14** | 0.14 | 0.14 | 0.11 | 0.09 |
| Number of Countries | 177 | 198 | 189 | 198 | **189** | 184 | 189 | 189 | 127 |
| Number of Observations | 8,147 | 9,114 | 8,815 | 9,114 | **8,815** | 8,756 | 8,815 | 8,917 | 6,135 |
| B. Impact of a 1°C Increase in Temperature on Real Output per Capita Level at Horizon 0 | | | | | | | | | |
| AE (T=11°C) | 0.331* | 0.370* | 0.365* | 0.197 | **0.218** | 0.280 | 0.217 | 0.277 | |
| | (0.196) | (0.196) | (0.195) | (0.191) | **(0.196)** | (0.190) | (0.195) | (0.212) | |
| EM (T=22°C) | –0.736** | –0.703*** | –0.697*** | –0.949*** | **–0.911*** ** | –0.687*** | –0.907*** | –0.695*** | |
| | (0.309) | (0.223) | (0.223) | (0.266) | **(0.264)** | (0.228) | (0.263) | (0.243) | |
| LIDC (T=25°C) | –1.027*** | –0.996*** | –0.987*** | –1.261*** | **–1.219*** ** | –0.951*** | –1.214*** | –0.960*** | |
| | (0.370) | (0.268) | (0.267) | (0.318) | **(0.315)** | (0.270) | (0.313) | (0.287) | |
| Impact of a 1°C Increase in Temperature on Real Output per Capita Level at Horizon 7 | | | | | | | | | |
| AE (T=11°C) | 0.898 | 0.889 | 0.822 | 0.457 | **0.558** | 0.560 | 0.552 | 0.023 | |
| | (0.705) | (0.701) | (0.697) | (0.744) | **(0.752)** | (0.744) | (0.751) | (0.478) | |
| EM (T=22°C) | –1.173 | –0.957 | –1.048 | –1.117* | **–1.115**** | –1.088* | –1.138* | –0.547 | |
| | (0.852) | (0.665) | (0.651) | (0.604) | **(0.591)** | (0.595) | (0.589) | (0.386) | |
| LIDC (T=25°C) | –1.738* | –1.461* | –1.558** | –1.547** | **–1.571** ** | –1.537** | –1.599** | –0.702 | |
| | (1.002) | (0.761) | (0.745) | (0.686) | **(0.667)** | (0.670) | (0.664) | (0.450) | |
| C. Impact of a 100 mm per Year Increase in Precipitation on Real Output per Capita Level at Horizon 0 | | | | | | | | | |
| AE (P=800 mm per year) | 0.018 | 0.066 | 0.101* | 0.028 | **0.066** | 0.076 | 0.073 | 0.050 | |
| | (0.067) | (0.046) | (0.059) | (0.046) | **(0.071)** | (0.070) | (0.071) | (0.077) | |
| EM (P=900 mm per year) | 0.013 | 0.061 | 0.093* | 0.026 | **0.060** | 0.070 | 0.067 | 0.046 | |
| | (0.063) | (0.045) | (0.056) | (0.045) | **(0.067)** | (0.066) | (0.067) | (0.072) | |
| LIDC (P=1,100 mm per year) | 0.004 | 0.052 | 0.078 | 0.022 | **0.049** | 0.057 | 0.056 | 0.038 | |
| | (0.057) | (0.041) | (0.050) | (0.042) | **(0.059)** | (0.058) | (0.059) | (0.064) | |
| Impact of a 100 mm per Year Increase in Precipitation on Real Output per Capita Level at Horizon 7 | | | | | | | | | |
| AE (P=800 mm per year) | 0.304 | 0.171 | 0.179 | –0.173 | **–0.187** | –0.207 | –0.209 | –0.287 | |
| | (0.198) | (0.216) | (0.227) | (0.214) | **(0.223)** | (0.225) | (0.224) | (0.229) | |
| EM (P=900 mm per year) | 0.295 | 0.166 | 0.174 | –0.156 | **–0.166** | –0.187 | –0.188 | –0.267 | |
| | (0.188) | (0.205) | (0.215) | (0.200) | **(0.209)** | (0.210) | (0.210) | (0.216) | |
| LIDC (P=1,100 mm per year) | 0.278 | 0.155 | 0.164 | –0.121 | **–0.126** | –0.148 | –0.146 | –0.227 | |
| | (0.169) | (0.185) | (0.192) | (0.174) | **(0.182)** | (0.182) | (0.183) | (0.191) | |

Source: IMF staff calculations.
Note: The table presents results from estimating equation (3.2), with separate regressions for each horizon. Panel A reports the estimated coefficients on the weather variables for horizon 0. Panels B and C show the marginal impact of a change in temperature and precipitation computed as per equation (3.3) at the median temperature (T) and median precipitation (P) of advanced economies (AE), emerging markets (EM), and low-income developing countries (LIDC) contemporaneously (horizon 0) and cumulatively seven years after the shock. The specifications in columns (1)–(8) control for country fixed effects; lags and forwards of temperature, precipitation, and their squared terms; and lag of growth. Column (8) shows results from estimating an autoregressive distributed lag model with seven lags of the weather variables and their squared terms. Column (9) reports the coefficients on temperature and precipitation from a linear specification estimated on a sample of countries with average temperature above 15°C, also including controls for country fixed effects and lag of growth. In all specifications, standard errors are clustered at the country level. CRU = University of East Anglia, Climate Research Unit; mm = millimeter; UDEL = University of Delaware.
* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

**Annex Figure 3.3.1. Effect of Temperature Increase on Real per Capita Output across the Globe, with Countries Rescaled in Proportion to Their Projected Population as of 2100**
*(Percent)*




Sources: Natural Earth; ScapeToad; United Nations World Population Prospects database: the 2015 revision; and IMF staff calculations.
Note: The map depicts the contemporaneous effect of a 1°C increase in temperature on per capita output computed as per equation (3.3) using recent 10-year average country-level temperature together with estimated coefficients in Annex Table 3.3.1, column (5). Each country is rescaled in proportion to the projected population as of 2100. Using projected population as of 2100, 76 percent of world population will live in countries that experience a negative impact from 1°C increase. Gray areas indicate the estimated impact is not statistically significant.

present results for the baseline specification with region-year fixed effects instead of country-specific time trends. Column (6) limits the sample to countries with at least 20 years of data.

Column (7) controls separately for the occurrence of natural disasters given that temperature and precipitation fluctuations might affect economic activity through their effect on the incidence of natural disasters, as discussed in Annex 3.2. Controlling for natural disasters does not materially alter the estimated coefficients on temperature and precipitation.[52]

In columns (1)–(7), impulse responses were estimated using Jordà's (2005) local projection method. This approach is advocated by Stock and Watson (2007), among others, as a flexible alternative that does not impose the dynamic restrictions embedded in vector autoregressions (autoregressive distributed lag) specifications and is particularly suited to estimating nonlinearities in the dynamic response. Column (8), however, tests the robustness of the findings to using the autodistributed lag model with seven lags of the weather variables and their squared terms, as in Dell, Jones, and Olken (2012), who test different models from no lags up to 10 lags and find that, across different lag specifications, results are broadly consistent in magnitude and statistical significance.

Across all specifications, the estimated coefficient on temperature is positive, and the coefficient on temperature squared is negative, confirming the nonlinear relationship between growth and temperature shocks uncovered by Burke, Hsiang, and Miguel (2015a). At low temperatures, an increase in temperature boosts growth, whereas at high temperatures, an increase in temperature hurts growth, with the threshold average annual temperature estimated to be about 13°C–15°C. As an additional robustness check, column (9) presents results of a linear regression without the squared terms of the weather variables in which the sample is limited to countries with average annual temperature above 15°C. Indeed, within the sample of relatively hot countries, the coefficient on temperature is negative and statistically significant. The effect of temperature increase across the globe is shown in Figure 3.8 panel 1 at grid level; in panel 2, where countries are rescaled in proportion to their 2015 population; and in Annex

[52]To further explore the robustness of these results, weather variables were transformed using natural logarithms or normalized by subtracting the country mean and dividing by the country standard deviation. Availability of data on subnational per capita GDP and annual average temperature and precipitation allows us to estimate the same regression at a subnational level using province fixed effects. Through all three specifications the main finding persists: there is a nonlinear relationship between temperature and economic performance (results available on request).

Figure 3.3.1, where countries are rescaled in proportion to projected 2100 population.

There is no consistently significant relationship between precipitation and per capita GDP growth across the various specifications. The lack of robust relationship could reflect potentially larger measurement error in the precipitation variable, as discussed in Auffhammer and others (2011), which could be further amplified by temporal aggregation. For example, if the only channel through which precipitation affects aggregate outcomes is through its effect on agriculture, then only precipitation during crops' growing period—poorly proxied by annual precipitation—may be relevant.

Annex Table 3.3.1 also reveals the very persistent effects of temperature shocks. The lower half of panel B presents the cumulative effects of a 1°C increase in temperature estimated at the median temperature of advanced, emerging market, and low-income developing countries seven years after the shock. All but one specification show evidence of a long-lasting and potentially deepening adverse impact of temperature shocks on per capita output at the temperatures experienced by the median low-income developing country.

To examine how widespread the effects of temperature may be, equation (3.2) is estimated using sectoral value added and agricultural production as the outcomes of interest. Real value added of the agricultural, manufacturing, and services sectors from the World Bank's World Development Indicators database is complemented with an index of crop production volume compiled by the United Nations Food and Agriculture Organization. Results are presented in Annex Table 3.3.2. There is a concave relationship between temperature and output in both the agricultural and manufacturing sectors, whereas services value added appears to be relatively protected from the effects of higher temperature. In other words, at the median temperature of low-income countries, an increase in temperature significantly reduces agricultural value added and crop production and lowers manufacturing output.

It is important to note that, unlike aggregate output, agricultural production is significantly affected by precipitation in addition to temperature shocks. Although the results suggest a concave relationship between agricultural output and precipitation, at the typical levels of precipitation of all three country groups, an increase in precipitation unambiguously improves agricultural productivity. The effects of precipitation are also short lived; agricultural output seven years down the line is not affected by a precipitation shock today, which is different from the effect of temperature.

### Channels

The chapter examines the potential channels through which temperature shocks affect the macroeconomy in a broad and long-lasting manner by studying the relationship between temperature and each of the main components of the aggregate production function.

### Investment

As hypothesized by Fankhauser and Tol (2005), weather shocks could have long-lasting effects on output if they influence investment decisions, and hence capital input. Equation (3.2) is estimated using real gross fixed capital formation as the outcome of interest. The analysis also examines weather's impacts on imports, given the tight link between imports and investment. Results, presented in Annex Table 3.3.3, columns (1)–(2), confirm the idea that temperature shocks suppress investment. Although the uncertainty surrounding the estimated contemporaneous effects is large, seven years after a temperature increase, both investment and imports are significantly lower in countries with relatively hot climates (see also Figure 3.10).

### Labor Input

The analysis also examines whether labor supply may be affected by temperature increases. Using infant mortality as the outcome of interest, equation (3.2) is estimated, uncovering a convex relationship between temperature and current (or future) labor supply (Annex Table 3.3.3, column [3]). In hot countries, an increase in temperature raises infant mortality instantaneously, with the effect growing over time. In these countries, higher temperatures also have a negative effect on a broader measure of human well-being—the Human Development Index, a weighted average of per capita income, educational achievement, and life expectancy (column [4]).

### Productivity

Motivated by the body of evidence of reduced human cognitive and physical performance at high temperatures from laboratory experiments and country-specific studies, the analysis examines whether reduced labor productivity may underpin the negative temperature–aggregate output relationship in countries with hot climates. If this is indeed

## Annex Table 3.3.2. Effect of Weather Shocks on Sectoral Output

| | Agriculture | Manufacturing | Services | Crop Production |
|---|---|---|---|---|
| A. Dependent Variable | (1) | (2) | (3) | (4) |
| Temperature | 0.283 | 1.281 | –0.268 | 3.860* |
| | (0.871) | (1.035) | (0.585) | (2.085) |
| Temperature$^2$ | –0.043* | –0.051* | –0.007 | –0.151*** |
| | (0.023) | (0.027) | (0.016) | (0.050) |
| Precipitation | 0.705*** | 0.108 | –0.000 | 1.287*** |
| | (0.228) | (0.149) | (0.111) | (0.332) |
| Precipitation$^2$ | –0.015*** | –0.002 | –0.001 | –0.028*** |
| | (0.005) | (0.003) | (0.002) | (0.007) |
| Adjusted $R^2$ | 0.10 | 0.13 | 0.12 | 0.09 |
| Number of Countries | 174 | 168 | 174 | 185 |
| Number of Observations | 5,847 | 5,225 | 5,730 | 8,836 |
| B. Impact of a 1°C Increase in Temperature on Dependent Variable Level at Horizon 0 | | | | |
| AE (T=11°C) | –0.664 | 0.152 | –0.423 | 0.547 |
| | (0.464) | (0.532) | (0.303) | (1.077) |
| EM (T=22°C) | –1.610*** | –0.977** | –0.578* | –2.767*** |
| | (0.431) | (0.439) | (0.298) | (0.664) |
| LIDC (T=25°C) | –1.868*** | –1.285** | –0.621* | –3.671*** |
| | (0.517) | (0.538) | (0.362) | (0.820) |
| Impact of a 1°C Increase in Temperature on Dependent Variable Level at Horizon 7 | | | | |
| AE (T=11°C) | 2.070*** | 1.642 | –0.220 | 1.177 |
| | (0.753) | (1.798) | (1.445) | (0.889) |
| EM (T=22°C) | –0.498 | –0.926 | 0.054 | –0.509 |
| | (0.654) | (0.939) | (0.734) | (0.812) |
| LIDC (T=25°C) | –1.198 | –1.626 | 0.129 | –0.969 |
| | (0.769) | (1.117) | (0.910) | (0.985) |
| C. Impact of a 100 mm per Year Increase in Precipitation on Dependent Variable Level at Horizon 0 | | | | |
| AE (P=800 mm per year) | 0.458*** | 0.076 | –0.013 | 0.835*** |
| | (0.149) | (0.105) | (0.075) | (0.223) |
| EM (P=900 mm per year) | 0.428*** | 0.072 | –0.015 | 0.778*** |
| | (0.139) | (0.100) | (0.071) | (0.210) |
| LIDC (P=1,100 mm per year) | 0.366*** | 0.065 | –0.018 | 0.665*** |
| | (0.121) | (0.090) | (0.063) | (0.185) |
| Impact of a 100 mm per Year Increase in Precipitation on Dependent Variable Level at Horizon 7 | | | | |
| AE (P=800 mm per year) | –0.228 | 0.024 | –0.141 | –0.237 |
| | (0.257) | (0.390) | (0.286) | (0.284) |
| EM (P=900 mm per year) | –0.213 | 0.030 | –0.125 | –0.217 |
| | (0.243) | (0.371) | (0.269) | (0.267) |
| LIDC (P=1,100 mm per year) | –0.184 | 0.041 | –0.094 | –0.177 |
| | (0.217) | (0.332) | (0.235) | (0.235) |

Source: IMF staff calculations.
Note: The table presents results from estimating equation (3.2) using the same specification as in Annex Table 3.3.1, column (5), for different dependent variables, with separate regressions estimated for each horizon. In all specifications, standard errors are clustered at the country level. Panel A reports the estimated coefficients on the weather variables for horizon 0. Panels B and C show the marginal impact of a change in temperature and precipitation computed as per equation (3.3) at the median temperature (T) and median precipitation (P) of advanced economies (AE), emerging markets (EM), and low-income developing countries (LIDC) contemporaneously (horizon 0) and cumulatively seven years after the shock. mm = millimeter.
* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

the case, sectors where workers are more exposed to heat should see a bigger decrease in labor productivity when temperatures rise in relatively hot countries. The analysis uses the Groningen Growth and Development Centre 10-sector database, which provides sectoral real value added and employment in 40 countries over 1950–2012, and Graff Zivin and Neidell's (2014) classification of sectors into those that are "heat-exposed" and others to estimate the following specification:[53]

[53]According to Graff Zivin and Neidell (2014), who follow definitions from the National Institute for Occupational Safety and Health, heat-exposed industries include agriculture, forestry, fishing and hunting, construction, mining, transportation, and utilities—as well as manufacturing, in which facilities may not be climate controlled in low-income countries and production processes often generate considerable heat.

## Annex Table 3.3.3. Effect of Weather Shocks on Productivity, Capital, and Labor

| | Capital Input | | Labor Input | | Labor Productivity | |
|---|---|---|---|---|---|---|
| | Investment | Imports | Infant Mortality | HDI | Non-Heat Exposed | Heat Exposed |
| A. Dependent Variable | (1) | (2) | (3) | (4) | (5) | |
| Temperature | 0.850 | 0.467 | –0.147 | 0.269*** | 0.246 | 1.902* |
| | (2.042) | (0.943) | (0.117) | (0.078) | (0.681) | (1.002) |
| Temperature$^2$ | –0.045 | –0.068** | 0.005* | –0.008*** | –0.010 | –0.087*** |
| | (0.059) | (0.033) | (0.003) | (0.002) | (0.018) | (0.026) |
| Precipitation | –0.377 | –0.654** | –0.001 | 0.000 | 0.047 | 0.272 |
| | (0.398) | (0.271) | (0.024) | (0.018) | (0.201) | (0.195) |
| Precipitation$^2$ | 0.003 | 0.006 | 0.001 | –0.000 | –0.003 | –0.008* |
| | (0.009) | (0.007) | (0.001) | (0.000) | (0.005) | (0.004) |
| Adjusted $R^2$ | 0.03 | 0.08 | 0.64 | 0.31 | 0.03 | |
| Number of Countries | 169 | 178 | 182 | 181 | 40 | |
| Number of Observations | 6,093 | 6,866 | 8,685 | 3,864 | 17,848 | |
| B. Impact of a 1°C Increase in Temperature on Dependent Variable Level at Horizon 0 | | | | | | |
| AE (T=11°C) | –0.138 | –1.029** | –0.028 | 0.094** | 0.030 | –0.003 |
| | (0.976) | (0.455) | (0.067) | (0.043) | (0.396) | (0.502) |
| EM (T=22°C) | –1.126 | –2.525*** | 0.092* | –0.082 | –0.185 | –1.909*** |
| | (1.064) | (0.753) | (0.055) | (0.056) | (0.412) | (0.363) |
| LIDC (T=25°C) | –1.395 | –2.934*** | 0.124* | –0.129* | –0.244 | –2.428*** |
| | (1.331) | (0.919) | (0.063) | (0.067) | (0.478) | (0.456) |
| Impact of a 1°C Increase in Temperature on Dependent Variable Level at Horizon 7 | | | | | | |
| AE (T=11°C) | 1.812 | 2.361 | –0.364 | 0.609** | 0.305 | –1.142 |
| | (2.029) | (1.494) | (0.427) | (0.259) | (1.183) | (0.986) |
| EM (T=22°C) | –4.225** | –2.439* | 0.569 | –0.237 | –0.063 | –1.642 |
| | (1.803) | (1.303) | (0.375) | (0.175) | (1.114) | (1.119) |
| LIDC (T=25°C) | –5.871*** | –3.747** | 0.824* | –0.467** | –0.163 | –1.778 |
| | (2.074) | (1.516) | (0.426) | (0.195) | (1.306) | (1.365) |
| C. Impact of a 100 mm per Year Increase in Precipitation on Dependent Variable Level at Horizon 0 | | | | | | |
| AE (P=800 mm per year) | –0.329 | –0.558*** | 0.008 | –0.007 | –0.009 | 0.148 |
| | (0.262) | (0.180) | (0.015) | (0.013) | (0.133) | (0.136) |
| EM (P=900 mm per year) | –0.323 | –0.547*** | 0.009 | –0.008 | –0.016 | 0.132 |
| | (0.246) | (0.170) | (0.015) | (0.012) | (0.125) | (0.130) |
| LIDC (P=1,100 mm per year) | –0.311 | –0.523*** | 0.011 | –0.010 | –0.030 | 0.101 |
| | (0.216) | (0.151) | (0.013) | (0.011) | (0.109) | (0.118) |
| Impact of a 100 mm per Year Increase in Precipitation on Dependent Variable Level at Horizon 7 | | | | | | |
| AE (P=800 mm per year) | –0.478 | –0.984** | 0.071 | –0.102* | –0.295 | 0.072 |
| | (0.689) | (0.498) | (0.163) | (0.061) | (0.832) | (0.554) |
| EM (P=900 mm per year) | –0.423 | –0.961** | 0.074 | –0.097* | –0.265 | 0.041 |
| | (0.649) | (0.472) | (0.149) | (0.057) | (0.776) | (0.524) |
| LIDC (P=1,100 mm per year) | –0.313 | –0.914** | 0.080 | –0.087* | –0.206 | –0.022 |
| | (0.573) | (0.422) | (0.123) | (0.050) | (0.666) | (0.467) |

Source: IMF staff calculations.
Note: Columns (1–4) present results from estimating equation (3.2) using the same specification as in Annex Table 3.3.1, column (5), for different dependent variables. Specification in column (5) presents results from estimating equation (3.4) where an indicator for heat exposed sectors is interacted with temperature and precipitation, their squared terms, and their lags and forwards; also controlling for country-sector and region-year fixed effects, and lag of growth. Separate regressions are estimated for each horizon. In all specifications, standard errors are clustered at the country level. Panel A reports the estimated coefficients on the weather variables for horizon 0. Panels B and C show the marginal impact of a change in temperature and precipitation computed as per equation (3.3) at the median temperature (T) and median precipitation (P) of advanced economies (AE), emerging markets (EM), and low-income developing countries (LIDC), contemporaneously (horizon 0) and cumulatively seven years after the shock. HDI = Human Development Index; mm = millimeter.
* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

$$
\begin{aligned}
y_{i,s,t+h} - y_{i,s,t-1} = {} & \beta_1^h c_{i,t} + \beta_2^h c_{i,t}^2 + \gamma_1^h c_{i,t-1} \\
& + \gamma_2^h c_{i,t-1}^2 + \textstyle\sum_{j=1}^{h-1} \delta_1^h c_{i,t+h-j} \\
& + \textstyle\sum_{j=1}^{h-1} \delta_2^h c_{i,t+h-j}^2 + \alpha_1^h c_{i,t} \times H_s \\
& + \alpha_2^h c_{i,t}^2 \times H_s + \omega_1^h c_{i,t-1} \times H_s \\
& + \omega_2^h c_{i,t-1}^2 \times H_s + \textstyle\sum_{j=1}^{h-1} \tau_1^h c_{i,t+h-j} \times H_s \\
& + \textstyle\sum_{j=1}^{h-1} \tau_2^h c_{i,t+h-j}^2 \times H_s \\
& + \varphi_1^h \Delta y_{i,s,t-1} + \mu_{i,s}^h + \theta_{r,t}^h + \varepsilon_{i,s,t}^h, \qquad (3.4)
\end{aligned}
$$

in which $y_{i,s,t}$ is the log of real sectoral value added per worker, $H_s$ is an indicator for sectors that are "heat-exposed," $\mu_{i,s}^h$ are country-sector fixed effects, and $\theta_{r,t}^h$ are region-year fixed effects. Standard errors are clustered at the country level.

Annex Table 3.3.3, specification (5) summarizes the results of this estimation. At higher temperatures, an increase in temperature significantly lowers labor productivity in heat-exposed industries. Temperature increases, however, have no discernible effect on the productivity of workers in non-heat-exposed sectors, even in countries with hot climates.

## The Role of Policies and Institutional Settings

To study the extent to which macroeconomic and structural policies and country characteristics mediate the effect of weather shocks, the analysis extends the empirical approach described above by allowing the response of per capita output to weather shocks to vary with various proxies for these policies. The estimated specification augments equation (3.2) to include an interaction term between the weather shock and the policy variable:

$$
\begin{aligned}
y_{i,t+h} - y_{i,t-1} = {} & \beta_1^h c_{i,t} + \gamma_1^h (c_{i,t} \times p_{i,t-1}) + \delta_1^h p_{i,t-1} \\
& + \beta_2^h c_{i,t-1} + \gamma_2^h (c_{i,t-1} \times p_{i,t-2}) + \delta_2^h p_{i,t-2} \\
& + \textstyle\sum_{j=1}^{h-1} \beta_3^h c_{i,t+h-j} + \varphi_1^h \Delta y_{i,t-1} \\
& + \mu_i^h + \theta_{r,t}^h + \varepsilon_{i,t}^h. \qquad (3.5)
\end{aligned}
$$

The sample is restricted to countries with average annual temperature exceeding 15°C, in which an increase in temperature has a statistically significant linear negative impact on economic activity, as in Annex Table 3.3.1, column (9). Consequently, the weather shock $c_{i,t}$ refers to average annual temperature and precipitation. Most of the policy variables $p_{i,t}$ are lagged to minimize reverse causality concerns and are included one at a time. As emphasized in the chapter, it is difficult to interpret causally the coefficients on the interaction terms, given that the variation in policies and institutions across countries and over time is not random. Policies and institutions could also be correlated with relevant country attributes that are not controlled for in the regression. Moreover, policy data availability varies significantly in both temporal and country coverage, resulting in sizable differences in the estimation sample.

For ease of interpretation, in the baseline results, each policy variable is transformed into an indicator variable depending on whether, in year *t*, the country is above or below the median value of this particular policy in the estimation sample.[54] An exception to this approach is the measurement of buffers. A country is considered to have (1) fiscal buffers if public debt as a share of GDP is less than the 75th percentile, (2) monetary buffers if annual inflation is less than 10 percent, (3) high international reserves if international reserves minus gold can cover at least four months of imports, (4) high foreign aid if foreign aid inflows as a share of GDP are in the 75th percentile, and (5) high remittances if per capita remittances in real dollars received are greater than the 75th percentile. For exchange rate policy, the analysis uses an indicator if the de facto exchange rate regime of a country is not pegged based on the coarse classification of Reinhart and Rogoff (2004).

Annex Tables 3.3.4 and 3.3.5 present the main findings. For each policy, the tables report the estimated effect of a 1°C increase in temperature on per capita output at horizons 0 through 7, where the policy is not in place and where the policy is in place. The tables also report the *p*-value of a statistical test of the difference between the effect of temperature in different policy scenarios.

The short-term negative effects of temperature shocks tend to be larger in countries with lower buffers, as evidenced by the larger estimated responses in columns (2), (5), and (8) in Annex Table 3.3.4. However, the differences are typically not statistically significant, and in the few cases in which they are (fiscal buffers, foreign aid, and remittances), they tend to be very short lived. Exchange rate regime, however, seems to be significantly associated with the extent of damage caused by weather shocks. Countries with nonpegged exchange rates tend to recover faster from these shocks. A similar pattern was documented by Ramcharan (2009), who finds that exchange rate flexibility helps economies adjust better in the aftermath of windstorms and earthquakes.

[54]Results from an alternative specification in which the policy variables are used in their continuous forms rather than transformed into indicators are available on request.

## Annex Table 3.3.4. Role of Policy Buffers

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| Impact of a 1°C Increase in Temperature on per Capita Output | Public Debt | | | Inflation | | | International Reserves | | |
| | Low | High | P-value | Low | High | P-value | High | Low | P-value |
| Horizon 0 | –1.057*** | –1.460*** | 0.09 | –1.183*** | –1.275*** | 0.40 | –1.015** | –1.171*** | 0.52 |
| | (0.387) | (0.352) | | (0.295) | (0.322) | | (0.414) | (0.314) | |
| Horizon 1 | –1.029** | –1.627*** | 0.24 | –0.952*** | –0.985** | 0.87 | –0.556 | –0.782** | 0.36 |
| | (0.471) | (0.466) | | (0.362) | (0.425) | | (0.492) | (0.395) | |
| Horizon 2 | –0.914* | –1.695** | 0.24 | –0.933** | –0.907** | 0.87 | –0.952** | –1.030*** | 0.58 |
| | (0.492) | (0.690) | | (0.375) | (0.416) | | (0.390) | (0.382) | |
| Horizon 3 | –1.597*** | –2.159*** | 0.34 | –1.279*** | –1.333*** | 0.79 | –1.182*** | –1.140*** | 0.78 |
| | (0.525) | (0.758) | | (0.419) | (0.429) | | (0.404) | (0.411) | |
| Horizon 4 | –1.512** | –1.986** | 0.46 | –1.355** | –1.487** | 0.55 | –1.404*** | –1.440*** | 0.85 |
| | (0.704) | (0.972) | | (0.560) | (0.571) | | (0.522) | (0.522) | |
| Horizon 5 | –0.899 | –1.341 | 0.42 | –1.014* | –1.181* | 0.46 | –1.390** | –1.270** | 0.66 |
| | (0.758) | (0.936) | | (0.583) | (0.628) | | (0.609) | (0.603) | |
| Horizon 6 | –1.075 | –1.277 | 0.68 | –1.315** | –1.572** | 0.32 | –1.524** | –1.362** | 0.55 |
| | (0.844) | (0.867) | | (0.626) | (0.675) | | (0.614) | (0.597) | |
| Horizon 7 | –0.552 | –0.633 | 0.87 | –0.842 | –1.032 | 0.52 | –1.566** | –1.353** | 0.49 |
| | (0.819) | (0.859) | | (0.610) | (0.628) | | (0.629) | (0.611) | |
| Adjusted $R^2$ | | 0.15 | | | 0.12 | | | 0.09 | |
| Number of Countries | | 119 | | | 122 | | | 127 | |
| Number of Observations | | 4,492 | | | 5,365 | | | 6,135 | |

| Impact of a 1°C Increase in Temperature on per Capita Output | Foreign Aid | | | Remittances | | | Exchange Rate Flexibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | High | Low | P-value | High | Low | P-value | Not Pegged | Pegged | P-value |
| Horizon 0 | –0.840** | –1.194*** | 0.06 | –1.345*** | –1.449*** | 0.34 | –1.183*** | –1.436*** | 0.16 |
| | (0.380) | (0.334) | | (0.337) | (0.312) | | (0.321) | (0.315) | |
| Horizon 1 | –0.996** | –1.132*** | 0.59 | –1.212*** | –1.472*** | 0.13 | –0.792* | –1.249*** | 0.08 |
| | (0.448) | (0.396) | | (0.389) | (0.410) | | (0.426) | (0.415) | |
| Horizon 2 | –0.958** | –0.979** | 0.94 | –0.799* | –1.030** | 0.31 | –0.575 | –1.191** | 0.08 |
| | (0.433) | (0.401) | | (0.436) | (0.456) | | (0.483) | (0.503) | |
| Horizon 3 | –0.931* | –1.020** | 0.74 | –1.271** | –1.488*** | 0.45 | –0.769 | –1.342** | 0.20 |
| | (0.551) | (0.475) | | (0.530) | (0.499) | | (0.574) | (0.600) | |
| Horizon 4 | –0.724 | –1.061* | 0.32 | –1.260* | –1.348** | 0.77 | –0.975 | –1.853** | 0.08 |
| | (0.672) | (0.539) | | (0.678) | (0.664) | | (0.781) | (0.801) | |
| Horizon 5 | –0.772 | –0.913* | 0.70 | –1.182* | –1.287** | 0.76 | –0.408 | –1.556* | 0.04 |
| | (0.635) | (0.534) | | (0.691) | (0.644) | | (0.830) | (0.851) | |
| Horizon 6 | –0.753 | –1.108* | 0.36 | –1.571* | –1.860** | 0.45 | 0.011 | –1.109 | 0.06 |
| | (0.731) | (0.598) | | (0.842) | (0.751) | | (0.828) | (0.780) | |
| Horizon 7 | –0.620 | –0.863* | 0.59 | –0.900 | –1.179 | 0.49 | –0.220 | –1.418* | 0.05 |
| | (0.677) | (0.499) | | (0.749) | (0.731) | | (0.871) | (0.852) | |
| Adjusted $R^2$ | | 0.16 | | | 0.14 | | | 0.10 | |
| Number of Countries | | 120 | | | 115 | | | 115 | |
| Number of Observations | | 5,175 | | | 3,441 | | | 3,942 | |

Source: IMF staff calculations.
Note: The table presents results from estimating equation (3.5) on a sample of countries with average annual temperature above 15°C. In the regressions, indicators for policy measures are interacted with temperature, precipitation, and their lags, controlling for country and region-year fixed effects, lags of growth and policy measure, forwards of temperature and precipitation. Separate regressions are estimated for each horizon. Regression summary statistics are reported for horizon 0. In all specifications, standard errors are clustered at the country level.
* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

## Annex Table 3.3.5. Role of Structural Policies and Institutions

| Impact of a 1°C Increase in Temperature on per Capita Output | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| | Domestic Financial Sector Reform Index | | | International Finance Restrictions | | | Human Capital | | |
| | High | Low | P-value | Low | High | P-value | High | Low | P-value |
| Horizon 0 | −1.540*** | −1.631*** | 0.59 | −0.766** | −1.139*** | 0.07 | −1.039*** | −1.152*** | 0.63 |
| | (0.437) | (0.439) | | (0.293) | (0.275) | | (0.291) | (0.349) | |
| Horizon 1 | −1.539*** | −1.853*** | 0.17 | −0.906** | −1.054*** | 0.50 | −0.891** | −1.250*** | 0.25 |
| | (0.518) | (0.598) | | (0.391) | (0.367) | | (0.411) | (0.420) | |
| Horizon 2 | −0.413 | −0.923 | 0.15 | −0.622 | −1.090** | 0.10 | −0.669 | −1.092** | 0.27 |
| | (0.538) | (0.711) | | (0.434) | (0.472) | | (0.437) | (0.494) | |
| Horizon 3 | −0.964 | −1.724** | 0.06 | −1.089** | −1.359*** | 0.39 | −1.065** | −1.250** | 0.64 |
| | (0.712) | (0.854) | | (0.462) | (0.487) | | (0.475) | (0.491) | |
| Horizon 4 | −0.325 | −1.118 | 0.10 | −1.601*** | −1.757*** | 0.69 | −1.345** | −1.686*** | 0.49 |
| | (0.829) | (0.855) | | (0.502) | (0.529) | | (0.527) | (0.576) | |
| Horizon 5 | −0.707 | −1.561* | 0.13 | −1.790** | −2.180*** | 0.41 | −1.161 | −1.590** | 0.46 |
| | (0.844) | (0.868) | | (0.702) | (0.761) | | (0.699) | (0.704) | |
| Horizon 6 | −0.644 | −1.412* | 0.22 | −1.608*** | −1.868*** | 0.59 | −1.009 | −1.689** | 0.34 |
| | (0.805) | (0.807) | | (0.594) | (0.615) | | (0.685) | (0.724) | |
| Horizon 7 | −0.071 | −0.847 | 0.27 | −1.525** | −1.975*** | 0.39 | −0.657 | −1.236* | 0.44 |
| | (0.888) | (0.818) | | (0.682) | (0.718) | | (0.736) | (0.715) | |
| Adjusted $R^2$ | | 0.24 | | | 0.13 | | | 0.12 | |
| Number of Countries | | 46 | | | 74 | | | 89 | |
| Number of Observations | | 1,455 | | | 3,434 | | | 4,582 | |

| Impact of a 1°C Increase in Temperature on per Capita Output | Physical Capital | | | Political Regime Index | | | Inequality | | |
|---|---|---|---|---|---|---|---|---|---|
| | High | Low | P-value | High | Low | P-value | Low | High | P-value |
| Horizon 0 | −0.773*** | −0.861*** | 0.66 | −1.370*** | −1.452*** | 0.73 | −1.336*** | −1.559*** | 0.07 |
| | (0.294) | (0.302) | | (0.328) | (0.293) | | (0.431) | (0.390) | |
| Horizon 1 | −0.782* | −0.777* | 0.99 | −1.132*** | −1.392*** | 0.27 | −1.034* | −1.240** | 0.26 |
| | (0.405) | (0.423) | | (0.393) | (0.367) | | (0.580) | (0.588) | |
| Horizon 2 | −0.550 | −0.690 | 0.69 | −1.110*** | −1.729*** | 0.01 | −0.814 | −1.024* | 0.35 |
| | (0.442) | (0.459) | | (0.416) | (0.433) | | (0.584) | (0.591) | |
| Horizon 3 | −0.430 | −0.820 | 0.30 | −1.374*** | −1.929*** | 0.03 | −0.947 | −1.386* | 0.09 |
| | (0.411) | (0.497) | | (0.466) | (0.464) | | (0.714) | (0.738) | |
| Horizon 4 | −0.543 | −1.175** | 0.15 | −1.599*** | −2.095*** | 0.09 | −0.819 | −1.391* | 0.06 |
| | (0.464) | (0.573) | | (0.566) | (0.601) | | (0.827) | (0.820) | |
| Horizon 5 | −0.953 | −1.677** | 0.17 | −1.587** | −2.044*** | 0.15 | −0.699 | −1.634* | 0.01 |
| | (0.625) | (0.755) | | (0.671) | (0.705) | | (0.899) | (0.877) | |
| Horizon 6 | −0.381 | −1.546** | 0.09 | −1.416** | −2.128*** | 0.06 | −1.061 | −2.067** | 0.01 |
| | (0.586) | (0.691) | | (0.679) | (0.704) | | (0.930) | (0.913) | |
| Horizon 7 | −0.548 | −1.610* | 0.14 | −1.325* | −2.320*** | 0.02 | −0.233 | −1.320 | 0.01 |
| | (0.645) | (0.815) | | (0.751) | (0.788) | | (1.060) | (0.998) | |
| Adjusted $R^2$ | | 0.13 | | | 0.10 | | | 0.28 | |
| Number of Countries | | 114 | | | 106 | | | 95 | |
| Number of Observations | | 3,905 | | | 5,056 | | | 1,798 | |

Source: IMF staff calculations.
Note: The table presents results from estimating equation (3.5) on a sample of countries with average annual temperature above 15°C. In the regressions, indicators for policy measures are interacted with temperature, precipitation, and their lags, controlling for country and region-year fixed effects, lags of growth and policy measure, forwards of temperature and precipitation. Separate regressions are estimated for each horizon. Regression summary statistics are reported for horizon 0. In all specifications, standard errors are clustered at the country level.
* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

### Annex Table 3.3.6. Role of Development: Evidence from Subnational Data

| Impact of a 1°C Increase in Temperature on per Capita Output | Full Sample (1) | Advanced Economies | Non-Advanced Economies (2) | P-value |
|---|---|---|---|---|
| Horizon 0 | −0.705*** | −0.025 | −0.727*** | 0.01 |
| | (0.174) | (0.159) | (0.210) | |
| Horizon 1 | −0.908*** | 0.320 | −0.978*** | 0.00 |
| | (0.263) | (0.232) | (0.315) | |
| Horizon 2 | −0.599** | 0.952*** | −0.768** | 0.00 |
| | (0.290) | (0.350) | (0.357) | |
| Horizon 3 | −0.543 | 1.089*** | −0.875** | 0.00 |
| | (0.340) | (0.339) | (0.429) | |
| Horizon 4 | −0.752* | 0.736* | −1.130** | 0.01 |
| | (0.386) | (0.385) | (0.499) | |
| Horizon 5 | −1.246*** | 0.485 | −1.321** | 0.04 |
| | (0.460) | (0.510) | (0.588) | |
| Horizon 6 | −1.156** | 0.005 | −1.596** | 0.10 |
| | (0.478) | (0.526) | (0.646) | |
| Horizon 7 | −1.333** | 0.145 | −1.496** | 0.13 |
| | (0.527) | (0.601) | (0.714) | |
| Adjusted $R^2$ | 0.18 | 0.20 | | |
| Number of Countries | 44 | 7 | 37 | |
| Number of Provinces | 607 | 51 | 556 | |
| Number of Observations | 16,148 | 16,148 | | |

Source: IMF staff calculations.
Note: Regression (2) presents results from estimating equation (3.5) using subnational data on a sample of provinces with average annual temperature above 15°C. In the regression, the indicator for whether a province is located in an advanced economy is interacted with temperature, precipitation, their lags, lag of growth, and region-year fixed effects; controlling for province fixed effects and forwards of temperature and precipitation. Separate regressions are estimated for each horizon. Regression summary statistics are reported for horizon 0. In all specifications, standard errors are clustered at the province level.
* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

The medium-term negative effects of temperature shocks tend to be smaller in countries with better structural policies and institutions (Annex Table 3.3.5). Standard errors are again quite large, and it is often difficult to reject the hypothesis that policies do not have an effect, but the point estimates of the effect of temperature shocks in the outer horizons are substantially larger in columns (2), (5), and (8). This evidence is in line with findings in the literature on the role of policies in attenuating the effects of natural disasters. See, among others, Kahn (2005); Noy (2009); Cavallo and others (2013); Felbermayr and Gröschl (2014); and Breckner and others (2016) for the role of institutional strength and democracy; Noy (2009); Von Peter, Dahlen, and Saxena (2012); McDermott, Barry, and Tol (2013); Felbermayr and Gröschl (2014); and Breckner and others (2016) for the role of financial markets; and Noy (2009); Raddatz (2009); and Von Peter, Dahlen, and Saxena (2012) for the role of development status.

## The Role of Development

The chapter examines whether the overall level of development attenuates the negative effects of temperature shocks in hot countries, using subnational cross-country data. Combining subnational growth data from roughly 1,460 provinces and states across 79 countries from Gennaioli and others (2014) and annual temperature and precipitation data at the same level of aggregation, the analysis confirms that there is a nonlinear relationship between subnational growth and temperature by estimating equation (3.2). It then zooms in on the set of provinces and states with average temperature greater than 15°C to examine whether economic activity in the "hot" states or provinces of advanced economies responds to a temperature increase in the same way as in states or provinces of emerging market and developing economies with a similar average temperature. Equation (3.5) is estimated with $p_{i,t}$ taking the value of 1 for states or provinces located in advanced economies. $p_{i,t}$ is also interacted with lag of growth, $\mu_i^h$ denote state or province fixed effects, and region-year fixed effects, $\theta_{r,t}^h$, are allowed to vary across advanced and non-advanced economies. Standard errors are clustered at the province level.

Annex Table 3.3.6 presents the estimated effects of a 1°C increase in temperature at horizons 0 to 7 in all subnational regions with temperature greater than 15°C in column (1). The subsequent columns present the estimated effects for subnational regions in advanced and non-advanced economies, as well as the

**Annex Table 3.4.1. Effect of Weather Shocks and Natural Disasters on Emigration, 1980–2015**

| Percent of Emigrants in Total Population | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Temperature | 3.963 | 8.008* | 8.067* | 8.134* | 8.127* | 8.074* |
| | (2.522) | (4.477) | (4.476) | (4.357) | (4.480) | (4.287) |
| Precipitation | –0.206 | –0.477 | –0.484 | –0.484 | –0.491 | –0.492 |
| | (0.710) | (0.880) | (0.878) | (0.881) | (0.878) | (0.880) |
| Temperature × LIDC | | –7.475* | –7.672* | –7.788* | –7.571* | –7.634* |
| | | (4.253) | (4.255) | (4.092) | (4.249) | (4.088) |
| Precipitation × LIDC | | 0.935 | 0.918 | 0.929 | 0.972 | 0.992 |
| | | (1.022) | (1.018) | (1.024) | (1.039) | (1.033) |
| Number of Natural Disasters | | | 0.228* | 0.228* | 0.458 | 0.465* |
| | | | (0.138) | (0.136) | (0.281) | (0.269) |
| War | | | | 0.409 | | –0.418 |
| | | | | (2.283) | | (3.771) |
| Number of Natural Disasters × LIDC | | | | | –0.358 | –0.359 |
| | | | | | (0.309) | (0.296) |
| War × LIDC | | | | | | 1.216 |
| | | | | | | (4.034) |
| Adjusted $R^2$ | 0.04 | 0.06 | 0.06 | 0.06 | 0.06 | 0.05 |
| Number of Observations | 337 | 337 | 337 | 337 | 337 | 337 |

Source: IMF staff calculations.
Note: All specifications include country-of-origin fixed effects, decade-region fixed effects, and decade fixed effects interacted with a dummy for low-income developing country (LIDC). Standard errors are clustered at the country level.
* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

*p*-value of a test of their difference. The negative effects of temperature shocks are felt much more heavily in non-advanced economies.

## Annex 3.4. The Impact of Weather Changes and Natural Disasters on International Migration

This annex provides additional details on the empirical analysis of the effect of temperature shocks and natural disasters on international migration. The analysis relies on data from Özden and others (2011) on emigrant stocks for 117 economies with average temperature greater than 15°C between 1980 and 2015. Migrant stocks, which are available at 10-year intervals, are differenced to compute net emigrant flows in each decade.

Building on Cattaneo and Peri (2016), the analysis estimates the following specification:

$$\begin{aligned} Emigrant_{i,d} = \ & \alpha + \gamma T_{i,d} + \beta\, T_{i,d} \times LIDC_i + \mu P_{i,d} \\ & + \theta P_{i,d} \times LIDC_i + \rho Disaster_{i,d} \\ & + \tau\, Disaster_{i,d} \times LIDC_i + \mu_i \\ & + \theta_{r,d} + \varphi_d \times LIDC_i + \epsilon_{i,d}, \end{aligned} \quad (3.6)$$

in which $i$ indexes countries, $d$ indexes decades,[55] *Emigrant* is the net flow of emigrants over the decade as a percentage of the total population of the origin (source) country, $T$ is the average temperature and $P$ the average precipitation for the decade, and *Disaster* is the average number of natural disasters for each country-decade. The latter three variables are further interacted with a dummy identifying low-income developing countries (*LIDC*) to capture potential differences in the emigration response to the weather fluctuations and natural disasters. As in Cattaneo and Peri (2016), the regression further controls for country fixed effects ($\mu_i$), region-decade fixed effects ($\theta_{r,d}$), and decade fixed effects interacted with the *LIDC* dummy. The random error term $\epsilon_{i,d}$ is clustered at the country level.[56] The specification is purposefully parsimonious. Controls typically included as determinants of migrations, such as population size, sociopolitical environment, and others, could themselves be affected by weather fluctuations and natural disasters. In a robustness check, the exercise controls for the incidence of war, an important push factor for emigration, although arguably this could be yet another channel through which weather fluctuations trigger movements of people (see Burke, Hsiang, and Miguel 2015b).

Annex Table 3.4.1 reports the main findings from estimating equation (3.6). Higher average temperatures

[55]The 2010 decade includes data up to 2015.

[56]Following Dell, Jones, and Olken (2012), the specification includes only fixed effects as controls, since other potential controls, such as population size or sociopolitical environment, may themselves be affected by agricultural productivity—a key channel through which weather shocks may influence emigration—potentially producing a bias in the estimation by introducing an overcontrolling problem. The only exception is a dummy for wars (see Beaton and others 2017), which is included in some of the specifications and confirms the robustness of the findings.

over a decade do not have a significant effect on emigration in the full sample of countries (column [1]). However, once the response is allowed to vary across broad groups of countries, the results suggest that in countries that are not classified as low income, higher temperature is indeed associated with greater emigration flows (column [2]). A 1°C increase in average decadal temperature leads to an increase in the share of net emigrants of about 8 percentage points (which is equivalent to one standard deviation in the sample investigated).[57] Similarly, more natural disasters over a decade also increase net emigration flows, especially in countries not classified as low income.[58]

## Annex 3.5. Model-Based Analysis

The model used to analyze the long-term impact of climate change and simulate the effects of policies in Box 3.2 is developed and presented in Buffie and others (2012). It is commonly known as the Debt, Investment, and Growth (DIG) model and has served as a workhorse in many IMF studies of low-income countries. The DIG is an optimizing intertemporal model with perfect foresight. It describes a two-sector small open economy model with private and public capital, learning by doing, and endogenous fiscal policies. Public capital is productive and is used in the production function in both sectors. Government spending can raise output directly by augmenting the stock of public capital and can crowd in and crowd out private investment.

Firms operate Cobb-Douglas technologies to combine labor, private capital, and public capital (infrastructure) into output in the traded and nontraded sectors. The evolution of total factor productivity (TFP) is exogenous in both sectors. Firms face separate prices for exports, and imports and are assumed to be profit maximizing.

Consumers supply labor and derive utility from consuming the domestic traded good, the foreign traded good, and the domestic nontraded good. These goods are combined into a constant elasticity of substitution basket, and savers maximize the present value of their lifetime utility. The model breaks Ricardian equivalence by including both savers and hand-to-mouth consumers.

The government spends on transfers, debt service, and (partially inefficient) infrastructure investment. It collects revenue from the consumption value-added tax and from user fees for infrastructure services. The deficit is financed through domestic borrowing, external concessional borrowing, or external commercial borrowing. Policymakers accept all concessional loans offered by official creditors. The borrowing and amortization schedule for these loans is fixed exogenously. Debt sustainability requires that the value-added tax and transfers eventually adjust to cover the entire deficit, given the exogenously determined upper limit on taxes and lower limit on transfers. The model incorporates shocks to the government external debt risk premium (or world interest rates).

The majority of the model parameters are set to the same values as in Buffie and others (2012), with few exceptions, mostly to reflect the decline in global interest rates, the projection of trend GDP growth in low-income countries, and the sample median of public-debt-to-GDP ratios. The parameters that differ from the ones in Buffie and others (2012) are presented in Annex Table 3.5.1.

### Simulating the Long-Term Impact of Climate Change

To trace the long-term impact of climate change, the model incorporates the estimated relationship between temperature and per capita output discussed in Annex 3.3 and presented in Annex Table 3.3.1, column (5). The effect is assumed to occur through temperature's effect on TFP; therefore, the estimated parameters are rescaled so that the model matches the empirically estimated decline of GDP if temperature increases by 1°C.[59]

The temperature during 2017–2100 is assumed to follow one of two alternative scenarios: Representative Concentration Pathway (RCP) 4.5 or RCP 8.5. The temperature increases during 2017–2100 are calculated for the median low-income country in the sample and are equal to 2.0°C and 3.9°C for RCP 4.5 and RCP 8.5, respectively.

[57]The flow of emigrants as a share of population in countries that are not classified as low income in this sample is 2.5 percent, on average, with a standard deviation of 8.1 percentage points. For low-income countries, these statistics are 0.6 percent and 2.2 percentage points, respectively.

[58]Results (not shown here and available on request) are robust to the use of other proxies for low-income countries, such as a dummy identifying the countries in the bottom quartile of the average GDP per capita distribution of the country sample during the full sample period analyzed.

[59]Estimates of the damage to GDP cannot be used directly given that GDP is endogenous.

**Annex Table 3.5.1. Parameterization of the Debt, Investment, and Growth Model**

| Parameter | Value (percent) |
|---|---|
| Initial Return on Infrastructure Investment | 30 |
| Public Domestic Debt-to-GDP Ratio | 10 |
| Public Concessional Debt-to-GDP Ratio | 30 |
| Public External Commercial Debt-to-GDP Ratio | 5 |
| Oil Revenues-to-GDP Ratio | 2 |
| Real Interest Rate on Public Domestic Debt | 7 |
| Real Interest Rate on Public External Commercial Debt | 4 |
| Trend per Capita Growth Rate | 2.8 |

Sources: Buffie and others (2012); and IMF staff calculations.

There are two sources of uncertainty in the simulation—the uncertainty of RCP projections and the uncertainty of the effect of temperature on TFP. Both sources of uncertainty are combined in the analysis as follows. The upper-bound scenario is simulated assuming that the temperature increase is equal to the lowest 5th percentile for each RCP.[60] To account for the uncertainty of estimated parameters, the TFP parameters are set to the conditional expected value for the upper 50 percent of the TFP distribution. The worst lower-bound scenario is simulated analogously.

## Modeling Structural Transformation

Structural transformation is generated in the DIG model by introducing diverging trends in sectoral TFP growth, along the lines of Ngai and Pissarides (2007). In their model, faster productivity growth in the traded goods sector goes along with a decline in the relative price of traded versus nontraded goods. Given complementarity in final demand, production in the former sector relative to the latter does not increase in the same proportion. The value share of the traded goods sector eventually shrinks, even in the presence of international trade. While this approach relies on only one potential driver of structural transformation, it generates the desired increase in employment and nominal-value-added shares of the nontraded goods sector, which is mostly composed of services. The gap in sectoral TFP growth rates is set to replicate the average increase in the service share of value added in low-income developing countries in 1990–2015, which has risen at the rate of 2.5 percentage points a decade. Given this calibration, in the scenario without rising temperatures, the employment share of nontraded goods increases from the baseline value of 42.27 percent to 65 percent over 90 years.

## Modeling Optimal Adaptation

Box 3.2 extends the original DIG model to incorporate direct investment in adaptation strategies. The main addition is the inclusion of private adaptation and public subsidies to private adaptation, whereas damages are modeled as before. In the absence of any adaptation measure, increased temperature causes gross damage, denoted by $GD_{jt}$, at time $t$ in sector $j$. The gross damage is expressed as a fraction of sectoral output:

$$gd_{jt} = \frac{GD_{jt}}{q_{jt}} = f\left(T\right).$$

Gross damage can be reduced by investing in adaptation. Firm $i$'s capacity to adapt to climate change is denoted by $O_{i,jt}$. It is increasing in firm $i$'s protection expenditures $AD_{i,jt}$ as well as in the total sectoral protection expenditures $\overline{AD}_{jt} = \int_0^1 AD_{i,jt}di$.[61] The residual damage for firm $i$ in sector $j$ is

$$\Omega_{i,jt} = \frac{gd_{jt}}{O_{i,jt}\left(AD_{i,jt}, \overline{AD}_{jt}\right)^{\phi}},$$

in which the marginal damage reduction from adaptation spending is decreasing. The positive parameter $\varphi$ is the elasticity of damage reduction to the level of adaptation.

If the cost of a unit of protection is equal to $P_{AD,t}$ and the functional form for the capacity to adapt is $O_{i,jt}\left(AD_{i,jt}, \overline{AD}_{jt}; \varsigma\right) = AD_{i,jt}\overline{AD}_{jt}^{\varsigma}$ (with $0 \le \varsigma \le 1$), then cost minimization by firms in the symmetric

[60]Here, the 5–95 percent confidence intervals for the temperature increases are 1.2°C to 2.8°C and 2.8°C to 5.1°C for RCP 4.5 and RCP 8.5, respectively.

[61]Many adaptation measures have the nature of public goods; hence, firms benefit from total sectoral protection spending.

equilibrium $AD_{i,jt} = \overline{AD}_{jt}$ determines the optimal level of adaptation expenditure for each firm

$$AD_{i,jt} = \left(\phi \frac{GD_{jt}}{P_{AD,t}}\right)^{\frac{1}{1+\phi(1+\varsigma)}}$$

The optimal level of firm-specific residual damage is then

$$\Omega_{jt} = \frac{gd_{jt}}{AD_{jt}^{\phi(1+\varsigma)}},$$

which can be shown to be socially suboptimal.

The social planner's cost function, $TotD_{i,jt}$, differs from that of individual firms

$$TotD_{i,jt}^{SP} = GD_{jt}\left(AD_{jt}^{SP}\right)^{-\phi(1+\varsigma)} + P_{AD,t}AD_{jt}^{SP}.$$

Minimizing the social cost gives socially optimal adaptation expenditures

$$AD_{jt}^{SP} = \left[\phi\left(1+\varsigma\right)\frac{GD_{jt}}{P_{AD,t}}\right]^{\frac{1}{1+\phi(1+\varsigma)}}$$

It can be shown that private agents invest less than the socially optimal amount. The adaptation spending gap (as a fraction of the socially optimal adaptation spending) is equal to

$$1 - \left(\frac{1}{1+\varsigma}\right)^{\frac{1}{1+\phi(1+\varsigma)}}.$$

It can also be shown that the socially optimal amount of adaptation expenditures can be achieved if subsidies in the amount of $\upsilon_{\varsigma,jt}$ per unit cost of protection are paid by the government to the firms

$$\upsilon_{\varsigma,jt} = \frac{\varsigma}{(1+\varsigma)}.$$

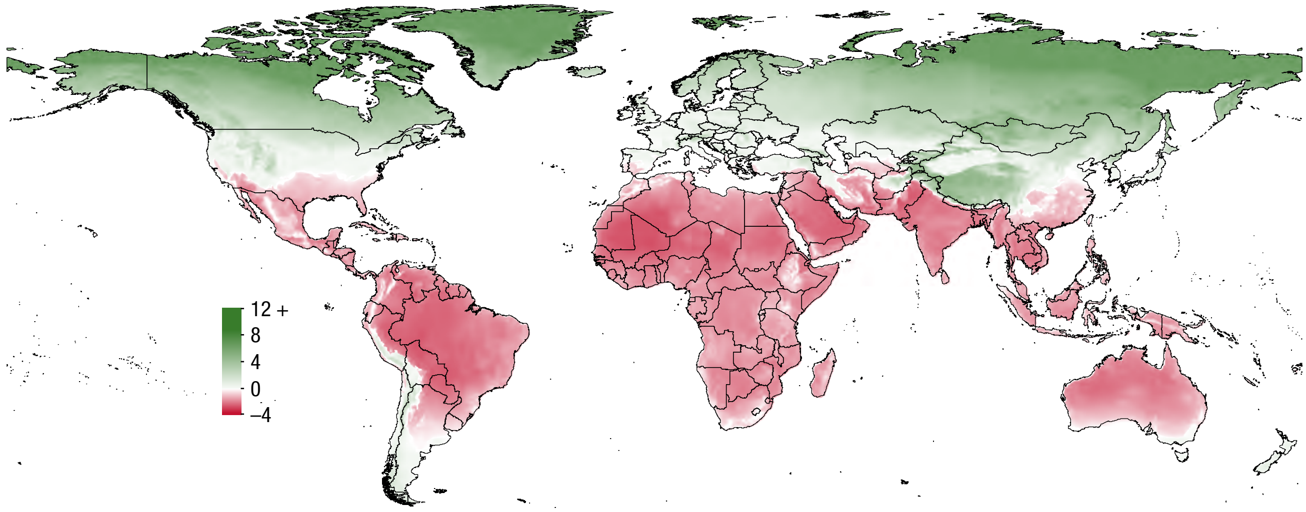
## Annex 3.6. Reduced Form Approach to Estimating Potential Long-Term Effects of Climate Change

Indicative evidence of the potential impacts of climate change and their distribution across the globe could also be gleaned by combining the estimated sensitivity of per capita output to temperature increase (Annex Table 3.3.1, column [5]), baseline annual temperatures, and projected temperature changes for each geographic location. As in the modeling exercise, this analysis takes the most conservative approach and assumes temperature increases have a permanent level, rather than growth, effect on per capita output. The estimated cumulative impact on 2100 per capita GDP under the Representative Concentration Pathway (RCP) 4.5 and RCP 8.5 scenarios are presented in Annex Figure 3.6.1. It is important to note that this exercise captures the likely impact of one particular aspect of climate change, namely temperature increases. The macroeconomic effects of many expected or possible events (such as higher incidence of natural disasters, rising sea levels, ocean acidification, and the like) are not quantified in this exercise. Furthermore, the analysis abstracts from cross-border spillovers that may arise if climate change triggers more frequent epidemics, famines, and other natural disasters along with social unrest, armed conflict, and associated refugee flows.

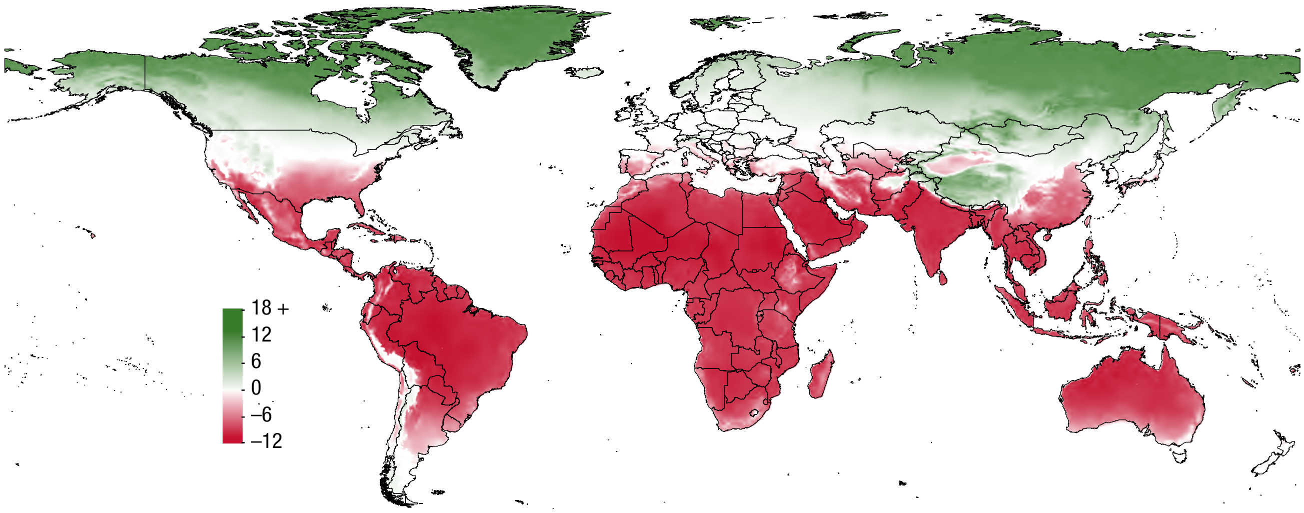
The analysis suggests that the projected warming will have uneven effects across the globe. However, the increase in temperature, especially under the RCP 8.5 scenario, will push many advanced economies beyond the threshold temperature level, thus triggering direct economic losses for these countries as well.

**Annex Figure 3.6.1. The Long-Term Impact of Temperature Increase on Real per Capita Output across the Globe**
*(Percent)*

**1. RCP 4.5 Scenario**




**2. RCP 8.5 Scenario**




Sources: National Aeronautics and Space Administration (NASA) Earth Exchange Global Daily Downscaled Projections (NEX-GDDP); World Bank Group Cartography Unit; and IMF staff calculations.
Note: The maps depict the effect of the projected increase in temperature between 2005 and 2100 under RCP 4.5 and RCP 8.5 scenarios on real per capita output in 2100. Gray areas indicate the estimated impact is not statistically significant. RCP = Representative Concentration Pathways.

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CHAPTER 4

# CROSS-BORDER IMPACTS OF FISCAL POLICY: STILL RELEVANT?

*Positive cross-country spillovers from collective fiscal action by the world's largest economies helped speed the recovery from the global financial crisis nearly a decade ago. But do fiscal spillovers still matter today? The answer is yes—but the extent depends on circumstances in both the countries that generate fiscal shocks and in those that are recipients of the shocks. This chapter combines new empirical research and model-based simulations to show that fiscal spillovers tend to be low when a fiscal shock originates from a country without output gaps, but the impact intensifies when a source or recipient country is in recession and/or benefiting from accommodative monetary policy—which suggests that spillovers are large when domestic multipliers are also large. The chapter also finds that spillovers from government spending shocks are larger than those associated with tax shocks, that the transmission of fiscal shocks may be stronger among countries with fixed exchange rates, and that fiscal spillovers impact the external positions of source and recipient countries alike. Model-based simulations suggest that the cross-border effects of budget-neutral fiscal reforms are generally modest, though large reforms can trigger spillovers, especially if they affect cross-border investment decisions. Overall, this evidence draws attention to the cross-border repercussions of corporate tax reform in the United States, for example, or of an increase in public investment in Germany.*

## Introduction

What is the potential for fiscal policy to affect macroeconomic outcomes in other economies through cross-border spillovers? This question has been at the center of the policy debate, especially in the aftermath of the global financial crisis, when many countries experienced persistent economic slack, and monetary policy interest rates approached the effective lower bound. Fiscal stimulus was then advocated widely, especially in major economies with sufficient fiscal space. This was not least because excess capacity and low interest rates would help limit crowding out of private spending and the expected positive spillovers would make collective efforts to boost activity more effective.

More recently, the global effects of fiscal policy have been discussed amid possible changes in the macroeconomic policy mix in Japan and the United States. Debate is also ongoing about the role of fiscal policies in addressing excess external imbalances, including whether euro area countries with excess current account surpluses should raise fiscal spending, which could also support growth in the currency union.

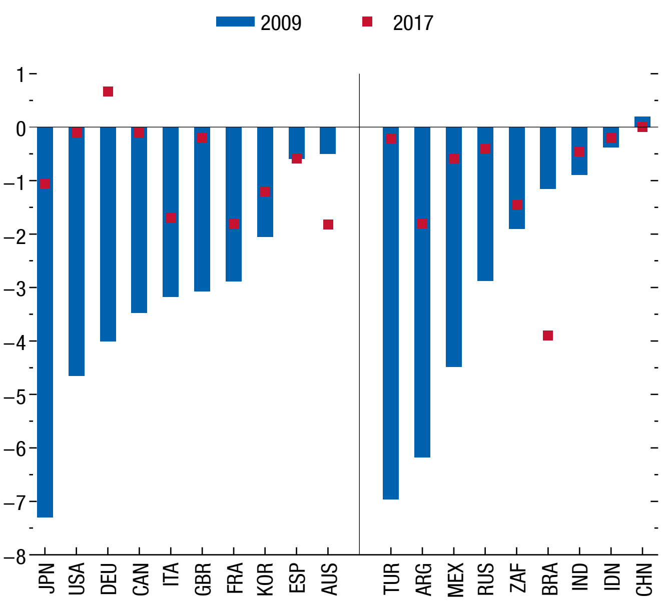
Recent improvements in economic conditions in many countries and their implications for monetary policy raise questions about the size of potential spillovers from fiscal stimulus today. Cyclical positions have improved across the board over the past few years, although with differences across countries (Figure 4.1). For example, the United States is operating at close to full employment and, as a result, the Federal Reserve has begun to normalize monetary policy conditions. At the same time, although euro area economies and Japan are experiencing an encouraging cyclical recovery, output gaps remain negative in many of these countries and core inflation is stubbornly low, prompting monetary authorities to commit to accommodative policies for an extended period. As the chapter discusses, cyclical conditions and the associated ability or willingness of monetary policy to act, both in countries emitting and receiving the fiscal shock, are key determinants of the magnitude of its impact.[1] Considerations regarding fiscal space in source countries are also relevant—if term premiums increase and financial conditions tighten following a fiscal stimulus, spillovers could be smaller.

Against this backdrop, the chapter aims to answer the following questions:

The authors of this chapter are Patrick Blagrave, Giang Ho, Ksenia Koloskova, and Esteban Vesperoni (lead author), with support from Sung Eun Jung and contributions from Jared Bebee, Ben Hunt, Adina Popescu, and Ippei Shibata.

[1]Throughout the chapter, countries from which fiscal shocks originate are referred to as "source" or "shock-emitting"; countries affected by these shocks are referred to as "recipient" or "shock-receiving."

**Figure 4.1. Output Gap in Selected Countries**
*(Percent)*




Source: IMF staff estimates.
Note: Data labels in the figure use International Organization for Standardization (ISO) country codes.

- Are fiscal spillovers large from a global or regional perspective? How do they depend on the fiscal instruments involved (for example, government spending or taxes)? How do they depend on fiscal space in source countries?
- To what extent does the size of fiscal spillovers depend on cyclical and monetary policy conditions, in both source and recipient countries?
- How do fiscal spillovers depend on exchange rate regimes?
- What is the impact of fiscal shocks on external positions and exchange rates in source and recipient countries?
- Do fiscal reforms generate spillovers, even if the reforms are budget neutral?

The chapter sheds light on these issues by looking at the implications of fiscal policy changes in some major advanced economies for activity across a large group of advanced and emerging market economies. The empirical analysis is based on a newly constructed data set of government spending and tax revenue shocks for five systemic economies between the first quarter of 2000 and the second quarter of 2016, identified using the structural vector autoregression methodology of Blanchard and Perotti (2002). Information from the five source-country shocks is combined using the strength of trade links with a range of advanced and emerging market recipient countries to assess global spillovers.

To analyze the role that economic slack, constraints on monetary policy, and exchange rate regimes play in transmission, the chapter uses an econometric framework that can flexibly test for the presence of nonlinear effects. Model-based simulations then help to illustrate the complex cross-border transmission channels of fiscal shocks. This approach offers insights into potential changes in the external positions of source and recipient countries, as well as the dynamic behavior of key macroeconomic variables, and elucidates spillovers from different types of fiscal reforms.

The chapter's findings add to the existing empirical literature on fiscal spillovers by expanding the scope of the analysis. Previous empirical studies focus on a relatively small sample of recipient countries—often those of the Organisation for Economic Co-operation and Development (OECD) or euro area (Beetsma and Giuliodori 2004; Beetsma, Klaassen, and Wieland 2006; Auerbach and Gorodnichenko 2013; Nicar 2015; Blanchard, Erceg, and Lindé 2016; Goujard 2017; Poghosyan 2017), and several studies consider only one fiscal instrument (government spending) and/or only fiscal consolidation episodes. The chapter also adds to the literature, extending the analysis of economic slack, monetary policy accommodation, and the role of exchange rate regimes in determining spillovers from fiscal shocks.

The chapter suggests that fiscal spillovers still matter, but their size depends on the type of fiscal action and on economic circumstances in both source and recipient countries:

- *Fiscal spillovers are larger for spending shocks.* On average, a 1 percent of GDP fiscal stimulus in a major advanced economy can raise output in recipient countries by 0.08 percent over the first year. But spillovers are larger for government spending shocks than for tax shocks, consistent with the literature that points to higher domestic multipliers for spending shocks—output in recipients can increase by 0.15 percent following a spending hike, versus 0.05 percent after a tax cut. Model simulations reinforce this message and provide more granular evidence—for example, changes in public investment tend to have larger cross-border effects than changes in public consumption.

- *Relatively weak cyclical positions imply larger spillovers.* Although modest in normal times, spillovers are larger when cyclical conditions are weak, likely due to the reduced crowding-out effects of public spending on private sector activity.
- *Monetary policy constraints also increase spillovers.* When monetary policy in either source or recipient countries does not counteract fiscal shocks—for example, because the effective lower bound is binding—spillovers are much larger than during normal times.
- *Currency pegs between source and recipient countries may amplify spillovers.* There is some evidence suggesting that fiscal shocks tend to have larger spillovers on recipient countries with currencies pegged to the source country's currency than on those with flexible exchange rates.
- *Fiscal policy can change external positions in source and recipient countries.* Trade balances deteriorate in source countries following a fiscal expansion, with a consequent improvement in recipients' external positions.
- *An increase in term premiums may dampen spillovers.* If fiscal stimulus at the source increases the term premium—for instance, because of concerns about debt sustainability—spillovers are somewhat lower compared with a constant term premium scenario.
- *Under some circumstances, fiscal reforms come with spillovers as well.* Most budget-neutral fiscal reforms have limited cross-border effects, although large reforms can generate significant spillovers. For example, a reform that substantially reduces corporate income tax rates and is offset by higher consumption taxes in major economies can have repercussions in the rest of the world, including through higher global interest rates and cross-border reallocation of investment and profits.

These results point to several important policy lessons that are relevant now. Although fiscal space is currently more limited, and improved cyclical conditions in many countries mean that spillovers from fiscal policy are likely to be lower than during the global financial crisis, the analysis suggests that fiscal stimulus in major economies can nonetheless be important in lifting economic activity abroad, although not everywhere. For example, given the cyclical position and gradually less accommodative monetary policy conditions in the United States, a US fiscal stimulus would likely have relatively modest cross-border spillovers, especially if stimulus takes the form of tax policy measures. In the euro area—where there is fiscal space in some countries—stimulus could have larger spillovers. This is in the context of prospects for continued monetary policy accommodation and still-significant slack in some recipient countries.

The impact on external imbalances would also depend on the source of fiscal stimulus, as stimulus in the United States is likely to increase imbalances, whereas stimulus in some surplus euro area countries could reduce them. Where countries are considering significant reductions in corporate income tax rates, the analysis suggests associated changes in investment-location and profit-reporting decisions by multinational corporations could have significant negative spillovers on activity and the fiscal position of nonreforming countries.

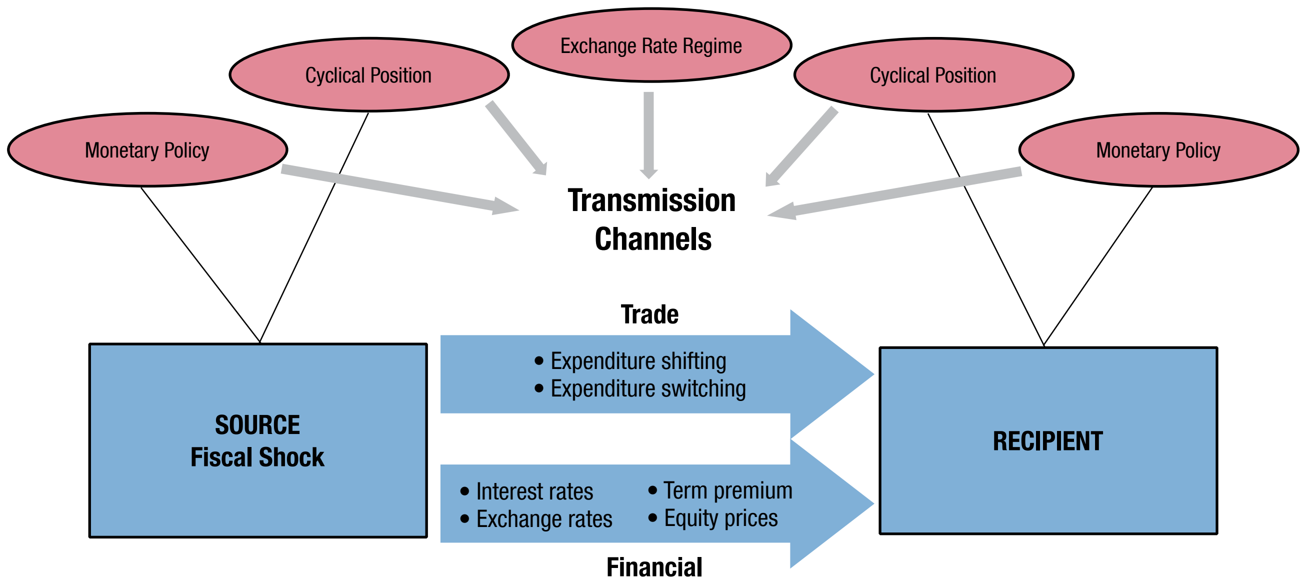
## Spillovers from Fiscal Policy—A Conceptual Framework

The cross-border impact of fiscal policy changes in a given country depends on their initial domestic effects and the transmission mechanisms of shocks. This means that factors affecting the source's domestic fiscal multiplier are relevant for determining spillovers on recipient countries. The fiscal shock is propagated through different channels—primarily associated with trade links—with the final impact also depending on the economic and policy conditions in the recipient countries (Figure 4.2). This section provides a brief overview of the domestic impact of fiscal shocks, outlines their possible transmission channels, and discusses the factors affecting transmission.

### Domestic Impact of a Fiscal Shock

A large body of literature on domestic fiscal multipliers suggests that cyclical and policy conditions play a role in the response of a domestic economy to fiscal shocks. In general, multiplier estimates vary significantly across countries, sample periods, and methodologies. While a comprehensive summary is beyond the scope of this chapter (see, for example, Batini and others 2014), dynamic stochastic general equilibrium and structural vector autoregression models developed since the early 1990s suggest that the size of multipliers tends to be modest (between zero and one over the first year) in "normal times"—generally understood as circumstances in which the economy

**Figure 4.2. The Transmission of a Fiscal Shock**




Source: IMF staff compilation.

does not have a significant output gap—and depends on a number of structural characteristics, including a country's trade openness, exchange rate regime, labor market rigidities, and size of public debt.[2] Outside normal times, multipliers can vary with the state of the business cycle (generally larger in a downturn than in an expansion, although the empirical evidence is not conclusive) or the degree of monetary accommodation (larger when monetary policy is unresponsive, such as at the effective lower bound).[3] All else equal, a larger domestic multiplier should be associated with greater cross-border spillovers.

The composition of the fiscal intervention—whether it is based on government spending or revenue measures—also influences the size of the domestic multiplier. Many studies have found that, for advanced economies, short-term spending multipliers tend to be larger than revenue multipliers (for example, see a survey in Mineshima, Poplawski-Ribeiro, and Weber 2014). This has been explained using traditional Keynesian theory—for example, while an additional dollar of government spending contributes directly to higher aggregate demand, a dollar of tax cuts can be either spent or saved by firms and/or households (that is, the marginal propensity to consume can be less than one). Recent empirical evidence using the narrative approach has found somewhat larger tax multipliers than spending multipliers, although narrative-based evidence on the latter is primarily limited to defense-related spending.[4] Yet other studies suggest that the relative magnitude of the

[2]For example, see Cole and Ohanian (2004); Kirchner, Cimadomo, and Hauptmeier (2010); Corsetti, Meier, and Müller (2012); Gorodnichenko, Mendoza, and Tesar (2012); Born, Juessen, and Müller (2013); and Ilzetzki, Mendoza, and Vegh (2013). A multiplier of one would suggest that a change in the fiscal balance translates—dollar for dollar—into a similar change in GDP.

[3]For example, see Erceg and Lindé (2010); Christiano, Eichenbaum, and Rebelo (2011); Eggertsson (2011); Woodford (2011); Auerbach and Gorodnichenko (2012a, 2012b); Owyang, Ramey, and Zubairy (2013); Nakamura and Steinsson (2014); Riera-Crichton, Vegh, and Vuletin (2015); Blanchard, Erceg, and Lindé (2016); and Canzoneri and others (2016). However, Ramey and Zubairy (forthcoming) found little evidence of state dependence of the government spending multiplier based on historical data from the United States.

[4]The narrative method, pioneered by Romer and Romer (2010), makes use of narrative records, such as budget documents and speeches, to identify the size, timing, and principal motivation for fiscal actions. The Romer and Romer (2010) data set also divides fiscal policy changes into those made for reasons related to prospective economic conditions and discretionary actions (for example, actions aimed at reducing public debt), thereby allowing for a causal analysis of the impact of fiscal policy on output. See also Ramey (2011); Cloyne (2013); Mertens and Ravn (2013); and Guajardo, Leigh, and Pescatori (2014).

spending and revenue multipliers may differ between consolidation and expansion episodes and among different degrees of monetary accommodation.[5]

## Channels of Cross-Border Transmission

In standard open-economy macroeconomic models, a fiscal shock is transmitted abroad primarily through the trade channel, which consists of two effects:[6]

- *Expenditure shifting* (sometimes referred to as "leakages") refers to the direct impact of a fiscal policy change on the source country's import demand through changes in domestic consumption and investment, which affects trading partners. Here, the marginal propensity to import by both the public and private sectors plays a key role—if most spending changes are in nontradable sectors and do not translate into a higher or lower level of imports, spillovers from expenditure shifting may be smaller. Larger and more open economies tend to import more, suggesting that fiscal policy changes in these countries will have larger spillovers on others through the expenditure shifting channel.
- *Expenditure switching* refers to the impact of a fiscal shock operating through changes in the real exchange rate, which can trigger substitution between domestic and foreign goods consumption. For example, in a Mundell-Fleming-Dornbusch framework, fiscal expansion puts upward pressure on interest rates, the nominal exchange rate appreciates in the source country, and domestic prices increase.[7] The resulting real appreciation boosts import demand as foreign goods become cheaper. This effect will be more significant, especially in the short term, when the nominal exchange rate is fully flexible; where nominal exchange rates are fixed, relative price—and hence real exchange rate—adjustments can take longer. Either way, expenditure switching effects imply that a fiscal shock can have nontrivial cross-border spillovers, even if its domestic impact is muted, because the boost to import demand can occur without an increase in domestic income.

In addition to the trade channel, the response of financial variables to a fiscal shock can trigger spillovers through changes in global financial conditions. A fiscal policy change in a large economy can impact global interest rates, exchange rates, and the slope of the yield curve—the latter stemming from any perceived or actual impact of the policy change on long-term fiscal sustainability in the source country. The financial channel can work in the opposite direction to the trade channel. For example, the higher interest rates and exchange rate appreciation associated with an expansionary fiscal shock in the source country can increase the cost of foreign currency borrowing and worsen the balance sheets of corporations and households in recipient countries if there are currency mismatches, generating negative spillovers. Equity prices may also adjust, with cross-border repercussions.

Overall, the relative strength of each transmission channel will depend on the extent of trade and financial linkages between the source and recipient countries. Thus, the net spillover impact of a fiscal shock is an empirical question.

## Factors Affecting the Transmission

Like the domestic fiscal multiplier, cross-border spillovers from fiscal actions tend to vary with economic circumstances. Two factors play particularly important roles:

- *Cyclical position:* The domestic multiplier—and hence spillovers through expenditure shifting—may be larger when the source country has more economic slack. For example, a fiscal stimulus that boosts public employment would be more likely to crowd out private employment when labor markets are tight (Michaillat 2014), resulting in smaller domestic and spillover impacts; the same logic applies to the case of fiscal tightening. Another possibility is that a fiscal stimulus relaxes borrowing constraints (which tend to be tighter during a downturn), for example, by raising the value of collateralizable assets along with demand, helping to increase credit and investment (Canzoneri and others 2016). Somewhat similarly, if the recipient country is operating close to full capacity when an external fiscal shock hits, greater demand in tradable sectors may crowd out activity in the rest of the economy, resulting in a more muted impact on overall economic activity.
- *Monetary policy constraints:* Whether monetary policy accommodates the fiscal shock matters, and it is relevant for both source and recipient countries.

[5]For example, see Eggertsson (2011); and Erceg and Lindé (2013).
[6]For example, see Fleming (1962); Mundell (1963); Dornbusch (1976); and Obstfeld and Rogoff (1995).
[7]Notice that other frameworks can deliver different exchange rate predictions (see Obstfeld and Rogoff 1995).

Under normal circumstances, monetary policy reacts to counter the demand and price effects of a fiscal shock. However, when monetary policy is stuck at the effective lower bound, the domestic and spillover effects can be greater. For example, if nominal interest rates in the source country do not rise in response to higher expected inflation following an expansionary fiscal shock, real interest rates decline, crowding in domestic demand and increasing the multiplier (Blanchard, Erceg, and Lindé 2016).[8] In this case, the reduction in the real interest rate in the source country may lead its real exchange rate to depreciate, changing the direction of the expenditure switching effect. In a recipient country, when at the effective lower bound, monetary policy will do little to dampen the effect of the external shock.

Aside from conjunctural factors, institutional or structural features such as the *exchange rate regime* can also affect the transmission of fiscal shocks and hence the size of spillovers. On one hand, most theoretical frameworks predict that lack of nominal exchange rate flexibility delays real exchange rate adjustments to a fiscal shock, dampening the expenditure switching effect and hence the size of spillovers. On the other hand, currency pegs can strengthen expenditure shifting between the source and recipient—for example, by reducing expected exchange rate volatility and cross-border transaction costs, which is helpful in forming trade relationships (Klein and Shambaugh 2006; Qureshi and Tsangarides 2010; Aglietta and Brand 2013)—and potentially increase spillovers. This may be particularly relevant in currency unions, as long-standing economic and institutional integration and the use of a common currency can strengthen trade (Rose and van Wincoop 2001; Berger and Nitsch 2008). The exchange rate regime also matters for the transmission of fiscal shocks through the financial channel. For example, under flexible regimes, spillovers from an expansionary fiscal shock can be dampened if currency mismatches in balance sheets of households and corporations in the recipient country make depreciations contractionary. Ultimately, which of these considerations dominates is an empirical question.

[8]This insight works for both contractionary and expansionary shocks. Low interest rates prevent the central bank from counteracting a contractionary shock by reducing rates further, while in the case of an expansionary shock, it may be fully accommodated if the central bank aims for a more accommodative stance than feasible; in either case, spillovers are amplified.

## Spillovers on Economic Activity: Empirical Evidence

This section examines the relevance of fiscal spillovers in practice and how they vary with economic circumstances. It does so by looking at a very broad sample of source and recipient countries and analyzing different types of shocks under both fiscal consolidations and expansions. It first describes the empirical strategy used to estimate spillovers and then presents the estimated impact on economic activity in recipient countries.

### Empirical Strategy

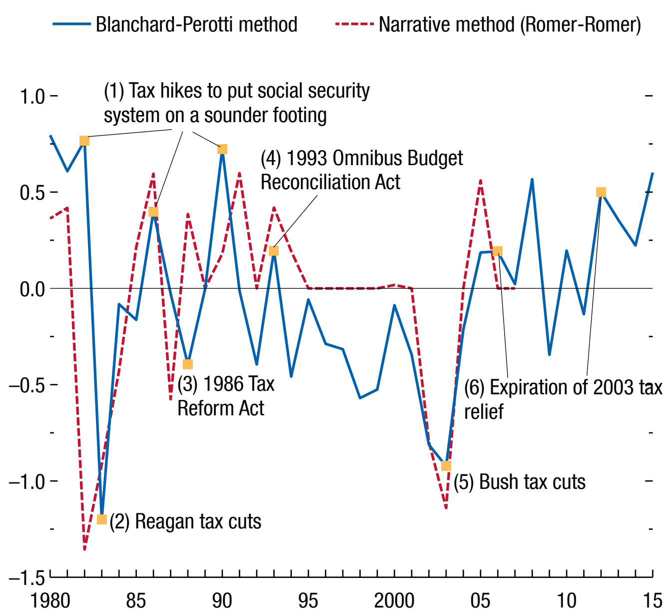
The baseline approach jointly identifies government spending and revenue shocks in five major advanced economies—France, Germany, Japan, the United Kingdom, and the United States—using the structural vector autoregression methodology of Blanchard and Perotti (2002).[9] A key assumption is that discretionary fiscal policy does not respond contemporaneously to unexpected changes in output, as it takes time for policymakers to assess the output shock and make spending and/or tax decisions, including passing and implementing new legislation. The assumption is more likely to hold in the short term, and therefore the identification uses quarterly data.[10]

The shocks identified by this approach offer a sensible narrative of the fiscal policies adopted over the past several decades. Comparison of structural shocks with historical policy records (quantified using the narrative approach in the literature) shows that structural shocks can broadly reflect major policy changes in timing and order of magnitude. For example, for the United States, the structural tax shocks capture tax cuts enacted under the Ronald Reagan and George W. Bush administrations as well as their subsequent expiration. The same is true of tax hikes during the 1980s, which

[9]Although spillovers from fiscal policy in China are potentially important, data limitations prevent the inclusion of China as a source country in the empirical analysis. Later in the chapter, model-based simulations help shed light on the potential spillover effects from China's fiscal policy.

[10]Although the use of quarterly fiscal data comes with challenges, it is instrumental to implementing the identification method used by Blanchard and Perotti (2002). These data (in real terms and seasonally adjusted) are used for shock identification only and for major advanced economies with high-quality statistics. As discussed later in the chapter, it is also reassuring that alternative identification methods that do not rely on quarterly fiscal data yield similar results for spillovers.

**Figure 4.3. Tracking Tax Shocks in the United States**
*(Percent of GDP)*




Sources: Romer and Romer (2010); and IMF staff calculations.

were put in place following the Greenspan Commission's recommendations to shore up financing of the social security system (Figure 4.3).[11]

The structural shocks also have a statistically and economically significant domestic impact. Consistent with traditional Keynesian theory and previous empirical work that uses a similar methodology, estimates of domestic multipliers using the structural shocks tend to be larger for spending instruments (slightly above one) than for tax instruments (slightly below one). Some differences are seen in the size of domestic tax multipliers across the five source countries, with the multiplier of the United States being larger than that of European peers or Japan, possibly reflecting different tax structures and the specific tax instruments used (Blagrave and others, forthcoming).

The spillover effects from the fiscal shocks are estimated using the local projections method.[12] The econometric specification relates an economic outcome in a recipient country, such as the level of output, to a fiscal shock from the five source countries—constructed by pooling together shocks from source countries and weighting them by the strength of trade links between the source and the recipient.[13] The baseline specification controls for factors that affect the normal short-term dynamics of output in the recipient country, such as past growth rates and external demand developments. The specification is estimated using quarterly data from the first quarter of 2000 through the second quarter of 2016, and the sample of 55 advanced and emerging market economies represents almost 85 percent of world output. Thus, the panel estimation gives spillover estimates for an "average" country in the sample.[14] For the panel estimation, the shocks are expressed as a share of recipient countries' output to facilitate aggregation across sources. For ease of interpretation of the economic magnitude, results are presented with shocks normalized to an average 1 percent of GDP change in the fiscal position across source countries (see details in Annex 4.2, which shows how panel results are rescaled using relative GDP levels and trade links).

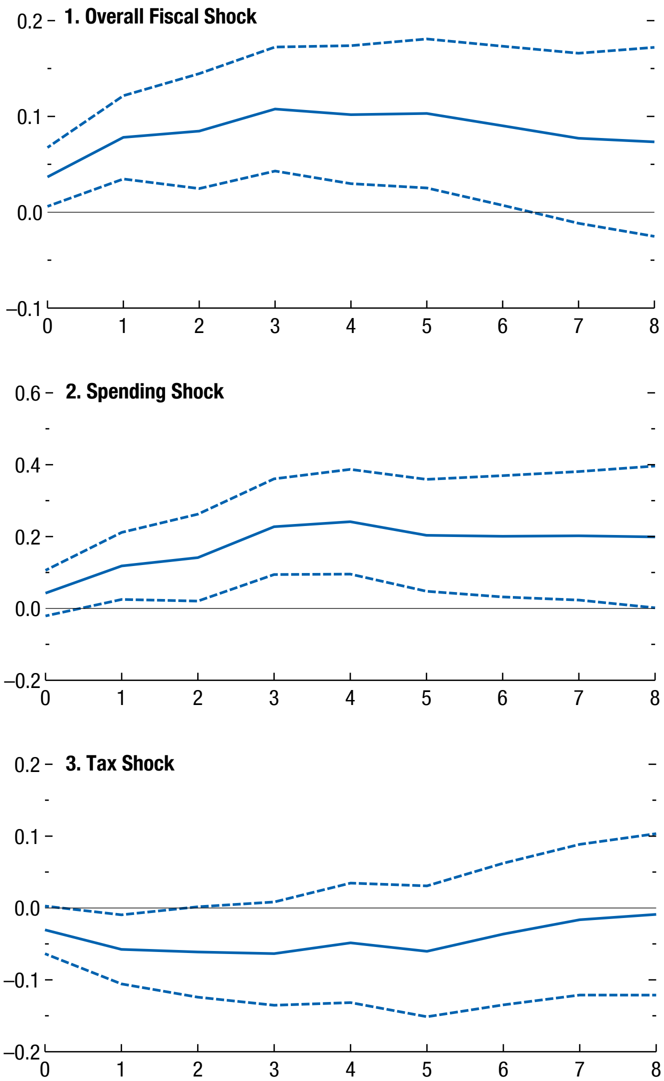
## Spillovers on Economic Activity

The results point to significant spillover effects from fiscal policy, especially from government spending shocks. Figure 4.4 shows the estimated response to a foreign fiscal shock of an average recipient country's output over eight quarters. A shock to the fiscal balance—henceforth referred to as the *overall fiscal shock*—is constructed as a shock to government spending minus a shock to tax revenues, such that a positive shock implies a *reduction* in the source country's fiscal balance (or an increase in the deficit). An overall fiscal shock would increase recipient output on impact, reaching a peak around the third quarter after the shock before starting to dissipate (Figure 4.4, panel 1). Estimations for specific fiscal instruments show that spillovers from a government spending shock are larger, more persistent, and more precisely estimated

[11]See Blagrave and others (forthcoming) for more examples.
[12]See Jordà (2005).

[13]The use of trade links to weight the shock is instrumental to obtaining country-specific external fiscal shocks, but it does not preclude spillovers through channels other than trade given that the estimates capture the overall response of recipient-country GDP regardless of the channel of transmission. Combining shocks from several source countries is important to use the variability emanating from different sources, given that trade patterns differ. In particular, while some source countries—such as the United States—can have a global impact, the impact of others is more regional; for example, Germany's and France's trading partners are more concentrated in Europe.
[14]More details about the data and empirical methodology are provided in Annexes 4.1 and 4.2, respectively, as well as in Blagrave and others, forthcoming.

**Figure 4.4. Dynamic Responses of Recipient Countries' Output to Fiscal Shocks**
*(Impact on output level, percent; quarters on x-axis)*




Source: IMF staff calculations.
Note: $t = 0$ is the quarter of the respective shocks. Solid lines denote point estimates and dashed lines denote 90 percent confidence bands. Shocks are normalized to an average of 1 percent of GDP across source countries.

than those from a tax shock of equal size (Figure 4.4, panels 2 and 3).[15] This is consistent with the evidence pointing to larger domestic spending multipliers than domestic tax multipliers—as discussed earlier. Data constraints prevent a more detailed empirical examination of spillovers from specific spending or tax instruments, such as government consumption or investment—an issue assessed later in the chapter through model-based simulations.

Spillovers are economically significant and in line with earlier estimates. For example, a 1 percent of GDP overall fiscal shock in an average major advanced economy would raise output in the average recipient country by about 0.08 percent over the first year. For a government spending increase of the same magnitude, the average spillover impact in recipient countries increases to 0.15 percent over the first year; for a tax hike of similar size, output falls by about 0.05 percent (Figure 4.5). As expected, spillovers from fiscal shocks are substantially lower than domestic fiscal multipliers in source countries, but still relevant.[16] These are of the same order of magnitude as those found in previous work—for example, Beetsma, Klaassen, and Wieland (2006)—although differences in country and time samples as well as shock identification make a direct comparison challenging.[17] While the spillover estimates in this section are averages across different economic and policy conditions, subsequent analysis also shows that there is a large difference between estimates in normal times and those in times of economic slack, for example.

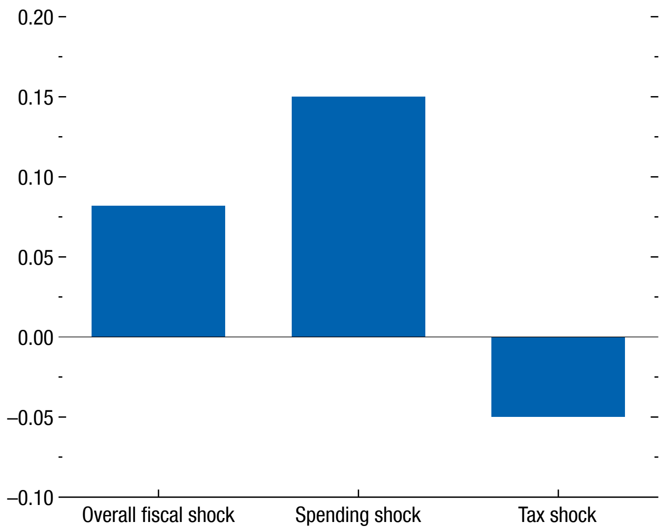
Further analysis of components of recipient-country output corroborates the importance of trade for the transmission of fiscal shocks (Figure 4.6), consistent with the conceptual framework outlined above. In particular, a positive fiscal shock from abroad is estimated to raise recipient-country bilateral exports to the source countries. With higher export demand, firms expand investment to build production capacity, generating a second-round effect on recipient-country investment, whereas the impact on consumption appears negligible. The boost to exports and investment increases imports, some of which come from source countries. With bilateral imports rising by much less than bilateral exports, however, the recipient's trade balance with the source countries improves following the fiscal shock.

[15]These effects are assumed to be symmetric during fiscal expansions and consolidations—the panel analysis cannot disentangle a potential asymmetry from different policy actions.

[16]As discussed earlier, fiscal shocks in the chapter yield domestic spending multipliers slightly above one and tax multipliers slightly below one, on average, across the source countries.

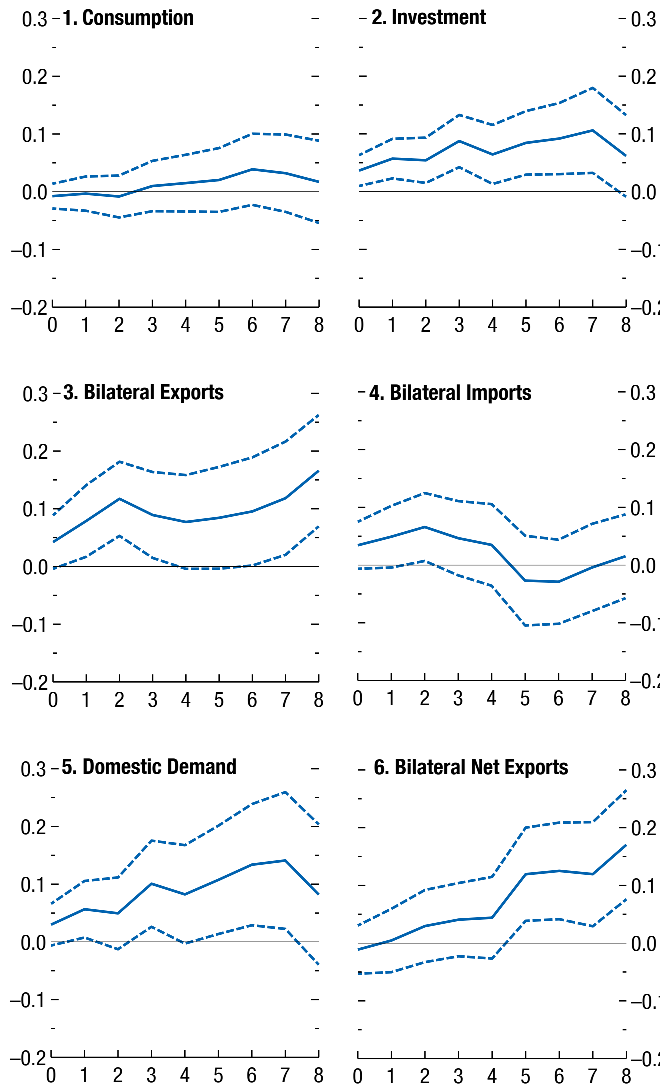
[17]Beetsma and others (2006) find that a 1 percent of German (French) GDP shock to government spending results in a European GDP response of about 0.14 (0.08) percent after two years. For a tax shock, spillovers are about –0.05 (–0.03) percent. Compared with studies that express shocks in units of recipient-country GDP (Auerbach and Gorodnichenko 2013; Goujard 2017), estimates are also broadly similar. A detailed comparison to the literature is provided in Blagrave and others, forthcoming.

**Figure 4.5. Spillovers of Fiscal Shocks on Recipient Countries' Output**
*(One-year average impact on output; percent)*




Source: IMF staff calculations.
Note: Shocks are normalized to an average of 1 percent of GDP across source countries.

**Figure 4.6. Dynamic Responses of Components of Recipient Countries' Output to a Fiscal Shock**
*(Percent of output; quarters on x-axis)*




Source: IMF staff calculations.
Note: $t = 0$ is the quarter of the shock. Solid lines denote point estimates, and dashed lines denote 90 percent confidence bands. Responses to an overall fiscal shock are presented. Shocks are normalized to an average of 1 percent of GDP across source countries.

The empirical spillover estimates are robust to alternative specifications and shock-identification strategies. For example, the baseline results do not change much with the inclusion of additional control variables (for example, the recipient-country short-term interest rate, output gap, unemployment rate, and fiscal stance).[18] Estimates are also similar—though slightly larger—using a panel vector autoregression estimation methodology that allows for potential feedback effects of exchange rates and interest rates on output. In addition, estimates using comparable fiscal shocks obtained from alternative identification strategies—namely forecast errors and narrative approach—also yield spillover estimates that are similar in size and dynamics. This provides reassurance that the baseline results are not driven by the structural vector autoregression methodology for identifying fiscal shocks.[19] Annex 4.3 gives more details about robustness tests.

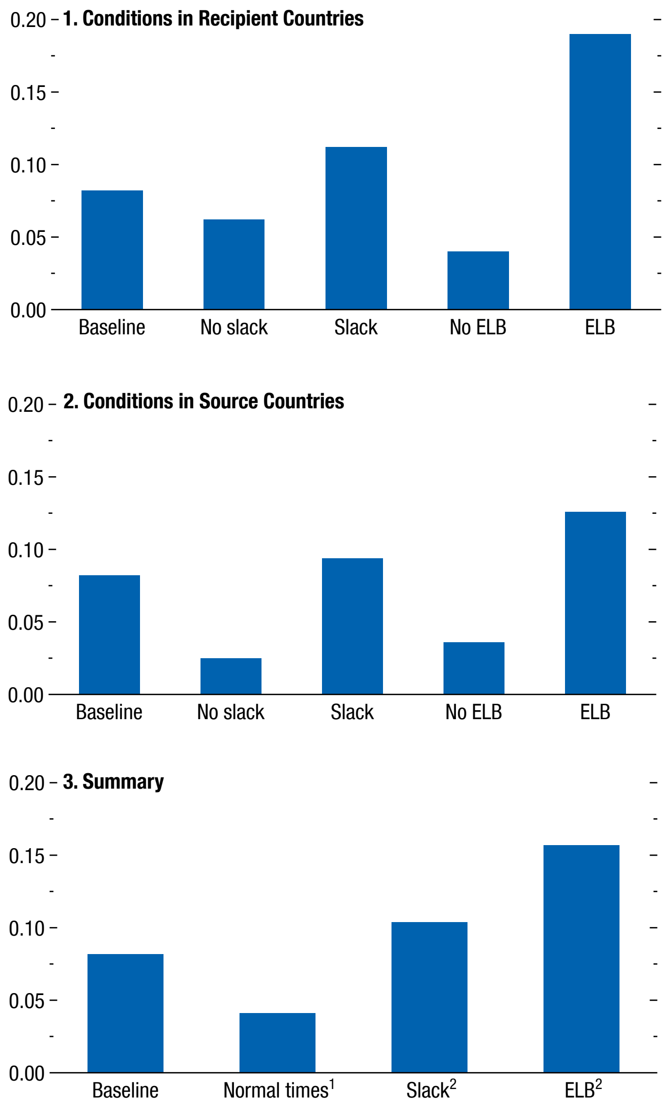
## Spillovers under Different Economic and Policy Conditions

Business cycle and monetary policy conditions in both source and recipient countries, along with the bilateral exchange rate regime, can affect the magnitude of spillovers from fiscal policy. As outlined earlier in the conceptual framework, these factors are expected to affect the domestic impact of fiscal shocks—if

[18]These robustness checks can be found in Blagrave and others (forthcoming).

[19]Forecast errors are constructed as the difference between actual and projected values of the relevant fiscal variable (spending or tax revenues). The shocks based on forecast errors are identified as residuals from a regression of the spending- or tax-based forecast errors on GDP forecast errors and lagged macroeconomic variables.

**Figure 4.7. Spillovers under Various Economic and Policy Conditions**
*(One-year average impact on output; percent)*




Source: IMF staff calculations.
Note: ELB = effective lower bound. Slack is defined as output gap below zero; and ELB corresponds to short-term interest rates in the bottom 25 percent of cross-country historical distribution. Responses to an overall fiscal shock are presented. Shocks are normalized to an average of 1 percent of GDP across source countries.
[1]Normal times refer to average of no slack and no ELB in both source and recipient countries.
[2]Average estimates for conditions in source countries and conditions in recipient countries.

they pertain to the source country—as well as their cross-border transmission. In general, a larger impact in the source country is expected to give rise to more significant spillovers.

### *Cyclical Position and Monetary Policy Constraints*

To test how cyclical positions and monetary policy affect the impact of fiscal shocks, the baseline econometric framework is augmented to allow for potential regime dependence (see Annex 4.2 for details). The definitions of regimes are based on the prevailing output gap or the level of the short-term interest rate in either source or recipient countries. Specifically, a negative output gap is assumed to represent economic slack, and a short-term interest rate below the 25th percentile of the relevant cross-country distribution is a proxy for monetary policy constrained by the effective lower bound.[20] Results are robust to using alternative definitions of slack, including the unemployment gap or smooth-transition probability as in Auerbach and Gorodnichenko (2013). For the effective lower bound, results are also robust to using an absolute interest rate threshold that is common to all countries.

Consistent with theory and empirical findings in the domestic multiplier literature, spillovers are estimated to be larger during episodes of economic slack than in normal times. For example, if the recipient country has slack when the external fiscal shock hits, its output would rise by 0.11 percent over the first year in response to a 1 percent of GDP overall fiscal shock in an average major advanced economy. By contrast, the response to the same shock would be almost halved—to 0.06 percent—when there is no economic slack (Figure 4.7, panel 1). Differential effects are also observed when the *source* economy has slack, compared with when it does not—with estimates varying between 0.09 percent and 0.03 percent, respectively (Figure 4.7, panel 2).

Spillovers can be even larger when monetary policy is constrained by the effective lower bound, either in the source or the recipient country (Figure 4.7, panels 1 and 2). For example, subject to a 1 percent of GDP overall fiscal shock in an average major advanced economy, the response of recipient-country output can be more than four times greater when its interest rate is exceptionally lower than in normal times.[21] Monetary

[20]Separate distributions are applied for advanced and emerging market economies.
[21]These results—for both slack and effective lower bound cases, in both recipient and source countries—also extend to disaggregated spending and tax shocks (see Blagrave and others, forthcoming, for more details).

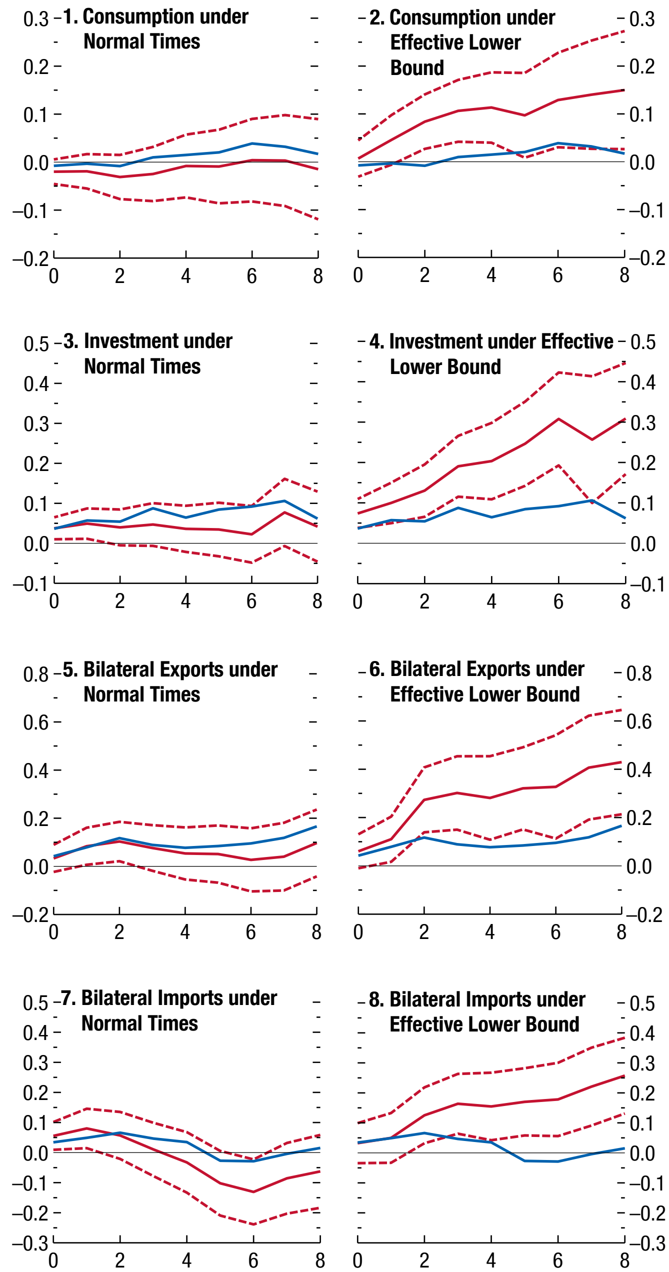
policy constraints in source countries have a similar effect on spillovers, as they can amplify the domestic impact of fiscal shocks. Although slack and the effective lower bound have distinct mechanisms to amplify spillovers, it is often difficult to clearly distinguish the two states in empirical estimation because they can coincide in practice, as has occurred in recent years.[22] This caveat should be kept in mind when interpreting the results.

The response of GDP components under monetary policy constraints offers further insights into how a fiscal shock is transmitted to recipient countries (Figure 4.8). Faced with a positive fiscal shock from abroad, consumption—and particularly investment—in a recipient country responds much more strongly when the domestic nominal interest rate is close to the effective lower bound, likely reflecting declining real interest rates associated with higher expected inflation. This is consistent with results from theoretical models (see section on factors affecting transmission) and is confirmed by the results of the model-based simulations presented in the next section. The responses of exports to and imports from the source countries are also stronger when monetary policy accommodates the fiscal shock, in line with the domestic response of investment.

### *Exchange Rate Regime*

As discussed in the section on factors affecting transmission, the exchange rate regime can also impact the size of fiscal spillovers. To investigate this question, this section analyzes whether the impact of a fiscal shock in the United States varies for recipient countries with fixed and flexible exchange rate regimes vis-à-vis the US dollar. The United States—with its global currency and systemic trade importance—is a suitable source country for this exercise. Countries do not typically peg to the British pound or the Japanese yen. In the case of the euro, Germany's and France's trade importance is mostly within Europe, where most sample countries are

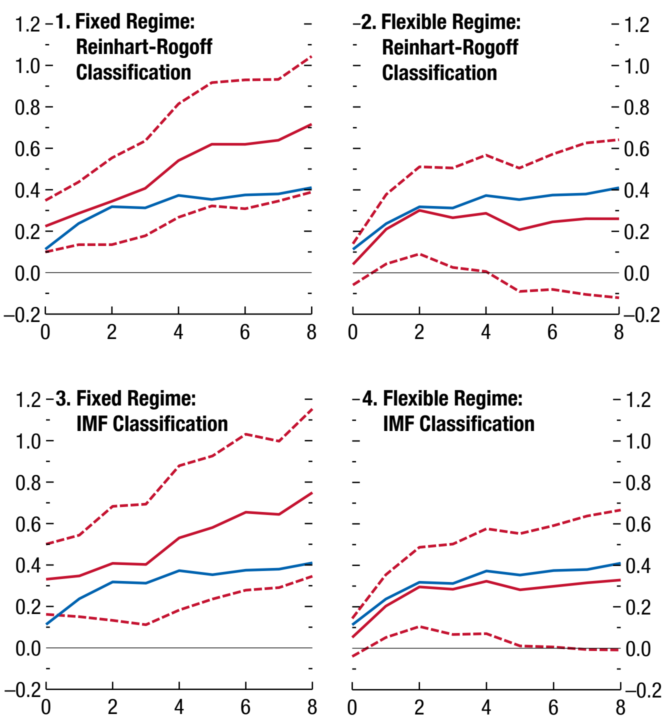
**Figure 4.8. Dynamic Reponses of Components of Recipient Countries' Output under Normal Times and Effective Lower Bound in Recipient Countries**
*(Percent of output; quarters on x-axis)*




Source: IMF staff calculations.
Note: Normal times = no effective lower bound. $t = 0$ is the quarter of the shock. Solid red lines denote point estimates under different conditions; dashed red lines denote 90 percent confidence bands; and solid blue lines represent the unconditional response. Effective lower bound corresponds to short-term interest rates in the bottom 25 percent of cross-country historical distribution. Responses to an overall fiscal shock are presented. Shocks are normalized to an average of 1 percent of GDP across source countries.

[22]In the post-2000 sample considered in this empirical exercise, about 26 percent of country-quarter observations fall under the definition of "effective lower bound," three-quarters of which coincide with economic slack. Similarly, about 55 percent of observations fall under the definition of "slack," 35 percent of which coincide with the effective lower bound. For example, many advanced economies experienced both severe slack and very low interest rates in the aftermath of the global financial crisis. Japan, in particular, experienced both slack and effective lower bound for 84 percent of the observations during the sample period.

**Figure 4.9. Dynamic Reponses of Recipient Countries' Output to US Spending Shock under Various Exchange Rate Regimes**
*(Impact on output, percent; quarters on x-axis)*




Source: IMF staff calculations.
Note: $t = 0$ is the quarter of the shock. Solid red lines denote point estimates conditional on exchange rate regime; dashed red lines denote 90 percent confidence bands; and solid blue lines represent the unconditional estimates. Shocks are normalized to an average of 1 percent of GDP across source countries (note that this represents a less than 1 percent of US GDP shock).

either euro area members or peg to the euro, not allowing for enough variation in the data to identify the effect for those with flexible regimes.

The empirical framework is again modified to allow for regime dependence of the fiscal shock—now originating only in the United States—where the regime definition is based on the prevailing bilateral exchange rate arrangement between the United States and the recipient country in a particular period. Specifically, a "fixed" exchange rate regime is defined as encompassing de facto pegs or crawling pegs, classified using two alternative methods: (1) Reinhart and Rogoff (2004) updated by Ilzetzki, Reinhart, and Rogoff (2017a, 2017b)—henceforth called "Reinhart-Rogoff" classification; and (2) the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions* ("IMF" classification).[23] More details are provided in Annex 4.1.

The evidence suggests that a government spending shock in the United States generates stronger and more persistent impacts on countries whose exchange rates are pegged to the US dollar than on those whose exchange rates are more flexible (Figure 4.9). This is the case regardless of which exchange regime classification is used. The difference in the output responses between fixed and flexible regimes is statistically significant on impact under both classifications and also during the second year under the Reinhart-Rogoff classification. At the same time, no difference in spillovers is observed between fixed and flexible regimes from an overall fiscal shock or a tax shock (not shown). Taken at face value, this result seems to point to relatively weak expenditure switching effects in the transmission of spending shocks. This weakness could reflect that, for a significant portion of the sample, US monetary policy was constrained by the effective lower bound, limiting interest rate and hence exchange rate movements. Another possibility is that, as discussed earlier, trade integration may be stronger under pegs—beyond what can be captured by the simple import ratios used in weighting the shocks.

## The Transmission of Fiscal Shocks—Model-Based Analysis

To complement the empirical analysis, the chapter presents model-based simulations using a multiregion general equilibrium model—the IMF's G20 Model. The model simulations are intended to be illustrative and offer further insights into the macroeconomic adjustment to fiscal shocks—including the response of exchange and interest rates—and more granularity on the impacts of various fiscal instruments. Overall, simulations serve as theory-based cross-checks on the empirical results and provide insights into how fiscal shocks are propagated.[24]

The results are generally consistent with the empirical findings in this chapter: simulations show that spillovers from temporary fiscal shocks can differ

[23]In 2015, for example, the Reinhart-Rogoff classification has more recipient countries classified as having "fixed" exchange rates compared with the IMF classification. The number of fixed-rate countries varies over time. In general, there tend to be more fixed exchange rate regimes in earlier years of the sample.

[24]Additional details on the G20 Model are available in Andrle and others (2015).

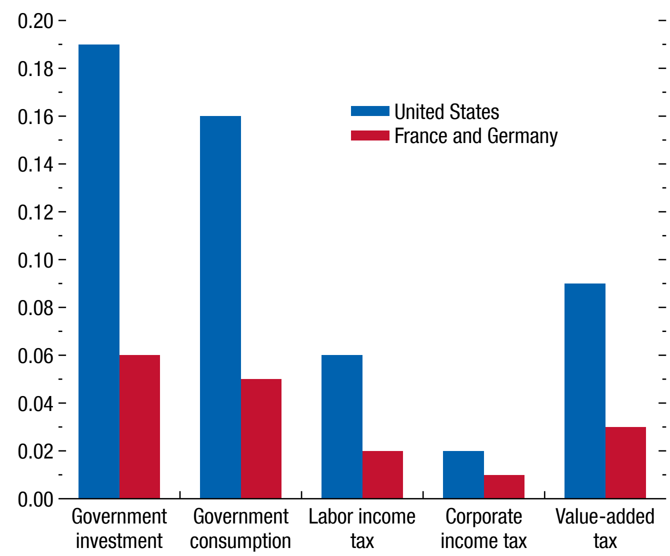
substantially depending on the monetary policy response and the fiscal instruments used. In addition, the responses of GDP components under different assumptions on monetary accommodation closely resemble those identified empirically.[25] In all cases, fiscal shocks are expressed as a share (generally 1 percent) of a particular source country's GDP—this differs from how results were presented in the empirical section and implies that, all else equal, shocks emanating from larger countries will have larger spillover effects.

### Spillovers on Output: Fiscal Instruments and Policy Accommodation

The model simulations confirm substantial spillovers from government spending shocks. Specifically, they show that spending shocks have larger spillover effects than do tax shocks.[26] This coincides with results from the empirical analysis described in this chapter. However, structural models offer insights into the impact of specific fiscal instruments as well, as shown in Figure 4.10:

- *Spending instruments:* Government investment shocks in the G20 Model have larger domestic and spillover effects than shocks to government consumption. This is because government investment increases the public capital stock, which is assumed to increase private sector productivity, stimulating private investment and labor demand and in turn raising wages and labor income. By contrast, government consumption does not affect private sector productivity.
- *Tax instruments:* Model simulations suggest that temporary changes in consumption taxes have the largest domestic and spillover effects among tax instruments. Unlike cuts in labor income or corporate taxes, where benefits can be saved, households must increase their current-period spending to take advantage of temporarily lower consumption taxes.[27] In addition, because investment decisions have a long planning horizon and investment can be costly to adjust (Christiano, Eichenbaum, and Evans 2005), the impact of temporary corporate income tax changes is smaller than that of temporary labor income tax changes—the latter affect liquidity-constrained households, which fully adjust consumption in response.

**Figure 4.10. Impact of Fiscal Shocks on Global GDP Based on Various Instruments**
*(Two-year average impact, percent)*




Source: IMF, G20 Model (G20MOD) simulations.
Note: All shocks are 1 percent of source-country GDP, lasting two years.

Consistent with the empirical analysis, model simulations show that spillovers on output can vary widely, depending on the response of monetary policy, in both source and recipient countries. Figure 4.11 depicts the impact of the same temporary two-year US government spending and tax shocks considered in Figure 4.10—using the *average* across spending and tax instruments—on recipient-country GDP under different monetary policy assumptions: (1) a rule-based response in both source and recipient countries, (2) accommodation in the United States during the first two years following the fiscal shock, (3) accommodation in recipient countries during the first two

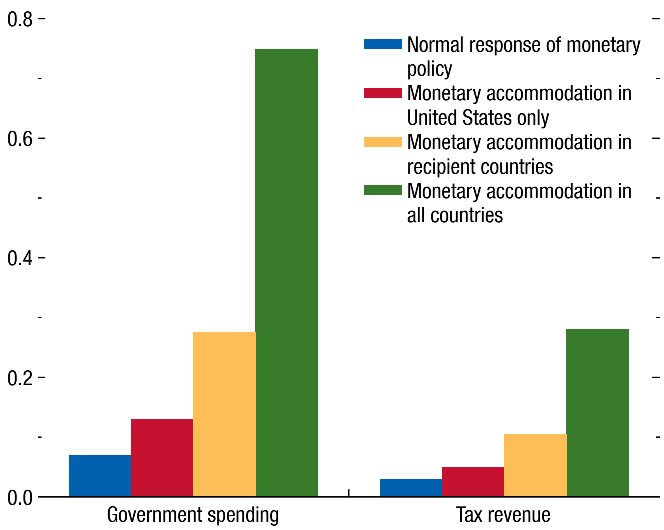
[25]The domestic and spillover effects of permanent fiscal shocks may differ from those of temporary shocks, partly because of their effects on interest rates. For example, permanent fiscal consolidations in large countries may lower global interest rates, thereby crowding in investment and boosting GDP over the long term. Some permanent fiscal reform scenarios are considered in the next section.

[26]For simplicity, the analysis presented here is conducted for France, Germany, and the United States; the intention is to draw broad lessons about the heterogeneity of spillovers across different fiscal instruments. The findings presented here apply equally to other countries' fiscal shocks.

[27]Conversely, when consumption taxes increase temporarily, households can avoid some of the burden by postponing consumption.

**Figure 4.11. Spillovers from US Fiscal Shocks with and without Monetary Accommodation**

*(Two-year average impact on rest of the world GDP, percent)*




Source: IMF, G20 Model (G20MOD) simulations.
Note: Normal response of monetary policy is a rule-based response, in countries without fixed exchange rate regimes, where monetary policy responds to an increase in expected future inflation by increasing nominal interest rates to reduce demand and return inflation to target.

years, and (4) accommodation in both the United States and recipient countries during the same period. Spillovers vary markedly depending on the response of monetary policy—for example, they can be about four times larger if monetary policy in recipient countries fully accommodates the shock, as compared with when monetary policy follows the inflation-forecast targeting rule in each country.[28,29] These results are closely aligned with the empirical analysis presented in Figure 4.7—when interest rates in the recipient country are at or near the effective lower bound, spillover effects are estimated to be about four times larger than they are during normal times.

Model-based simulations can also offer insights in terms of regional patterns of the impact of fiscal shocks. Spillovers from stimulus in the United States have the broadest global reach—due to the large size of the US economy and its moderately strong trade links with most regions (Figure 4.12).[30] Spillovers from the United States are largest on countries in Latin America and Canada—all of which account for significant shares of US import demand. For shocks from France and Germany, spillovers are largest on Europe, given deep trade integration, but relatively small on other regions. Finally, fiscal measures in China have meaningful spillovers on each region due to the size and openness of the Chinese economy. By region, spillovers are slightly larger on countries in Asia—given strong trade links—though spillovers on Europe, Canada, and Latin America are not trivial. China's economy, given its growing global clout, is playing an important role in driving spillovers onto neighboring countries through the trade channel and the impact of fluctuations in demand on commodity prices (IMF 2016).

## Macroeconomic Adjustment and the Role of Financial Variables

Model simulations can give a richer description of the macroeconomic dynamics behind fiscal spillovers. In particular, simulations allow for an examination of the dynamics of interest rates and exchange rates—because these variables are forward-looking in nature, they respond to changes in the expected future state of the economy, so when a change in fiscal policy is announced or expected, these variables react immediately. This makes it difficult to capture their behavior in empirical exercises using structural shocks, which typically assess the impact of the implementation of fiscal changes.[31] The chapter uses both model-based analysis and an alternative empirical approach that isolates anticipation effects to assess the impact of fiscal shocks on exchange rates and external positions in recipient countries.

To shed light on the dynamics of adjustment following fiscal shocks, Figure 4.13 presents the response of several variables in the United States and the global

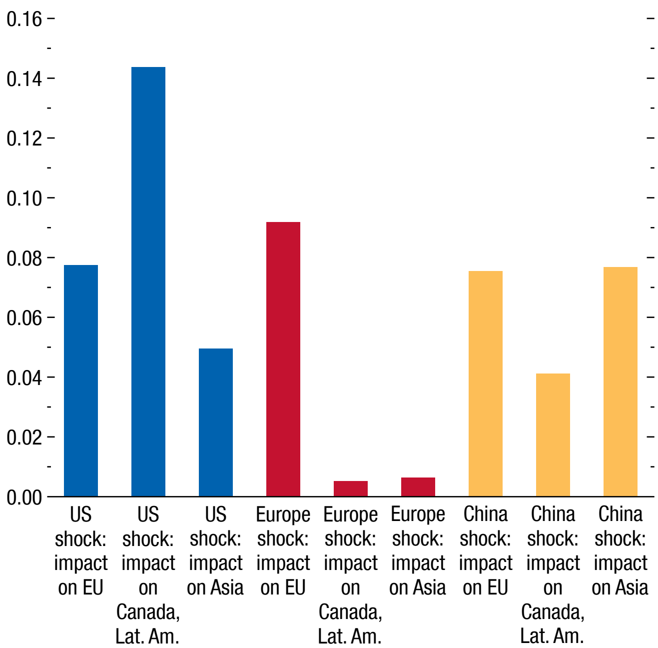
[28]In the G20 Model, monetary policy in countries with flexible exchange rate regimes responds to an increase in expected future inflation by increasing nominal interest rates to reduce demand and return inflation to target.

[29]Spillovers are even larger under the full accommodation scenario—they should be viewed as an upper bound, as such a scenario would require an exceptional coordinated accommodation by monetary policy in all countries.

[30]The regional distribution of spillovers predicted by model simulations closely resembles those implied by the empirical analysis presented earlier. See Blagrave and others (forthcoming) for more details.

[31]Several studies estimating fiscal shocks in structural vector autoregression models find that increases in government spending trigger exchange rate *depreciations*—see, for example, Corsetti and Müller (2006); Kim and Roubini (2008); Monacelli and Perotti (2010); Enders, Müller, and Scholl (2011); and Ravn, Schmitt-Grohé, and Uribe (2012). This empirical result runs counter to the predictions of the Mundell-Fleming-Dornbusch framework, although it is consistent with some new open-economy macroeconomic models (Obstfeld and Rogoff 1995).

**Figure 4.12. Regional GDP Impact of Government Spending Shocks from the United States, Europe, and China**
*(Two-year average impact, percent)*

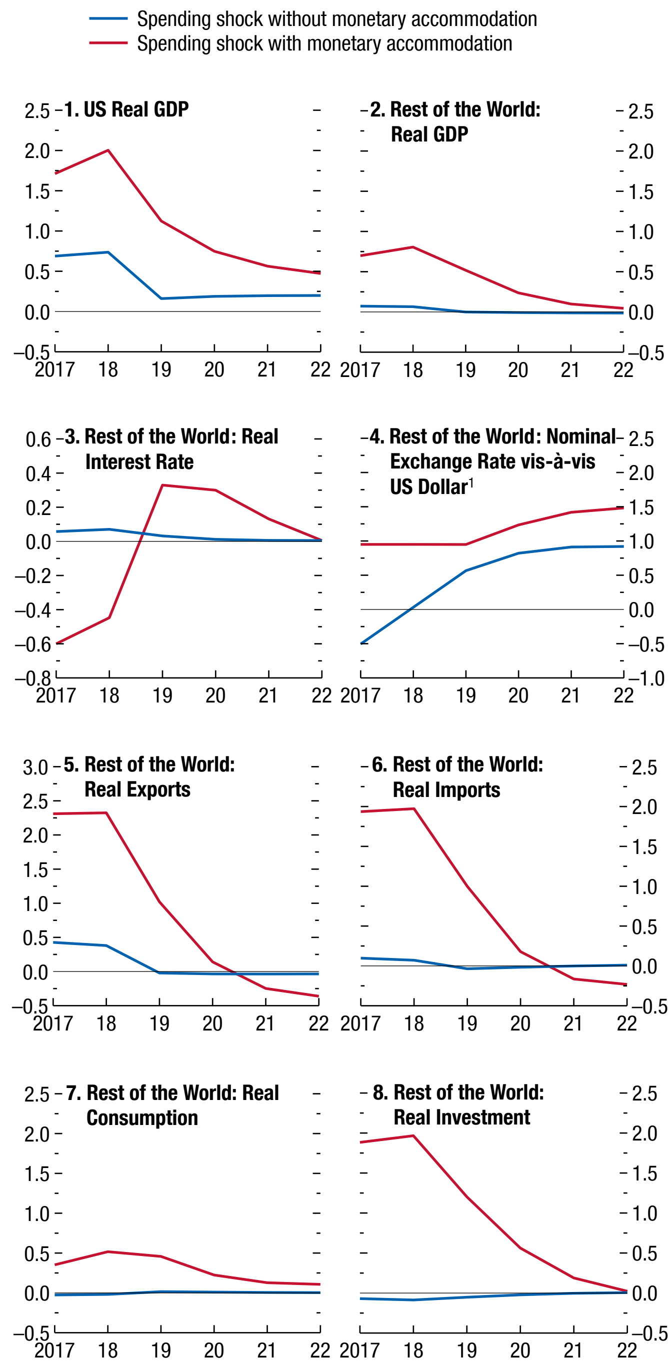



Source: IMF, G20 Model (G20MOD) simulations.
Note: EU = European Union; Lat. Am. = Latin America (Argentina, Brazil, Mexico). Europe shock refers to France and Germany shocks. Shock to government spending is equivalent to 1 percent of GDP, lasting two years. Average level impact over two years with no monetary accommodation in any country is presented.

economy to a temporary government spending increase in the United States. Given the importance of the monetary policy reaction, it presents a two-year stimulus scenario under both a normal monetary policy response (blue line) and monetary policy accommodation in all countries (red line).

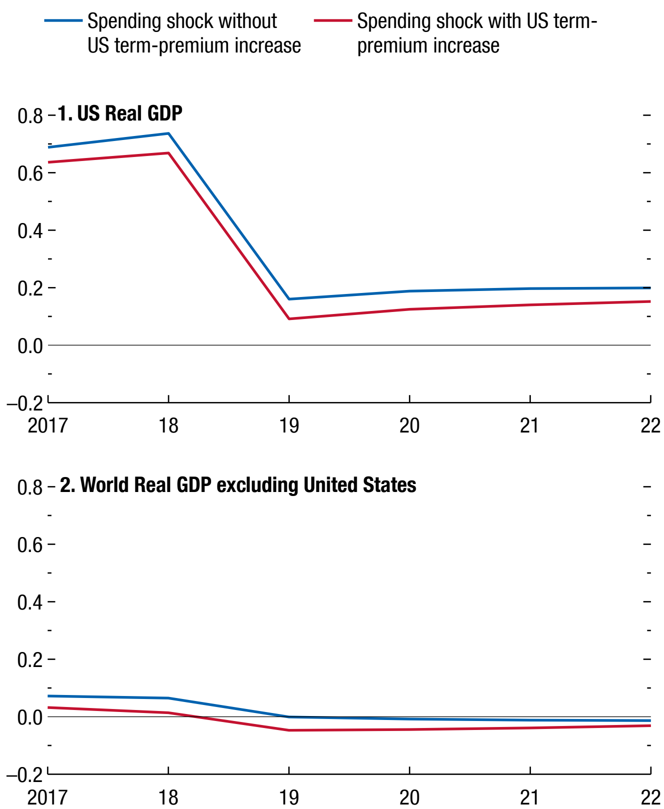
- *Monetary policy response:* Following the fiscal shock, policy rates increase to curb inflationary pressures from the demand shock both in the United States and in recipient countries. The uncovered interest parity condition implies that bilateral nominal exchange rates in relation to the US dollar depreciate in the short term given that the response of US monetary policy is more pronounced than elsewhere—being the source of the shock, inflationary pressures are greater there. The increase in US external demand and the nominal exchange rate depreciation in recipient countries induce a modest increase in exports from the rest of the world, and thus a slight improvement in the corresponding trade balances. However,

**Figure 4.13. Dynamic Reponses to a US Government Spending Shock**
*(Percent deviation from baseline)*




Source: IMF, G20 Model (G20MOD) simulations.
Note: Red lines denote the response to a 1 percent of GDP US government spending shock lasting two years with monetary accommodation in both source and recipient countries lasting two years, and blue lines represent the response to the same shock without monetary accommodation in any country.
[1]Increase represents appreciation.

**Figure 4.14. Spillovers from US Spending Shock with and without a US Term-Premium Increase**
*(Percent deviation from baseline)*




Source: IMF, G20 Model (G20MOD) simulations.
Note: Red lines denote the response to a 1 percent of GDP US government spending shock lasting two years, with a 25 basis point increase in the US term premium and subsequent spillovers to term premiums in other countries. Blue lines represent the response to the same spending shock with no term-premium increase. No monetary accommodation is assumed for any country.

the increase in world interest rates reduces consumption and investment in the rest of the world. The net effect on GDP is small but positive.

- *Monetary accommodation:* In this scenario, the positive impact on inflation goes unchecked, causing real interest rates to decline. This triggers a strong positive response in both consumption and investment in the rest of the world as the cost of capital and current-period consumption declines. The contrast between the dynamics of consumption and investment under monetary accommodation, as opposed to normal times, is consistent with the empirical findings shown in Figure 4.8. Monetary accommodation also implies a much larger impact on both exports—due to stronger external demand conditions—and imports, due to stronger domestic activity in recipients. The expenditure switching channel operates in the opposite direction under monetary accommodation, with recipient countries' real exchange rates *appreciating* against the US dollar. This occurs because the negative impact on US real interest rates is more pronounced than elsewhere. Recipients' trade balances still improve because of the strong increase in demand from the United States. Overall, as shown in Figure 4.11, the cumulative effect on global GDP is amplified under monetary accommodation.

If the term premium increases following a fiscal impulse—capturing potential concerns about debt sustainability or higher future inflation—and monetary policy responds normally, the impact of stimulus in the United States is reduced and spillovers are marginally smaller (Figure 4.14). In this case, higher interest rates than in the baseline scenario discourage investment and consumption in the United States. Therefore, the net effect on GDP in the rest of the world is slightly smaller, illustrating the potential for an adverse reaction of financial markets to an increase in spending to reduce spillovers.[32] This possibility underscores the importance of having a credible medium-term macroeconomic framework, which gives market participants confidence that inflation will be held in check because debt dynamics are sustainable.

An empirical examination of how exchange rates and external positions respond to fiscal shocks is presented in Box 4.1. To capture anticipation effects, the analysis constructs fiscal shocks based on the methodology of Forni and Gambetti (2016), which identifies these shocks at announcement dates, as captured by changes in professional forecasts. It shows that an increase in government spending in the United States leads to a real appreciation of the dollar and a worsening of the US trade balance, as predicted by standard macroeconomic models.

## Fiscal Reforms

The model-based analysis also facilitates the examination of spillovers from so-called fiscal reforms—defined

[32]In this scenario, the increase in the US term premium is assumed to drive up term premiums in other countries as well, according to historical correlations between these variables across countries.

as permanent budget-neutral shifts in the composition of the public sector budget. The scenarios considered so far in the chapter deal with temporary fiscal impulses associated with a change in the fiscal stance in the source country. However, budget-neutral fiscal reforms may also have spillover effects. To demonstrate these differences, the following two scenarios are considered: (1) a budget-neutral corporate income tax reform and (2) a budget-neutral infrastructure spending increase. These illustrative scenarios suggest that fiscal reforms have limited cross-border effects, though significant changes can still generate large spillovers.

## Budget-Neutral Corporate Income Tax Reform

The direct spillovers of a (simultaneous) budget-neutral reduction in corporate income tax rates in France, Germany, and the United States—the "source" countries in this scenario—would be slightly negative.[33] The scenario's main assumptions are that corporate tax rates are reduced by 15 percentage points, consumption-tax rates rise to offset the revenue loss, and monetary policy responds normally.[34] The direct impact of the reform is captured by the blue lines in Figure 4.15. As shown in the figure,

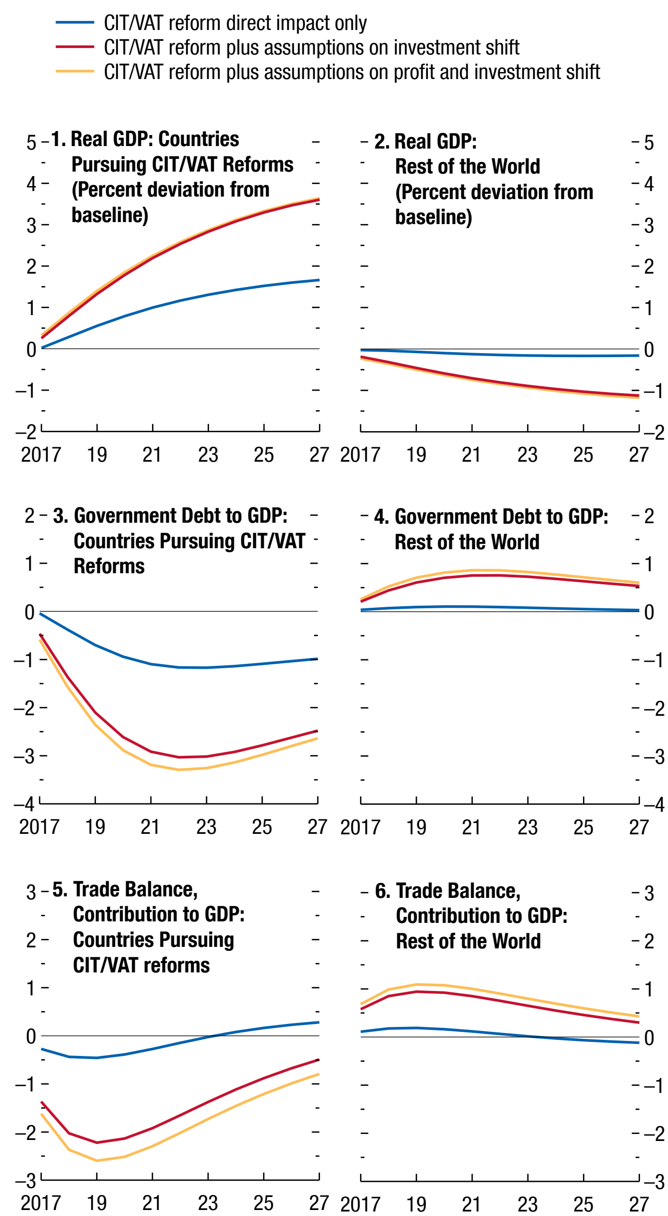
- Real GDP increases gradually as lower corporate income tax rates raise the return to capital in the source countries, stimulating investment. This positive effect on reform-country GDP is only partly counteracted by the increase in the consumption tax rate, which depresses consumption. Although these reforms are initially budget neutral, the expansion of investment increases tax revenues over time, which reduces the deficit and the debt stock in source countries.[35] Their trade balances deteriorate slightly due to investment-driven import demand.
- Given the lack of fiscal stimulus in the short term, the direct spillovers on recipient countries are limited. Over the medium term, GDP in recipient countries is slightly reduced, as recipient countries are now at a

[33]France, Germany, and the United States are considered in this scenario given that they currently have corporate income tax rates above the OECD average, giving them scope for a substantial reduction. Reforms are budget neutral, contingent on the baseline path of output.

[34]In the case of the United States, which has no federal consumption tax, this would imply enacting such a tax.

[35]Absent the offsetting increase in consumption taxes, the corporate income tax reduction would result in a net loss of tax revenues, even after accounting for the increase in the tax base due to stronger investment.

**Figure 4.15. Spillovers from Corporate Income Tax Reduction Financed by an Offsetting Increase in Value-Added Tax**
*(Percentage-point deviation from baseline, unless noted otherwise)*




Sources: IMF, G20 Model (G20MOD) simulations; and IMF staff estimates.
Note: Blue lines denote the response to CIT/VAT reforms only, red lines denote the response to CIT/VAT reforms plus assumptions on investment shift, and yellow lines denote the response to CIT/VAT reforms plus assumptions on profit and investment shift. No monetary accommodation is assumed for any country. For rest of the world, no reforms are assumed. CIT = corporate income tax; VAT = value-added tax.

competitive disadvantage with respect to their return to capital, and real interest rates are slightly higher—implying lower investment. This negative impact more than offsets the small impetus to exports associated with increased demand from source countries.

However, beyond this direct effect, fiscal reforms may also affect investment and profit-reporting decisions. As discussed in Devereux (2008) and De Mooij and Ederveen (2008), corporate tax rates influence both intensive and extensive (discrete or location) decisions of firms, suggesting that multinational companies may relocate operations when faced with significant changes in relative tax rates in different jurisdictions. In addition, both studies note that it is feasible for multinational companies to shift profits between countries. In the scenario, the lower corporate income tax rates prompt these firms to shift operations—both investment and the jurisdiction in which profits are reported—to source countries, to the detriment of recipients.

The effect of investment and profit shifting are illustrated by the red (investment shifting only) and yellow (investment and profit shifting together) lines of Figure 4.15. Based on estimates in the literature on profit and investment shifting, the scenario assumes that foreign direct investment in countries not pursuing reforms could decline by about $400 billion—this loss is assumed to be distributed equally across all countries as a share of GDP.[36] By contrast, the countries pursuing reforms are assumed to benefit by a similar amount, above and beyond the immediate impact on investment from the corporate income tax reduction discussed above.[37] Profit shifting is assumed to be a pure fiscal revenue gain for source countries and a corresponding loss for other countries.[38]

The results suggest that investment shifting and profit shifting could trigger more significant spillovers on activity and affect fiscal positions. Activity in source countries would be considerably higher—with GDP increasing by almost 4 percent after 10 years—although significantly reduced elsewhere, by about 1 percent. Corresponding changes in trade balances would imply a material deterioration for corporate-tax-reforming countries—as import demand rises significantly—and an improvement for the rest of the world, due to import compression and export growth. Both investment shifting and profit shifting can also have an impact on fiscal positions, improving the primary balance of source countries and undermining the balance of others, above and beyond the direct effects of the corporate income tax reform itself. The marginal impact of profit shifting on public debt stocks can be seen by comparing the red and yellow lines in panels 3 and 4 of Figure 4.15—it is clear that the impact of investment shifting (measured by comparing the blue and the red lines) is much larger than that of profit shifting.[39]

### Budget-Neutral Permanent Increase in Public Investment

Compared with corporate income tax reforms that trigger investment and profit shifting, a budget-neutral permanent increase in public investment would have very modest spillovers.[40] The scenario assumes a ½ percent of GDP increase in public investment in the five large economies considered in the empirical exercise—France, Germany, Japan, the United Kingdom, and the United States—which is financed by an increase

[36]This is a simplifying assumption. Countries that currently benefit from a significant corporate income tax gap relative to the source countries, or those with a significant presence of multinational corporations based in countries pursuing corporate income tax reforms, may be more adversely affected by investment shifting.

[37]The assumed impact of investment shifting is derived by applying an estimated semielasticity of the corporate tax base to tax rate changes from De Mooij and Ederveen (2008)—taken to be –3.2—to foreign direct investment inflows and outflow data for France, Germany, and the United States, which proxy the foreign portion of the corporate tax base subject to relocation. Under a large corporate income tax rate reduction, foreign direct investment inflows would increase as foreign multinationals choose to locate more production in the countries pursuing reforms, and outflows would decline as domestic multinationals choose to develop more production capacity domestically. It is important to note that semielasticities in the literature vary widely and that the estimated investment-shifting impact of corporate income tax reform is sensitive to these assumptions.

[38]The assumed impact of profit shifting is derived by applying an estimated semielasticity of profits with respect to the tax rate—a value of 2, taken from De Mooij and Ederveen (2008)—to estimates of the share of multinational firms in each country, which is assumed to be approximately 0.6 in Germany and France and 0.3 in the United States, and to the corporate income tax rate reduction being considered (15 percentage points). The same caveats mentioned for investment shifting regarding elasticities apply.

[39]The impact on public debt in this scenario is only transitory, with all debt-to-GDP ratios returning to baseline in the long term. The speed of adjustment back to baseline depends on assumptions regarding the aggressiveness of the model's fiscal rule—other assumptions would lead to different adjustment dynamics.

[40]This result is broadly consistent with results reported in Bussière and others (2017), who find that most budget-neutral fiscal reforms do not have large cross-border trade spillovers, except in the case of coordinated reforms in periods of accommodative monetary policy.

in consumption taxes. Such a reform would boost the capital stock in source countries, thereby increasing output permanently—the increase in investment resulting from the higher productivity associated with an expansion of the public capital stock outweighs the negative impact on domestic consumption of higher consumption taxes. However, as shown in Figure 4.16, although there would be some modest cross-border impact due to expenditure shifting, the impact would be muted by an exchange rate depreciation in source countries, implying that the expenditure switching channel will eventually offset the positive effect.[41] The impact on recipient countries' trade balances is small, but negative.

## Conclusions

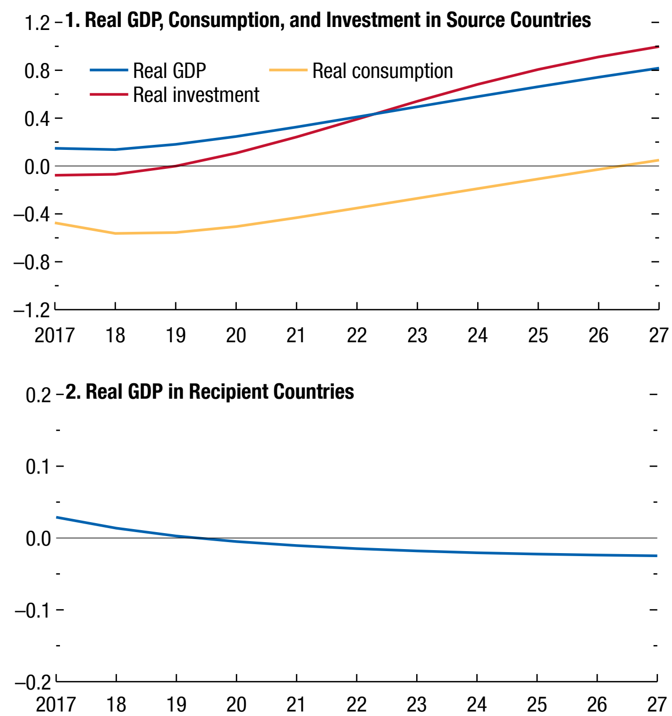
Positive cross-country spillovers from collective fiscal policy actions helped the global economy recover from the global financial crisis, but do fiscal spillovers still matter under much-improved economic conditions today? The chapter finds that spillovers continue to be relevant, but to what extent depends on circumstances in both source and recipient countries. It shows that fiscal spillovers tend to be lower when a fiscal shock originates from a country where GDP is at its potential, but that the impact intensifies when either the source or recipient country is in recession and/or benefiting from accommodative monetary policy. This suggests that spillovers are generally large when domestic multipliers are also large. The chapter also finds that spillovers from government spending shocks are larger than those associated with tax shocks, that the transmission of fiscal shocks may be greater among countries with fixed exchange rates, and that transmission may be dampened if the fiscal impulse at the source tightens global financial conditions.

While the chapter does not offer conclusions about how individual countries should conduct fiscal policy from a domestic perspective, it provides information about potential cross-country effects from such action. The current juncture suggests that positive cross-border effects from stimulus in countries with broadly closed output gaps will generally be smaller than during the crisis, but there could still be benefits. For example, in the euro area, spillovers from a more expansionary fiscal stance in countries with fiscal space—such as higher public investment to raise potential output in Germany—on some trading partners experiencing weak cyclical positions might still be important due to continued accommodative monetary policy and evidence suggesting that spillovers tend to be amplified by currency pegs. More generally, the fiscal instrument also matters: spending on public investment is likely to produce greater cross-border dividends than tax cuts.

The chapter also presents illustrative scenarios of fiscal reforms in which a change in the makeup of the government budget that does not generate a short-term change in the fiscal stance come with small spillovers. However, substantial fiscal reforms, such as large budget-neutral corporate income tax rate reductions—compensated with increases in consumption taxes—that affect the investment-location and

[41]A permanent productivity shock in source countries increases supply by more than demand, implying that the relative price of source-country goods must fall in equilibrium.

**Figure 4.16. Spillovers from Increase in Government Investment in Five Major Economies**
*(Percent deviation from baseline)*




Source: IMF, G20 Model (G20MOD) simulations.
Note: Spillovers from a permanent 0.5 percent of GDP increase in government investment in five major economies (France, Germany, Japan, United Kingdom, United States) financed via value-added tax. No monetary accommodation is assumed for any country.

profit-reporting decisions of multinational firms, could have large spillovers.

Finally, and not surprisingly, fiscal actions with economically meaningful cross-border effects can also impact trade balances. For example, the chapter suggests that fiscal stimulus tends to lead to a deterioration in the trade balance of the country where it occurs, with corresponding improvements in the positions of trading partners. This implies that a fiscal expansion in the United States could exacerbate global current account imbalances, while stimulus in Germany would tend to reduce them.

## Box 4.1. The Spillover Impact of US Government Spending Shocks on External Positions

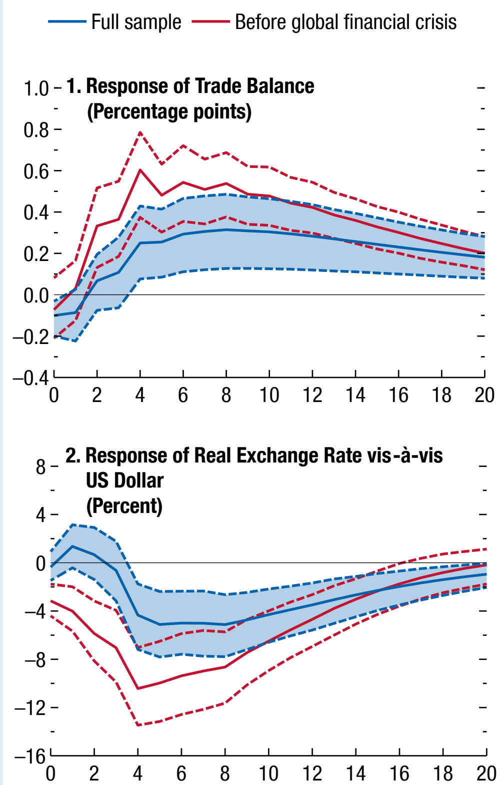
Consensus on the effect of government spending shocks on a country's exchange rate and external balance remains elusive in the empirical literature.[1] This may stem partly from the difficulty of isolating agents' anticipation of fiscal policies, given both legislative and implementation lags, as highlighted by Ramey (2011), among others. This box and a related spillover note (Popescu and Shibata, forthcoming) examine the impact of fiscal spending shocks from the United States on the US trade balance and real exchange rate, from both a multilateral and a bilateral perspective, while carefully taking into consideration the issue of fiscal foresight.

To capture anticipation effects, the approach follows Forni and Gambetti (2016) and relies on professional forecasters' surveys to identify fiscal shocks at the announcement rather than implementation date.[2] Methodologically, the fiscal foresight ("news") shock is identified in a vector autoregression using US data from the first quarter of 1981 through the fourth quarter of 2016.[3] The analysis further extends Forni and Gambetti (2016) to a cross-country perspective to account for recipients' macroeconomic conditions, which is the main unique contribution of this exercise.

The results suggest that news of future government spending leads to a real appreciation of the US dollar and deterioration of the US trade balance—in line with theory and solving the "depreciation puzzle" found in most previous studies. As discussed in Forni and Gambetti (2016), the key intuition is that the inclusion of additional information on fiscal expectations and forecasts improves the estimation of the effects of fiscal spending shocks by capturing more precisely the timing of the impact. The timing is likely significant in assessing the response of fast-moving variables, such as the exchange rate, which react quickly to perceived changes in future conditions.

Moving on to the analysis of spillovers, a panel vector autoregression analysis makes it possible to take into account the recipient country's macro and policy variables (such as cyclical positions, monetary policy, and domestic fiscal policy). The estimation uses an unbalanced panel of 30 US trading partners (23 advanced economies and 7 emerging market economies representing about 80 percent of US imports) from the fourth quarter of 1982 through the third quarter of 2016. Results suggest that an anticipated increase in US government spending triggers real

**Figure 4.1.1. Response of Recipient Countries' Trade Balance and Real Exchange Rate vis-à-vis US Dollar**
*(Quarters on x-axis)*




Source: IMF staff calculations.
Note: $t = 0$ is the quarter of the shock. Dashed lines denote 90 percent confidence bands.

The authors of this box are Adina Popescu and Ippei Shibata.

[1]For example, while the theoretical literature tends to predict that increases in government spending would trigger exchange rate appreciations, the empirical literature often finds the opposite in the case of the United States; this is usually referred to as the "depreciation puzzle."

[2]More specifically, the Survey of Professional Forecasters forecasts of government spending are used to capture preannounced or anticipated (also called "news" or "foresight") fiscal spending by exploiting the change in forecast expectations.

[3]The vector autoregression includes, in this order: real federal government consumption expenditures and gross investment, the fiscal news variable based on Survey of Professional Forecasters forecasts, real GDP, private consumption, the federal surplus divided by GDP, net exports of goods and services divided by GDP, the 10-year Treasury constant maturity rate, and the real effective exchange rate.

## Box 4.1 *(continued)*

exchange rate depreciations in other countries and improvements in their trade balances with the United States. More specifically, an announcement of a 1 percent of US GDP increase in government spending will depreciate a trading partner's exchange rate by about 5 percent after one and a half years while improving the partner's net exports vis-à-vis the United States by 0.3 percentage point of its own GDP after two years (Figure 4.1.1, blue lines).

Estimation over subsamples reveals that the impact on exchange rates and trade balances may have diminished following the global financial crisis. The red lines in Figure 4.1.1 plot the response of the trade balance and real exchange rates vis-à-vis the United States before the global financial crisis (before 2007), suggesting that responses were significantly larger before the onset of the crisis. These results may reflect constrained monetary policy in recent years, which could have dampened US exchange rate appreciation (in response to expansionary fiscal shocks), thus also potentially contributing to a smaller trade balance response.

Performing the same analysis for different groups of countries—only advanced economies or only Group of Twenty economies—suggests that the results are quantitatively robust. The results are also robust to variations in the methodology, including different variable ordering and the inclusion of additional variables, as well as to different weighting schemes (including time-varying weights).

### Annex Table 4.1.1. Data Sources for Quarterly Fiscal Data by Source Country

| Country | Fiscal Data | Data Source | Seasonal Adjustment | Note |
|---|---|---|---|---|
| France | Government spending | Eurostat[1] | SWDA by source | Sum of government final consumption and GFCF |
| | Tax revenue | Eurostat[1] | SWDA by source | Current taxes on income and wealth, excluding social contributions |
| Germany | Government spending | Deutsche Bundesbank | SWDA by source | Sum of government final consumption and GFCF |
| | Tax revenue | Eurostat[1] | X-12-ARIMA by IMF staff | |
| Japan | Government spending | Cabinet Office of Japan | SAAR by source | Sum of government final consumption and GFCF |
| | Government total revenue | Ministry of Finance and Cabinet Office | X-12-ARIMA by IMF staff | Extrapolated using Denton method |
| United Kingdom | Government spending | Office for National Statistics | Seasonally adjusted by source | Sum of government final consumption and GFCF |
| | Tax revenue | Eurostat[1] | X-12-ARIMA by IMF staff | |
| United States | Government spending | US Bureau of Economic Analysis | Seasonally adjusted by source | Sum of government final consumption and GFCF |
| | Tax revenue | US Bureau of Economic Analysis | Seasonally adjusted by source | |

Source: IMF staff compilation.
Note: For government spending, nominal levels are deflated using the GDP deflator when real levels are not directly available from the source. For tax revenue (total revenue for Japan), real levels are calculated by deflating nominal levels using each country's GDP deflator. GFCF = gross fixed capital formation; SAAR = seasonally adjusted and annualized data; SWDA = seasonally and working-day adjusted data; X-12-ARIMA = US Census Bureau software package for seasonal adjustment.
[1]Quarterly nonfinancial accounts for general government database from Eurostat.

## Annex 4.1. Data

### Data for Shock Identification

Quarterly fiscal data used in shock identification for five shock-emitting (source) countries stem from national statistical bureaus, either directly or via Haver Analytics.[42] Quarterly real government spending and tax revenue data used in constructing fiscal shocks are expressed in local currency units, seasonally adjusted, and annualized for the sample period of 2000:Q1–2016:Q2. Government spending is calculated as the sum of quarterly general government consumption and general government gross fixed capital formation from national accounts. For tax revenue, quarterly general government total tax income is used, except for Japan. Data sources for each country are listed in Annex Table 4.1.1. See Blagrave and others, forthcoming, for more details on the data, as well as a discussion of data limitations and construction of fiscal shocks.

[42]France, Germany, Japan, United Kingdom, United States.

### Data for Spillover Analysis

Quarterly data from 55 recipient countries for 2000:Q1–2016:Q2 include series on real output, consumption, investment, exports/imports, bilateral good exports/imports, external demand, short-term interest rates, output gaps, and exchange rate regimes, collected from multiple data sources. Data sources for each series are listed in detail in Annex Table 4.1.2, followed by a list of all the countries in the sample in Annex Table 4.1.3.

#### *Data Description*

- *Real GDP, consumption, investment:* Quarterly real levels are rebased to 2010 prices, expressed in local currency units, seasonally adjusted and annualized. Investment data refer to gross fixed capital formation.
- *Exports/imports:* Quarterly real levels are rebased to 2010 prices, expressed in local currency units, seasonally adjusted and annualized. Data from national accounts stem from Haver Analytics and refer to total exports/imports of goods and services.

### Annex Table 4.1.2. Data Sources for Recipient Countries

| Series | Data Sources | Estimation | Countries Missing Data | Note |
|---|---|---|---|---|
| Real Output | WEO; Haver Analytics | Rebased to 2010; deflated using GDP deflator | None in the sample | Seasonally adjusted, annualized, in national currency |
| Real Consumption, Investment, Exports, Imports | Haver Analytics | Rebased to 2010; deflated using respective deflators for each country and variable | Vietnam | Seasonally adjusted, annualized, in national currency; data from national accounts |
| Bilateral Goods Exports/Imports | DOTS | Average of values reported by the reporter and partner countries | None in the sample | Original data at monthly frequency, aggregated by sum |
| External Demand | WEO; DOTS; Haver Analytics | Export-weighted sum of partner countries' real GDP growth | None in the sample | Seasonally adjusted, quarter over quarter growth, log difference, percent |
| Short-Term Monetary Policy Rate | Bloomberg Finance L.P.; Haver Analytics | Three-month LIBOR, three-month Treasury bill rate, where available | Cyprus, Estonia, Luxembourg, Slovak Republic, Uruguay | Policy rate, deposit rate, target rate used where LIBOR and treasury bill rates were not available |
| Output Gap | WEO; Haver Analytics | Gap between real output and potential output estimated by HP filter | None in the sample | Denton method used to match annual output gap numbers in WEO |

Source: IMF staff compilation.
Note: DOTS = IMF, *Direction of Trade Statistics*; HP = Hodrick-Prescott; LIBOR = London interbank offered rate; WEO = *World Economic Outlook*.

- *Bilateral goods exports/imports:* Bilateral weights are calculated using bilateral exports/imports of goods between 55 countries in the sample and five source countries (5 x 55 = 275 pairs). For each country pair, the average is that of reported values of both countries.
- *External demand:* This is calculated as a weighted sum of partner countries' real growth based on bilateral export weights.
- *Short-term interest rate:* The three-month London interbank offered rate (LIBOR) and three-month Treasury bill rate are used. For more comprehensive country and historical coverage, policy, deposit, and target rates are used where three-month LIBOR and Treasury bill data are not available.
- *Output gap:* The quarterly output gap is first calculated as the gap between real output and potential output, estimated by the Hodrick-Prescott filter. Then, to reconcile any potential difference between the estimated output gap and the annual output gap numbers published in the IMF's *World Economic Outlook* (WEO), the Denton proportional benchmarking method is used. This method both preserves the seasonality observed from quarterly estimated output gap series and matches the data published in the WEO when converted to annual basis.

Variables with notable trends over the sample period are detrended using country-specific linear

### Annex Table 4.1.3. Recipient Countries in Sample

| Region | Countries (55 total) |
|---|---|
| Africa | South Africa |
| Americas | Argentina, Brazil, Canada, Chile, Colombia, Costa Rica, Mexico, Peru, United States,* Uruguay |
| Asia | Australia, China, India, Indonesia, Japan,* Korea, Malaysia, New Zealand, Philippines, Thailand, Vietnam |
| Europe | Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France,* Germany,* Greece, Hungary, Ireland, Israel, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Russia, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom* |

Source: IMF staff compilation.
*Shock-emitting (source) country. Source country is excluded from the set of recipient countries when analyzing fiscal shocks from the same source.

trends. In addition, outliers—observations with quarter-over-quarter GDP growth rates higher than 10 percent or lower than –10 percent in any given quarter (very few observations)—are excluded.

### Exchange Rate Regime Classification

A measure of bilateral exchange rate arrangement vis-à-vis the US dollar is constructed to estimate spillovers for different exchange rate regimes.

For the Reinhart-Rogoff classification, the exchange rate regime is expressed as a time-varying index based on the annual coarse de facto classification from Ilzetzki, Reinhart, and Rogoff (2017a, 2017b), ranging from 1 (most rigid) to 6 (most flexible). For each period, if a country is assigned a value of 1 (de facto peg) or 2 (de facto crawling peg), it is deemed a "fixed regime." The quarterly index is interpolated from annual data, assigning the same value for all four quarters within a year. For example, in 2015, this classification yields seven "fixed" rate countries (Argentina, China, Costa Rica, India, Peru, Philippines, Vietnam) out of the sample of 55 countries.[43]

The IMF pre-2008 classification (coarse) consists of six categories, with 1 being the most rigid and 6 the most flexible.[44] The classification changed in 2008, and post-2008 data are obtained from the IMF's website. As under the Reinhart-Rogoff classification, a country is generally classified as having a fixed exchange rate vis-à-vis the US dollar if it is assigned a value of 1 (de facto peg) or 2 (de facto crawling peg or crawling band narrower than or equal to ±2 percent). Again, the quarterly index is interpolated from annual data. For example, for 2015, this classification yields two fixed-rate countries (China, Vietnam) out of the sample of 55 countries, although there are more fixed-rate countries in earlier periods.

## Annex 4.2. Empirical Strategy

### Baseline Specification

As in Auerbach and Gorodnichenko (2013), the response of output in the recipient country to a fiscal shock abroad is estimated using the local projections method. This approach is particularly well suited to accommodate nonlinearity; that is, it allows estimation of spillovers under different states of the economy. Moreover, the method is more robust to misspecification of the data-generating process than a vector autoregression, for which the misspecification error is compounded at each horizon of the impulse response.

The following baseline linear model at time horizon $h$ (for $h = 0, \ldots, H$) is estimated using a panel ordinary least squares estimator:

$$\frac{Z_{i,t+h} - Z_{i,t-1}}{Y_{i,t-1}} = \alpha_h \frac{Shock_{it}}{Y_{i,t-1}} + \sum_{l=1}^{L} \beta_{hl} X_{i,t-l} + \theta_{hi} + \mu_{ht} + \varepsilon_{iht}, \quad (4.1)$$

in which $Z_{it}$ is the variable of interest (real GDP, consumption, investment, and the like) in recipient country $i$ at quarter $t$, $Y_{it}$ is real GDP in recipient country $i$ at quarter $t$, $Shock_{it}$ is the foreign fiscal shock facing country $i$ at time $t$ (see below), and $X_{it}$ is a vector of control variables including lags of the fiscal shock, lags of GDP growth, and lags of external demand, measured as a weighted average of trading partner growth rates (the number of lags $L = 4$ was chosen). Variables $\theta_{hi}$ and $\mu_{ht}$ capture the country and time fixed effects. Given that the foreign fiscal shock is expressed in units of recipient-country GDP ($Shock_{it}$ is scaled by lagged GDP $Y_{it-1}$), the coefficient $\alpha_h$ is analogous to a domestic multiplier of an external shock (Hall 2009; Barro and Redlick 2011). The impulse response for $H$ periods is constructed from a sequence of estimates $\{\alpha_h\}_{h=0}^{H}$.

The baseline fiscal shock combines country-specific shocks from the five source countries (France, Germany, Japan, United Kingdom, United States) and weights them using trade links with recipient countries. The assumption behind the weighting system is that fiscal policy is transmitted mainly through trade—countries with tighter trade links to the source would be expected to receive larger shocks in the form of larger changes in export demand, and therefore larger spillovers. However, the estimated spillovers capture those from all transmission channels, including the financial channel. The external fiscal shock facing recipient country $i$ in time $t$ is given by

$$Shock_{it} = \sum_{j=1}^{5} \frac{M_{ij,t-1}}{M_{j,t-1}} \frac{s_{jt} E_{j,t-1}}{E_{i,t-1}}, \quad (4.2)$$

in which $j$ denotes source country, $M_{ijt}$ is country $j$'s goods imports from country $i$ at time $t$, $M_{jt}$ is

[43]The number of countries classified as "fixed" can generally vary over time given that the exchange rate regime classification is time varying.

[44]Data for regime classification before 2008 is from Carmen Reinhart's website, http://www.carmenreinhart.com.

total goods imports by country $j$, $s_{jt}$ is the identified fiscal shock in country $j$ expressed in real terms in country $j$'s currency, and $E_{jt}$ is country $j$'s US dollar real exchange rate. Therefore, the second term on the right side $\left(s_{jt}E_{j,t-1}/E_{i,t-1}\right)$ equals the real monetary value of the fiscal shock coming from country $j$ converted into units of recipient country $i$'s currency. This term is then scaled by the import share $\left(M_{ij,t-1}/M_{j,t-1}\right)$, which captures the relative importance of recipient country $i$ as a supplier of the source country's imports.[45] Finally, the weighted shocks are added up across the five source countries.[46] The combined shocks are relatively small: for example, spending (tax) shocks average about 0.06 (0.1) percent of recipient-country GDP over the sample period.

## Nonlinear Specifications

### *Role of Cyclical Conditions and Monetary Policy Constraints*

To study the state-dependent effects for *recipient* countries, a nonlinear version of the baseline specification is estimated. Regression coefficients on the shock and the control variables are allowed to vary with different states. The state is defined with respect to the economic cycle ("slack/no slack") or with respect to monetary policy stance ("effective lower bound/ no effective lower bound"). Slack corresponds to a negative output gap. Effective lower bound corresponds to short-term interest rate below the 25th percentile value of the cross-country distribution, which is about 0.57 percent for advanced economies and 3.0 percent for emerging market economies.

Following Auerbach and Gorodnichenko (2013), the baseline specification is modified in the following way:

$$\begin{aligned}\frac{Z_{i,t+h}-Z_{i,t-1}}{Y_{i,t-1}} = {} & \alpha_{1h}I_{i,t-1}\frac{Shock_{it}}{Y_{i,t-1}} \\ & + \alpha_{2h}\left(1-I_{i,t-1}\right)\frac{Shock_{it}}{Y_{i,t-1}} \\ & + \textstyle\sum_{l=1}^{4}\beta'_{1hl}I_{i,t-1}X_{i,t-l} \\ & + \textstyle\sum_{l=1}^{4}\beta'_{2hl}\left(1-I_{i,t-1}\right)X_{i,t-l} \\ & + \theta_{hi}+\mu_{ht}+\varepsilon_{iht}, \end{aligned} \tag{4.3}$$

in which $I_{i,t}$ takes the values of either 1 or 0, indicating the state in recipient country $i$ in period $t$. Spillovers in the two different states can then be analyzed by comparing the estimated parameters $\alpha_{1h}$ and $\alpha_{2h}$.

For the *source* country, only the shock is partitioned according to the state of the economy, which can be again either the cyclical position or monetary policy near the effective lower bound. The states are defined in the same way as in the specification for recipient countries. The source-country shock therefore becomes

$$Shock^j_{it}\ :\ I^j_{t-1}\,Shock^j_{it}+\left(1-I^j_{t-1}\right)Shock^j_{it}, \tag{4.4}$$

in which $I^j_t$ is a {0;1} dummy variable indicating the state in the shock-emitting country. The assumption behind interacting only the shock with the state dummy is that although shocks in the source country and its domestic response might be regime dependent, their propagation to recipient countries is not.

### *Spillovers to Recipients with Different Exchange Rate Regimes*

Similar to the nonlinear specification in which the shock is partitioned based on the source country's state, the shock is decomposed into two components according to the bilateral exchange rate arrangement between recipient $i$ and the United States:

$$Shock^{US}_{it}\ :\ Fix^{US}_{i,t-1}\,Shock^{US}_{it}+\left(1-Fix^{US}_{i,t-1}\right)Shock^{US}_{it}, \tag{4.5}$$

in which $Fix^{iUS}_{it} = 1$ if country $i$ and the United States share a fixed regime in period $t$.

### *Spillover Estimates Expressed in Terms of Source-Country GDP*

While the baseline specification expresses fiscal shocks in terms of *recipient-country GDP*—given the decision to combine shocks from different sources and following standard practice in the literature—this transformation might complicate the interpretation of the magnitude of spillovers. To facilitate the interpretation, the estimates presented in the chapter are rescaled as spillovers in response to a 1 percent of *source country GDP* fiscal shock. This is done by normalizing the estimated spillover coefficient α in the following way:

$$Spill_{i,j} = S_j\frac{M_{i,j}}{M_j}\frac{Y_j}{Y_i}\alpha, \tag{4.6}$$

in which $S_j$ is the source-country shock as a percent of its own GDP (assumed to be 1); $\left(M_{i,j}/M_j\right)$ is the recipient country's share in the source country's total imports (the weighting factor in the baseline model);

[45]See Blagrave and others, forthcoming, for a discussion of alternative weighting systems.

[46]Estimated fiscal shocks are not correlated across countries.

and $\left(Y_j / Y_i\right)$ is the ratio of source to recipient-country GDP—both measured in US dollars.[47]

## Annex 4.3. Robustness Tests

To ensure that the baseline results are not driven by the selected shock identification scheme or econometric approach, this section performs several robustness checks. The results are robust to (1) estimation of spillovers using a panel vector autoregression, which accounts for the endogenous response of exchange rates and monetary policy in recipient countries; and (2) the use of alternative fiscal shocks based on forecast error and narrative approaches.

### Estimation with a Panel Vector Autoregression

Analysis in a panel vector autoregression is conducted to ensure that the results are not driven by the choice of the local projections method. A panel vector autoregression explicitly takes into account the endogenous response of key macro variables when estimating spillovers from a fiscal shock. The following six-variable panel vector autoregression model is estimated:

$$Y_{i,t} = c_i + \sum_{p=0}^{I} A_p Y_{i,t-p} + \mu_{i,t}, \qquad (4.7)$$

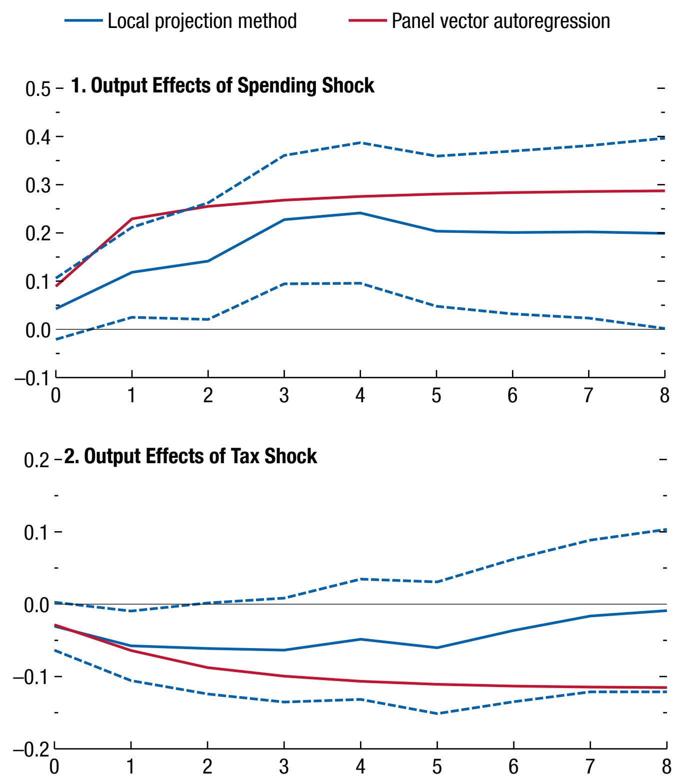
in which $c_i$ is a vector of country-specific fixed effects, $A_p$ is a reduced-form coefficient matrix, $\mu_{i,t}$ is a vector of shock terms, and $Y_{i,t}$ is a vector of six endogenous variables:

$$Y = \{Gshock; Tshock; effective\ ext.demand; GDP\ growth; interest\ rate; REER\}.$$

With the exceptions of *Gshock* and *Tshock*, which are identical to the weighted shocks used in the baseline analysis presented in equation 4.1, each variable is in (detrended) quarter-over-quarter growth rates and relates to the recipient country *i*'s domestic economy.[48] The sample period is the same as in the baseline local projections analysis.

Panel vector autoregression analysis confirms the findings from the baseline regression model estimated with the local projections method. The results, expressed in terms of the cumulative impulse response following a 1 percent of source-country GDP shock to government spending (tax revenue), are presented in Annex Figure 4.3.1 (red line). Spillovers from an increase in government spending at the source are larger than spillovers from a tax cut. The results are statistically different from zero at the 5 percent level, based on simulations conducted using standard (Monte Carlo) resampling methods.

**Annex Figure 4.3.1. Effects of Spending and Tax Shock on Recipient Countries' Output: Comparison with Panel Vector Autoregression**
*(Percent; quarters on x-axis)*




Source: IMF staff calculations.
Note: *t* = 0 is the quarter of respective shocks. Solid blue lines denote the baseline response to respective shocks using local projection method; dashed lines denote 90 percent confidence bands; and solid red lines represent the response to respective shocks using panel vector autoregressions. Shocks are normalized to an average of 1 percent of GDP across source countries.

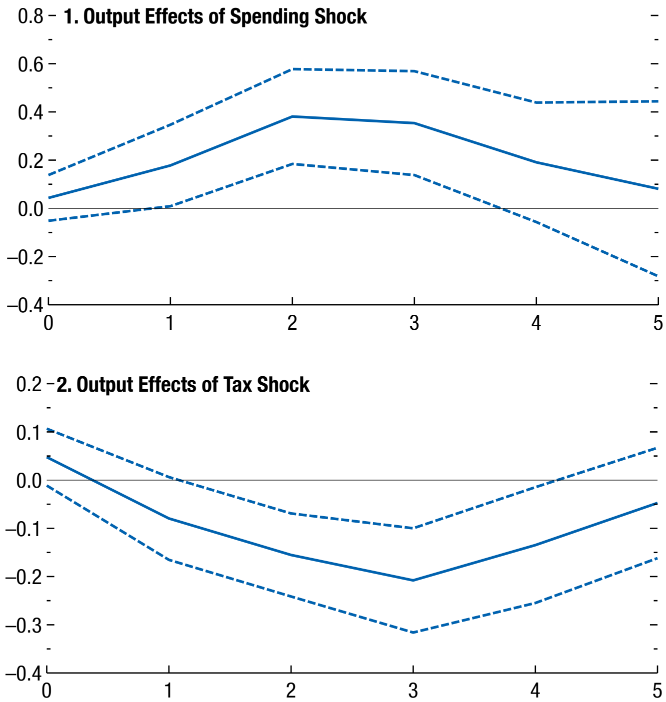
### Identification Using Forecast Errors

The second robustness check focuses on the identification of fiscal shocks. The alternative methodology identifies shocks as forecast errors (the difference

[47]Plausible alternative weighting systems of the source-country shock would deliver the same results in terms of source-country GDP. Alternative weighting systems would also require recalculating the spillover coefficient estimated in the baseline (α), resulting in an equal and offsetting adjustment of this coefficient, given that any transformation applied to the *source* shock would be constant across all *recipient* countries.

[48]Results from the panel vector autoregression are robust to several alternative specifications, including not detrending the data.

**Annex Figure 4.3.2. Effects of Spending and Tax Shock on Recipient Countries' Output: Forecast Errors**
*(Percent; years on x-axis)*




Source: IMF staff calculations.
Note: $t = 0$ is the year of respective shocks. Solid lines denote the response to respective shocks, and dashed lines denote 90 percent confidence bands. Effects are estimated based on shocks derived from forecast errors. Shocks are normalized to an average of 1 percent of GDP across source countries.

between actual variable and its forecast from the previous period) in the growth rates of government spending or tax revenues, this way capturing only unanticipated fiscal changes. This differs from the structural shocks used in the baseline analysis, which are based on actual changes in fiscal variables and can be anticipated by agents if they were announced earlier. The presence of such anticipated shocks could bias the estimates because the information set of the econometrician is different from the information set of the agents. Because forecast errors capture unexpected changes, the problem with fiscal foresight is reduced under this approach, as the information set of the econometrician and private agents is more aligned.

The approach uses real-time fiscal projections by the Organisation for Economic Co-operation and Development and real-time actual data to construct the forecast error shocks at annual frequency on the sample from 2000 to 2012.[49] The forecast error for each variable $X = \{G, T, Y\}$ is constructed as

$$FE_t^X = X_t - X_{t|t-1}^f, \tag{4.8}$$

in which $X_t$ is the growth rate of the variable from the contemporaneous data release and $X_{t|t-1}^f$ is the forecast one period earlier. A positive forecast error means an expansionary spending shock and a contractionary tax shock. Following Auerbach and Gorodnichenko (2013), the forecast errors of spending and taxes are regressed on the forecast errors of output to take into account any changes as a result of surprises in the business cycle. They are also regressed on lagged macroeconomic variables' growth rates (GDP, deflator, investment, government spending or tax revenues) to account for the portion of the innovation that can be predicted from past observations. The forecast error shocks for each source country are then constructed as residuals from this regression, converted to levels using base year (2010) expenditures or revenue, and replaced in equations (4.1) and (4.2).

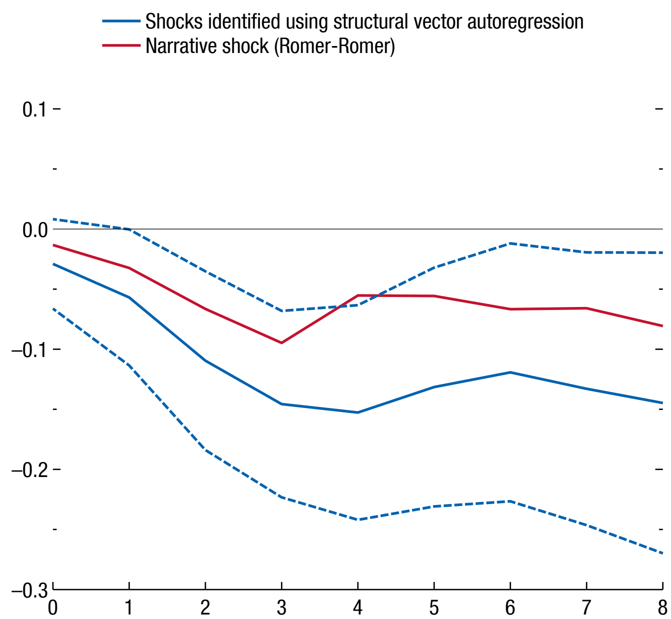
Spillover analysis using forecast error shocks confirms the baseline results—that spending shocks have larger spillovers than tax shocks (Annex Figure 4.3.2)—and provides a strong robustness check. These shocks are constructed using an entirely different methodology, a different database and estimated at a different frequency than the shocks used in the baseline specification. The size of spillovers is somewhat larger compared with the baseline, which can be explained, in part, by a stronger response of source-country spending and revenues to forecast error shocks compared with structural shocks (although these impulse responses are imprecisely estimated because of the small sample).

## Identification Using Narrative Approach

To further confirm that the baseline results are not driven by the shock identification scheme, a robustness check using the narrative tax shocks of Romer and Romer (2010) is conducted. Several studies in the literature present narrative fiscal shocks (for example, DeVries and others 2011), but the data set of Romer and Romer (2010) is the most suitable for comparison with the baseline analysis of the chapter given that it covers both expansion and consolidation episodes.[50]

[49]After 2012 the forecast data are not continuous.
[50]Narrative shock databases for government spending are much less common in the literature, which precludes a robustness check of spillovers from spending shocks based on narrative shocks.

**Annex Figure 4.3.3. Effects of US Tax Shock on Recipient Countries' Output: Comparison with US Narrative Tax Shock, 1995–2007**
*(Percent; quarters on x-axis)*




Sources: Romer and Romer (2010); and IMF staff calculations.
Note: $t = 0$ is the quarter of the US tax shock. Solid blue line denotes the response to US tax shock using structural vector autoregression; dashed lines denote 90 percent confidence bands; and solid red line represents the response to US narrative tax shock based on Romer and Romer (2010). Shocks are normalized to an average of 1 percent of GDP across source countries (note that this will represent a less than 1 percent of US GDP shock).

The shock is simply replaced in equations (4.1) and (4.2), with analysis conducted only for the United States over the period 1995:Q1–2007:Q4 (2007:Q4 is last period for which the narrative shock is available). A comparable set of time-sample-modified baseline results is obtained by estimating spillovers from the United States on the same sample.

Results presented in Annex Figure 4.3.3 show similar spillovers from US tax shocks for shocks identified using a structural vector autoregression and those coming from the narrative approach. Although the spillovers identified using the narrative approach are somewhat smaller compared with the (time-sample-modified) baseline, they fall comfortably within the confidence bands of the baseline estimates. Given that the narrative shocks are based on a completely different identification scheme, these results provide another strong robustness check.

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# STATISTICAL APPENDIX

The Statistical Appendix presents historical data as well as projections. It comprises seven sections: Assumptions, What's New, Data and Conventions, Country Notes, Classification of Countries, Key Data Documentation, and Statistical Tables.

The assumptions underlying the estimates and projections for 2017–18 and the medium-term scenario for 2019–22 are summarized in the first section. The second section presents a brief description of the changes to the database and statistical tables since the April 2017 *World Economic Outlook* (WEO). The third section provides a general description of the data and the conventions used for calculating country group composites. The fourth section summarizes selected key information for each country. The classification of countries in the various groups presented in the WEO is summarized in the fifth section. The sixth section provides information on methods and reporting standards for the member countries' national account and government finance indicators included in the report.

The last, and main, section comprises the statistical tables. (Statistical Appendix A is included here; Statistical Appendix B is available online.) Data in these tables have been compiled on the basis of information available through September 22, 2017. The figures for 2017 and beyond are shown with the same degree of precision as the historical figures solely for convenience; because they are projections, the same degree of accuracy is not to be inferred.

## Assumptions

Real effective *exchange rates* for the advanced economies are assumed to remain constant at their average levels measured during the period July 20 to August 17, 2017. For 2017 and 2018, these assumptions imply average US dollar–special drawing right (SDR) conversion rates of 1.385 and 1.409, US dollar–euro conversion rates of 1.128 and 1.176, and yen–US dollar conversion rates of 111.4 and 109.1, respectively.

It is assumed that the *price of oil* will average $50.28 a barrel in 2017 and $50.17 a barrel in 2018.

Established *policies* of national authorities are assumed to be maintained. The more specific policy assumptions underlying the projections for selected economies are described in Box A1.

With regard to *interest rates*, it is assumed that the London interbank offered rate (LIBOR) on six-month US dollar deposits will average 1.4 percent in 2017 and 1.9 percent in 2018, that three-month euro deposits will average –0.3 percent in 2017 and 2018, and that six-month yen deposits will average 0.1 percent in 2017 and 0.2 percent in 2018.

As a reminder, with respect to *introduction of the euro*, on December 31, 1998, the Council of the European Union decided that, effective January 1, 1999, the irrevocably fixed conversion rates between the euro and currencies of the member countries adopting the euro are as follows:

| | | | |
|---|---|---|---|
| 1 euro | = | 13.7603 | Austrian schillings |
| | = | 40.3399 | Belgian francs |
| | = | 0.585274 | Cyprus pound[1] |
| | = | 1.95583 | Deutsche marks |
| | = | 15.6466 | Estonian krooni[2] |
| | = | 5.94573 | Finnish markkaa |
| | = | 6.55957 | French francs |
| | = | 340.750 | Greek drachmas[3] |
| | = | 0.787564 | Irish pound |
| | = | 1,936.27 | Italian lire |
| | = | 0.702804 | Latvian lat[4] |
| | = | 3.45280 | Lithuanian litas[5] |
| | = | 40.3399 | Luxembourg francs |
| | = | 0.42930 | Maltese lira[1] |
| | = | 2.20371 | Netherlands guilders |
| | = | 200.482 | Portuguese escudos |
| | = | 30.1260 | Slovak koruna[6] |
| | = | 239.640 | Slovenian tolars[7] |
| | = | 166.386 | Spanish pesetas |

[1]Established on January 1, 2008.
[2]Established on January 1, 2011.
[3]Established on January 1, 2001.
[4]Established on January 1, 2014.
[5]Established on January 1, 2015.
[6]Established on January 1, 2009.
[7]Established on January 1, 2007.

See Box 5.4 of the October 1998 WEO for details on how the conversion rates were established.

## What's New

- Data for Somalia are included in the emerging market and developing economies group composites, enlarging the database to a total of 193 countries. Somalia is classified as a member of the Middle East and North Africa region.
- Starting with the October 2017 WEO, the real GDP per capita data in Statistical Tables A1, B1, and B2 are shown at *purchasing power parity*. This differs from the treatment of these data in the April 2017 WEO and earlier issues, in which the data were shown in local national currency.

## Data and Conventions

*Data and projections* for 193 economies form the statistical basis of the WEO database. The data are maintained jointly by the IMF's Research Department and regional departments, with the latter regularly updating country projections based on consistent global assumptions.

Although national statistical agencies are the ultimate providers of historical data and definitions, international organizations are also involved in statistical issues, with the objective of harmonizing methodologies for the compilation of national statistics, including analytical frameworks, concepts, definitions, classifications, and valuation procedures used in the production of economic statistics. The WEO database reflects information from both national source agencies and international organizations.

Most countries' macroeconomic data presented in the WEO conform broadly to the 1993 version of the *System of National Accounts* (SNA). The IMF's sector statistical standards—the sixth edition of the *Balance of Payments and International Investment Position Manual* (BPM6), the *Monetary and Financial Statistics Manual and Compilation Guide* (MFSMCG), and the *Government Finance Statistics Manual 2014* (GFSM 2014)—have been or are being aligned with the SNA 2008. These standards reflect the IMF's special interest in countries' external positions, financial sector stability, and public sector fiscal positions. The process of adapting country data to the new standards begins in earnest when the manuals are released. However, full concordance with the manuals is ultimately dependent on the provision by national statistical compilers of revised country data; hence, the WEO estimates are only partially adapted to these manuals. Nonetheless, for many countries the impact, on major balances and aggregates, of conversion to the updated standards will be small. Many other countries have partially adopted the latest standards and will continue implementation over a period of years.[1]

The fiscal gross and net debt data reported in the WEO are drawn from official data sources and IMF staff estimates. While attempts are made to align gross and net debt data with the definitions in the GFSM, as a result of data limitations or specific country circumstances, these data can sometimes deviate from the formal definitions. Although every effort is made to ensure the WEO data are relevant and internationally comparable, differences in both sectoral and instrument coverage mean that the data are not universally comparable. As more information becomes available, changes in either data sources or instrument coverage can give rise to data revisions that can sometimes be substantial. For clarification on the deviations in sectoral or instrument coverage, please refer to the metadata for the online WEO database.

Composite data for country groups in the WEO are either sums or weighted averages of data for individual countries. Unless noted otherwise, multiyear averages of growth rates are expressed as compound annual rates of change.[2] Arithmetically weighted averages are used for all data for the emerging market and developing economies group except data on inflation and money growth, for which geometric averages are used. The following conventions apply:

- Country group composites for exchange rates, interest rates, and growth rates of monetary aggregates are weighted by GDP converted to US dollars at market exchange rates (averaged over the preceding three years) as a share of group GDP.
- Composites for other data relating to the domestic economy, whether growth rates or ratios, are weighted by GDP valued at purchasing power parity as a share of total world or group GDP.[3] Annual inflation rates are simple percentage changes from the previous years, except in the case of emerging market and developing economies, for which the rates are based on logarithmic differences.
- Composites for real GDP per capita in *purchasing power parity* terms are sums of individual country

[1] Many countries are implementing the SNA 2008 or European System of National and Regional Accounts (ESA) 2010, and a few countries use versions of the SNA older than that from 1993. A similar adoption pattern is expected for the BPM6 and GFSM 2014. Please refer to Table G, which lists the statistical standards adhered to by each country.

[2] Averages for real GDP and its components, employment, inflation, factor productivity, trade, and commodity prices are calculated based on the compound annual rate of change, except in the case of GDP per capita and the unemployment rate, which are based on the simple arithmetic average.

[3] See "Revised Purchasing Power Parity Weights" in the July 2014 *WEO Update* for a summary of the revised purchasing-power-parity-based weights, as well as Box A2 of the April 2004 WEO and Annex IV of the May 1993 WEO. See also Anne-Marie Gulde and Marianne Schulze-Ghattas, "Purchasing Power Parity Based Weights for the *World Economic Outlook*," in *Staff Studies for the World Economic Outlook* (Washington, DC: International Monetary Fund, December 1993), 106–23.

data after conversion to the international dollar in the years indicated.

- Unless noted otherwise, composites for all sectors for the euro area are corrected for reporting discrepancies in intra-area transactions. Annual data are not adjusted for calendar-day effects. For data prior to 1999, data aggregations apply 1995 European currency unit exchange rates.
- Composites for fiscal data are sums of individual country data after conversion to US dollars at the average market exchange rates in the years indicated.
- Composite unemployment rates and employment growth are weighted by labor force as a share of group labor force.
- Composites relating to external sector statistics are sums of individual country data after conversion to US dollars at the average market exchange rates in the years indicated for balance of payments data and at end-of-year market exchange rates for debt denominated in currencies other than US dollars.
- Composites of changes in foreign trade volumes and prices, however, are arithmetic averages of percent changes for individual countries weighted by the US dollar value of exports or imports as a share of total world or group exports or imports (in the preceding year).
- Unless noted otherwise, group composites are computed if 90 percent or more of the share of group weights is represented.

Data refer to calendar years, except in the case of a few countries that use fiscal years. Please refer to Table F, which lists the economies with exceptional reporting periods for national accounts and government finance data for each country.

For some countries, the figures for 2016 and earlier are based on estimates rather than actual outturns. Please refer to Table G, which lists the latest actual outturns for the indicators in the national accounts, prices, government finance, and balance of payments indicators for each country.

## Country Notes

- The consumer price data for *Argentina* before December 2013 reflect the consumer price index (CPI) for the Greater Buenos Aires Area (CPI-GBA), while from December 2013 to October 2015 the data reflect the national CPI (IPCNu). The new government that took office in December 2015 discontinued the IPCNu, stating that it was flawed, and released a new CPI for the Greater Buenos Aires Area on June 15, 2016 (a new national CPI has been disseminated starting in June 2016). At its November 9, 2016, meeting, the IMF Executive Board considered the new CPI series to be in line with international standards and lifted the declaration of censure issued in 2013. Given the differences in geographical coverage, weights, sampling, and methodology of these series, the average CPI inflation for 2014, 2015, and 2016 and end-of-period inflation for 2015 and 2016 are not reported in the October 2017 *World Economic Outlook*.
- *Argentina*'s authorities discontinued the publication of labor market data in December 2015 and released new series starting in the second quarter of 2016.
- *Argentina*'s and *Venezuela*'s consumer prices are excluded from all WEO group aggregates.
- *Greece*'s primary balance estimates for 2016 are based on preliminary excessive deficit procedure (EDP) data on an accrual basis (ESA 2010) provided by the National Statistical Service (ELSTAT) as of April 21, 2017. Fiscal data since 2010 are adjusted in line with program definitions.
- *India*'s growth rates of real GDP calculated from 1998 to 2011 are as per national accounts with base year 2004/05, and thereafter are as per national accounts with base year 2011/12.
- Against the background of a civil war and weak capacities, the reliability of *Libya*'s data, especially medium-term projections, is low.
- Data for *Syria* are excluded from 2011 onward because of the uncertain political situation.
- Projecting the economic outlook in *Venezuela*, including assessing past and current economic developments as the basis for the projections, is complicated by the lack of discussions with the authorities (the last Article IV consultation took place in 2004), long intervals in receiving data with information gaps, incomplete provision of information, and difficulties in interpreting certain reported economic indicators in line with economic developments. The fiscal accounts include the budgetary central government and Petróleos de Venezuela, S.A. (PDVSA), and the fiscal accounts data for 2016–22 are IMF staff estimates. Revenue includes the IMF staff's estimated foreign exchange profits transferred from the central bank to the government (buying US dollars at the most appreciated rate and selling at more depreciated rates in a multitier exchange rate system) and excludes the staff's estimated revenue from PDVSA's sale of PetroCaribe assets to the central bank. Fiscal accounts for 2010–22 correspond to the budgetary central government and PDVSA. Fiscal accounts before 2010 correspond to the budgetary central government, public enterprises (including PDVSA), Instituto Venezolano de los Seguros Sociales (IVSS—social security), and Fondo de Garantía de Depósitos y Protección Bancaria (FOGADE—deposit insurance).

## Classification of Countries

### Summary of the Country Classification

The country classification in the WEO divides the world into two major groups: advanced economies and emerging market and developing economies.[4] This classification is not based on strict criteria, economic or otherwise, and it has evolved over time. The objective is to facilitate analysis by providing a reasonably meaningful method of organizing data. Table A provides an overview of the country classification, showing the number of countries in each group by region and summarizing some key indicators of their relative size (GDP valued at purchasing power parity, total exports of goods and services, and population).

Some countries remain outside the country classification and therefore are not included in the analysis. Cuba and the Democratic People's Republic of Korea are examples of countries that are not IMF members, and their economies therefore are not monitored by the IMF.

## General Features and Composition of Groups in the *World Economic Outlook* Classification

### Advanced Economies

The 39 advanced economies are listed in Table B. The seven largest in terms of GDP based on market exchange rates—the United States, Japan, Germany, France, Italy, the United Kingdom, and Canada—constitute the subgroup of *major advanced economies* often referred to as the Group of Seven (G7). The members of the *euro area* are also distinguished as a subgroup. Composite data shown in the tables for the euro area cover the current members for all years, even though the membership has increased over time.

Table C lists the member countries of the European Union, not all of which are classified as advanced economies in the WEO.

### Emerging Market and Developing Economies

The group of emerging market and developing economies (154) includes all those that are not classified as advanced economies.

The *regional breakdowns* of emerging market and developing economies are *Commonwealth of Independent States* (CIS), *emerging and developing Asia, emerging and developing Europe* (sometimes also referred to as "central and eastern Europe"), *Latin America and the Caribbean* (LAC), the *Middle East, North Africa, Afghanistan, and Pakistan* (MENAP), and *sub-Saharan Africa* (SSA).

Emerging market and developing economies are also classified according to *analytical criteria*. The analytical criteria reflect the composition of export earnings and a distinction between net creditor and net debtor economies. The detailed composition of emerging market and developing economies in the regional and analytical groups is shown in Tables D and E.

The analytical criterion *source of export earnings* distinguishes between the categories *fuel* (Standard International Trade Classification [SITC] 3) and *nonfuel* and then focuses on *nonfuel primary products* (SITCs 0, 1, 2, 4, and 68). Economies are categorized into one of these groups when their main source of export earnings exceeded 50 percent of total exports on average between 2012 and 2016.

The financial criteria focus on *net creditor economies, net debtor economies, heavily indebted poor countries* (HIPCs), and *low-income developing countries* (LIDCs). Economies are categorized as net debtors when their latest net international investment position, where available, was less than zero or their current account balance accumulations from 1972 (or earliest available data) to 2016 were negative. Net debtor economies are further differentiated on the basis of *experience with debt servicing*.[5]

The HIPC group comprises the countries that are or have been considered by the IMF and the World Bank for participation in their debt initiative known as the HIPC Initiative, which aims to reduce the external debt burdens of all the eligible HIPCs to a "sustainable" level in a reasonably short period of time.[6] Many of these countries have already benefited from debt relief and have graduated from the initiative.

The LIDCs are countries that have per capita income levels below a certain threshold (currently set at $2,700 in 2016 as measured by the World Bank's Atlas method), structural features consistent with limited development and structural transformation, and insufficiently close external financial linkages to be widely seen as emerging market economies.

[4] As used here, the terms "country" and "economy" do not always refer to a territorial entity that is a state as understood by international law and practice. Some territorial entities included here are not states, although their statistical data are maintained on a separate and independent basis.

[5] During 2012–16, 25 economies incurred external payments arrears or entered into official or commercial bank debt-rescheduling agreements. This group is referred to as *economies with arrears and/or rescheduling during 2012–16*.

[6] See David Andrews, Anthony R. Boote, Syed S. Rizavi, and Sukwinder Singh, *Debt Relief for Low-Income Countries: The Enhanced HIPC Initiative*, IMF Pamphlet Series 51 (Washington, DC: International Monetary Fund, November 1999).

## Table A. Classification by *World Economic Outlook* Groups and Their Shares in Aggregate GDP, Exports of Goods and Services, and Population, 2017[1]
*(Percent of total for group or world)*

| | Number of Economies | GDP: Advanced Economies | GDP: World | Exports of Goods and Services: Advanced Economies | Exports of Goods and Services: World | Population: Advanced Economies | Population: World |
|---|---|---|---|---|---|---|---|
| **Advanced Economies** | **39** | **100.0** | **41.8** | **100.0** | **64.4** | **100.0** | **14.5** |
| United States | | 37.0 | 15.5 | 16.6 | 10.7 | 30.5 | 4.4 |
| Euro Area | 19 | 28.1 | 11.7 | 41.2 | 26.5 | 31.9 | 4.6 |
| Germany | | 7.9 | 3.3 | 12.1 | 7.8 | 7.8 | 1.1 |
| France | | 5.4 | 2.3 | 5.7 | 3.7 | 6.1 | 0.9 |
| Italy | | 4.4 | 1.9 | 4.2 | 2.7 | 5.7 | 0.8 |
| Spain | | 3.4 | 1.4 | 3.1 | 2.0 | 4.4 | 0.6 |
| Japan | | 10.4 | 4.4 | 6.1 | 3.9 | 12.0 | 1.7 |
| United Kingdom | | 5.5 | 2.3 | 5.6 | 3.6 | 6.2 | 0.9 |
| Canada | | 3.3 | 1.4 | 3.6 | 2.3 | 3.4 | 0.5 |
| Other Advanced Economies | 16 | 15.6 | 6.5 | 26.9 | 17.3 | 16.0 | 2.3 |
| *Memorandum* | | | | | | | |
| Major Advanced Economies | 7 | 74.1 | 31.0 | 53.8 | 34.7 | 71.7 | 10.4 |
| | | Emerging Market and Developing Economies | World | Emerging Market and Developing Economies | World | Emerging Market and Developing Economies | World |
| **Emerging Market and Developing Economies** | **154** | **100.0** | **58.2** | **100.0** | **35.6** | **100.0** | **85.5** |
| **Regional Groups** | | | | | | | |
| Commonwealth of Independent States[2] | 12 | 7.8 | 4.5 | 6.9 | 2.5 | 4.6 | 3.9 |
| Russia | | 5.5 | 3.2 | 4.5 | 1.6 | 2.3 | 2.0 |
| Emerging and Developing Asia | 30 | 54.3 | 31.6 | 50.1 | 17.8 | 56.9 | 48.6 |
| China | | 30.5 | 17.7 | 30.0 | 10.7 | 22.2 | 19.0 |
| India | | 12.4 | 7.2 | 6.0 | 2.2 | 20.9 | 17.8 |
| Excluding China and India | 28 | 11.4 | 6.6 | 14.1 | 5.0 | 13.8 | 11.8 |
| Emerging and Developing Europe | 12 | 6.1 | 3.5 | 9.8 | 3.5 | 2.8 | 2.4 |
| Latin America and the Caribbean | 32 | 13.5 | 7.8 | 14.2 | 5.1 | 9.9 | 8.4 |
| Brazil | | 4.5 | 2.6 | 3.0 | 1.1 | 3.3 | 2.8 |
| Mexico | | 3.3 | 1.9 | 5.4 | 1.9 | 2.0 | 1.7 |
| Middle East, North Africa, Afghanistan, and Pakistan | 23 | 13.2 | 7.7 | 14.7 | 5.2 | 10.7 | 9.2 |
| Middle East and North Africa | 21 | 11.7 | 6.8 | 14.3 | 5.1 | 7.1 | 6.0 |
| Sub-Saharan Africa | 45 | 5.2 | 3.0 | 4.3 | 1.5 | 15.1 | 12.9 |
| Excluding Nigeria and South Africa | 43 | 2.6 | 1.5 | 2.5 | 0.9 | 11.3 | 9.7 |
| **Analytical Groups[3]** | | | | | | | |
| **By Source of Export Earnings** | | | | | | | |
| Fuel | 28 | 18.6 | 10.8 | 20.2 | 7.2 | 11.7 | 10.0 |
| Nonfuel | 125 | 81.4 | 47.3 | 79.8 | 28.4 | 88.3 | 75.5 |
| Of Which, Primary Products | 31 | 4.6 | 2.7 | 4.7 | 1.7 | 7.9 | 6.7 |
| **By External Financing Source** | | | | | | | |
| Net Debtor Economies | 121 | 49.6 | 28.9 | 46.2 | 16.5 | 66.8 | 57.1 |
| **Net Debtor Economies by Debt-Servicing Experience** | | | | | | | |
| Economies with Arrears and/or Rescheduling during 2012–16 | 25 | 3.3 | 1.9 | 2.1 | 0.8 | 5.5 | 4.7 |
| **Other Groups** | | | | | | | |
| Heavily Indebted Poor Countries | 39 | 2.4 | 1.4 | 1.9 | 0.7 | 11.3 | 9.7 |
| Low-Income Developing Countries | 59 | 7.2 | 4.2 | 6.6 | 2.3 | 22.5 | 19.2 |

[1]The GDP shares are based on the purchasing-power-parity valuation of economies' GDP. The number of economies comprising each group reflects those for which data are included in the group aggregates.

[2]Georgia, Turkmenistan, and Ukraine, which are not members of the Commonwealth of Independent States, are included in this group for reasons of geography and similarity in economic structure.

[3]Syria is omitted from the source of export earnings and South Sudan and Syria are omitted from the net external position group composites because of insufficient data.

## Table B. Advanced Economies by Subgroup

| | | |
|---|---|---|
| **Major Currency Areas** | | |
| United States | | |
| Euro Area | | |
| Japan | | |
| **Euro Area** | | |
| Austria | Greece | Netherlands |
| Belgium | Ireland | Portugal |
| Cyprus | Italy | Slovak Republic |
| Estonia | Latvia | Slovenia |
| Finland | Lithuania | Spain |
| France | Luxembourg | |
| Germany | Malta | |
| **Major Advanced Economies** | | |
| Canada | Italy | United States |
| France | Japan | |
| Germany | United Kingdom | |
| **Other Advanced Economies** | | |
| Australia | Korea | Singapore |
| Czech Republic | Macao SAR[2] | Sweden |
| Denmark | New Zealand | Switzerland |
| Hong Kong SAR[1] | Norway | Taiwan Province of China |
| Iceland | Puerto Rico | |
| Israel | San Marino | |

[1]On July 1, 1997, Hong Kong was returned to the People's Republic of China and became a Special Administrative Region of China.
[2]On December 20, 1999, Macao was returned to the People's Republic of China and became a Special Administrative Region of China.

## Table C. European Union

| | | |
|---|---|---|
| Austria | Germany | Poland |
| Belgium | Greece | Portugal |
| Bulgaria | Hungary | Romania |
| Croatia | Ireland | Slovak Republic |
| Cyprus | Italy | Slovenia |
| Czech Republic | Latvia | Spain |
| Denmark | Lithuania | Sweden |
| Estonia | Luxembourg | United Kingdom |
| Finland | Malta | |
| France | Netherlands | |

## Table D. Emerging Market and Developing Economies by Region and Main Source of Export Earnings

| | Fuel | Nonfuel Primary Products |
|---|---|---|
| **Commonwealth of Independent States** | | |
| | Azerbaijan | Uzbekistan |
| | Kazakhstan | |
| | Russia | |
| | Turkmenistan[1] | |
| **Emerging and Developing Asia** | | |
| | Brunei Darussalam | Lao P.D.R. |
| | Timor-Leste | Marshall Islands |
| | | Mongolia |
| | | Papua New Guinea |
| | | Solomon Islands |
| | | Tuvalu |
| **Latin America and the Caribbean** | | |
| | Bolivia | Argentina |
| | Ecuador | Chile |
| | Trinidad and Tobago | Guyana |
| | Venezuela | Honduras |
| | | Paraguay |
| | | Suriname |
| | | Uruguay |
| **Middle East, North Africa, Afghanistan, and Pakistan** | | |
| | Algeria | Afghanistan |
| | Bahrain | Mauritania |
| | Iran | Sudan |
| | Iraq | |
| | Kuwait | |
| | Libya | |
| | Oman | |
| | Qatar | |
| | Saudi Arabia | |
| | United Arab Emirates | |
| | Yemen | |
| **Sub-Saharan Africa** | | |
| | Angola | Burkina Faso |
| | Chad | Burundi |
| | Republic of Congo | Central African Republic |
| | Equatorial Guinea | Democratic Republic of the Congo |
| | Gabon | Côte d'Ivoire |
| | Nigeria | Eritrea |
| | South Sudan | Guinea |
| | | Guinea-Bissau |
| | | Liberia |
| | | Malawi |
| | | Mali |
| | | Sierra Leone |
| | | South Africa |
| | | Zambia |

[1]Turkmenistan, which is not a member of the Commonwealth of Independent States, is included in this group for reasons of geography and similarity in economic structure.

## Table E. Emerging Market and Developing Economies by Region, Net External Position, and Status as Heavily Indebted Poor Countries and Low-Income Developing Countries

| | Net External Position[1] | Heavily Indebted Poor Countries[2] | Low-Income Developing Countries |
|---|---|---|---|
| **Commonwealth of Independent States** | | | |
| Armenia | * | | |
| Azerbaijan | • | | |
| Belarus | * | | |
| Georgia[3] | * | | |
| Kazakhstan | * | | |
| Kyrgyz Republic | * | | * |
| Moldova | * | | * |
| Russia | • | | |
| Tajikistan | * | | * |
| Turkmenistan[3] | • | | |
| Ukraine[3] | * | | |
| Uzbekistan | • | | * |
| **Emerging and Developing Asia** | | | |
| Bangladesh | * | | * |
| Bhutan | * | | * |
| Brunei Darussalam | • | | |
| Cambodia | * | | * |
| China | • | | |
| Fiji | * | | |
| India | * | | |
| Indonesia | * | | |
| Kiribati | • | | * |
| Lao P.D.R. | * | | * |
| Malaysia | • | | |
| Maldives | * | | |
| Marshall Islands | * | | |
| Micronesia | • | | |
| Mongolia | * | | |
| Myanmar | * | | * |
| Nauru | * | | |
| Nepal | • | | * |
| Palau | • | | |
| Papua New Guinea | * | | * |
| Philippines | * | | |
| Samoa | * | | |
| Solomon Islands | * | | * |
| Sri Lanka | * | | |
| Thailand | * | | |
| Timor-Leste | • | | * |
| Tonga | * | | |
| Tuvalu | * | | |
| Vanuatu | * | | |
| Vietnam | * | | * |

| | Net External Position[1] | Heavily Indebted Poor Countries[2] | Low-Income Developing Countries |
|---|---|---|---|
| **Emerging and Developing Europe** | | | |
| Albania | * | | |
| Bosnia and Herzegovina | * | | |
| Bulgaria | * | | |
| Croatia | * | | |
| Hungary | * | | |
| Kosovo | * | | |
| FYR Macedonia | * | | |
| Montenegro | * | | |
| Poland | * | | |
| Romania | * | | |
| Serbia | * | | |
| Turkey | * | | |
| **Latin America and the Caribbean** | | | |
| Antigua and Barbuda | * | | |
| Argentina | • | | |
| The Bahamas | * | | |
| Barbados | * | | |
| Belize | * | | |
| Bolivia | * | • | |
| Brazil | * | | |
| Chile | * | | |
| Colombia | * | | |
| Costa Rica | * | | |
| Dominica | * | | |
| Dominican Republic | * | | |
| Ecuador | * | | |
| El Salvador | * | | |
| Grenada | * | | |
| Guatemala | * | | |
| Guyana | * | • | |
| Haiti | * | • | * |
| Honduras | * | • | * |
| Jamaica | * | | |
| Mexico | * | | |
| Nicaragua | * | • | * |
| Panama | * | | |
| Paraguay | * | | |
| Peru | * | | |
| St. Kitts and Nevis | * | | |
| St. Lucia | * | | |
| St. Vincent and the Grenadines | * | | |
| Suriname | * | | |
| Trinidad and Tobago | • | | |
| Uruguay | * | | |
| Venezuela | • | | |

## Table E. Emerging Market and Developing Economies by Region, Net External Position, and Status as Heavily Indebted Poor Countries and Low-Income Developing Countries *(continued)*

| | Net External Position[1] | Heavily Indebted Poor Countries[2] | Low-Income Developing Countries |
|---|---|---|---|
| **Middle East, North Africa, Afghanistan, and Pakistan** | | | |
| Afghanistan | • | • | * |
| Algeria | • | | |
| Bahrain | • | | |
| Djibouti | * | | * |
| Egypt | * | | |
| Iran | • | | |
| Iraq | • | | |
| Jordan | * | | |
| Kuwait | • | | |
| Lebanon | * | | |
| Libya | • | | |
| Mauritania | * | • | * |
| Morocco | * | | |
| Oman | • | | |
| Pakistan | * | | |
| Qatar | • | | |
| Saudi Arabia | • | | |
| Somalia | * | * | * |
| Sudan | * | * | * |
| Syria[4] | . . . | | |
| Tunisia | * | | |
| United Arab Emirates | • | | |
| Yemen | * | | * |
| **Sub-Saharan Africa** | | | |
| Angola | • | | |
| Benin | * | • | * |
| Botswana | • | | |
| Burkina Faso | * | • | * |
| Burundi | * | • | * |
| Cabo Verde | * | | |
| Cameroon | * | • | * |
| Central African Republic | * | • | * |
| Chad | * | • | * |
| Comoros | * | • | * |

| | Net External Position[1] | Heavily Indebted Poor Countries[2] | Low-Income Developing Countries |
|---|---|---|---|
| Democratic Republic of the Congo | * | • | * |
| Republic of Congo | * | • | * |
| Côte d'Ivoire | * | • | * |
| Equatorial Guinea | * | | |
| Eritrea | * | * | * |
| Ethiopia | * | • | * |
| Gabon | • | | |
| The Gambia | * | • | * |
| Ghana | * | • | * |
| Guinea | * | • | * |
| Guinea-Bissau | * | • | * |
| Kenya | * | | * |
| Lesotho | * | | * |
| Liberia | * | • | * |
| Madagascar | * | • | * |
| Malawi | * | • | * |
| Mali | * | • | * |
| Mauritius | • | | |
| Mozambique | * | • | * |
| Namibia | * | | |
| Niger | * | • | * |
| Nigeria | * | | * |
| Rwanda | * | • | * |
| São Tomé and Príncipe | * | • | * |
| Senegal | * | • | * |
| Seychelles | * | | |
| Sierra Leone | * | • | * |
| South Africa | • | | |
| South Sudan[4] | . . . | | * |
| Swaziland | * | | |
| Tanzania | * | • | * |
| Togo | * | • | * |
| Uganda | * | • | * |
| Zambia | * | • | * |
| Zimbabwe | * | | * |

[1]Dot (star) indicates that the country is a net creditor (net debtor).
[2]Dot instead of star indicates that the country has reached the completion point, which allows it to receive the full debt relief committed to at the decision point.
[3]Georgia, Turkmenistan, and Ukraine, which are not members of the Commonwealth of Independent States, are included in this group for reasons of geography and similarity in economic structure.
[4]South Sudan and Syria are omitted from the net external position group composite for lack of a fully developed database.

### Table F. Economies with Exceptional Reporting Periods[1]

| | National Accounts | Government Finance |
|---|---|---|
| The Bahamas | | Jul/Jun |
| Bangladesh | | Jul/Jun |
| Barbados | | Apr/Mar |
| Belize | | Apr/Mar |
| Bhutan | Jul/Jun | Jul/Jun |
| Botswana | | Apr/Mar |
| Dominica | | Jul/Jun |
| Egypt | Jul/Jun | Jul/Jun |
| Ethiopia | Jul/Jun | Jul/Jun |
| Haiti | Oct/Sep | Oct/Sep |
| Hong Kong SAR | | Apr/Mar |
| India | Apr/Mar | Apr/Mar |
| Iran | Apr/Mar | Apr/Mar |
| Jamaica | | Apr/Mar |
| Lesotho | Apr/Mar | Apr/Mar |
| Malawi | | Jul/Jun |
| Marshall Islands | Oct/Sep | Oct/Sep |
| Mauritius | | Jul/Jun |
| Micronesia | Oct/Sep | Oct/Sep |
| Myanmar | Apr/Mar | Apr/Mar |
| Namibia | | Apr/Mar |
| Nauru | Jul/Jun | Jul/Jun |
| Nepal | Aug/Jul | Aug/Jul |
| Pakistan | Jul/Jun | Jul/Jun |
| Palau | Oct/Sep | Oct/Sep |
| Puerto Rico | Jul/Jun | Jul/Jun |
| St. Lucia | | Apr/Mar |
| Samoa | Jul/Jun | Jul/Jun |
| Singapore | | Apr/Mar |
| Swaziland | | Apr/Mar |
| Thailand | | Oct/Sep |
| Trinidad and Tobago | | Oct/Sep |

[1]Unless noted otherwise, all data refer to calendar years.

## Table G. Key Data Documentation

| | | National Accounts | | | | | Prices (CPI) | |
|---|---|---|---|---|---|---|---|---|
| Country | Currency | Historical Data Source[1] | Latest Actual Annual Data | Base Year[2] | System of National Accounts | Use of Chain-Weighted Methodology[3] | Historical Data Source[1] | Latest Actual Annual Data |
| Afghanistan | Afghan afghani | NSO | 2015 | 2002/03 | SNA 1993 | | NSO | 2015 |
| Albania | Albanian lek | IMF staff | 2016 | 1996 | SNA 1993 | From 1996 | NSO | 2016 |
| Algeria | Algerian dinar | NSO | 2016 | 2001 | SNA 1993 | From 2005 | NSO | 2016 |
| Angola | Angolan kwanza | MEP | 2015 | 2002 | ESA 1995 | | NSO | 2015 |
| Antigua and Barbuda | Eastern Caribbean dollar | CB | 2016 | 2006[6] | SNA 1993 | | NSO | 2016 |
| Argentina | Argentine peso | NSO | 2016 | 2004 | SNA 2008 | | NSO | 2016 |
| Armenia | Armenian dram | NSO | 2016 | 2005 | SNA 2008 | | NSO | 2016 |
| Australia | Australian dollar | NSO | 2016 | 2014/15 | SNA 2008 | From 1980 | NSO | 2016 |
| Austria | Euro | NSO | 2016 | 2010 | ESA 2010 | From 1995 | NSO | 2016 |
| Azerbaijan | Azerbaijan manat | NSO | 2016 | 2003 | SNA 1993 | From 1994 | NSO | 2016 |
| The Bahamas | Bahamian dollar | NSO | 2015 | 2006 | SNA 1993 | | NSO | 2016 |
| Bahrain | Bahrain dinar | NSO | 2016 | 2010 | SNA 2008 | | NSO | 2016 |
| Bangladesh | Bangladesh taka | NSO | 2016 | 2005 | SNA 1993 | | NSO | 2016 |
| Barbados | Barbados dollar | NSO and CB | 2014 | 1974[6] | SNA 1993 | | NSO | 2016 |
| Belarus | Belarusian ruble | NSO | 2016 | 2014 | SNA 2008 | From 2005 | NSO | 2016 |
| Belgium | Euro | CB | 2016 | 2014 | ESA 2010 | From 1995 | CB | 2016 |
| Belize | Belize dollar | NSO | 2015 | 2000 | SNA 1993 | | NSO | 2015 |
| Benin | CFA franc | NSO | 2015 | 2007 | SNA 1993 | | NSO | 2016 |
| Bhutan | Bhutanese ngultrum | NSO | 2015/16 | 2000[6] | SNA 1993 | | CB | 2015/16 |
| Bolivia | Bolivian boliviano | NSO | 2015 | 1990 | Other | | NSO | 2016 |
| Bosnia and Herzegovina | Bosnia convertible marka | NSO | 2016 | 2010 | ESA 2010 | From 2000 | NSO | 2016 |
| Botswana | Botswana pula | NSO | 2015 | 2006 | SNA 1993 | | NSO | 2016 |
| Brazil | Brazilian real | NSO | 2016 | 1995 | SNA 2008 | | NSO | 2016 |
| Brunei Darussalam | Brunei dollar | NSO and GAD | 2016 | 2010 | SNA 1993 | | NSO and GAD | 2016 |
| Bulgaria | Bulgarian lev | NSO | 2016 | 2010 | ESA 2010 | From 1996 | NSO | 2016 |
| Burkina Faso | CFA franc | NSO and MEP | 2016 | 1999 | SNA 1993 | | NSO | 2016 |
| Burundi | Burundi franc | NSO | 2015 | 2005 | SNA 1993 | | NSO | 2016 |
| Cabo Verde | Cabo Verdean escudo | NSO | 2016 | 2007 | SNA 2008 | From 2011 | NSO | 2016 |
| Cambodia | Cambodian riel | NSO | 2016 | 2000 | SNA 1993 | | NSO | 2016 |
| Cameroon | CFA franc | NSO | 2016 | 2000 | SNA 1993 | | NSO | 2016 |
| Canada | Canadian dollar | NSO | 2016 | 2007 | SNA 2008 | From 1980 | NSO | 2016 |
| Central African Republic | CFA franc | NSO | 2012 | 2005 | SNA 1993 | | NSO | 2015 |
| Chad | CFA franc | CB | 2015 | 2005 | Other | | NSO | 2015 |
| Chile | Chilean peso | CB | 2016 | 2013[6] | SNA 2008 | From 2003 | NSO | 2016 |
| China | Chinese yuan | NSO | 2016 | 2015 | SNA 2008 | | NSO | 2016 |
| Colombia | Colombian peso | NSO | 2016 | 2005 | Other | From 2000 | NSO | 2016 |
| Comoros | Comorian franc | MEP | 2015 | 2000 | Other | | NSO | 2015 |
| Democratic Republic of the Congo | Congolese franc | NSO | 2015 | 2005 | SNA 1993 | | CB | 2015 |
| Republic of Congo | CFA franc | NSO | 2016 | 1990 | SNA 1993 | | NSO | 2016 |
| Costa Rica | Costa Rican colón | CB | 2016 | 2012 | SNA 2008 | | CB | 2016 |

## Table G. Key Data Documentation *(continued)*

| | Government Finance | | | | | Balance of Payments | | |
|---|---|---|---|---|---|---|---|---|
| Country | Historical Data Source[1] | Latest Actual Annual Data | Statistics Manual in Use at Source | Subsectors Coverage[4] | Accounting Practice[5] | Historical Data Source[1] | Latest Actual Annual Data | Statistics Manual in Use at Source |
| Afghanistan | MoF | 2015 | 2001 | CG | C | NSO, MoF, and CB | 2015 | BPM 5 |
| Albania | IMF staff | 2016 | 1986 | CG,LG,SS,MPC, NFPC | Other | CB | 2016 | BPM 6 |
| Algeria | MoF | 2016 | 1986 | CG | C | CB | 2016 | BPM 5 |
| Angola | MoF | 2015 | 2001 | CG,LG | Other | CB | 2015 | BPM 6 |
| Antigua and Barbuda | MoF | 2016 | 2001 | CG | C | CB | 2016 | BPM 6 |
| Argentina | MEP | 2016 | 1986 | CG,SG,LG,SS | C | NSO | 2016 | BPM 5 |
| Armenia | MoF | 2016 | 2001 | CG | C | CB | 2016 | BPM 6 |
| Australia | MoF | 2015 | 2014 | CG,SG,LG,TG | A | NSO | 2016 | BPM 6 |
| Austria | NSO | 2016 | 2001 | CG,SG,LG,SS | A | CB | 2016 | BPM 6 |
| Azerbaijan | MoF | 2015 | Other | CG | C | CB | 2016 | BPM 5 |
| The Bahamas | MoF | 2016/17 | 2001 | CG | C | CB | 2016 | BPM 5 |
| Bahrain | MoF | 2016 | 2001 | CG | C | CB | 2016 | BPM 6 |
| Bangladesh | MoF | 2015/16 | Other | CG | C | CB | 2015 | BPM 6 |
| Barbados | MoF | 2016/17 | 1986 | CG | C | CB | 2016 | BPM 6 |
| Belarus | MoF | 2016 | 2001 | CG,LG,SS | C | CB | 2016 | BPM 6 |
| Belgium | CB | 2016 | ESA 2010 | CG,SG,LG,SS | A | CB | 2016 | BPM 6 |
| Belize | MoF | 2015/16 | 1986 | CG,MPC | Mixed | CB | 2015 | BPM 6 |
| Benin | MoF | 2016 | 1986 | CG | C | CB | 2015 | BPM 6 |
| Bhutan | MoF | 2015/16 | 1986 | CG | C | CB | 2014/15 | BPM 6 |
| Bolivia | MoF | 2016 | 2001 | CG,LG,SS,NMPC, NFPC | C | CB | 2016 | BPM 6 |
| Bosnia and Herzegovina | MoF | 2015 | 2001 | CG,SG,LG,SS | Mixed | CB | 2016 | BPM 6 |
| Botswana | MoF | 2015/16 | 1986 | CG | C | CB | 2015 | BPM 5 |
| Brazil | MoF | 2016 | 2001 | CG,SG,LG,SS, MPC,NFPC | C | CB | 2016 | BPM 6 |
| Brunei Darussalam | MoF | 2016 | Other | CG,BCG | C | NSO, MEP, and GAD | 2015 | BPM 6 |
| Bulgaria | MoF | 2015 | 2001 | CG,LG,SS | C | CB | 2016 | BPM 6 |
| Burkina Faso | MoF | 2016 | 2001 | CG | CB | CB | 2016 | BPM 6 |
| Burundi | MoF | 2015 | 2001 | CG | A | CB | 2015 | BPM 6 |
| Cabo Verde | MoF | 2016 | 2001 | CG | A | NSO | 2016 | BPM 5 |
| Cambodia | MoF | 2016 | 1986 | CG,LG | A | CB | 2016 | BPM 5 |
| Cameroon | MoF | 2016 | 2001 | CG,NFPC | C | MoF | 2016 | BPM 5 |
| Canada | MoF | 2016 | 2001 | CG,SG,LG,SS | A | NSO | 2016 | BPM 6 |
| Central African Republic | MoF | 2016 | 2001 | CG | C | CB | 2015 | BPM 5 |
| Chad | MoF | 2015 | 1986 | CG,NFPC | C | CB | 2015 | BPM 5 |
| Chile | MoF | 2016 | 2001 | CG,LG | A | CB | 2016 | BPM 6 |
| China | MoF | 2016 | 2001 | CG,LG | C | GAD | 2016 | BPM 6 |
| Colombia | MoF | 2015 | 2001 | CG,SG,LG,SS | Other | CB and NSO | 2015 | BPM 6 |
| Comoros | MoF | 2016 | 1986 | CG | Mixed | CB and IMF staff | 2016 | BPM 5 |
| Democratic Republic of the Congo | MoF | 2015 | 2001 | CG,LG | A | CB | 2015 | BPM 5 |
| Republic of Congo | MoF | 2016 | 2001 | CG | A | CB | 2015 | BPM 5 |
| Costa Rica | MoF and CB | 2016 | 1986 | CG | C | CB | 2016 | BPM 6 |

## Table G. Key Data Documentation *(continued)*

| | | National Accounts | | | | | Prices (CPI) | |
|---|---|---|---|---|---|---|---|---|
| Country | Currency | Historical Data Source[1] | Latest Actual Annual Data | Base Year[2] | System of National Accounts | Use of Chain-Weighted Methodology[3] | Historical Data Source[1] | Latest Actual Annual Data |
| Côte d'Ivoire | CFA franc | NSO | 2014 | 2009 | SNA 1993 | | NSO | 2016 |
| Croatia | Croatian kuna | NSO | 2016 | 2010 | ESA 2010 | | NSO | 2016 |
| Cyprus | Euro | NSO | 2016 | 2005 | ESA 2010 | From 1995 | NSO | 2016 |
| Czech Republic | Czech koruna | NSO | 2016 | 2010 | ESA 2010 | From 1995 | NSO | 2016 |
| Denmark | Danish krone | NSO | 2015 | 2010 | ESA 2010 | From 1980 | NSO | 2016 |
| Djibouti | Djibouti franc | NSO | 2014 | 1990 | Other | | NSO | 2016 |
| Dominica | Eastern Caribbean dollar | NSO | 2015 | 2006 | SNA 1993 | | NSO | 2015 |
| Dominican Republic | Dominican peso | CB | 2016 | 2007 | SNA 2008 | From 2007 | CB | 2016 |
| Ecuador | US dollar | CB | 2016 | 2007 | SNA 1993 | | NSO and CB | 2016 |
| Egypt | Egyptian pound | MEP | 2015/16 | 2011/12 | SNA 1993 | | NSO | 2015/16 |
| El Salvador | US dollar | CB | 2016 | 1990 | Other | | NSO | 2016 |
| Equatorial Guinea | CFA franc | MEP and CB | 2016 | 2006 | SNA 1993 | | MEP | 2016 |
| Eritrea | Eritrean nakfa | IMF staff | 2006 | 2005 | SNA 1993 | | NSO | 2009 |
| Estonia | Euro | NSO | 2016 | 2010 | ESA 2010 | From 2010 | NSO | 2016 |
| Ethiopia | Ethiopian birr | NSO | 2015/16 | 2010/11 | SNA 1993 | | NSO | 2016 |
| Fiji | Fijian dollar | NSO | 2016 | 2011[6] | SNA 1993 | | NSO | 2015 |
| Finland | Euro | NSO | 2016 | 2010 | ESA 2010 | From 1980 | NSO | 2016 |
| France | Euro | NSO | 2016 | 2010 | ESA 2010 | From 1980 | NSO | 2016 |
| Gabon | CFA franc | MoF | 2015 | 2001 | SNA 1993 | | NSO | 2016 |
| The Gambia | Gambian dalasi | NSO | 2016 | 2004 | SNA 1993 | | NSO | 2016 |
| Georgia | Georgian lari | NSO | 2016 | 2000 | SNA 1993 | From 1996 | NSO | 2016 |
| Germany | Euro | NSO | 2016 | 2010 | ESA 2010 | From 1991 | NSO | 2016 |
| Ghana | Ghanaian cedi | NSO | 2016 | 2006 | SNA 1993 | | NSO | 2016 |
| Greece | Euro | NSO | 2016 | 2010 | ESA 2010 | From 1995 | NSO | 2016 |
| Grenada | Eastern Caribbean dollar | NSO | 2015 | 2006 | SNA 1993 | | NSO | 2016 |
| Guatemala | Guatemalan quetzal | CB | 2016 | 2001 | SNA 1993 | From 2001 | NSO | 2016 |
| Guinea | Guinean franc | NSO | 2011 | 2003 | SNA 1993 | | NSO | 2016 |
| Guinea-Bissau | CFA franc | NSO | 2015 | 2005 | SNA 1993 | | NSO | 2016 |
| Guyana | Guyanese dollar | NSO | 2016 | 2006[6] | SNA 1993 | | NSO | 2016 |
| Haiti | Haitian gourde | NSO | 2015/16 | 1986/87 | SNA 2008 | | NSO | 2015/16 |
| Honduras | Honduran lempira | CB | 2016 | 2000 | SNA 1993 | | CB | 2016 |
| Hong Kong SAR | Hong Kong dollar | NSO | 2016 | 2014 | SNA 2008 | From 1980 | NSO | 2016 |
| Hungary | Hungarian forint | NSO | 2016 | 2005 | ESA 2010 | From 2005 | IEO | 2016 |
| Iceland | Icelandic króna | NSO | 2016 | 2005 | ESA 2010 | From 1990 | NSO | 2016 |
| India | Indian rupee | NSO | 2016/17 | 2011/12 | SNA 2008 | | NSO | 2016/17 |
| Indonesia | Indonesian rupiah | NSO | 2016 | 2010 | SNA 2008 | | NSO | 2016 |
| Iran | Iranian rial | CB | 2015/16 | 2011/12 | SNA 1993 | | CB | 2015/16 |
| Iraq | Iraqi dinar | NSO | 2014 | 2007 | SNA 1968 | | NSO | 2014 |
| Ireland | Euro | NSO | 2016 | 2015 | ESA 2010 | From 1995 | NSO | 2016 |
| Israel | New Israeli shekel | NSO | 2016 | 2015 | SNA 2008 | From 1995 | NSO | 2016 |
| Italy | Euro | NSO | 2016 | 2010 | ESA 2010 | From 1980 | NSO | 2016 |
| Jamaica | Jamaican dollar | NSO | 2015 | 2007 | SNA 1993 | | NSO | 2015 |

## Table G. Key Data Documentation *(continued)*

| | Government Finance | | | | | Balance of Payments | | |
|---|---|---|---|---|---|---|---|---|
| Country | Historical Data Source[1] | Latest Actual Annual Data | Statistics Manual in Use at Source | Subsectors Coverage[4] | Accounting Practice[5] | Historical Data Source[1] | Latest Actual Annual Data | Statistics Manual in Use at Source |
| Côte d'Ivoire | MoF | 2016 | 1986 | CG | A | CB | 2015 | BPM 6 |
| Croatia | MoF | 2016 | 2001 | CG,LG | A | CB | 2016 | BPM 6 |
| Cyprus | NSO | 2016 | ESA 2010 | CG,LG,SS | Other | CB | 2016 | BPM 6 |
| Czech Republic | MoF | 2016 | 2001 | CG,LG,SS | A | NSO | 2016 | BPM 6 |
| Denmark | NSO | 2016 | 2001 | CG,LG,SS | A | NSO | 2015 | BPM 6 |
| Djibouti | MoF | 2016 | 2001 | CG | A | CB | 2016 | BPM 5 |
| Dominica | MoF | 2015/16 | 1986 | CG | C | CB | 2015 | BPM 6 |
| Dominican Republic | MoF | 2016 | 2001 | CG,SG,LG,SS,NMPC | Mixed | CB | 2016 | BPM 6 |
| Ecuador | CB and MoF | 2016 | 1986 | CG,SG,LG,SS,NFPC | C | CB | 2016 | BPM 6 |
| Egypt | MoF | 2015/16 | 2001 | CG,LG,SS,MPC | C | CB | 2015/16 | BPM 5 |
| El Salvador | MoF and CB | 2016 | 1986 | CG,LG,SS | C | CB | 2016 | BPM 6 |
| Equatorial Guinea | MoF | 2016 | 1986 | CG | C | CB | 2015 | BPM 5 |
| Eritrea | MoF | 2008 | 2001 | CG | C | CB | 2008 | BPM 5 |
| Estonia | MoF | 2016 | 1986/2001 | CG,LG,SS | C | CB | 2016 | BPM 6 |
| Ethiopia | MoF | 2015/16 | 1986 | CG,SG,LG,NFPC | C | CB | 2015/16 | BPM 5 |
| Fiji | MoF | 2015 | 1986 | CG | C | CB | 2015 | BPM 6 |
| Finland | MoF | 2016 | 2001 | CG,LG,SS | A | NSO | 2016 | BPM 6 |
| France | NSO | 2016 | 2001 | CG,LG,SS | A | CB | 2016 | BPM 6 |
| Gabon | IMF staff | 2016 | 2001 | CG | A | CB | 2015 | BPM 5 |
| The Gambia | MoF | 2016 | 1986 | CG | C | CB and IMF staff | 2016 | BPM 5 |
| Georgia | MoF | 2016 | 2001 | CG,LG | C | NSO and CB | 2015 | BPM 5 |
| Germany | NSO | 2016 | 2001 | CG,SG,LG,SS | A | CB | 2016 | BPM 6 |
| Ghana | MoF | 2016 | 2001 | CG | C | CB | 2016 | BPM 5 |
| Greece | NSO | 2016 | 2014 | CG,LG,SS | A | CB | 2016 | BPM 6 |
| Grenada | MoF | 2015 | 2001 | CG | CB | CB | 2015 | BPM 6 |
| Guatemala | MoF | 2016 | 2001 | CG | C | CB | 2015 | BPM 6 |
| Guinea | MoF | 2016 | 2001 | CG | Other | CB and MEP | 2016 | BPM 6 |
| Guinea-Bissau | MoF | 2014 | 2001 | CG | A | CB | 2015 | BPM 6 |
| Guyana | MoF | 2016 | 1986 | CG,SS,NFPC | C | CB | 2016 | BPM 5 |
| Haiti | MoF | 2015/16 | 2001 | CG | C | CB | 2015/16 | BPM 5 |
| Honduras | MoF | 2016 | 2014 | CG,LG,SS,NFPC | A | CB | 2015 | BPM 5 |
| Hong Kong SAR | NSO | 2016/17 | 2001 | CG | C | NSO | 2016 | BPM 6 |
| Hungary | MEP and NSO | 2016 | ESA 2010 | CG,LG,SS,NMPC | A | CB | 2015 | BPM 6 |
| Iceland | NSO | 2016 | 2001 | CG,LG,SS | A | CB | 2016 | BPM 6 |
| India | MoF and IMF staff | 2015/16 | 1986 | CG,SG | C | CB | 2016/17 | BPM 6 |
| Indonesia | MoF | 2016 | 2001 | CG,LG | C | CB | 2016 | BPM 6 |
| Iran | MoF | 2015/16 | 2001 | CG | C | CB | 2015/16 | BPM 5 |
| Iraq | MoF | 2014 | 2001 | CG | C | CB | 2014 | BPM 5 |
| Ireland | MoF and NSO | 2016 | 2001 | CG,LG,SS | A | NSO | 2016 | BPM 6 |
| Israel | MoF and NSO | 2016 | 2001 | CG,LG,SS | Other | NSO | 2016 | BPM 6 |
| Italy | NSO | 2016 | 2001 | CG,LG,SS | A | NSO | 2016 | BPM 6 |
| Jamaica | MoF | 2015/16 | 1986 | CG | C | CB | 2015 | BPM 5 |

## Table G. Key Data Documentation *(continued)*

| Country | Currency | National Accounts: Historical Data Source[1] | Latest Actual Annual Data | Base Year[2] | System of National Accounts | Use of Chain-Weighted Methodology[3] | Prices (CPI): Historical Data Source[1] | Latest Actual Annual Data |
|---|---|---|---|---|---|---|---|---|
| Japan | Japanese yen | GAD | 2016 | 2011 | SNA 2008 | From 1980 | GAD | 2016 |
| Jordan | Jordanian dinar | NSO | 2016 | 1994 | SNA 1993 | | NSO | 2016 |
| Kazakhstan | Kazakhstani tenge | NSO | 2016 | 2007 | SNA 1993 | From 1994 | CB | 2016 |
| Kenya | Kenya shilling | NSO | 2016 | 2009 | SNA 2008 | | NSO | 2016 |
| Kiribati | Australian dollar | NSO | 2015 | 2006 | SNA 2008 | | NSO | 2016 |
| Korea | South Korean won | CB | 2016 | 2010 | SNA 2008 | From 1980 | MoF | 2016 |
| Kosovo | Euro | NSO | 2015 | 2015 | ESA 2010 | | NSO | 2016 |
| Kuwait | Kuwaiti dinar | MEP and NSO | 2015 | 2010 | SNA 1993 | | NSO and MEP | 2016 |
| Kyrgyz Republic | Kyrgyz som | NSO | 2015 | 2005 | SNA 1993 | | NSO | 2016 |
| Lao P.D.R. | Lao kip | NSO | 2016 | 2012 | SNA 1993 | | NSO | 2016 |
| Latvia | Euro | NSO | 2016 | 2010 | ESA 2010 | From 1995 | NSO | 2016 |
| Lebanon | Lebanese pound | NSO | 2013 | 2010 | SNA 2008 | From 2010 | NSO | 2016 |
| Lesotho | Lesotho loti | NSO | 2015/16 | 2012/13 | Other | | NSO | 2016 |
| Liberia | US dollar | CB | 2016 | 1992 | SNA 1993 | | CB | 2016 |
| Libya | Libyan dinar | MEP | 2016 | 2003 | SNA 1993 | | NSO | 2016 |
| Lithuania | Euro | NSO | 2016 | 2010 | ESA 2010 | From 2005 | NSO | 2016 |
| Luxembourg | Euro | NSO | 2016 | 2010 | ESA 2010 | From 1995 | NSO | 2016 |
| Macao SAR | Macanese pataca | NSO | 2016 | 2015 | SNA 2008 | From 2001 | NSO | 2016 |
| FYR Macedonia | Macedonian denar | NSO | 2016 | 2005 | ESA 2010 | | NSO | 2016 |
| Madagascar | Malagasy ariary | NSO | 2015 | 2000 | SNA 1968 | | NSO | 2016 |
| Malawi | Malawian kwacha | NSO | 2011 | 2010 | SNA 2008 | | NSO | 2016 |
| Malaysia | Malaysian ringgit | NSO | 2016 | 2010 | SNA 2008 | | NSO | 2016 |
| Maldives | Maldivian rufiyaa | MoF and NSO | 2015 | 2014 | SNA 1993 | | CB | 2016 |
| Mali | CFA franc | NSO | 2016 | 1999 | SNA 1993 | | NSO | 2016 |
| Malta | Euro | NSO | 2016 | 2010 | ESA 2010 | From 2000 | NSO | 2016 |
| Marshall Islands | US dollar | NSO | 2015/16 | 2003/04 | SNA 1993 | | NSO | 2015/16 |
| Mauritania | Mauritanian ouguiya | NSO | 2014 | 2004 | SNA 1993 | | NSO | 2014 |
| Mauritius | Mauritian rupee | NSO | 2016 | 2006 | SNA 1993 | From 1999 | NSO | 2016 |
| Mexico | Mexican peso | NSO | 2016 | 2008 | SNA 2008 | | NSO | 2016 |
| Micronesia | US dollar | NSO | 2014/15 | 2004 | SNA 1993 | | NSO | 2014/15 |
| Moldova | Moldovan leu | NSO | 2016 | 1995 | SNA 1993 | | NSO | 2016 |
| Mongolia | Mongolian tögrög | NSO | 2016 | 2010 | SNA 1993 | | NSO | 2016 |
| Montenegro | Euro | NSO | 2015 | 2006 | ESA 1995 | | NSO | 2016 |
| Morocco | Moroccan dirham | NSO | 2016 | 2007 | SNA 1993 | From 1998 | NSO | 2016 |
| Mozambique | Mozambican metical | NSO | 2016 | 2009 | SNA 1993/2008 | | NSO | 2016 |
| Myanmar | Myanmar kyat | MEP | 2015/16 | 2010/11 | Other | | NSO | 2015/16 |
| Namibia | Namibia dollar | NSO | 2016 | 2000 | SNA 1993 | | NSO | 2016 |
| Nauru | Australian dollar | Other | 2015/16 | 2006/07 | SNA 1993 | | NSO | 2015/16 |
| Nepal | Nepalese rupee | NSO | 2015/16 | 2000/01 | SNA 1993 | | CB | 2016/17 |
| Netherlands | Euro | NSO | 2016 | 2010 | ESA 2010 | From 1980 | NSO | 2016 |
| New Zealand | New Zealand dollar | NSO | 2016 | 2009/10 | Other | From 1987 | NSO | 2016 |
| Nicaragua | Nicaraguan córdoba | CB | 2016 | 2006 | SNA 1993 | From 1994 | CB | 2016 |
| Niger | CFA franc | NSO | 2016 | 2000 | SNA 1993 | | NSO | 2016 |
| Nigeria | Nigerian naira | NSO | 2016 | 2010 | SNA 2008 | | NSO | 2016 |
| Norway | Norwegian krone | NSO | 2016 | 2014 | ESA 2010 | From 1980 | NSO | 2016 |

## Table G. Key Data Documentation *(continued)*

| | Government Finance | | | | | Balance of Payments | | |
|---|---|---|---|---|---|---|---|---|
| Country | Historical Data Source[1] | Latest Actual Annual Data | Statistics Manual in Use at Source | Subsectors Coverage[4] | Accounting Practice[5] | Historical Data Source[1] | Latest Actual Annual Data | Statistics Manual in Use at Source |
| Japan | GAD | 2016 | 2001 | CG,LG,SS | A | MoF | 2016 | BPM 6 |
| Jordan | MoF | 2016 | 2001 | CG,NFPC | C | CB | 2016 | BPM 5 |
| Kazakhstan | IMF staff | 2016 | 2001 | CG,LG | A | CB | 2016 | BPM 6 |
| Kenya | MoF | 2016 | 2001 | CG | A | CB | 2016 | BPM 6 |
| Kiribati | MoF | 2016 | 1986 | CG,LG | C | NSO | 2014 | BPM 6 |
| Korea | MoF | 2015 | 2001 | CG | C | CB | 2016 | BPM 6 |
| Kosovo | MoF | 2015 | Other | CG,LG | C | CB | 2015 | BPM 5 |
| Kuwait | MoF | 2015 | 1986 | CG | Mixed | CB | 2016 | BPM 6 |
| Kyrgyz Republic | MoF | 2016 | Other | CG,LG,SS | C | CB | 2016 | BPM 5 |
| Lao P.D.R. | MoF | 2016 | 2001 | CG | C | CB | 2016 | BPM 5 |
| Latvia | MoF | 2016 | 1986 | CG,LG,SS | C | CB | 2016 | BPM 6 |
| Lebanon | MoF | 2015 | 2001 | CG | Mixed | CB and IMF staff | 2015 | BPM 5 |
| Lesotho | MoF | 2016/17 | 2001 | CG,LG | C | CB | 2016/17 | BPM 5 |
| Liberia | MoF | 2016 | 2001 | CG | A | CB | 2015 | BPM 5 |
| Libya | MoF | 2016 | 1986 | CG,SG,LG | C | CB | 2016 | BPM 5 |
| Lithuania | MoF | 2015 | 2014 | CG,LG,SS | A | CB | 2016 | BPM 6 |
| Luxembourg | MoF | 2016 | 2001 | CG,LG,SS | A | NSO | 2016 | BPM 6 |
| Macao SAR | MoF | 2015 | 2014 | CG,SS | C | NSO | 2016 | BPM 6 |
| FYR Macedonia | MoF | 2016 | 1986 | CG,SG,SS | C | CB | 2016 | BPM 6 |
| Madagascar | MoF | 2016 | 1986 | CG,LG | C | CB | 2016 | BPM 5 |
| Malawi | MoF | 2015/16 | 1986 | CG | C | NSO and GAD | 2016 | BPM 5 |
| Malaysia | MoF | 2015 | 1986 | CG,SG,LG | C | NSO | 2016 | BPM 6 |
| Maldives | MoF | 2016 | 1986 | CG | C | CB | 2016 | BPM 5 |
| Mali | MoF | 2016 | 2001 | CG | Mixed | CB | 2016 | BPM 6 |
| Malta | NSO | 2016 | 2001 | CG,SS | A | NSO | 2016 | BPM 6 |
| Marshall Islands | MoF | 2015/16 | 2001 | CG,LG,SS | A | NSO | 2015/16 | BPM 6 |
| Mauritania | MoF | 2014 | 1986 | CG | C | CB | 2013 | BPM 5 |
| Mauritius | MoF | 2015/16 | 2001 | CG,LG,NFPC | C | CB | 2016 | BPM 5 |
| Mexico | MoF | 2016 | 2001 | CG,SS,NMPC,NFPC | C | CB | 2016 | BPM 6 |
| Micronesia | MoF | 2014/15 | 2001 | CG,SG,LG,SS | Other | NSO | 2014/15 | Other |
| Moldova | MoF | 2016 | 1986 | CG,LG,SS | C | CB | 2016 | BPM 5 |
| Mongolia | MoF | 2016 | 2001 | CG,SG,LG,SS | C | CB | 2016 | BPM 5 |
| Montenegro | MoF | 2015 | 1986 | CG,LG,SS | C | CB | 2015 | BPM 6 |
| Morocco | MEP | 2016 | 2001 | CG | A | GAD | 2016 | BPM 5 |
| Mozambique | MoF | 2016 | 2001 | CG,SG | Mixed | CB | 2015 | BPM 6 |
| Myanmar | MoF | 2015/16 | Other | CG,NFPC | Mixed | IMF staff | 2015/16 | BPM 5 |
| Namibia | MoF | 2015/16 | 2001 | CG | C | CB | 2015 | BPM 5 |
| Nauru | MoF | 2015/16 | 2001 | CG | Mixed | IMF staff | 2014/15 | BPM 6 |
| Nepal | MoF | 2015/16 | 2001 | CG | C | CB | 2015/16 | BPM 5 |
| Netherlands | MoF | 2016 | 2001 | CG,LG,SS | A | CB | 2016 | BPM 6 |
| New Zealand | MoF | 2015/16 | 2001 | CG | A | NSO | 2016 | BPM 6 |
| Nicaragua | MoF | 2016 | 1986 | CG,LG,SS | C | IMF staff | 2016 | BPM 6 |
| Niger | MoF | 2015 | 1986 | CG | A | CB | 2015 | BPM 6 |
| Nigeria | MoF | 2016 | 2001 | CG,SG,LG | C | CB | 2016 | BPM 5 |
| Norway | NSO and MoF | 2016 | 2014 | CG,LG,SS | A | NSO | 2016 | BPM 6 |

## Table G. Key Data Documentation *(continued)*

| | | National Accounts | | | | | Prices (CPI) | |
|---|---|---|---|---|---|---|---|---|
| Country | Currency | Historical Data Source[1] | Latest Actual Annual Data | Base Year[2] | System of National Accounts | Use of Chain-Weighted Methodology[3] | Historical Data Source[1] | Latest Actual Annual Data |
| Oman | Omani rial | NSO | 2015 | 2010 | SNA 1993 | | NSO | 2016 |
| Pakistan | Pakistan rupee | NSO | 2015/16 | 2005/06[6] | SNA 1968/ 1993 | | NSO | 2016/17 |
| Palau | US dollar | MoF | 2015/16 | 2004/05 | SNA 1993 | | MoF | 2015/16 |
| Panama | US dollar | NSO | 2015 | 2007 | SNA 1993 | From 2007 | NSO | 2015 |
| Papua New Guinea | Papua New Guinea kina | NSO and MoF | 2013 | 1998 | SNA 1993 | | NSO | 2013 |
| Paraguay | Paraguayan guaraní | CB | 2016 | 1994 | SNA 1993 | | CB | 2016 |
| Peru | Peruvian nuevo sol | CB | 2016 | 2007 | SNA 1993 | | CB | 2016 |
| Philippines | Philippine peso | NSO | 2016 | 2000 | SNA 2008 | | NSO | 2016 |
| Poland | Polish zloty | NSO | 2016 | 2010 | ESA 2010 | From 1995 | NSO | 2016 |
| Portugal | Euro | NSO | 2016 | 2011 | ESA 2010 | From 1980 | NSO | 2016 |
| Puerto Rico | US dollar | NSO | 2014/15 | 1954 | SNA1968 | | MEP | 2015/16 |
| Qatar | Qatari riyal | NSO and MEP | 2015 | 2013 | SNA 1993 | | NSO and MEP | 2015 |
| Romania | Romanian leu | NSO | 2016 | 2010 | ESA 2010 | From 2000 | NSO | 2016 |
| Russia | Russian ruble | NSO | 2016 | 2016 | SNA 2008 | From 1995 | NSO | 2016 |
| Rwanda | Rwandan franc | NSO | 2016 | 2014 | SNA 2008 | | NSO | 2016 |
| Samoa | Samoa tala | NSO | 2015/16 | 2009/10 | SNA 1993 | | NSO | 2015/16 |
| San Marino | Euro | NSO | 2015 | 2007 | Other | | NSO | 2016 |
| São Tomé and Príncipe | São Tomé and Príncipe dobra | NSO | 2015 | 2000 | SNA 1993 | | NSO | 2016 |
| Saudi Arabia | Saudi riyal | NSO and MEP | 2016 | 2010 | SNA 1993 | | NSO and MEP | 2016 |
| Senegal | CFA franc | NSO | 2016 | 2000 | SNA 1993 | | NSO | 2016 |
| Serbia | Serbian dinar | NSO | 2016 | 2010 | ESA 2010 | From 2010 | NSO | 2016 |
| Seychelles | Seychellois rupee | NSO | 2015 | 2006 | SNA 1993 | | NSO | 2016 |
| Sierra Leone | Sierra Leonean leone | NSO | 2016 | 2006 | SNA 1993 | From 2010 | NSO | 2016 |
| Singapore | Singapore dollar | NSO | 2016 | 2010 | SNA 1993 | From 2010 | NSO | 2016 |
| Slovak Republic | Euro | NSO | 2016 | 2010 | ESA 2010 | From 1997 | NSO | 2016 |
| Slovenia | Euro | NSO | 2016 | 2010 | ESA 2010 | From 2000 | NSO | 2016 |
| Solomon Islands | Solomon Islands dollar | CB | 2016 | 2004 | SNA 1993 | | NSO | 2016 |
| Somalia | US dollar | CB | 2015 | 2015 | SNA 1993 | | CB | 2014 |
| South Africa | South African rand | CB | 2016 | 2010 | SNA 1993 | | NSO | 2016 |
| South Sudan | South Sudanese pound | NSO | 2015 | 2010 | SNA 1993 | | NSO | 2016 |
| Spain | Euro | NSO | 2016 | 2010 | ESA 2010 | From 1995 | NSO | 2016 |
| Sri Lanka | Sri Lankan rupee | NSO | 2016 | 2010 | SNA 1993 | | NSO | 2016 |
| St. Kitts and Nevis | Eastern Caribbean dollar | NSO | 2016 | 2006[6] | SNA 1993 | | NSO | 2016 |
| St. Lucia | Eastern Caribbean dollar | NSO | 2016 | 2006 | SNA 1993 | | NSO | 2016 |
| St. Vincent and the Grenadines | Eastern Caribbean dollar | NSO | 2016 | 2006[6] | SNA 1993 | | NSO | 2016 |
| Sudan | Sudanese pound | NSO | 2010 | 2007 | Other | | NSO | 2015 |
| Suriname | Surinamese dollar | NSO | 2015 | 2007 | SNA 1993 | | NSO | 2016 |

## Table G. Key Data Documentation *(continued)*

| | Government Finance | | | | | Balance of Payments | | |
|---|---|---|---|---|---|---|---|---|
| Country | Historical Data Source[1] | Latest Actual Annual Data | Statistics Manual in Use at Source | Subsectors Coverage[4] | Accounting Practice[5] | Historical Data Source[1] | Latest Actual Annual Data | Statistics Manual in Use at Source |
| Oman | MoF | 2016 | 2001 | CG | C | CB | 2015 | BPM 5 |
| Pakistan | MoF | 2015/16 | 1986 | CG,SG,LG | C | CB | 2015/16 | BPM 5 |
| Palau | MoF | 2015/16 | 2001 | CG | Other | MoF | 2015/16 | BPM 6 |
| Panama | MoF | 2015 | 1986 | CG,SG,LG,SS,NFPC | C | NSO | 2015 | BPM 5 |
| Papua New Guinea | MoF | 2013 | 1986 | CG | C | CB | 2013 | BPM 5 |
| Paraguay | MoF | 2016 | 2001 | CG,SG,LG,SS,MPC, NFPC | C | CB | 2016 | BPM 5 |
| Peru | MoF | 2016 | 1986 | CG,SG,LG,SS | C | CB | 2016 | BPM 5 |
| Philippines | MoF | 2016 | 2001 | CG,LG,SS | C | CB | 2016 | BPM 6 |
| Poland | MoF and NSO | 2016 | ESA 2010 | CG,LG,SS | A | CB | 2016 | BPM 6 |
| Portugal | NSO | 2016 | 2001 | CG,LG,SS | A | CB | 2016 | BPM 6 |
| Puerto Rico | MEP | 2015/16 | 2001 | Other | A | . . . | . . . | . . . |
| Qatar | MoF | 2015 | 1986 | CG | C | CB and IMF staff | 2014 | BPM 5 |
| Romania | MoF | 2016 | 2001 | CG,LG,SS | C | CB | 2016 | BPM 6 |
| Russia | MoF | 2016 | 2001 | CG,SG,SS | Mixed | CB | 2016 | BPM 6 |
| Rwanda | MoF | 2016 | 2001 | CG,LG | Mixed | CB | 2016 | BPM 6 |
| Samoa | MoF | 2015/16 | 2001 | CG | A | CB | 2015/16 | BPM 6 |
| San Marino | MoF | 2016 | Other | CG | Other | . . . | . . . | . . . |
| São Tomé and Príncipe | MoF and Customs | 2016 | 2001 | CG | C | CB | 2016 | BPM 6 |
| Saudi Arabia | MoF | 2016 | 1986 | CG | C | CB | 2016 | BPM 5 |
| Senegal | MoF | 2016 | 2001 | CG | C | CB and IMF staff | 2016 | BPM 6 |
| Serbia | MoF | 2016 | 1986/2001 | CG,SG,LG,SS | C | CB | 2016 | BPM 6 |
| Seychelles | MoF | 2016 | 1986 | CG,SS | C | CB | 2016 | BPM 6 |
| Sierra Leone | MoF | 2016 | 1986 | CG | C | CB | 2016 | BPM 5 |
| Singapore | MoF | 2015/16 | 2001 | CG | C | NSO | 2016 | BPM 6 |
| Slovak Republic | NSO | 2016 | 2001 | CG,LG,SS | A | CB | 2016 | BPM 6 |
| Slovenia | MoF | 2016 | 1986 | CG,SG,LG,SS | C | NSO | 2016 | BPM 6 |
| Solomon Islands | MoF | 2016 | 1986 | CG | C | CB | 2016 | BPM 6 |
| Somalia | MoF | 2016 | 2001 | CG | C | CB | 2016 | BPM 5 |
| South Africa | MoF | 2016 | 2001 | CG,SG,SS | C | CB | 2016 | BPM 6 |
| South Sudan | MoF and MEP | 2016 | Other | CG | C | MoF, NSO, and MEP | 2016 | BPM 5 |
| Spain | MoF and NSO | 2016 | ESA 2010 | CG,SG,LG,SS | A | CB | 2016 | BPM 6 |
| Sri Lanka | MoF | 2016 | 2001 | CG | C | CB | 2016 | BPM 5 |
| St. Kitts and Nevis | MoF | 2016 | 1986 | CG | C | CB | 2016 | BPM 6 |
| St. Lucia | MoF | 2015/16 | 1986 | CG | C | CB | 2016 | BPM 6 |
| St. Vincent and the Grenadines | MoF | 2016 | 1986 | CG | C | CB | 2016 | BPM 6 |
| Sudan | MoF | 2015 | 2001 | CG | Mixed | CB | 2015 | BPM 5 |
| Suriname | MoF | 2015 | 1986 | CG | Mixed | CB | 2016 | BPM 5 |

## Table G. Key Data Documentation *(continued)*

| | | National Accounts | | | | | Prices (CPI) | |
|---|---|---|---|---|---|---|---|---|
| Country | Currency | Historical Data Source[1] | Latest Actual Annual Data | Base Year[2] | System of National Accounts | Use of Chain-Weighted Methodology[3] | Historical Data Source[1] | Latest Actual Annual Data |
| Swaziland | Swazi lilangeni | NSO | 2015 | 2011 | SNA 1993 | | NSO | 2016 |
| Sweden | Swedish krona | NSO | 2016 | 2016 | ESA 2010 | From 1993 | NSO | 2016 |
| Switzerland | Swiss franc | NSO | 2016 | 2010 | ESA 2010 | From 1980 | NSO | 2016 |
| Syria | Syrian pound | NSO | 2010 | 2000 | SNA 1993 | | NSO | 2011 |
| Taiwan Province of China | New Taiwan dollar | NSO | 2015 | 2011 | SNA 2008 | | NSO | 2016 |
| Tajikistan | Tajik somoni | NSO | 2016 | 1995 | SNA 1993 | | NSO | 2016 |
| Tanzania | Tanzania shilling | NSO | 2016 | 2007 | SNA 1993 | | NSO | 2016 |
| Thailand | Thai baht | MEP | 2016 | 2002 | SNA 1993 | From 1993 | MEP | 2016 |
| Timor-Leste | US dollar | MoF | 2015 | 2015[6] | Other | | NSO | 2016 |
| Togo | CFA franc | NSO | 2013 | 2000 | SNA 1993 | | NSO | 2016 |
| Tonga | Tongan pa'anga | CB | 2016 | 2010 | SNA 1993 | | CB | 2016 |
| Trinidad and Tobago | Trinidad and Tobago dollar | NSO | 2016 | 2000 | SNA 1993 | | NSO | 2016 |
| Tunisia | Tunisian dinar | NSO | 2014 | 2004 | SNA 1993 | From 2009 | NSO | 2016 |
| Turkey | Turkish lira | NSO | 2016 | 2009 | ESA 2010 | From 2009 | NSO | 2016 |
| Turkmenistan | New Turkmen manat | NSO | 2015 | 2008 | SNA 1993 | From 2000 | NSO | 2015 |
| Tuvalu | Australian dollar | PFTAC advisors | 2015 | 2005 | SNA 1993 | | NSO | 2016 |
| Uganda | Ugandan shilling | NSO | 2016 | 2010 | SNA 1993 | | CB | 2015/16 |
| Ukraine | Ukrainian hryvnia | NSO | 2016 | 2010 | SNA 2008 | From 2005 | NSO | 2016 |
| United Arab Emirates | U.A.E. dirham | NSO | 2016 | 2010 | SNA 1993 | | NSO | 2016 |
| United Kingdom | Pound sterling | NSO | 2016 | 2013 | ESA 2010 | From 1980 | NSO | 2016 |
| United States | US dollar | NSO | 2016 | 2009 | Other | From 1980 | NSO | 2016 |
| Uruguay | Uruguayan peso | CB | 2016 | 2005 | SNA 1993 | | NSO | 2016 |
| Uzbekistan | Uzbek sum | NSO | 2016 | 1995 | SNA 1993 | | NSO | 2016 |
| Vanuatu | Vanuatu vatu | NSO | 2016 | 2006 | SNA 1993 | | NSO | 2016 |
| Venezuela | Venezuelan bolívar fuerte | CB | 2016 | 1997 | SNA 2008 | | CB | 2016 |
| Vietnam | Vietnamese dong | NSO | 2016 | 2010 | SNA 1993 | | NSO | 2016 |
| Yemen | Yemeni rial | IMF staff | 2008 | 1990 | SNA 1993 | | NSO,CB, and IMF staff | 2009 |
| Zambia | Zambian kwacha | NSO | 2015 | 2010 | SNA 1993 | | NSO | 2016 |
| Zimbabwe | US dollar | NSO | 2013 | 2009 | Other | | NSO | 2016 |

## Table G. Key Data Documentation *(continued)*

| | Government Finance | | | | | Balance of Payments | | |
|---|---|---|---|---|---|---|---|---|
| Country | Historical Data Source[1] | Latest Actual Annual Data | Statistics Manual in Use at Source | Subsectors Coverage[4] | Accounting Practice[5] | Historical Data Source[1] | Latest Actual Annual Data | Statistics Manual in Use at Source |
| Swaziland | MoF | 2016/17 | 2001 | CG | A | CB | 2016 | BPM 6 |
| Sweden | MoF | 2015 | 2001 | CG,LG,SS | A | NSO | 2016 | BPM 6 |
| Switzerland | MoF | 2015 | 2001 | CG,SG,LG,SS | A | CB | 2016 | BPM 6 |
| Syria | MoF | 2009 | 1986 | CG | C | CB | 2009 | BPM 5 |
| Taiwan Province of China | MoF | 2015 | 1986 | CG,LG,SS | C | CB | 2015 | BPM 6 |
| Tajikistan | MoF | 2016 | 1986 | CG,LG,SS | C | CB | 2016 | BPM 5 |
| Tanzania | MoF | 2015 | 1986 | CG,LG | C | CB | 2015 | BPM 5 |
| Thailand | MoF | 2014/15 | 2001 | CG,BCG,LG,SS | A | CB | 2016 | BPM 6 |
| Timor-Leste | MoF | 2015 | 2001 | CG | C | CB | 2016 | BPM 6 |
| Togo | MoF | 2016 | 2001 | CG | C | CB | 2016 | BPM 6 |
| Tonga | MoF | 2016 | 2014 | CG | C | CB and NSO | 2015 | BPM 6 |
| Trinidad and Tobago | MoF | 2015/16 | 1986 | CG | C | CB and NSO | 2016 | BPM 6 |
| Tunisia | MoF | 2016 | 1986 | CG | C | CB | 2016 | BPM 5 |
| Turkey | MoF | 2015 | 2001 | CG,LG,SS | A | CB | 2016 | BPM 6 |
| Turkmenistan | MoF | 2015 | 1986 | CG,LG | C | NSO and IMF staff | 2013 | BPM 5 |
| Tuvalu | MoF | 2016 | Other | CG | Mixed | IMF staff | 2013 | BPM 6 |
| Uganda | MoF | 2015 | 2001 | CG | C | CB | 2015 | BPM 6 |
| Ukraine | MoF | 2016 | 2001 | CG,SG,LG,SS | C | CB | 2016 | BPM 6 |
| United Arab Emirates | MoF | 2015 | 2001 | CG,BCG,SG,SS | C | CB | 2016 | BPM 5 |
| United Kingdom | NSO | 2016 | 2001 | CG,LG | A | NSO | 2016 | BPM 6 |
| United States | MEP | 2016 | 2014 | CG,SG,LG | A | NSO | 2016 | BPM 6 |
| Uruguay | MoF | 2016 | 1986 | CG,LG,SS,MPC, NFPC | A | CB | 2016 | BPM 6 |
| Uzbekistan | MoF | 2016 | Other | CG,SG,LG,SS | C | MEP | 2016 | BPM 5 |
| Vanuatu | MoF | 2016 | 2001 | CG | C | CB | 2016 | BPM 5 |
| Venezuela | MoF | 2013 | 2001 | BCG,NFPC | C | CB | 2016 | BPM 5 |
| Vietnam | MoF | 2014 | 2001 | CG,SG,LG | C | CB | 2016 | BPM 5 |
| Yemen | MoF | 2013 | 2001 | CG,LG | C | IMF staff | 2009 | BPM 5 |
| Zambia | MoF | 2016 | 1986 | CG | C | CB | 2016 | BPM 6 |
| Zimbabwe | MoF | 2014 | 1986 | CG | C | CB and MoF | 2013 | BPM 4 |

Note: BPM = *Balance of Payments Manual*; CPI = consumer price index; ESA = European System of National and Regional Accounts; SNA = System of National Accounts.

[1]CB = central bank; Customs = Customs Authority; GAD = General Administration Department; IEO = international economic organization; MEP = Ministry of Economy, Planning, Commerce, and/or Development; MoF = Ministry of Finance and/or Treasury; NSO = National Statistics Office; PFTAC = Pacific Financial Technical Assistance Centre.

[2]National accounts base year is the period with which other periods are compared and the period for which prices appear in the denominators of the price relationships used to calculate the index.

[3]Use of chain-weighted methodology allows countries to measure GDP growth more accurately by reducing or eliminating the downward biases in volume series built on index numbers that average volume components using weights from a year in the moderately distant past.

[4]For some countries, the structures of government consist of a broader coverage than specified for the general government. Coverage: BCG = budgetary central government; CG = central government; LG = local government; MPC = monetary public corporation, including central bank; NFPC = nonfinancial public corporation; NMPC = nonmonetary financial public corporation; SG = state government; SS = social security fund; TG = territorial governments.

[5]Accounting standard: A = accrual accounting; C = cash accounting; CB = commitments basis accounting; Mixed = combination of accrual and cash accounting.

[6]Base year is not equal to 100 because the nominal GDP is not measured in the same way as real GDP or the data are seasonally adjusted.

## Box A1. Economic Policy Assumptions Underlying the Projections for Selected Economies

### *Fiscal Policy Assumptions*

The short-term fiscal policy assumptions used in the *World Economic Outlook* (WEO) are normally based on officially announced budgets, adjusted for differences between the national authorities and the IMF staff regarding macroeconomic assumptions and projected fiscal outturns. When no official budget has been announced, projections incorporate policy measures that are judged likely to be implemented. The medium-term fiscal projections are similarly based on a judgment about the most likely path of policies. For cases in which the IMF staff has insufficient information to assess the authorities' budget intentions and prospects for policy implementation, an unchanged structural primary balance is assumed unless indicated otherwise. Specific assumptions used in regard to some of the advanced economies follow. (See also Tables B5 to B9 in the online section of the Statistical Appendix for data on fiscal net lending/borrowing and structural balances.)[1]

*Argentina:* Fiscal projections are based on the available information regarding budget outturn and budget plans for the federal and provincial governments, fiscal measures announced by the authorities, and IMF staff macroeconomic projections.

*Australia:* Fiscal projections are based on Australian Bureau of Statistics data, the fiscal year 2017/18 budget, and IMF staff estimates.

*Austria:* Fiscal projections are based on data from Statistics Austria, the authorities' projections, and IMF staff estimates and projections.

*Belgium:* Projections reflect the IMF staff's assessment of policies and measures laid out in the 2017 budget and the 2016–19 Stability Programme, incorporated into the IMF staff's macroeconomic framework.

[1] The output gap is actual minus potential output, as a percentage of potential output. Structural balances are expressed as a percentage of potential output. The structural balance is the actual net lending/borrowing minus the effects of cyclical output from potential output, corrected for one-time and other factors, such as asset and commodity prices and output composition effects. Changes in the structural balance consequently include effects of temporary fiscal measures, the impact of fluctuations in interest rates and debt-service costs, and other noncyclical fluctuations in net lending/borrowing. The computations of structural balances are based on IMF staff estimates of potential GDP and revenue and expenditure elasticities. (See Annex I of the October 1993 WEO.) Net debt is calculated as gross debt minus financial assets corresponding to debt instruments. Estimates of the output gap and of the structural balance are subject to significant margins of uncertainty.

*Brazil:* Fiscal projections for the end of 2017 take into account budget performance through July 31, 2017, and the deficit target approved in the budget law.

*Canada:* Projections use the baseline forecasts in the 2017 federal budget and 2017 provincial budget updates as available. The IMF staff makes some adjustments to these forecasts, including for differences in macroeconomic projections. The IMF staff forecast also incorporates the most recent data releases from Statistics Canada's Canadian System of National Economic Accounts, including federal, provincial, and territorial budgetary outturns through the second quarter of 2017.

*Chile:* Projections are based on the authorities' budget projections, adjusted to reflect the IMF staff's projections for GDP and copper prices.

*China:* Projections assume that the pace of fiscal consolidation is likely to be more gradual, reflecting reforms to strengthen social safety nets and the social security system announced as part of the Third Plenum reform agenda.

*Denmark:* Estimates for 2016 are aligned with the latest official budget estimates and the underlying economic projections, adjusted where appropriate for the IMF staff's macroeconomic assumptions. For 2017–18, the projections incorporate key features of the medium-term fiscal plan as embodied in the authorities' Convergence Programme 2016 submitted to the European Union.

*France:* Projections for 2017 reflect the budget law and cancellation of spending taken in July 2017. For 2018–19, they are based on the multiyear budget and the preliminary fiscal path announced by the new government in July 2017, adjusted for differences in assumptions on macro and financial variables, and revenue projections. Historical fiscal data reflect the May 2017 revisions and update of the fiscal accounts, debt data, and national accounts for 2014 and 2015.

*Germany:* The IMF staff's projections for 2017 and beyond are based on the 2017 Stability Programme Update, adjusted for the differences in the IMF staff's macroeconomic framework and assumptions concerning revenue elasticities. The estimate of gross debt includes portfolios of impaired assets and noncore business transferred to institutions that are winding up, as well as other financial sector and EU support operations.

*Greece:* The fiscal projections reflect the IMF staff's assessment of implementation of legislated fiscal measures under the IMF and European Stability Mechanism (ESM) program.

## Box A1 *(continued)*

*Hong Kong Special Administrative Region:* Projections are based on the authorities' medium-term fiscal projections on expenditures.

*Hungary:* Fiscal projections include IMF staff projections of the macroeconomic framework and of the impact of recent legislative measures, as well as fiscal policy plans announced in the 2017 budget.

*India:* Historical data are based on budgetary execution data. Projections are based on available information on the authorities' fiscal plans, with adjustments for IMF staff assumptions. Subnational data are incorporated with a lag of up to two years; general government data are thus finalized well after central government data. IMF and Indian presentations differ, particularly regarding divestment and license auction proceeds, net versus gross recording of revenues in certain minor categories, and some public sector lending.

*Indonesia:* IMF projections are based on moderate tax policy and administration reforms, fuel subsidy pricing reforms introduced in January 2015, and a gradual increase in social and capital spending over the medium term in line with fiscal space.

*Ireland:* Fiscal projections are based on the country's Budget 2017, Stability Programme Update 2017, and Summer Economic Statement 2017.

*Israel:* Historical data are based on Government Finance Statistics data prepared by the Central Bureau of Statistics. Projections for 2017 and 2018 are based on the 2017–18 budget, adjusted for the fiscal impact of new measures announced in April 2017 (the "Net Family Plan") and for one-off revenues in 2017 arising from a large foreign direct investment transaction (0.3 percent of GDP). The central government deficit is assumed to remain at the current ceiling level of 2.9 percent of GDP in subsequent years, rather than declining in line with medium-term fiscal targets, consistent with long experience of revisions to those targets.

*Italy:* IMF staff estimates and projections are based on the fiscal plans included in the government's 2017 budget and April 2017 Economic and Financial Document.

*Japan:* The projections include fiscal measures already announced by the government, including the fiscal stimulus package for 2017 and the consumption tax hike in October 2019.

*Korea:* The medium-term forecast incorporates the government's announced medium-term consolidation path.

*Mexico:* Fiscal projections for 2017 are broadly in line with the approved budget; projections for 2018 onward assume compliance with rules established in the Fiscal Responsibility Law.

*Netherlands:* Fiscal projections for 2017–22 are based on the authorities' Bureau for Economic Policy Analysis budget projections, after differences in macroeconomic assumptions are adjusted for. Historical data were revised following the June 2014 Central Bureau of Statistics release of revised macro data because of the adoption of the European System of National and Regional Accounts (ESA 2010) and the revisions of data sources.

*New Zealand:* Fiscal projections are based on the authorities' fiscal year 2017/18 budget and on IMF staff estimates.

*Portugal:* Projections for 2017 are based on the authorities' approved budget, adjusted to reflect the IMF staff's macroeconomic forecast. Projections thereafter are based on the assumption of unchanged policies.

*Puerto Rico:* Fiscal projections are based on the Puerto Rico Fiscal and Economic Growth Plan (FEGP), which was prepared on March 13, 2017, and certified by the Oversight Board. In line with assumptions of this plan, IMF projections assume that Puerto Rico will lose federal funding for the Affordable Care Act (ACA) starting in 2018. Likewise, projections assume federal tax incentives, which were neutralizing the effects of Puerto Rico's Act 154 on foreign companies, will no longer be available, starting in 2018, leading to additional revenue losses. Given sizable policy uncertainty, some FEGP and IMF assumptions may differ, in particular, those relating to the effects of the corporate tax reform, tax compliance and tax adjustments (fees and rates); reduction of subsidies, freezing of payroll operational costs, improvement of mobility, and reduction of expenses; and increasing health care efficiency. On the expenditure side, measures include extension of Act 66, which freezes much government spending, through 2020; reduction of operating costs; decreases in government subsidies; and spending cuts in education. Although IMF policy assumptions are similar to those in the FEGP scenario with full measures, the IMF's projections of fiscal revenues, expenditures, and balance are different from FEGP's. This stems from two main differences in methodologies: first and foremost, while IMF projections are on an accrual basis, FEGP's are on a cash basis. Second, the IMF and FEGP make very different macroeconomic assumptions.

*Russia:* Projections for 2017–19 are IMF staff estimates, based on the authorities' budget. Projections for 2020–22

## Box A1 *(continued)*

are based on an oil price rule to be in effect in 2022, with adjustments by the IMF staff.

*Saudi Arabia:* IMF staff projections of oil revenues are based on WEO baseline oil prices and the assumption that Saudi Arabia continues to meet its commitments under the OPEC+ agreement. For non-oil revenues, IMF staff estimates of the revenue impact of announced policies in the Fiscal Balance Program are included in the baseline. On the expenditure side, starting in 2017, following recent reforms, the wage bill estimates no longer include the 13th-month wage payment that used to be awarded every three years in accordance with the lunar calendar. Expenditure projections take the 2017 budget as a starting point and reflect staff estimates of the effects of the latest changes in policies and economic developments.

*Singapore:* For fiscal years 2016/17 and 2017/18, projections are based on budget numbers. For the remainder of the projection period, the IMF staff assumes unchanged policies.

*South Africa:* Fiscal projections are based on the authorities' 2017 Budget Review.

*Spain:* For 2017, fiscal data are IMF staff projections, reflecting the cash outturn through May and the 2017 budget passed by Parliament. For 2018 and beyond, fiscal projections are based on the measures specified in the Stability Programme Update 2017–20 and on the IMF staff's macroeconomic projections.

*Sweden:* Fiscal projections take into account the authorities' projections based on the 2017 Spring Budget. The impact of cyclical developments on the fiscal accounts is calculated using the Organisation for Economic Co-operation and Development's 2005 elasticity to take into account output and employment gaps.

*Switzerland:* The projections assume that fiscal policy is adjusted as necessary to keep fiscal balances in line with the requirements of Switzerland's fiscal rules.

*Turkey:* The fiscal projections for 2017 are based on the authorities' Medium Term Programme 2017–19, with adjustments for additionally announced fiscal measures and the IMF staff's higher inflation forecast. For the medium term, the fiscal projections assume a more gradual fiscal consolidation than envisaged in the Medium Term Programme.

*United Kingdom:* Fiscal projections are based on the country's Budget 2017, published in March 2017, with expenditure projections based on the budgeted nominal values and with revenue projections adjusted for differences between IMF staff forecasts of macroeconomic variables (such as GDP growth and inflation) and the forecasts of these variables assumed in the authorities' fiscal projections. IMF staff data exclude public sector banks and the effect of transferring assets from the Royal Mail Pension Plan to the public sector in April 2012. Real government consumption and investment are part of the real GDP path, which, according to the IMF staff, may or may not be the same as projected by the U.K. Office for Budget Responsibility.

*United States:* Fiscal projections are based on the January 2017 Congressional Budget Office baseline adjusted for the IMF staff's policy and macroeconomic assumptions. The baseline incorporates the key provisions of the Bipartisan Budget Act of 2015, including a partial rollback of the sequester spending cuts in fiscal year 2016. In fiscal years 2017 through 2022, the IMF staff assumes that the sequester cuts will continue to be partially replaced, in proportions similar to those already implemented in fiscal years 2014 and 2015, with back-loaded measures generating savings in mandatory programs and additional revenues. Projections also incorporate the Protecting Americans from Tax Hikes Act of 2015, which extended some existing tax cuts for the short term and some permanently. Finally, fiscal projections are adjusted to reflect the IMF staff's forecasts for key macroeconomic and financial variables and different accounting treatment of financial sector support and of defined-benefit pension plans and are converted to a general government basis. Data are compiled using SNA 2008, and when translated into government finance statistics, this is in accordance with GFSM 2014. Because of data limitations, most series begin in 2001.

### *Monetary Policy Assumptions*

Monetary policy assumptions are based on the established policy framework in each country. In most cases, this implies a nonaccommodative stance over the business cycle: official interest rates will increase when economic indicators suggest that inflation will rise above its acceptable rate or range; they will decrease when indicators suggest that inflation will not exceed the acceptable rate or range, that output growth is below its potential rate, and that the margin of slack in the economy is significant. On this basis, the London interbank offered rate (LIBOR) on six-month US dollar

## Box A1 *(continued)*

deposits is assumed to average 1.4 percent in 2017 and 1.9 percent in 2018 (see Table 1.1). The rate on three-month euro deposits is assumed to average –0.3 percent in 2017 and 2018. The interest rate on six-month Japanese yen deposits is assumed to average 0.1 percent in 2017 and 0.2 percent in 2018.

*Australia:* Monetary policy assumptions are in line with market expectations.

*Brazil:* Monetary policy assumptions are consistent with gradual convergence of inflation toward the middle of the target range over the relevant horizon.

*Canada:* Monetary policy assumptions are in line with market expectations.

*China:* Monetary policy is expected to tighten with a gradual rise in the interest rate.

*Denmark:* The monetary policy is to maintain the peg to the euro.

*Euro area:* Monetary policy assumptions for euro area member countries are in line with market expectations.

*Hong Kong Special Administrative Region:* The IMF staff assumes that the currency board system remains intact.

*India:* The policy (interest) rate assumption is consistent with an inflation rate within the Reserve Bank of India's targeted band.

*Indonesia:* Monetary policy assumptions are in line with the maintenance of inflation within the central bank's targeted band.

*Japan:* Monetary policy assumptions are in line with market expectations.

*Korea:* Monetary policy assumptions are in line with market expectations.

*Mexico:* Monetary policy assumptions are consistent with attaining the inflation target.

*Russia:* Monetary projections assume that policy rates will be falling over the next year or two as inflation continues to be close to target in the context of a tight monetary stance.

*Saudi Arabia:* Monetary policy projections are based on the continuation of the exchange rate peg to the US dollar.

*Singapore:* Broad money is projected to grow in line with the projected growth in nominal GDP.

*Sweden:* Monetary projections are in line with Riksbank projections.

*Switzerland:* The projections assume no change in the policy rate in 2016–17.

*Turkey:* The outlook for monetary and financial conditions assumes no changes to the current policy stance.

*United Kingdom:* The short-term interest rate path is based on market interest rate expectations.

*United States:* Following the Federal Reserve's 25 basis point rate hike in mid-March, the IMF staff expects the federal funds target rate to increase by 25 more basis points in 2017 and rise gradually thereafter.

# List of Tables

## Output



## Inflation



## Financial Policies



## Foreign Trade



## Current Account Transactions



## Balance of Payments and External Financing



## Flow of Funds



## Medium-Term Baseline Scenario

## Table A1. Summary of World Output[1]

*(Annual percent change)*

| | Average | | | | | | | | | Projections | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1999–2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2022 |
| **World** | **4.2** | **–0.1** | **5.4** | **4.3** | **3.5** | **3.5** | **3.6** | **3.4** | **3.2** | **3.6** | **3.7** | **3.8** |
| **Advanced Economies** | **2.5** | **–3.4** | **3.1** | **1.7** | **1.2** | **1.3** | **2.1** | **2.2** | **1.7** | **2.2** | **2.0** | **1.7** |
| United States | 2.6 | –2.8 | 2.5 | 1.6 | 2.2 | 1.7 | 2.6 | 2.9 | 1.5 | 2.2 | 2.3 | 1.7 |
| Euro Area | 2.1 | –4.5 | 2.1 | 1.6 | –0.9 | –0.2 | 1.3 | 2.0 | 1.8 | 2.1 | 1.9 | 1.5 |
| Japan | 1.0 | –5.4 | 4.2 | –0.1 | 1.5 | 2.0 | 0.3 | 1.1 | 1.0 | 1.5 | 0.7 | 0.6 |
| Other Advanced Economies[2] | 3.5 | –2.0 | 4.6 | 2.9 | 1.9 | 2.3 | 2.9 | 2.0 | 2.0 | 2.4 | 2.2 | 2.2 |
| **Emerging Market and Developing Economies** | **6.2** | **2.8** | **7.4** | **6.4** | **5.4** | **5.1** | **4.7** | **4.3** | **4.3** | **4.6** | **4.9** | **5.0** |
| **Regional Groups** | | | | | | | | | | | | |
| Commonwealth of Independent States[3] | 7.2 | –6.4 | 4.7 | 5.3 | 3.6 | 2.5 | 1.1 | –2.2 | 0.4 | 2.1 | 2.1 | 2.4 |
| Emerging and Developing Asia | 8.0 | 7.5 | 9.6 | 7.9 | 7.0 | 6.9 | 6.8 | 6.8 | 6.4 | 6.5 | 6.5 | 6.3 |
| Emerging and Developing Europe | 4.3 | –3.0 | 4.6 | 6.5 | 2.4 | 4.9 | 3.9 | 4.7 | 3.1 | 4.5 | 3.5 | 3.2 |
| Latin America and the Caribbean | 3.3 | –1.8 | 6.1 | 4.7 | 3.0 | 2.9 | 1.2 | 0.1 | –0.9 | 1.2 | 1.9 | 2.7 |
| Middle East, North Africa, Afghanistan, and Pakistan | 5.2 | 1.1 | 4.7 | 4.5 | 5.2 | 2.7 | 2.8 | 2.7 | 5.0 | 2.6 | 3.5 | 3.8 |
| Middle East and North Africa | 5.2 | 1.0 | 4.9 | 4.6 | 5.3 | 2.5 | 2.6 | 2.6 | 5.1 | 2.2 | 3.2 | 3.5 |
| Sub-Saharan Africa | 5.6 | 3.9 | 7.0 | 5.1 | 4.4 | 5.3 | 5.1 | 3.4 | 1.4 | 2.6 | 3.4 | 3.9 |
| *Memorandum* | | | | | | | | | | | | |
| European Union | 2.5 | –4.3 | 2.1 | 1.8 | –0.4 | 0.3 | 1.8 | 2.3 | 2.0 | 2.3 | 2.1 | 1.7 |
| Low-Income Developing Countries | 6.1 | 5.8 | 7.5 | 5.2 | 5.2 | 6.1 | 6.0 | 4.7 | 3.6 | 4.6 | 5.2 | 5.3 |
| **Analytical Groups** | | | | | | | | | | | | |
| **By Source of Export Earnings** | | | | | | | | | | | | |
| Fuel | 6.2 | –1.9 | 5.1 | 5.2 | 5.0 | 2.7 | 2.2 | 0.3 | 1.9 | 1.3 | 2.1 | 2.4 |
| Nonfuel | 6.2 | 4.1 | 8.1 | 6.7 | 5.5 | 5.8 | 5.3 | 5.2 | 4.9 | 5.4 | 5.4 | 5.5 |
| Of Which, Primary Products | 3.7 | –0.8 | 6.7 | 4.9 | 2.6 | 4.1 | 1.8 | 3.0 | 1.2 | 2.7 | 3.0 | 3.7 |
| **By External Financing Source** | | | | | | | | | | | | |
| Net Debtor Economies | 5.0 | 2.2 | 6.9 | 5.3 | 4.4 | 4.8 | 4.4 | 4.1 | 3.7 | 4.5 | 4.7 | 5.4 |
| **Net Debtor Economies by Debt-Servicing Experience** | | | | | | | | | | | | |
| Economies with Arrears and/or Rescheduling during 2012–16 | 5.1 | 0.1 | 4.2 | 2.6 | 2.3 | 3.2 | 1.4 | 0.6 | 2.7 | 3.2 | 4.0 | 5.1 |
| *Memorandum* | | | | | | | | | | | | |
| **Median Growth Rate** | | | | | | | | | | | | |
| Advanced Economies | 3.1 | –3.8 | 2.3 | 2.0 | 1.0 | 1.6 | 2.5 | 1.8 | 2.0 | 3.0 | 2.5 | 1.8 |
| Emerging Market and Developing Economies | 4.7 | 1.6 | 4.6 | 4.7 | 4.3 | 4.3 | 3.8 | 3.5 | 3.0 | 3.5 | 3.5 | 3.8 |
| Low-Income Developing Countries | 5.0 | 3.9 | 6.1 | 5.6 | 5.1 | 5.3 | 4.8 | 4.3 | 4.0 | 4.5 | 5.0 | 5.4 |
| **Output per Capita[4]** | | | | | | | | | | | | |
| Advanced Economies | 1.8 | –4.0 | 2.5 | 1.1 | 0.7 | 0.8 | 1.6 | 1.7 | 1.1 | 1.7 | 1.6 | 1.3 |
| Emerging Market and Developing Economies | 4.5 | 1.1 | 5.9 | 4.9 | 3.7 | 3.7 | 3.2 | 2.8 | 2.8 | 3.2 | 3.5 | 3.6 |
| Low-Income Developing Countries | 3.4 | 3.5 | 5.2 | 3.7 | 2.4 | 3.8 | 3.7 | 2.2 | 1.2 | 2.2 | 3.0 | 3.1 |
| **World Growth Rate Based on Market Exchange Rates** | **3.1** | **–2.1** | **4.1** | **3.1** | **2.5** | **2.6** | **2.8** | **2.7** | **2.5** | **3.0** | **3.1** | **2.9** |
| **Value of World Output (billions of US dollars)** | | | | | | | | | | | | |
| At Market Exchange Rates | 43,843 | 60,280 | 65,906 | 73,119 | 74,489 | 76,551 | 78,594 | 74,311 | 75,368 | 79,281 | 84,375 | 103,201 |
| At Purchasing Power Parities | 62,820 | 83,777 | 89,271 | 94,857 | 99,664 | 104,684 | 110,258 | 115,108 | 120,197 | 126,634 | 133,805 | 167,782 |

[1]Real GDP.
[2]Excludes the United States, euro area countries, and Japan.
[3]Georgia, Turkmenistan, and Ukraine, which are not members of the Commonwealth of Independent States, are included in this group for reasons of geography and similarity in economic structure.
[4]The output per capita is at purchasing power parity.

## Table A2. Advanced Economies: Real GDP and Total Domestic Demand[1]

*(Annual percent change)*

| | Average | | | | | | | | | Projections | | | Fourth Quarter[2] | Projections | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1999–2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2022 | 2016:Q4 | 2017:Q4 | 2018:Q4 |
| **Real GDP** | | | | | | | | | | | | | | | |
| **Advanced Economies** | **2.5** | **–3.4** | **3.1** | **1.7** | **1.2** | **1.3** | **2.1** | **2.2** | **1.7** | **2.2** | **2.0** | **1.7** | **2.0** | **2.2** | **1.9** |
| United States | 2.6 | –2.8 | 2.5 | 1.6 | 2.2 | 1.7 | 2.6 | 2.9 | 1.5 | 2.2 | 2.3 | 1.7 | 1.8 | 2.3 | 2.3 |
| Euro Area | 2.1 | –4.5 | 2.1 | 1.6 | –0.9 | –0.2 | 1.3 | 2.0 | 1.8 | 2.1 | 1.9 | 1.5 | 1.9 | 2.2 | 1.7 |
| Germany | 1.6 | –5.6 | 3.9 | 3.7 | 0.7 | 0.6 | 1.9 | 1.5 | 1.9 | 2.0 | 1.8 | 1.2 | 1.9 | 2.2 | 1.8 |
| France | 2.0 | –2.9 | 2.0 | 2.1 | 0.2 | 0.6 | 0.9 | 1.1 | 1.2 | 1.6 | 1.8 | 1.8 | 1.2 | 2.1 | 1.4 |
| Italy | 1.2 | –5.5 | 1.7 | 0.6 | –2.8 | –1.7 | 0.1 | 0.8 | 0.9 | 1.5 | 1.1 | 0.8 | 1.2 | 1.5 | 1.0 |
| Spain | 3.6 | –3.6 | 0.0 | –1.0 | –2.9 | –1.7 | 1.4 | 3.2 | 3.2 | 3.1 | 2.5 | 1.7 | 3.0 | 3.1 | 2.1 |
| Netherlands | 2.5 | –3.8 | 1.4 | 1.7 | –1.1 | –0.2 | 1.4 | 2.3 | 2.2 | 3.1 | 2.6 | 1.8 | 2.7 | 3.4 | 1.9 |
| Belgium | 2.3 | –2.3 | 2.7 | 1.8 | 0.1 | –0.1 | 1.6 | 1.5 | 1.2 | 1.6 | 1.6 | 1.5 | 1.1 | 1.9 | 1.5 |
| Austria | 2.4 | –3.8 | 1.9 | 2.8 | 0.7 | 0.1 | 0.6 | 1.0 | 1.5 | 2.3 | 1.9 | 1.4 | 2.0 | 1.8 | 2.0 |
| Greece | 3.5 | –4.3 | –5.5 | –9.1 | –7.3 | –3.2 | 0.4 | –0.2 | 0.0 | 1.8 | 2.6 | 1.0 | –1.0 | 3.6 | 1.7 |
| Portugal | 1.6 | –3.0 | 1.9 | –1.8 | –4.0 | –1.1 | 0.9 | 1.6 | 1.4 | 2.5 | 2.0 | 1.2 | 2.0 | 2.0 | 2.3 |
| Ireland | 5.4 | –4.7 | 1.8 | 2.9 | 0.0 | 1.6 | 8.3 | 25.5 | 5.1 | 4.1 | 3.4 | 2.8 | 8.9 | 0.4 | 2.4 |
| Finland | 3.3 | –8.3 | 3.0 | 2.6 | –1.4 | –0.8 | –0.6 | 0.0 | 1.9 | 2.8 | 2.3 | 1.5 | 2.4 | 2.5 | 2.6 |
| Slovak Republic | 5.1 | –5.4 | 5.0 | 2.8 | 1.7 | 1.5 | 2.6 | 3.8 | 3.3 | 3.3 | 3.7 | 3.4 | 2.9 | 3.6 | 3.7 |
| Lithuania | 6.1 | –14.8 | 1.6 | 6.0 | 3.8 | 3.5 | 3.5 | 1.8 | 2.3 | 3.5 | 3.5 | 3.0 | 3.5 | 2.4 | 5.5 |
| Slovenia | 4.3 | –7.8 | 1.2 | 0.6 | –2.7 | –1.1 | 3.0 | 2.3 | 3.1 | 4.0 | 2.5 | 1.8 | 4.6 | 2.2 | 3.7 |
| Luxembourg | 4.3 | –4.4 | 4.9 | 2.5 | –0.4 | 4.0 | 5.6 | 4.0 | 4.2 | 3.9 | 3.6 | 3.0 | 3.9 | 3.9 | 2.9 |
| Latvia | 6.6 | –14.3 | –3.8 | 6.4 | 4.0 | 2.6 | 2.1 | 2.7 | 2.0 | 3.8 | 3.9 | 3.0 | 2.3 | 4.3 | 4.0 |
| Estonia | 5.7 | –14.7 | 2.3 | 7.6 | 4.3 | 1.9 | 2.9 | 1.7 | 2.1 | 4.0 | 3.7 | 3.0 | 3.2 | 3.0 | 4.0 |
| Cyprus | 4.1 | –1.8 | 1.3 | 0.3 | –3.2 | –6.0 | –1.5 | 1.7 | 2.8 | 3.4 | 2.6 | 2.2 | 2.9 | 3.1 | 2.6 |
| Malta | 2.2 | –2.4 | 3.5 | 1.4 | 2.6 | 4.6 | 8.2 | 7.1 | 5.5 | 5.1 | 4.4 | 3.2 | 5.9 | 3.9 | 4.4 |
| Japan | 1.0 | –5.4 | 4.2 | –0.1 | 1.5 | 2.0 | 0.3 | 1.1 | 1.0 | 1.5 | 0.7 | 0.6 | 1.7 | 1.4 | 0.5 |
| United Kingdom | 2.5 | –4.3 | 1.9 | 1.5 | 1.3 | 1.9 | 3.1 | 2.2 | 1.8 | 1.7 | 1.5 | 1.7 | 1.9 | 1.3 | 1.5 |
| Korea | 5.7 | 0.7 | 6.5 | 3.7 | 2.3 | 2.9 | 3.3 | 2.8 | 2.8 | 3.0 | 3.0 | 2.9 | 2.4 | 3.4 | 2.8 |
| Canada | 2.9 | –2.9 | 3.1 | 3.1 | 1.7 | 2.5 | 2.6 | 0.9 | 1.5 | 3.0 | 2.1 | 1.8 | 2.0 | 3.0 | 2.0 |
| Australia | 3.4 | 1.7 | 2.3 | 2.7 | 3.6 | 2.1 | 2.8 | 2.4 | 2.5 | 2.2 | 2.9 | 2.7 | 2.4 | 2.3 | 3.2 |
| Taiwan Province of China | 4.6 | –1.6 | 10.6 | 3.8 | 2.1 | 2.2 | 4.0 | 0.7 | 1.5 | 2.0 | 1.9 | 2.2 | 2.7 | 1.6 | 2.4 |
| Switzerland | 2.3 | –2.2 | 2.9 | 1.8 | 1.0 | 1.9 | 2.5 | 1.2 | 1.4 | 1.0 | 1.3 | 1.7 | 0.9 | 2.1 | 0.3 |
| Sweden | 3.0 | –5.2 | 6.0 | 2.7 | –0.3 | 1.2 | 2.6 | 4.1 | 3.2 | 3.1 | 2.4 | 1.7 | 2.1 | 2.7 | 2.6 |
| Singapore | 5.9 | –0.6 | 15.2 | 6.2 | 3.9 | 5.0 | 3.6 | 1.9 | 2.0 | 2.5 | 2.6 | 2.6 | 2.9 | 2.0 | 2.8 |
| Hong Kong SAR | 4.7 | –2.5 | 6.8 | 4.8 | 1.7 | 3.1 | 2.8 | 2.4 | 2.0 | 3.5 | 2.7 | 3.3 | 3.2 | 2.6 | 3.0 |
| Norway | 2.2 | –1.6 | 0.6 | 1.0 | 2.7 | 1.0 | 1.9 | 1.6 | 1.1 | 1.4 | 1.6 | 1.9 | 2.0 | 1.2 | 1.8 |
| Czech Republic | 4.0 | –4.8 | 2.3 | 1.8 | –0.8 | –0.5 | 2.7 | 5.3 | 2.6 | 3.5 | 2.6 | 2.3 | 1.8 | 3.6 | 3.0 |
| Israel | 3.7 | 1.5 | 5.5 | 5.2 | 2.2 | 4.2 | 3.5 | 2.6 | 4.0 | 3.1 | 3.4 | 3.0 | 4.7 | 2.7 | 3.1 |
| Denmark | 1.8 | –4.9 | 1.9 | 1.3 | 0.2 | 0.9 | 1.7 | 1.6 | 1.7 | 1.9 | 1.8 | 1.8 | 2.9 | 0.7 | 1.8 |
| New Zealand | 3.4 | 0.4 | 2.0 | 1.9 | 2.5 | 2.1 | 2.8 | 3.2 | 3.6 | 3.5 | 3.0 | 2.4 | 2.8 | 4.6 | 1.9 |
| Puerto Rico | 1.7 | –2.0 | –0.4 | –0.4 | 0.0 | –0.3 | –1.2 | –1.1 | –2.6 | –2.8 | –2.5 | –0.5 | . . . | . . . | . . . |
| Macao SAR | . . . | 1.3 | 25.3 | 21.7 | 9.2 | 11.2 | –1.2 | –21.5 | –2.1 | 13.4 | 7.0 | 4.3 | . . . | . . . | . . . |
| Iceland | 4.6 | –6.9 | –3.6 | 2.0 | 1.2 | 4.4 | 1.9 | 4.1 | 7.2 | 5.5 | 3.3 | 2.7 | 10.7 | 5.5 | 1.8 |
| San Marino | . . . | –12.8 | –4.6 | –9.5 | –7.5 | –3.0 | –0.9 | 0.5 | 1.0 | 1.2 | 1.3 | 1.3 | . . . | . . . | . . . |
| *Memorandum* | | | | | | | | | | | | | | | |
| Major Advanced Economies | 2.1 | –3.8 | 2.8 | 1.6 | 1.4 | 1.4 | 1.9 | 2.1 | 1.4 | 2.0 | 1.9 | 1.5 | 1.7 | 2.1 | 1.8 |
| **Real Total Domestic Demand** | | | | | | | | | | | | | | | |
| **Advanced Economies** | **2.4** | **–3.7** | **2.9** | **1.4** | **0.8** | **1.0** | **2.0** | **2.4** | **1.7** | **2.3** | **2.1** | **1.7** | **2.0** | **2.2** | **2.1** |
| United States | 2.7 | –3.8 | 2.9 | 1.6 | 2.1 | 1.3 | 2.7 | 3.5 | 1.7 | 2.3 | 2.5 | 1.6 | 2.1 | 2.2 | 2.5 |
| Euro Area | 2.0 | –4.0 | 1.5 | 0.7 | –2.4 | –0.6 | 1.3 | 1.9 | 2.3 | 2.1 | 1.9 | 1.5 | 2.4 | 2.4 | 0.9 |
| Germany | 0.9 | –3.2 | 2.9 | 3.0 | –0.8 | 1.0 | 1.3 | 1.5 | 2.4 | 2.1 | 2.0 | 1.5 | 2.3 | 2.0 | 1.7 |
| France | 2.4 | –2.5 | 2.1 | 2.0 | –0.3 | 0.7 | 1.4 | 1.6 | 1.9 | 1.9 | 1.7 | 1.8 | 1.5 | 1.7 | 1.9 |
| Italy | 1.4 | –4.1 | 2.0 | –0.6 | –5.6 | –2.6 | 0.2 | 1.3 | 1.0 | 1.6 | 1.1 | 0.7 | 1.3 | 1.4 | 1.1 |
| Spain | 4.2 | –6.0 | –0.5 | –3.1 | –5.1 | –3.2 | 1.9 | 3.4 | 2.9 | 2.6 | 2.2 | 1.5 | 2.3 | 2.9 | 1.8 |
| Japan | 0.6 | –4.0 | 2.4 | 0.7 | 2.3 | 2.4 | 0.4 | 0.7 | 0.4 | 1.1 | 0.7 | 0.6 | 0.5 | 1.5 | 0.5 |
| United Kingdom | 2.8 | –4.9 | 2.5 | –0.6 | 2.2 | 2.1 | 3.4 | 1.9 | 1.5 | 1.6 | 1.2 | 1.7 | 1.6 | 2.0 | 1.1 |
| Canada | 3.5 | –3.0 | 5.1 | 3.4 | 2.0 | 2.1 | 1.5 | 0.0 | 0.8 | 4.4 | 1.9 | 1.7 | 1.7 | 5.0 | 1.6 |
| Other Advanced Economies[3] | 3.7 | –2.6 | 6.1 | 3.1 | 2.0 | 1.5 | 2.6 | 2.5 | 1.9 | 3.1 | 2.6 | 2.6 | 2.0 | 2.7 | 3.3 |
| *Memorandum* | | | | | | | | | | | | | | | |
| Major Advanced Economies | 2.1 | –3.7 | 2.8 | 1.4 | 1.1 | 1.3 | 1.9 | 2.3 | 1.5 | 2.1 | 1.9 | 1.5 | 1.8 | 2.1 | 1.9 |

[1]In this and other tables, when countries are not listed alphabetically, they are ordered on the basis of economic size.
[2]From the fourth quarter of the preceding year.
[3]Excludes the G7 (Canada, France, Germany, Italy, Japan, United Kingdom, United States) and euro area countries.

## Table A3. Advanced Economies: Components of Real GDP

*(Annual percent change)*

| | Averages | | | | | | | | | | Projections | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1999–2008 | 2009–18 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
| **Private Consumer Expenditure** | | | | | | | | | | | | |
| **Advanced Economies** | **2.6** | **1.5** | **–1.2** | **1.9** | **1.3** | **0.9** | **1.2** | **1.8** | **2.4** | **2.2** | **2.3** | **1.9** |
| United States | 3.1 | 1.9 | –1.6 | 1.9 | 2.3 | 1.5 | 1.5 | 2.9 | 3.6 | 2.7 | 2.7 | 2.1 |
| Euro Area | 1.8 | 0.6 | –1.1 | 0.8 | –0.1 | –1.1 | –0.6 | 0.8 | 1.7 | 2.1 | 1.8 | 1.7 |
| Germany | 0.9 | 1.2 | 0.3 | 0.3 | 1.3 | 1.3 | 0.8 | 1.0 | 1.6 | 1.9 | 2.1 | 1.8 |
| France | 2.3 | 1.0 | 0.2 | 1.8 | 0.5 | –0.2 | 0.5 | 0.8 | 1.4 | 2.2 | 1.2 | 1.6 |
| Italy | 1.0 | –0.1 | –1.5 | 1.2 | 0.0 | –4.0 | –2.4 | 0.2 | 1.6 | 1.3 | 1.3 | 1.1 |
| Spain | 3.4 | 0.0 | –3.6 | 0.3 | –2.4 | –3.5 | –3.1 | 1.6 | 2.9 | 3.2 | 2.6 | 2.4 |
| Japan | 1.0 | 0.7 | –0.7 | 2.4 | –0.4 | 2.0 | 2.4 | –0.9 | –0.3 | 0.4 | 1.5 | 0.8 |
| United Kingdom | 3.0 | 1.0 | –3.2 | 0.6 | –0.5 | 1.7 | 1.6 | 2.2 | 2.4 | 2.8 | 1.7 | 1.1 |
| Canada | 3.6 | 2.3 | 0.0 | 3.6 | 2.3 | 1.9 | 2.6 | 2.7 | 1.9 | 2.3 | 3.4 | 1.9 |
| Other Advanced Economies[1] | 3.7 | 2.4 | 0.0 | 3.7 | 3.0 | 2.1 | 2.3 | 2.3 | 2.7 | 2.3 | 2.4 | 2.7 |
| *Memorandum* | | | | | | | | | | | | |
| Major Advanced Economies | 2.3 | 1.4 | –1.2 | 1.7 | 1.3 | 1.1 | 1.3 | 1.8 | 2.4 | 2.2 | 2.2 | 1.7 |
| **Public Consumption** | | | | | | | | | | | | |
| **Advanced Economies** | **2.2** | **1.0** | **2.9** | **1.0** | **–0.5** | **0.1** | **–0.3** | **0.6** | **1.5** | **1.6** | **1.1** | **1.9** |
| United States | 2.1 | 0.3 | 3.7 | 0.1 | –2.7 | –0.9 | –2.4 | –0.5 | 1.3 | 1.0 | 0.2 | 3.0 |
| Euro Area | 2.0 | 0.9 | 2.4 | 0.7 | –0.1 | –0.3 | 0.3 | 0.7 | 1.3 | 1.7 | 1.2 | 0.9 |
| Germany | 1.0 | 2.0 | 3.0 | 1.3 | 0.9 | 1.1 | 1.4 | 1.5 | 2.9 | 3.7 | 1.8 | 2.1 |
| France | 1.6 | 1.3 | 2.4 | 1.3 | 1.0 | 1.6 | 1.5 | 1.3 | 1.1 | 1.3 | 1.2 | 0.5 |
| Italy | 1.4 | –0.3 | 0.4 | 0.6 | –1.8 | –1.4 | –0.3 | –0.7 | –0.7 | 0.6 | 0.9 | –0.4 |
| Spain | 5.1 | 0.2 | 4.1 | 1.5 | –0.3 | –4.7 | –2.1 | –0.3 | 2.0 | 0.8 | 0.9 | 0.4 |
| Japan | 1.8 | 1.3 | 2.0 | 1.9 | 1.9 | 1.7 | 1.5 | 0.5 | 1.7 | 1.3 | 0.6 | –0.2 |
| United Kingdom | 3.1 | 1.0 | 1.1 | 0.2 | 0.2 | 1.7 | 0.3 | 2.3 | 1.3 | 0.8 | 1.4 | 0.8 |
| Canada | 2.6 | 1.5 | 2.7 | 2.3 | 1.3 | 0.7 | –0.7 | 0.8 | 1.5 | 2.0 | 2.7 | 2.2 |
| Other Advanced Economies[1] | 2.8 | 2.5 | 3.4 | 2.8 | 1.5 | 2.0 | 2.3 | 2.5 | 2.4 | 3.4 | 2.8 | 2.4 |
| *Memorandum* | | | | | | | | | | | | |
| Major Advanced Economies | 1.9 | 0.8 | 2.9 | 0.7 | –0.9 | 0.1 | –0.7 | 0.3 | 1.4 | 1.3 | 0.7 | 1.9 |
| **Gross Fixed Capital Formation** | | | | | | | | | | | | |
| **Advanced Economies** | **2.3** | **1.1** | **–11.0** | **1.7** | **2.9** | **2.4** | **1.5** | **3.3** | **2.6** | **1.7** | **3.4** | **3.0** |
| United States | 2.3 | 1.5 | –13.1 | 1.1 | 3.7 | 6.3 | 3.1 | 4.8 | 3.5 | 0.6 | 3.4 | 3.3 |
| Euro Area | 2.7 | 0.0 | –11.2 | –0.3 | 1.5 | –3.4 | –2.5 | 1.7 | 3.1 | 4.4 | 3.9 | 3.4 |
| Germany | 1.0 | 1.5 | –9.9 | 5.0 | 7.4 | –0.1 | –1.2 | 3.8 | 1.1 | 2.9 | 3.7 | 3.2 |
| France | 3.4 | 0.4 | –9.1 | 2.1 | 2.1 | 0.2 | –0.8 | 0.1 | 1.0 | 2.9 | 2.9 | 3.1 |
| Italy | 2.3 | –2.2 | –9.9 | –0.5 | –1.9 | –9.3 | –6.6 | –2.3 | 1.6 | 2.9 | 2.1 | 2.7 |
| Spain | 5.3 | –2.3 | –16.9 | –4.9 | –6.9 | –8.6 | –3.4 | 3.8 | 6.0 | 3.1 | 4.3 | 3.5 |
| Japan | –1.0 | 0.6 | –9.7 | –1.6 | 1.7 | 3.5 | 4.9 | 2.9 | 0.1 | 0.9 | 2.8 | 1.7 |
| United Kingdom | 1.8 | 1.0 | –15.2 | 5.0 | 1.9 | 2.3 | 3.2 | 6.7 | 3.4 | 0.5 | 2.2 | 1.7 |
| Canada | 4.9 | 0.7 | –11.8 | 11.4 | 4.6 | 4.9 | 1.3 | 0.9 | –4.6 | –3.1 | 3.4 | 2.2 |
| Other Advanced Economies[1] | 3.7 | 2.3 | –5.1 | 5.9 | 4.0 | 2.9 | 2.5 | 2.1 | 1.9 | 2.2 | 3.7 | 3.0 |
| *Memorandum* | | | | | | | | | | | | |
| Major Advanced Economies | 1.8 | 1.0 | –11.8 | 1.8 | 3.2 | 3.4 | 1.9 | 3.6 | 2.1 | 1.0 | 3.2 | 2.8 |

## Table A3. Advanced Economies: Components of Real GDP *(continued)*

*(Annual percent change)*

| | Averages | | | | | | | | | | Projections | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1999–2008 | 2009–18 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
| **Final Domestic Demand** | | | | | | | | | | | | |
| **Advanced Economies** | **2.5** | **1.3** | **–2.6** | **1.7** | **1.3** | **1.1** | **1.0** | **1.9** | **2.3** | **2.1** | **2.4** | **2.1** |
| United States | 2.8 | 1.6 | –3.1 | 1.5 | 1.7 | 1.9 | 1.2 | 2.7 | 3.3 | 2.1 | 2.5 | 2.4 |
| Euro Area | 2.0 | 0.5 | –2.7 | 0.5 | 0.3 | –1.5 | –0.8 | 1.0 | 1.9 | 2.5 | 2.1 | 1.9 |
| Germany | 0.9 | 1.4 | –1.4 | 1.4 | 2.5 | 1.0 | 0.5 | 1.7 | 1.8 | 2.5 | 2.4 | 2.2 |
| France | 2.4 | 0.9 | –1.5 | 1.8 | 0.9 | 0.3 | 0.4 | 0.7 | 1.2 | 2.2 | 1.6 | 1.7 |
| Italy | 1.3 | –0.6 | –2.9 | 0.7 | –0.8 | –4.5 | –2.8 | –0.4 | 1.1 | 1.5 | 1.4 | 1.1 |
| Spain | 4.2 | –0.5 | –5.9 | –0.7 | –3.0 | –4.8 | –3.0 | 1.6 | 3.3 | 2.7 | 2.6 | 2.3 |
| Japan | 0.6 | 0.8 | –2.4 | 1.4 | 0.5 | 2.3 | 2.8 | 0.2 | 0.2 | 0.7 | 1.8 | 0.8 |
| United Kingdom | 2.8 | 1.0 | –4.4 | 1.1 | 0.0 | 1.8 | 1.6 | 2.9 | 2.3 | 2.0 | 1.8 | 1.1 |
| Canada | 3.7 | 1.8 | –2.2 | 5.0 | 2.6 | 2.4 | 1.6 | 1.9 | 0.3 | 1.0 | 3.3 | 2.0 |
| Other Advanced Economies[1] | 3.5 | 2.4 | –0.7 | 4.1 | 2.9 | 2.3 | 2.3 | 2.3 | 2.5 | 2.4 | 2.9 | 2.6 |
| *Memorandum* | | | | | | | | | | | | |
| Major Advanced Economies | 2.2 | 1.3 | –2.7 | 1.6 | 1.3 | 1.4 | 1.1 | 1.9 | 2.2 | 1.8 | 2.2 | 1.9 |
| **Stock Building[2]** | | | | | | | | | | | | |
| **Advanced Economies** | **0.0** | **0.0** | **–1.1** | **1.3** | **0.1** | **–0.2** | **0.0** | **0.1** | **0.1** | **–0.3** | **–0.1** | **0.0** |
| United States | –0.1 | 0.0 | –0.8 | 1.5 | –0.1 | 0.1 | 0.2 | –0.1 | 0.2 | –0.4 | –0.2 | 0.0 |
| Euro Area | 0.0 | –0.1 | –1.3 | 0.9 | 0.5 | –0.9 | 0.2 | 0.3 | 0.0 | –0.1 | 0.0 | 0.0 |
| Germany | –0.1 | –0.2 | –1.7 | 1.4 | 0.5 | –1.6 | 0.5 | –0.4 | –0.3 | –0.1 | –0.2 | –0.2 |
| France | 0.0 | 0.1 | –1.1 | 0.3 | 1.1 | –0.6 | 0.2 | 0.7 | 0.3 | –0.1 | 0.4 | 0.0 |
| Italy | 0.0 | 0.0 | –1.2 | 1.3 | 0.2 | –1.1 | 0.2 | 0.6 | 0.2 | –0.5 | 0.2 | 0.0 |
| Spain | 0.0 | 0.0 | –0.2 | 0.2 | –0.1 | –0.2 | –0.3 | 0.3 | 0.1 | 0.1 | 0.0 | 0.0 |
| Japan | 0.0 | –0.1 | –1.6 | 1.0 | 0.2 | 0.0 | –0.4 | 0.1 | 0.6 | –0.3 | –0.5 | –0.1 |
| United Kingdom | –0.1 | 0.1 | –0.5 | 1.5 | –0.6 | 0.2 | 0.3 | 0.7 | –0.2 | –0.5 | –0.1 | 0.0 |
| Canada | 0.0 | 0.1 | –0.7 | 0.1 | 0.7 | –0.3 | 0.5 | –0.3 | –0.3 | –0.3 | 1.1 | 0.8 |
| Other Advanced Economies[1] | 0.2 | –0.1 | –1.9 | 1.9 | 0.2 | –0.3 | –0.8 | 0.2 | 0.1 | –0.5 | 0.1 | 0.0 |
| *Memorandum* | | | | | | | | | | | | |
| Major Advanced Economies | 0.0 | 0.0 | –1.0 | 1.2 | 0.1 | –0.2 | 0.2 | 0.1 | 0.2 | –0.3 | –0.1 | 0.0 |
| **Foreign Balance[2]** | | | | | | | | | | | | |
| **Advanced Economies** | **0.0** | **0.1** | **0.4** | **0.1** | **0.3** | **0.4** | **0.3** | **0.1** | **–0.2** | **–0.1** | **–0.1** | **0.0** |
| United States | –0.2 | 0.0 | 1.2 | –0.5 | 0.0 | 0.1 | 0.3 | –0.2 | –0.7 | –0.2 | –0.2 | –0.2 |
| Euro Area | 0.1 | 0.3 | –0.6 | 0.7 | 0.9 | 1.5 | 0.4 | 0.1 | 0.1 | –0.4 | 0.2 | 0.1 |
| Germany | 0.7 | 0.1 | –2.6 | 1.1 | 0.9 | 1.4 | –0.3 | 0.7 | 0.1 | –0.4 | 0.0 | 0.0 |
| France | –0.3 | –0.2 | –0.4 | –0.1 | 0.0 | 0.5 | –0.1 | –0.5 | –0.5 | –0.8 | –0.3 | 0.0 |
| Italy | –0.1 | 0.2 | –1.3 | –0.3 | 1.2 | 2.8 | 0.8 | –0.1 | –0.5 | –0.1 | –0.1 | 0.0 |
| Spain | –0.7 | 1.0 | 2.8 | 0.5 | 2.1 | 2.2 | 1.5 | –0.5 | –0.1 | 0.5 | 0.5 | 0.3 |
| Japan | 0.2 | –0.1 | –1.2 | 1.6 | –0.9 | –0.8 | –0.4 | 0.0 | 0.3 | 0.6 | 0.3 | –0.1 |
| United Kingdom | –0.2 | –0.1 | 0.3 | –0.8 | 1.4 | –0.7 | –0.8 | –0.4 | 0.0 | –0.4 | –0.1 | 0.3 |
| Canada | –0.7 | 0.0 | 0.0 | –2.1 | –0.3 | –0.4 | 0.3 | 1.1 | 1.0 | 0.6 | –0.5 | 0.3 |
| Other Advanced Economies[1] | 0.4 | 0.3 | 1.5 | 0.1 | 0.5 | 0.5 | 0.9 | 0.5 | –0.4 | 0.1 | –0.4 | 0.1 |
| *Memorandum* | | | | | | | | | | | | |
| Major Advanced Economies | –0.1 | 0.0 | 0.0 | –0.1 | 0.1 | 0.2 | 0.0 | 0.0 | –0.3 | –0.1 | –0.1 | –0.1 |

[1]Excludes the G7 (Canada, France, Germany, Italy, Japan, United Kingdom, United States) and euro area countries.
[2]Changes expressed as percent of GDP in the preceding period.

## Table A4. Emerging Market and Developing Economies: Real GDP

*(Annual percent change)*

| | Average | | | | | | | | | Projections | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1999–2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2022 |
| **Commonwealth of Independent States[1,2]** | **7.2** | **–6.4** | **4.7** | **5.3** | **3.6** | **2.5** | **1.1** | **–2.2** | **0.4** | **2.1** | **2.1** | **2.4** |
| Russia | 6.9 | –7.8 | 4.5 | 5.1 | 3.7 | 1.8 | 0.7 | –2.8 | –0.2 | 1.8 | 1.6 | 1.5 |
| Excluding Russia | 8.0 | –2.4 | 5.0 | 6.0 | 3.6 | 4.2 | 1.9 | –0.6 | 1.9 | 2.9 | 3.3 | 4.3 |
| Armenia | 10.5 | –14.1 | 2.2 | 4.7 | 7.1 | 3.3 | 3.6 | 3.3 | 0.2 | 3.5 | 2.9 | 4.0 |
| Azerbaijan | 14.6 | 9.3 | 5.0 | –1.6 | 2.2 | 5.8 | 2.7 | 0.6 | –3.1 | –1.0 | 1.3 | 3.1 |
| Belarus | 7.5 | 0.2 | 7.7 | 5.5 | 1.7 | 1.0 | 1.7 | –3.8 | –2.6 | 0.7 | 0.7 | 2.0 |
| Georgia | 6.6 | –3.7 | 6.2 | 7.2 | 6.4 | 3.4 | 4.6 | 2.9 | 2.7 | 4.0 | 4.2 | 5.5 |
| Kazakhstan | 8.7 | 1.2 | 7.3 | 7.5 | 5.0 | 6.0 | 4.3 | 1.2 | 1.1 | 3.3 | 2.8 | 4.3 |
| Kyrgyz Republic | 4.7 | 2.9 | –0.5 | 6.0 | –0.1 | 10.9 | 4.0 | 3.5 | 3.8 | 3.5 | 3.8 | 5.4 |
| Moldova | 4.9 | –6.0 | 7.1 | 6.8 | –0.7 | 9.4 | 4.8 | –0.4 | 4.3 | 4.0 | 3.7 | 3.9 |
| Tajikistan | 8.1 | 3.9 | 6.5 | 7.4 | 7.5 | 7.4 | 6.7 | 6.0 | 6.9 | 4.5 | 4.0 | 4.0 |
| Turkmenistan | 15.2 | 6.1 | 9.2 | 14.7 | 11.1 | 10.2 | 10.3 | 6.5 | 6.2 | 6.5 | 6.3 | 5.4 |
| Ukraine[3] | 6.2 | –15.1 | 0.3 | 5.5 | 0.2 | 0.0 | –6.6 | –9.8 | 2.3 | 2.0 | 3.2 | 4.0 |
| Uzbekistan | 6.1 | 8.1 | 8.5 | 8.3 | 8.2 | 8.0 | 8.1 | 8.0 | 7.8 | 6.0 | 6.0 | 6.0 |
| **Emerging and Developing Asia** | **8.0** | **7.5** | **9.6** | **7.9** | **7.0** | **6.9** | **6.8** | **6.8** | **6.4** | **6.5** | **6.5** | **6.3** |
| Bangladesh | 5.8 | 5.3 | 6.0 | 6.5 | 6.3 | 6.0 | 6.3 | 6.8 | 7.2 | 7.1 | 7.0 | 7.0 |
| Bhutan | 8.3 | 5.7 | 9.3 | 9.7 | 6.4 | 3.6 | 4.0 | 6.1 | 6.2 | 5.9 | 11.2 | 6.3 |
| Brunei Darussalam | 1.9 | –1.8 | 2.7 | 3.7 | 0.9 | –2.1 | –2.5 | –0.4 | –2.5 | –1.3 | 0.6 | 5.3 |
| Cambodia | 9.5 | 0.1 | 6.0 | 7.2 | 7.3 | 7.4 | 7.1 | 7.2 | 7.0 | 6.9 | 6.8 | 6.0 |
| China | 10.1 | 9.2 | 10.6 | 9.5 | 7.9 | 7.8 | 7.3 | 6.9 | 6.7 | 6.8 | 6.5 | 5.8 |
| Fiji | 1.9 | –1.4 | 3.0 | 2.7 | 1.4 | 4.7 | 5.6 | 3.8 | 0.4 | 3.8 | 3.5 | 3.2 |
| India[4] | 6.9 | 8.5 | 10.3 | 6.6 | 5.5 | 6.4 | 7.5 | 8.0 | 7.1 | 6.7 | 7.4 | 8.2 |
| Indonesia | 4.9 | 4.7 | 6.4 | 6.2 | 6.0 | 5.6 | 5.0 | 4.9 | 5.0 | 5.2 | 5.3 | 5.5 |
| Kiribati | 1.1 | 1.1 | –1.6 | 0.6 | 5.1 | 5.0 | 0.4 | 7.5 | 4.2 | 2.8 | 2.3 | 1.8 |
| Lao P.D.R. | 6.7 | 7.4 | 8.0 | 8.0 | 7.8 | 8.0 | 7.6 | 7.3 | 7.0 | 6.9 | 6.9 | 7.0 |
| Malaysia | 5.5 | –1.5 | 7.5 | 5.3 | 5.5 | 4.7 | 6.0 | 5.0 | 4.2 | 5.4 | 4.8 | 4.9 |
| Maldives | 7.8 | –6.6 | 7.1 | 8.4 | 2.3 | 7.1 | 7.6 | 3.3 | 3.9 | 4.6 | 4.7 | 5.0 |
| Marshall Islands | 1.9 | 6.5 | 1.2 | 3.5 | 2.9 | –0.8 | –0.4 | 1.9 | 2.0 | 1.9 | 1.8 | 1.5 |
| Micronesia | 0.5 | 1.2 | 3.3 | 1.0 | –1.7 | –3.0 | –2.4 | 3.7 | 3.0 | 2.0 | 1.4 | 0.6 |
| Mongolia | 6.2 | –2.1 | 7.3 | 17.3 | 12.3 | 11.6 | 7.9 | 2.4 | 1.0 | 2.0 | 2.5 | 8.2 |
| Myanmar | 11.7 | 5.1 | 5.3 | 5.6 | 7.3 | 8.4 | 8.0 | 7.0 | 6.1 | 7.2 | 7.6 | 7.5 |
| Nauru | . . . | 8.7 | 13.6 | 11.7 | 10.1 | 34.2 | 36.5 | 2.8 | 10.4 | 4.0 | –4.0 | 2.0 |
| Nepal | 4.1 | 4.5 | 4.8 | 3.4 | 4.8 | 4.1 | 6.0 | 3.3 | 0.4 | 7.5 | 5.0 | 3.8 |
| Palau | . . . | –9.1 | 3.0 | 5.1 | 3.9 | –2.1 | 5.4 | 11.4 | 1.9 | 1.0 | 5.5 | 2.0 |
| Papua New Guinea | 2.3 | 6.8 | 10.1 | 1.1 | 4.6 | 3.8 | 12.5 | 9.2 | 2.4 | 3.1 | 2.9 | 3.3 |
| Philippines | 4.6 | 1.1 | 7.6 | 3.7 | 6.7 | 7.1 | 6.1 | 6.1 | 6.9 | 6.6 | 6.7 | 6.8 |
| Samoa | 3.8 | –6.1 | –2.0 | 5.6 | 0.4 | –1.9 | 1.2 | 1.6 | 7.1 | 2.1 | 0.9 | 2.1 |
| Solomon Islands | 1.6 | –4.7 | 6.8 | 13.2 | 4.6 | 3.0 | 2.3 | 2.5 | 3.3 | 3.0 | 3.1 | 2.7 |
| Sri Lanka | 5.1 | 3.5 | 8.0 | 8.4 | 9.1 | 3.4 | 5.0 | 4.8 | 4.4 | 4.7 | 4.8 | 5.2 |
| Thailand | 4.8 | –0.7 | 7.5 | 0.8 | 7.2 | 2.7 | 0.9 | 2.9 | 3.2 | 3.7 | 3.5 | 3.0 |
| Timor-Leste[5] | . . . | 13.0 | 10.2 | 7.9 | 5.0 | 2.7 | 4.3 | 4.0 | 5.0 | 4.0 | 6.0 | 5.2 |
| Tonga | 1.1 | 2.9 | 3.2 | 1.8 | –1.1 | –0.6 | 2.9 | 3.5 | 3.1 | 3.1 | 3.2 | 1.4 |
| Tuvalu | . . . | –4.4 | –3.1 | 7.9 | –3.8 | 4.6 | 1.3 | 9.1 | 3.0 | 3.2 | 2.5 | 2.0 |
| Vanuatu | 3.0 | 3.3 | 1.6 | 1.2 | 1.8 | 2.0 | 2.3 | 1.6 | 4.0 | 4.5 | 4.0 | 3.0 |
| Vietnam | 6.8 | 5.4 | 6.4 | 6.2 | 5.2 | 5.4 | 6.0 | 6.7 | 6.2 | 6.3 | 6.3 | 6.2 |
| **Emerging and Developing Europe** | **4.3** | **–3.0** | **4.6** | **6.5** | **2.4** | **4.9** | **3.9** | **4.7** | **3.1** | **4.5** | **3.5** | **3.2** |
| Albania | 6.8 | 3.4 | 3.7 | 2.5 | 1.4 | 1.0 | 1.8 | 2.2 | 3.4 | 3.7 | 3.7 | 4.0 |
| Bosnia and Herzegovina | 5.4 | –0.8 | 0.8 | 0.9 | –0.9 | 2.4 | 1.1 | 3.0 | 2.0 | 2.5 | 2.6 | 3.0 |
| Bulgaria | 5.3 | –3.6 | 1.3 | 1.9 | 0.0 | 0.9 | 1.3 | 3.6 | 3.4 | 3.6 | 3.2 | 2.5 |
| Croatia | 3.7 | –7.4 | –1.7 | –0.3 | –2.2 | –1.1 | –0.5 | 2.2 | 3.0 | 2.9 | 2.7 | 2.1 |
| Hungary | 3.4 | –6.6 | 0.7 | 1.7 | –1.6 | 2.1 | 4.0 | 3.1 | 2.0 | 3.2 | 3.4 | 2.2 |
| Kosovo | . . . | 3.6 | 3.3 | 4.4 | 2.8 | 3.4 | 1.2 | 4.1 | 3.4 | 3.5 | 3.5 | 4.0 |
| FYR Macedonia | 3.6 | –0.4 | 3.4 | 2.3 | –0.5 | 2.9 | 3.6 | 3.8 | 2.4 | 2.5 | 3.2 | 3.8 |
| Montenegro | . . . | –5.7 | 2.5 | 3.2 | –2.7 | 3.5 | 1.8 | 3.4 | 2.5 | 3.0 | 2.8 | 3.1 |
| Poland | 4.1 | 2.6 | 3.7 | 5.0 | 1.6 | 1.4 | 3.3 | 3.9 | 2.6 | 3.8 | 3.3 | 2.6 |
| Romania | 5.4 | –7.1 | –0.8 | 1.1 | 0.6 | 3.5 | 3.1 | 3.9 | 4.8 | 5.5 | 4.4 | 3.3 |
| Serbia | 4.1 | –3.1 | 0.6 | 1.4 | –1.0 | 2.6 | –1.8 | 0.8 | 2.8 | 3.0 | 3.5 | 4.0 |
| Turkey | 4.0 | –4.7 | 8.5 | 11.1 | 4.8 | 8.5 | 5.2 | 6.1 | 3.2 | 5.1 | 3.5 | 3.6 |

## Table A4. Emerging Market and Developing Economies: Real GDP *(continued)*

*(Annual percent change)*

| | Average | | | | | | | | | Projections | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1999–2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2022 |
| **Latin America and the Caribbean** | **3.3** | **–1.8** | **6.1** | **4.7** | **3.0** | **2.9** | **1.2** | **0.1** | **–0.9** | **1.2** | **1.9** | **2.7** |
| Antigua and Barbuda | 4.6 | –12.1 | –7.2 | –2.1 | 3.5 | –0.1 | 5.1 | 4.1 | 5.3 | 2.7 | 3.0 | 2.0 |
| Argentina | 2.6 | –5.9 | 10.1 | 6.0 | –1.0 | 2.4 | –2.5 | 2.6 | –2.2 | 2.5 | 2.5 | 3.2 |
| The Bahamas | 2.1 | –4.2 | 1.5 | 0.6 | 3.1 | 0.0 | –0.5 | –1.7 | –0.3 | 1.8 | 2.5 | 1.5 |
| Barbados | 1.8 | –4.0 | 0.3 | 0.8 | 0.3 | –0.1 | 0.1 | 0.9 | 1.6 | 0.9 | 0.5 | 1.6 |
| Belize | 5.7 | 0.8 | 3.3 | 2.1 | 3.7 | 0.7 | 4.1 | 2.9 | –0.8 | 2.5 | 2.3 | 1.7 |
| Bolivia | 3.4 | 3.4 | 4.1 | 5.2 | 5.1 | 6.8 | 5.5 | 4.9 | 4.3 | 4.2 | 4.0 | 3.7 |
| Brazil | 3.4 | –0.1 | 7.5 | 4.0 | 1.9 | 3.0 | 0.5 | –3.8 | –3.6 | 0.7 | 1.5 | 2.0 |
| Chile | 4.3 | –1.6 | 5.8 | 6.1 | 5.3 | 4.0 | 1.9 | 2.3 | 1.6 | 1.4 | 2.5 | 3.3 |
| Colombia | 3.4 | 1.7 | 4.0 | 6.6 | 4.0 | 4.9 | 4.4 | 3.1 | 2.0 | 1.7 | 2.8 | 3.6 |
| Costa Rica | 4.7 | –1.0 | 5.0 | 4.3 | 4.8 | 2.3 | 3.7 | 4.7 | 4.3 | 3.8 | 3.8 | 3.9 |
| Dominica | 2.8 | –1.2 | 0.7 | –0.2 | –1.1 | –0.6 | 4.4 | –2.5 | 2.6 | 3.9 | 2.8 | 1.5 |
| Dominican Republic | 4.8 | 0.9 | 8.3 | 3.1 | 2.8 | 4.7 | 7.6 | 7.0 | 6.6 | 4.8 | 5.8 | 5.0 |
| Ecuador | 3.3 | 0.6 | 3.5 | 7.9 | 5.6 | 4.9 | 4.0 | 0.2 | –1.5 | 0.2 | 0.6 | 1.6 |
| El Salvador | 2.6 | –3.1 | 1.4 | 2.2 | 1.9 | 1.8 | 1.4 | 2.3 | 2.4 | 2.3 | 2.1 | 2.0 |
| Grenada | 3.7 | –6.6 | –0.5 | 0.8 | –1.2 | 2.4 | 7.3 | 6.4 | 3.7 | 2.5 | 2.3 | 2.7 |
| Guatemala | 3.6 | 0.5 | 2.9 | 4.2 | 3.0 | 3.7 | 4.2 | 4.1 | 3.1 | 3.2 | 3.4 | 4.0 |
| Guyana | 1.8 | 3.3 | 4.4 | 5.4 | 4.8 | 5.2 | 3.8 | 3.1 | 3.3 | 3.5 | 3.6 | 2.8 |
| Haiti | 0.7 | 3.1 | –5.5 | 5.5 | 2.9 | 4.2 | 2.8 | 1.2 | 1.4 | 1.0 | 3.0 | 3.0 |
| Honduras | 4.5 | –2.4 | 3.7 | 3.8 | 4.1 | 2.8 | 3.1 | 3.6 | 3.6 | 4.0 | 3.6 | 3.8 |
| Jamaica | 1.3 | –3.4 | –1.4 | 1.4 | –0.5 | 0.2 | 0.5 | 0.9 | 1.3 | 1.7 | 2.3 | 2.8 |
| Mexico | 2.6 | –4.7 | 5.1 | 4.0 | 4.0 | 1.4 | 2.3 | 2.6 | 2.3 | 2.1 | 1.9 | 2.7 |
| Nicaragua | 3.9 | –3.3 | 4.4 | 6.3 | 6.5 | 4.9 | 4.8 | 4.9 | 4.7 | 4.5 | 4.3 | 4.5 |
| Panama | 5.7 | 1.6 | 5.8 | 11.8 | 9.2 | 6.6 | 6.1 | 5.8 | 4.9 | 5.3 | 5.6 | 5.5 |
| Paraguay | 2.2 | –4.0 | 13.1 | 4.3 | –1.2 | 14.0 | 4.7 | 3.0 | 4.1 | 3.9 | 4.0 | 3.8 |
| Peru | 5.1 | 1.0 | 8.5 | 6.5 | 6.0 | 5.8 | 2.4 | 3.3 | 4.0 | 2.7 | 3.8 | 3.8 |
| St. Kitts and Nevis | 3.7 | –1.0 | –2.9 | –0.8 | –0.8 | 6.6 | 5.1 | 4.9 | 3.1 | 2.7 | 3.5 | 2.7 |
| St. Lucia | 2.1 | –0.8 | 0.1 | 3.4 | –0.7 | 0.2 | –0.9 | 2.0 | 1.0 | 1.6 | 2.8 | 1.5 |
| St. Vincent and the Grenadines | 3.5 | –2.0 | –2.3 | 0.2 | 1.3 | 2.5 | 0.3 | 0.9 | 0.8 | 2.2 | 2.8 | 3.0 |
| Suriname | 4.1 | 3.0 | 5.2 | 5.8 | 2.7 | 2.9 | 0.4 | –2.7 | –10.5 | –1.2 | 1.2 | 3.1 |
| Trinidad and Tobago | 7.6 | –4.4 | 3.3 | –0.3 | 1.3 | 2.7 | –0.6 | –0.6 | –5.4 | –3.2 | 1.9 | 1.4 |
| Uruguay | 1.5 | 4.2 | 7.8 | 5.2 | 3.5 | 4.6 | 3.2 | 0.4 | 1.5 | 3.5 | 3.1 | 3.0 |
| Venezuela | 3.4 | –3.2 | –1.5 | 4.2 | 5.6 | 1.3 | –3.9 | –6.2 | –16.5 | –12.0 | –6.0 | –1.3 |
| **Middle East, North Africa, Afghanistan, and Pakistan** | **5.2** | **1.1** | **4.7** | **4.5** | **5.2** | **2.7** | **2.8** | **2.7** | **5.0** | **2.6** | **3.5** | **3.8** |
| Afghanistan | . . . | 20.6 | 8.4 | 6.5 | 14.0 | 5.7 | 2.7 | 1.3 | 2.4 | 2.5 | 3.0 | 5.0 |
| Algeria | 4.0 | 1.6 | 3.6 | 2.8 | 3.4 | 2.8 | 3.8 | 3.7 | 3.3 | 1.5 | 0.8 | 2.4 |
| Bahrain | 6.0 | 2.5 | 4.3 | 2.0 | 3.7 | 5.4 | 4.4 | 2.9 | 3.0 | 2.5 | 1.7 | 2.2 |
| Djibouti | 3.3 | 1.6 | 4.1 | 7.3 | 4.8 | 5.0 | 6.0 | 6.5 | 6.5 | 7.0 | 7.0 | 6.0 |
| Egypt | 5.1 | 4.7 | 5.1 | 1.8 | 2.2 | 3.3 | 2.9 | 4.4 | 4.3 | 4.1 | 4.5 | 6.0 |
| Iran | 4.4 | 0.3 | 5.8 | 3.5 | –7.7 | –0.3 | 3.2 | –1.6 | 12.5 | 3.5 | 3.8 | 4.1 |
| Iraq | 13.0 | 3.4 | 6.4 | 7.5 | 13.9 | 7.6 | 0.7 | 4.8 | 11.0 | –0.4 | 2.9 | 2.1 |
| Jordan | 6.3 | 5.5 | 2.3 | 2.6 | 2.7 | 2.8 | 3.1 | 2.4 | 2.0 | 2.3 | 2.5 | 3.0 |
| Kuwait | 5.9 | –7.1 | –2.4 | 10.9 | 7.9 | 0.4 | 0.6 | 2.1 | 2.5 | –2.1 | 4.1 | 3.2 |
| Lebanon | 3.8 | 10.1 | 8.0 | 0.9 | 2.8 | 2.6 | 2.0 | 0.8 | 1.0 | 1.5 | 2.0 | 3.0 |
| Libya[4] | 4.5 | –3.0 | 3.2 | –66.7 | 124.7 | –36.8 | –53.0 | –10.3 | –3.0 | 55.1 | 31.2 | 2.6 |
| Mauritania | 5.2 | –1.0 | 4.8 | 4.7 | 5.8 | 6.1 | 5.6 | 0.9 | 1.7 | 3.8 | 3.0 | 4.0 |
| Morocco | 4.4 | 4.2 | 3.8 | 5.2 | 3.0 | 4.5 | 2.7 | 4.5 | 1.2 | 4.8 | 3.0 | 4.6 |
| Oman | 2.9 | 6.1 | 4.8 | –1.1 | 9.3 | 4.4 | 2.5 | 4.2 | 3.0 | 0.0 | 3.7 | 2.2 |
| Pakistan | 5.1 | 0.4 | 2.6 | 3.6 | 3.8 | 3.7 | 4.1 | 4.1 | 4.5 | 5.3 | 5.6 | 5.9 |
| Qatar | 11.3 | 12.0 | 18.1 | 13.4 | 4.7 | 4.4 | 4.0 | 3.6 | 2.2 | 2.5 | 3.1 | 3.2 |
| Saudi Arabia | 3.2 | –2.1 | 4.8 | 10.3 | 5.4 | 2.7 | 3.7 | 4.1 | 1.7 | 0.1 | 1.1 | 2.0 |
| Somalia | . . . | . . . | . . . | . . . | 1.2 | 2.8 | 3.6 | 3.6 | 3.2 | 2.4 | 3.5 | 3.8 |
| Sudan[6] | 6.2 | 4.7 | 2.5 | –1.2 | –3.0 | 5.2 | 1.6 | 4.9 | 3.0 | 3.7 | 3.6 | 3.5 |
| Syria[7] | 3.4 | 5.9 | 3.4 | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . |
| Tunisia | 4.9 | 3.1 | 2.6 | –1.9 | 3.9 | 2.4 | 2.3 | 1.1 | 1.0 | 2.3 | 3.0 | 4.3 |
| United Arab Emirates | 5.9 | –5.2 | 1.6 | 6.4 | 5.1 | 5.8 | 3.3 | 3.8 | 3.0 | 1.3 | 3.4 | 3.1 |
| Yemen | 4.1 | 3.9 | 7.7 | –12.7 | 2.4 | 4.8 | –0.2 | –28.1 | –9.8 | –2.0 | 8.5 | 5.5 |

## Table A4. Emerging Market and Developing Economies: Real GDP *(continued)*
*(Annual percent change)*

| | Average 1999–2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | Projections 2017 | 2018 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sub-Saharan Africa** | **5.6** | **3.9** | **7.0** | **5.1** | **4.4** | **5.3** | **5.1** | **3.4** | **1.4** | **2.6** | **3.4** | **3.9** |
| Angola | 11.2 | 2.4 | 3.4 | 3.9 | 5.2 | 6.8 | 4.8 | 3.0 | –0.7 | 1.5 | 1.6 | 1.4 |
| Benin | 4.5 | 2.3 | 2.1 | 3.0 | 4.8 | 7.2 | 6.4 | 2.1 | 4.0 | 5.4 | 6.0 | 6.2 |
| Botswana | 5.2 | –7.7 | 8.6 | 6.0 | 4.5 | 11.3 | 4.1 | –1.7 | 4.3 | 4.5 | 4.8 | 4.2 |
| Burkina Faso | 5.7 | 3.0 | 8.4 | 6.6 | 6.5 | 5.7 | 4.2 | 4.0 | 5.9 | 6.4 | 6.5 | 6.0 |
| Burundi | 3.1 | 3.8 | 5.1 | 4.0 | 4.4 | 5.9 | 4.5 | –4.0 | –1.0 | 0.0 | 0.1 | 0.5 |
| Cabo Verde | 7.4 | –1.3 | 1.5 | 4.0 | 1.1 | 0.8 | 0.6 | 1.0 | 3.8 | 4.0 | 4.1 | 4.1 |
| Cameroon | 3.6 | 1.9 | 3.3 | 4.1 | 4.6 | 5.6 | 5.9 | 5.8 | 4.7 | 4.0 | 4.6 | 5.5 |
| Central African Republic | 1.2 | 1.7 | 3.0 | 3.3 | 4.1 | –36.7 | 1.0 | 4.8 | 4.5 | 4.7 | 5.0 | 5.6 |
| Chad | 7.8 | 4.1 | 13.6 | 0.1 | 8.8 | 5.8 | 6.9 | 1.8 | –6.4 | 0.6 | 2.4 | 3.7 |
| Comoros | 2.0 | 1.8 | 2.1 | 2.2 | 3.0 | 3.5 | 2.0 | 1.0 | 2.2 | 3.3 | 4.0 | 4.0 |
| Democratic Republic of the Congo | 2.4 | 2.9 | 7.1 | 6.9 | 7.1 | 8.5 | 9.5 | 6.9 | 2.4 | 2.8 | 3.0 | 4.7 |
| Republic of Congo | 3.5 | 7.8 | 8.7 | 3.4 | 3.8 | 3.3 | 6.8 | 2.6 | –2.8 | –3.6 | 2.8 | 0.3 |
| Côte d'Ivoire | 0.5 | 3.3 | 2.0 | –4.2 | 10.1 | 9.3 | 8.8 | 8.9 | 7.7 | 7.6 | 7.3 | 6.5 |
| Equatorial Guinea | 28.1 | 1.3 | –8.9 | 6.5 | 8.3 | –4.1 | –0.7 | –9.1 | –9.7 | –7.4 | –7.8 | –1.4 |
| Eritrea | –1.1 | 3.9 | 2.2 | 8.7 | 7.0 | 3.1 | 5.0 | 4.8 | 3.7 | 3.3 | 3.6 | 4.0 |
| Ethiopia | 8.1 | 10.0 | 10.6 | 11.4 | 8.7 | 9.9 | 10.3 | 10.4 | 8.0 | 8.5 | 8.5 | 7.5 |
| Gabon | –0.1 | –2.3 | 6.3 | 7.1 | 5.3 | 5.5 | 4.4 | 3.9 | 2.1 | 1.0 | 2.7 | 5.1 |
| The Gambia | 3.7 | 6.4 | 6.5 | –4.3 | 5.6 | 4.8 | 0.9 | 4.3 | 2.2 | 3.0 | 3.5 | 4.8 |
| Ghana | 5.3 | 4.8 | 7.9 | 14.0 | 9.3 | 7.3 | 4.0 | 3.8 | 3.5 | 5.9 | 8.9 | 5.4 |
| Guinea | 3.5 | –1.5 | 4.2 | 5.6 | 5.9 | 3.9 | 3.7 | 3.5 | 6.6 | 6.7 | 5.8 | 5.2 |
| Guinea-Bissau | 2.9 | 3.4 | 4.6 | 8.1 | –1.7 | 3.3 | 1.0 | 5.1 | 5.1 | 5.0 | 5.0 | 5.0 |
| Kenya | 3.3 | 3.3 | 8.4 | 6.1 | 4.6 | 5.9 | 5.4 | 5.7 | 5.8 | 5.0 | 5.5 | 6.5 |
| Lesotho | 3.5 | 4.5 | 6.9 | 4.5 | 5.3 | 3.6 | 3.4 | 2.5 | 2.4 | 4.6 | 3.1 | 5.6 |
| Liberia | . . . | 5.1 | 6.1 | 7.4 | 8.2 | 8.7 | 0.7 | 0.0 | –1.6 | 2.6 | 4.0 | 6.8 |
| Madagascar | 4.0 | –4.7 | 0.3 | 1.5 | 3.0 | 2.3 | 3.3 | 3.1 | 4.2 | 4.3 | 5.3 | 5.0 |
| Malawi | 3.8 | 8.3 | 6.9 | 4.9 | 1.9 | 5.2 | 5.7 | 2.9 | 2.3 | 4.5 | 5.0 | 5.5 |
| Mali | 5.4 | 4.7 | 5.4 | 3.2 | –0.8 | 2.3 | 7.0 | 6.0 | 5.8 | 5.3 | 5.0 | 4.7 |
| Mauritius | 4.3 | 3.0 | 4.1 | 3.9 | 3.2 | 3.2 | 3.6 | 3.5 | 3.9 | 3.9 | 4.0 | 4.1 |
| Mozambique | 7.8 | 6.4 | 6.7 | 7.1 | 7.2 | 7.1 | 7.4 | 6.6 | 3.8 | 4.7 | 5.3 | 14.0 |
| Namibia | 4.1 | 0.3 | 6.0 | 5.1 | 5.1 | 5.6 | 6.4 | 6.0 | 1.1 | 0.8 | 2.5 | 3.6 |
| Niger | 4.4 | –0.7 | 8.4 | 2.2 | 11.8 | 5.3 | 7.5 | 4.0 | 5.0 | 4.2 | 4.7 | 6.2 |
| Nigeria | 7.5 | 8.4 | 11.3 | 4.9 | 4.3 | 5.4 | 6.3 | 2.7 | –1.6 | 0.8 | 1.9 | 1.7 |
| Rwanda | 8.0 | 6.3 | 7.3 | 7.8 | 8.8 | 4.7 | 7.6 | 8.9 | 5.9 | 6.2 | 6.8 | 7.5 |
| São Tomé and Príncipe | 4.3 | 4.0 | 4.5 | 4.8 | 4.5 | 4.3 | 4.1 | 4.0 | 4.1 | 5.0 | 5.5 | 5.5 |
| Senegal | 4.4 | 2.4 | 4.3 | 1.9 | 4.5 | 3.6 | 4.1 | 6.5 | 6.7 | 6.8 | 7.0 | 6.4 |
| Seychelles | 2.2 | –1.1 | 5.9 | 5.4 | 3.7 | 6.0 | 4.5 | 5.0 | 4.5 | 4.1 | 3.4 | 4.0 |
| Sierra Leone | 7.5 | 3.2 | 5.3 | 6.3 | 15.2 | 20.7 | 4.6 | –20.5 | 6.1 | 6.0 | 6.1 | 7.4 |
| South Africa | 4.0 | –1.5 | 3.0 | 3.3 | 2.2 | 2.5 | 1.7 | 1.3 | 0.3 | 0.7 | 1.1 | 2.2 |
| South Sudan | . . . | . . . | . . . | . . . | –52.4 | 29.3 | 2.9 | –0.2 | –13.8 | –6.3 | –3.4 | 3.9 |
| Swaziland | 3.6 | 4.5 | 3.5 | 2.0 | 3.5 | 4.8 | 3.6 | 1.1 | 0.0 | 0.3 | –0.9 | 2.2 |
| Tanzania | 6.1 | 5.4 | 6.4 | 7.9 | 5.1 | 7.3 | 7.0 | 7.0 | 7.0 | 6.5 | 6.8 | 6.6 |
| Togo | 1.6 | 3.5 | 4.1 | 4.8 | 5.9 | 6.1 | 5.4 | 5.3 | 5.0 | 5.0 | 5.3 | 5.6 |
| Uganda | 7.5 | 8.1 | 7.7 | 6.8 | 2.2 | 4.7 | 4.6 | 5.7 | 2.3 | 4.4 | 5.2 | 7.3 |
| Zambia | 6.4 | 9.2 | 10.3 | 5.6 | 7.6 | 5.1 | 4.7 | 2.9 | 3.4 | 4.0 | 4.5 | 4.5 |
| Zimbabwe[8] | –6.8 | 7.4 | 15.4 | 16.3 | 13.6 | 5.3 | 2.8 | 1.4 | 0.7 | 2.8 | 0.8 | –0.9 |

[1]Data for some countries refer to real net material product (NMP) or are estimates based on NMP. The figures should be interpreted only as indicative of broad orders of magnitude because reliable, comparable data are not generally available. In particular, the growth of output of new private enterprises of the informal economy is not fully reflected in the recent figures.
[2]Georgia, Turkmenistan, and Ukraine, which are not members of the Commonwealth of Independent States, are included in this group for reasons of geography and similarity in economic structure.
[3]Data are based on the 2008 System of National Accounts. The revised national accounts data are available beginning in 2000 and exclude Crimea and Sevastopol from 2010 onward.
[4]See country-specific notes for India and Libya in the "Country Notes" section of the Statistical Appendix.
[5]In this table only, the data for Timor-Leste are based on non-oil GDP.
[6]Data for 2011 exclude South Sudan after July 9. Data for 2012 and onward pertain to the current Sudan.
[7]Data for Syria are excluded for 2011 onward owing to the uncertain political situation.
[8]The Zimbabwe dollar ceased circulating in early 2009. Data are based on IMF staff estimates of price and exchange rate developments in US dollars. IMF staff estimates of US dollar values may differ from authorities' estimates. Real GDP is in constant 2009 prices.

## Table A5. Summary of Inflation

*(Percent)*

| | Average | | | | | | | | | Projections | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1999–2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2022 |
| **GDP Deflators** | | | | | | | | | | | | |
| **Advanced Economies** | **1.8** | **0.7** | **0.9** | **1.3** | **1.2** | **1.2** | **1.4** | **1.3** | **1.0** | **1.4** | **1.6** | **1.8** |
| United States | 2.3 | 0.8 | 1.2 | 2.1 | 1.8 | 1.6 | 1.8 | 1.1 | 1.3 | 1.7 | 1.9 | 1.9 |
| Euro Area | 2.0 | 1.0 | 0.7 | 1.0 | 1.3 | 1.2 | 0.9 | 1.4 | 0.8 | 0.9 | 1.3 | 1.8 |
| Japan | –1.2 | –0.6 | –1.9 | –1.7 | –0.8 | –0.3 | 1.7 | 2.1 | 0.3 | –0.2 | 0.9 | 1.1 |
| Other Advanced Economies[1] | 2.1 | 0.9 | 2.0 | 2.0 | 1.2 | 1.4 | 1.3 | 1.0 | 1.1 | 2.0 | 1.6 | 2.0 |
| **Consumer Prices** | | | | | | | | | | | | |
| **Advanced Economies** | **2.2** | **0.2** | **1.5** | **2.7** | **2.0** | **1.4** | **1.4** | **0.3** | **0.8** | **1.7** | **1.7** | **2.1** |
| United States | 2.8 | –0.3 | 1.6 | 3.1 | 2.1 | 1.5 | 1.6 | 0.1 | 1.3 | 2.1 | 2.1 | 2.3 |
| Euro Area[2] | 2.2 | 0.3 | 1.6 | 2.7 | 2.5 | 1.3 | 0.4 | 0.0 | 0.2 | 1.5 | 1.4 | 2.0 |
| Japan | –0.2 | –1.3 | –0.7 | –0.3 | –0.1 | 0.3 | 2.8 | 0.8 | –0.1 | 0.4 | 0.5 | 1.6 |
| Other Advanced Economies[1] | 2.1 | 1.4 | 2.4 | 3.3 | 2.1 | 1.7 | 1.5 | 0.5 | 1.0 | 1.8 | 1.9 | 2.0 |
| **Emerging Market and Developing Economies[3]** | **7.6** | **5.0** | **5.6** | **7.1** | **5.8** | **5.5** | **4.7** | **4.7** | **4.3** | **4.2** | **4.4** | **3.9** |
| **Regional Groups** | | | | | | | | | | | | |
| Commonwealth of Independent States[4] | 18.8 | 11.1 | 7.2 | 9.8 | 6.2 | 6.5 | 8.1 | 15.5 | 8.3 | 5.8 | 5.2 | 4.6 |
| Emerging and Developing Asia | 4.0 | 2.8 | 5.1 | 6.5 | 4.6 | 4.6 | 3.4 | 2.7 | 2.8 | 2.6 | 3.2 | 3.4 |
| Emerging and Developing Europe | 15.4 | 4.8 | 5.7 | 5.5 | 6.1 | 4.5 | 4.1 | 3.2 | 3.3 | 6.0 | 5.7 | 4.9 |
| Latin America and the Caribbean | 6.7 | 4.6 | 4.2 | 5.2 | 4.6 | 4.6 | 4.9 | 5.5 | 5.6 | 4.2 | 3.6 | 3.4 |
| Middle East, North Africa, Afghanistan, and Pakistan | 6.4 | 7.3 | 6.6 | 9.2 | 9.8 | 9.2 | 6.8 | 5.7 | 5.1 | 6.8 | 7.7 | 4.9 |
| Middle East and North Africa | 6.4 | 6.1 | 6.2 | 8.7 | 9.7 | 9.4 | 6.6 | 5.9 | 5.4 | 7.1 | 8.1 | 4.8 |
| Sub-Saharan Africa | 10.5 | 9.8 | 8.1 | 9.4 | 9.3 | 6.6 | 6.3 | 7.0 | 11.3 | 11.0 | 9.5 | 7.8 |
| *Memorandum* | | | | | | | | | | | | |
| European Union | 2.7 | 1.0 | 2.0 | 3.1 | 2.6 | 1.5 | 0.5 | 0.0 | 0.2 | 1.7 | 1.7 | 2.0 |
| Low-Income Developing Countries | 9.9 | 8.2 | 9.2 | 11.7 | 9.9 | 8.1 | 7.2 | 7.2 | 8.9 | 9.7 | 8.8 | 7.2 |
| **Analytical Groups** | | | | | | | | | | | | |
| **By Source of Export Earnings** | | | | | | | | | | | | |
| Fuel | 12.3 | 7.7 | 6.7 | 8.6 | 8.0 | 8.1 | 6.5 | 8.8 | 7.3 | 5.9 | 6.2 | 5.1 |
| Nonfuel | 6.3 | 4.3 | 5.3 | 6.7 | 5.3 | 4.9 | 4.2 | 3.8 | 3.7 | 3.9 | 4.1 | 3.7 |
| Of Which, Primary Products[5] | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . |
| **By External Financing Source** | | | | | | | | | | | | |
| Net Debtor Economies | 8.2 | 7.2 | 6.7 | 7.7 | 7.0 | 6.3 | 5.7 | 5.5 | 5.1 | 5.5 | 5.5 | 4.7 |
| **Net Debtor Economies by Debt-Servicing Experience** | | | | | | | | | | | | |
| Economies with Arrears and/or Rescheduling during 2012–16 | 8.8 | 12.6 | 9.8 | 10.2 | 7.9 | 6.8 | 10.5 | 15.6 | 9.6 | 17.1 | 15.3 | 6.5 |
| *Memorandum* | | | | | | | | | | | | |
| **Median Inflation Rate** | | | | | | | | | | | | |
| Advanced Economies | 2.3 | 0.8 | 1.9 | 3.2 | 2.6 | 1.4 | 0.7 | 0.1 | 0.6 | 1.6 | 1.5 | 2.0 |
| Emerging Market and Developing Economies[3] | 5.4 | 3.7 | 4.1 | 5.4 | 4.5 | 3.9 | 3.2 | 2.7 | 2.8 | 3.4 | 3.5 | 3.1 |

[1]Excludes the United States, euro area countries, and Japan.
[2]Based on Eurostat's harmonized index of consumer prices.
[3]Excludes Argentina and Venezuela. See country-specific notes for Argentina and Venezuela in the "Country Notes" section of the Statistical Appendix.
[4]Georgia, Turkmenistan, and Ukraine, which are not members of the Commonwealth of Independent States, are included in this group for reasons of geography and similarity in economic structure.
[5]Data are missing because of Argentina, which accounts for more than 30 percent of the weights of the group. See country-specific notes for Argentina in the "Country Notes" section of the Statistical Appendix.

## Table A6. Advanced Economies: Consumer Prices[1]

*(Annual percent change)*

| | Average | | | | | | | | | Projections | | | End of Period[2] | Projections | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1999–2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2022 | 2016 | 2017 | 2018 |
| **Advanced Economies** | **2.2** | **0.2** | **1.5** | **2.7** | **2.0** | **1.4** | **1.4** | **0.3** | **0.8** | **1.7** | **1.7** | **2.1** | **1.5** | **1.5** | **1.9** |
| United States | 2.8 | –0.3 | 1.6 | 3.1 | 2.1 | 1.5 | 1.6 | 0.1 | 1.3 | 2.1 | 2.1 | 2.3 | 2.2 | 1.8 | 2.3 |
| Euro Area[3] | 2.2 | 0.3 | 1.6 | 2.7 | 2.5 | 1.3 | 0.4 | 0.0 | 0.2 | 1.5 | 1.4 | 2.0 | 1.1 | 1.1 | 1.6 |
| Germany | 1.7 | 0.2 | 1.1 | 2.5 | 2.1 | 1.6 | 0.8 | 0.1 | 0.4 | 1.6 | 1.5 | 2.5 | 1.7 | 1.1 | 1.8 |
| France | 1.9 | 0.1 | 1.7 | 2.3 | 2.2 | 1.0 | 0.6 | 0.1 | 0.3 | 1.2 | 1.3 | 1.8 | 0.6 | 1.1 | 1.5 |
| Italy | 2.4 | 0.8 | 1.6 | 2.9 | 3.3 | 1.2 | 0.2 | 0.1 | –0.1 | 1.4 | 1.2 | 1.4 | 0.5 | 0.9 | 1.6 |
| Spain | 3.3 | –0.3 | 1.8 | 3.2 | 2.4 | 1.4 | –0.1 | –0.5 | –0.2 | 2.0 | 1.5 | 1.9 | 1.6 | 1.2 | 1.4 |
| Netherlands | 2.4 | 1.0 | 0.9 | 2.5 | 2.8 | 2.6 | 0.3 | 0.2 | 0.1 | 1.3 | 1.4 | 1.6 | 0.7 | 1.4 | 1.5 |
| Belgium | 2.2 | 0.0 | 2.3 | 3.4 | 2.6 | 1.2 | 0.5 | 0.6 | 1.8 | 2.2 | 1.5 | 2.0 | 2.2 | 1.4 | 1.7 |
| Austria | 1.9 | 0.4 | 1.7 | 3.5 | 2.6 | 2.1 | 1.5 | 0.8 | 1.0 | 1.6 | 1.8 | 2.2 | 1.5 | 1.7 | 1.9 |
| Greece | 3.3 | 1.3 | 4.7 | 3.1 | 1.0 | –0.9 | –1.4 | –1.1 | 0.0 | 1.2 | 1.3 | 1.7 | 0.3 | 1.0 | 1.1 |
| Portugal | 2.9 | –0.9 | 1.4 | 3.6 | 2.8 | 0.4 | –0.2 | 0.5 | 0.6 | 1.6 | 2.0 | 2.4 | 0.9 | 2.3 | 2.6 |
| Ireland | 3.4 | –1.7 | –1.6 | 1.2 | 1.9 | 0.5 | 0.3 | 0.0 | –0.2 | 0.4 | 1.5 | 1.9 | –0.2 | 0.9 | 1.7 |
| Finland | 1.8 | 1.6 | 1.7 | 3.3 | 3.2 | 2.2 | 1.2 | –0.2 | 0.4 | 0.8 | 1.2 | 2.0 | 1.1 | 0.5 | 1.6 |
| Slovak Republic | 6.2 | 0.9 | 0.7 | 4.1 | 3.7 | 1.5 | –0.1 | –0.3 | –0.5 | 1.2 | 1.4 | 2.0 | 0.2 | 1.3 | 1.4 |
| Lithuania | 2.7 | 4.2 | 1.2 | 4.1 | 3.2 | 1.2 | 0.2 | –0.7 | 0.7 | 3.5 | 2.0 | 2.5 | 2.0 | 3.3 | 2.0 |
| Slovenia | 5.4 | 0.8 | 1.8 | 1.8 | 2.6 | 1.8 | 0.2 | –0.5 | –0.1 | 1.6 | 1.8 | 2.0 | 0.5 | 1.7 | 2.0 |
| Luxembourg | 2.8 | 0.0 | 2.8 | 3.7 | 2.9 | 1.7 | 0.7 | 0.1 | 0.0 | 1.2 | 1.3 | 2.0 | 1.6 | –1.3 | 3.7 |
| Latvia | 5.6 | 3.3 | –1.2 | 4.2 | 2.3 | 0.0 | 0.7 | 0.2 | 0.1 | 3.0 | 3.0 | 2.3 | 2.1 | 3.0 | 3.0 |
| Estonia | 4.7 | 0.2 | 2.7 | 5.1 | 4.2 | 3.2 | 0.5 | 0.1 | 0.8 | 3.8 | 3.4 | 2.5 | 2.4 | 4.5 | 2.5 |
| Cyprus | 2.7 | 0.2 | 2.6 | 3.5 | 3.1 | 0.4 | –0.3 | –1.5 | –1.2 | 0.8 | 0.7 | 2.0 | 0.1 | 0.8 | 0.7 |
| Malta | 2.6 | 1.8 | 2.0 | 2.5 | 3.2 | 1.0 | 0.8 | 1.2 | 0.9 | 1.3 | 1.6 | 1.8 | 1.0 | 1.5 | 1.7 |
| Japan | –0.2 | –1.3 | –0.7 | –0.3 | –0.1 | 0.3 | 2.8 | 0.8 | –0.1 | 0.4 | 0.5 | 1.6 | 0.3 | 0.1 | 0.6 |
| United Kingdom[3] | 1.8 | 2.2 | 3.3 | 4.5 | 2.8 | 2.6 | 1.5 | 0.0 | 0.7 | 2.6 | 2.6 | 2.0 | 1.2 | 2.8 | 2.6 |
| Korea | 2.9 | 2.8 | 2.9 | 4.0 | 2.2 | 1.3 | 1.3 | 0.7 | 1.0 | 1.9 | 1.9 | 2.0 | 1.3 | 1.9 | 1.9 |
| Canada | 2.3 | 0.3 | 1.8 | 2.9 | 1.5 | 0.9 | 1.9 | 1.1 | 1.4 | 1.6 | 1.8 | 1.9 | 1.4 | 1.6 | 1.9 |
| Australia | 3.1 | 1.8 | 2.9 | 3.3 | 1.7 | 2.5 | 2.5 | 1.5 | 1.3 | 2.0 | 2.2 | 2.5 | 1.4 | 2.0 | 2.3 |
| Taiwan Province of China | 1.1 | –0.9 | 1.0 | 1.4 | 1.9 | 0.8 | 1.2 | –0.3 | 1.4 | 1.0 | 1.4 | 2.0 | 1.7 | 1.0 | 1.4 |
| Switzerland | 1.1 | –0.5 | 0.7 | 0.2 | –0.7 | –0.2 | 0.0 | –1.1 | –0.4 | 0.5 | 0.6 | 1.0 | 0.0 | 0.6 | 0.8 |
| Sweden | 1.7 | 1.9 | 1.9 | 1.4 | 0.9 | 0.4 | 0.2 | 0.7 | 1.1 | 1.6 | 1.6 | 2.0 | 1.7 | 1.8 | 1.5 |
| Singapore | 1.4 | 0.6 | 2.8 | 5.2 | 4.6 | 2.4 | 1.0 | –0.5 | –0.5 | 0.9 | 1.3 | 1.9 | 0.0 | 1.4 | 1.4 |
| Hong Kong SAR | –0.6 | 0.6 | 2.3 | 5.3 | 4.1 | 4.3 | 4.4 | 3.0 | 2.6 | 2.0 | 2.2 | 3.0 | 2.6 | 2.0 | 2.2 |
| Norway | 2.1 | 2.2 | 2.4 | 1.3 | 0.7 | 2.1 | 2.0 | 2.2 | 3.6 | 2.1 | 2.0 | 2.5 | 3.5 | 1.9 | 2.1 |
| Czech Republic | 2.9 | 1.0 | 1.5 | 1.9 | 3.3 | 1.4 | 0.3 | 0.3 | 0.7 | 2.3 | 1.8 | 2.0 | 2.0 | 2.1 | 2.0 |
| Israel | 2.2 | 3.3 | 2.7 | 3.5 | 1.7 | 1.5 | 0.5 | –0.6 | –0.5 | 0.2 | 0.5 | 2.0 | –0.2 | 0.2 | 1.0 |
| Denmark | 2.2 | 1.3 | 2.3 | 2.8 | 2.4 | 0.8 | 0.6 | 0.5 | 0.3 | 1.0 | 1.4 | 2.0 | 0.5 | 1.2 | 1.6 |
| New Zealand | 2.5 | 2.1 | 2.3 | 4.0 | 1.1 | 1.1 | 1.2 | 0.3 | 0.6 | 2.2 | 2.0 | 2.0 | 1.3 | 2.4 | 2.0 |
| Puerto Rico | 2.8 | 0.3 | 2.5 | 2.9 | 1.3 | 1.1 | 0.6 | –0.8 | –0.3 | 1.1 | 0.9 | 0.8 | 0.5 | 1.1 | 0.9 |
| Macao SAR | . . . | 1.2 | 2.8 | 5.8 | 6.1 | 5.5 | 6.0 | 4.6 | 2.4 | 1.5 | 2.2 | 2.8 | 1.4 | 1.5 | 2.2 |
| Iceland | 5.3 | 12.0 | 5.4 | 4.0 | 5.2 | 3.9 | 2.0 | 1.6 | 1.7 | 1.8 | 2.6 | 2.5 | 1.9 | 2.0 | 2.9 |
| San Marino | . . . | 2.4 | 2.6 | 2.0 | 2.8 | 1.6 | 1.1 | 0.1 | 0.6 | 0.9 | 1.0 | 1.2 | 0.6 | 0.9 | 1.0 |
| *Memorandum* | | | | | | | | | | | | | | | |
| Major Advanced Economies | 2.0 | –0.1 | 1.4 | 2.6 | 1.9 | 1.3 | 1.5 | 0.3 | 0.8 | 1.7 | 1.7 | 2.1 | 1.6 | 1.4 | 1.9 |

[1]Movements in consumer prices are shown as annual averages.
[2]Monthly year-over-year changes and, for several countries, on a quarterly basis.
[3]Based on Eurostat's harmonized index of consumer prices.

## Table A7. Emerging Market and Developing Economies: Consumer Prices[1]

*(Annual percent change)*

| | Average | | | | | | | | | Projections | | | End of Period[2] | Projections | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1999–2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2022 | 2016 | 2017 | 2018 |
| **Commonwealth of Independent States[3,4]** | **18.8** | **11.1** | **7.2** | **9.8** | **6.2** | **6.5** | **8.1** | **15.5** | **8.3** | **5.8** | **5.2** | **4.6** | **6.5** | **5.4** | **4.9** |
| Russia | 19.8 | 11.7 | 6.9 | 8.4 | 5.1 | 6.8 | 7.8 | 15.5 | 7.0 | 4.2 | 3.9 | 4.0 | 5.4 | 4.0 | 4.0 |
| Excluding Russia | 15.7 | 9.6 | 8.1 | 13.3 | 9.2 | 5.7 | 8.8 | 15.6 | 11.3 | 9.6 | 8.2 | 5.8 | 9.3 | 8.9 | 7.2 |
| Armenia | 3.3 | 3.5 | 7.3 | 7.7 | 2.5 | 5.8 | 3.0 | 3.7 | –1.4 | 1.9 | 3.5 | 4.0 | –1.1 | 2.1 | 4.0 |
| Azerbaijan | 5.9 | 1.6 | 5.7 | 7.9 | 1.0 | 2.4 | 1.4 | 4.0 | 12.4 | 12.0 | 8.0 | 6.0 | 13.3 | 8.0 | 7.5 |
| Belarus | 49.1 | 13.0 | 7.7 | 53.2 | 59.2 | 18.3 | 18.1 | 13.5 | 11.8 | 8.0 | 7.5 | 7.0 | 10.6 | 8.0 | 7.5 |
| Georgia | 8.0 | 1.7 | 7.1 | 8.5 | –0.9 | –0.5 | 3.1 | 4.0 | 2.1 | 6.0 | 3.0 | 3.0 | 1.8 | 6.2 | 3.4 |
| Kazakhstan | 9.3 | 7.3 | 7.1 | 8.3 | 5.1 | 5.8 | 6.7 | 6.7 | 14.6 | 7.3 | 6.5 | 4.0 | 8.5 | 7.0 | 6.2 |
| Kyrgyz Republic | 11.2 | 6.8 | 8.0 | 16.6 | 2.8 | 6.6 | 7.5 | 6.5 | 0.4 | 3.8 | 5.1 | 5.0 | –0.5 | 4.8 | 5.5 |
| Moldova | 15.5 | 0.0 | 7.4 | 7.6 | 4.6 | 4.6 | 5.1 | 9.6 | 6.4 | 6.5 | 5.3 | 5.0 | 2.4 | 7.0 | 5.2 |
| Tajikistan | 18.1 | 6.4 | 6.5 | 12.4 | 5.8 | 5.0 | 6.1 | 5.8 | 5.9 | 8.9 | 8.0 | 6.0 | 6.1 | 10.0 | 8.0 |
| Turkmenistan | 10.2 | –2.7 | 4.4 | 5.3 | 5.3 | 6.8 | 6.0 | 7.4 | 3.6 | 6.0 | 6.2 | 6.2 | 6.2 | 6.1 | 6.2 |
| Ukraine[5] | 13.5 | 15.9 | 9.4 | 8.0 | 0.6 | –0.3 | 12.1 | 48.7 | 13.9 | 12.8 | 10.0 | 5.0 | 12.4 | 10.0 | 7.0 |
| Uzbekistan | 17.4 | 12.3 | 12.3 | 12.4 | 11.9 | 11.7 | 9.1 | 8.5 | 8.0 | 13.0 | 12.7 | 10.0 | 7.9 | 15.7 | 10.7 |
| **Emerging and Developing Asia** | **4.0** | **2.8** | **5.1** | **6.5** | **4.6** | **4.6** | **3.4** | **2.7** | **2.8** | **2.6** | **3.2** | **3.4** | **2.7** | **3.1** | **3.2** |
| Bangladesh | 5.7 | 4.9 | 9.4 | 11.5 | 6.2 | 7.5 | 7.0 | 6.2 | 5.7 | 5.7 | 5.8 | 5.6 | 5.7 | 6.0 | 5.8 |
| Bhutan | 5.0 | 6.3 | 5.7 | 7.3 | 9.3 | 11.3 | 9.9 | 6.3 | 3.9 | 3.5 | 4.2 | 4.7 | 3.0 | 3.3 | 4.5 |
| Brunei Darussalam | 0.5 | 1.0 | 0.2 | 0.1 | 0.1 | 0.4 | –0.2 | –0.4 | –0.7 | –0.2 | 0.0 | 0.2 | –1.6 | 0.1 | 0.3 |
| Cambodia | 4.9 | –0.7 | 4.0 | 5.5 | 2.9 | 3.0 | 3.9 | 1.2 | 3.0 | 3.7 | 3.5 | 3.0 | 3.9 | 3.1 | 3.4 |
| China | 1.8 | –0.7 | 3.3 | 5.4 | 2.6 | 2.6 | 2.0 | 1.4 | 2.0 | 1.8 | 2.4 | 2.6 | 2.1 | 2.3 | 2.4 |
| Fiji | 3.2 | 3.7 | 3.7 | 7.3 | 3.4 | 2.9 | 0.5 | 1.4 | 3.9 | 3.8 | 3.5 | 3.0 | 3.9 | 3.5 | 3.5 |
| India | 4.9 | 10.6 | 9.5 | 9.5 | 10.0 | 9.4 | 5.8 | 4.9 | 4.5 | 3.8 | 4.9 | 5.0 | 3.6 | 4.5 | 4.8 |
| Indonesia | 10.0 | 5.0 | 5.1 | 5.3 | 4.0 | 6.4 | 6.4 | 6.4 | 3.5 | 4.0 | 3.9 | 3.5 | 3.0 | 4.0 | 3.7 |
| Kiribati | 2.7 | 9.8 | –3.9 | 1.5 | –3.0 | –1.5 | 2.1 | 0.6 | 1.9 | 2.2 | 2.5 | 2.5 | 0.7 | 2.2 | 2.5 |
| Lao P.D.R. | 17.1 | 0.0 | 6.0 | 7.6 | 4.3 | 6.4 | 4.1 | 1.3 | 2.0 | 2.3 | 2.7 | 3.1 | 3.2 | 2.3 | 2.6 |
| Malaysia | 2.4 | 0.6 | 1.7 | 3.2 | 1.7 | 2.1 | 3.1 | 2.1 | 2.1 | 3.8 | 2.9 | 3.0 | 1.8 | 3.8 | 2.9 |
| Maldives | 3.1 | 4.5 | 6.2 | 11.3 | 10.9 | 4.0 | 2.5 | 1.4 | 0.8 | 2.5 | 2.1 | 2.5 | 1.8 | 2.1 | 2.2 |
| Marshall Islands | . . . | 0.5 | 1.8 | 5.4 | 4.3 | 1.9 | 1.1 | –2.2 | –1.5 | 0.7 | 1.1 | 2.1 | –1.5 | 0.7 | 1.1 |
| Micronesia | 2.5 | 7.7 | 3.7 | 4.1 | 6.3 | 2.2 | 0.7 | –0.2 | 0.5 | 0.9 | 2.0 | 2.0 | 0.5 | 0.9 | 2.0 |
| Mongolia | 8.9 | 6.3 | 10.2 | 7.7 | 15.0 | 8.6 | 12.9 | 5.9 | 0.6 | 4.4 | 6.0 | 6.5 | 0.9 | 6.9 | 6.5 |
| Myanmar | 19.9 | 2.2 | 8.2 | 2.8 | 2.8 | 5.7 | 5.1 | 10.0 | 6.8 | 6.5 | 6.1 | 5.7 | 7.0 | 6.5 | 6.1 |
| Nauru | . . . | 22.4 | –2.0 | –3.4 | 0.3 | –1.1 | 0.3 | 9.8 | 8.2 | 5.1 | 2.0 | 2.0 | 8.2 | 1.6 | 2.0 |
| Nepal | 5.4 | 12.6 | 9.6 | 9.6 | 8.3 | 9.9 | 9.0 | 7.2 | 9.9 | 4.5 | 6.0 | 5.5 | 10.4 | 2.7 | 5.7 |
| Palau | . . . | 1.4 | 1.4 | 4.7 | 3.6 | 3.4 | 4.1 | 0.9 | –1.0 | 1.5 | 2.0 | 2.0 | 0.4 | 1.5 | 2.0 |
| Papua New Guinea | 8.3 | 6.9 | 5.1 | 4.4 | 4.5 | 5.0 | 5.2 | 6.0 | 6.7 | 5.7 | 5.5 | 5.0 | 6.6 | 5.5 | 5.0 |
| Philippines | 5.1 | 4.2 | 3.8 | 4.7 | 3.2 | 2.9 | 4.2 | 1.4 | 1.8 | 3.1 | 3.0 | 3.0 | 2.6 | 2.9 | 3.0 |
| Samoa | 4.3 | 14.6 | –0.2 | 2.9 | 6.2 | –0.2 | –1.2 | 1.9 | 0.1 | 1.8 | 1.9 | 3.0 | 2.3 | 1.4 | 2.4 |
| Solomon Islands | 9.2 | 7.1 | 1.0 | 7.4 | 5.9 | 5.4 | 5.2 | –0.6 | 0.5 | –0.5 | 1.7 | 4.0 | 3.5 | –2.2 | 1.9 |
| Sri Lanka | 11.1 | 3.4 | 6.2 | 6.7 | 7.5 | 6.9 | 2.8 | 2.2 | 4.0 | 6.0 | 5.0 | 5.0 | 4.5 | 5.1 | 5.0 |
| Thailand | 2.6 | –0.8 | 3.3 | 3.8 | 3.0 | 2.2 | 1.9 | –0.9 | 0.2 | 0.6 | 1.0 | 2.5 | 1.1 | 0.6 | 0.7 |
| Timor-Leste | . . . | –0.2 | 5.2 | 13.2 | 10.9 | 9.5 | 0.7 | 0.6 | –1.3 | 1.0 | 2.7 | 4.0 | 0.0 | 2.0 | 3.5 |
| Tonga | 8.3 | 1.4 | 3.5 | 6.3 | 1.1 | 2.1 | 1.2 | –1.1 | 2.6 | 7.5 | 2.7 | 2.5 | 6.7 | 6.6 | 2.5 |
| Tuvalu | . . . | –0.3 | –1.9 | 0.5 | 1.4 | 2.0 | 1.1 | 3.2 | 3.5 | 2.9 | 2.8 | 2.5 | 2.6 | 2.9 | 2.4 |
| Vanuatu | 2.8 | 4.3 | 2.8 | 0.9 | 1.3 | 1.5 | 0.8 | 2.5 | 0.9 | 2.6 | 2.8 | 3.0 | 2.1 | 2.7 | 2.9 |
| Vietnam | 6.3 | 6.7 | 9.2 | 18.7 | 9.1 | 6.6 | 4.1 | 0.6 | 2.7 | 4.4 | 4.0 | 4.0 | 4.7 | 4.0 | 4.0 |
| **Emerging and Developing Europe** | **15.4** | **4.8** | **5.7** | **5.5** | **6.1** | **4.5** | **4.1** | **3.2** | **3.3** | **6.0** | **5.7** | **4.9** | **4.2** | **5.7** | **5.9** |
| Albania | 2.5 | 2.2 | 3.6 | 3.4 | 2.0 | 1.9 | 1.6 | 1.9 | 1.3 | 2.1 | 2.8 | 3.0 | 2.2 | 2.3 | 3.0 |
| Bosnia and Herzegovina | 3.2 | –0.4 | 2.1 | 3.7 | 2.0 | –0.1 | –0.9 | –1.0 | –1.1 | 1.8 | 1.2 | 2.0 | –0.3 | 2.3 | 1.4 |
| Bulgaria[6] | 6.7 | 2.5 | 3.0 | 3.4 | 2.4 | 0.4 | –1.6 | –1.1 | –1.3 | 1.1 | 1.4 | 2.1 | –0.5 | 1.3 | 1.6 |
| Croatia | 3.3 | 2.4 | 1.0 | 2.3 | 3.4 | 2.2 | –0.2 | –0.5 | –1.1 | 1.1 | 1.2 | 1.9 | 0.2 | 1.0 | 1.2 |
| Hungary | 6.7 | 4.2 | 4.9 | 3.9 | 5.7 | 1.6 | –0.2 | –0.1 | 0.4 | 2.5 | 3.2 | 3.0 | 1.8 | 2.7 | 3.0 |
| Kosovo | . . . | –2.4 | 3.5 | 7.3 | 2.5 | 1.8 | 0.4 | –0.5 | 0.3 | 1.4 | 1.4 | 2.0 | 1.3 | 1.0 | 1.8 |
| FYR Macedonia | 2.6 | –0.7 | 1.5 | 3.9 | 3.3 | 2.8 | –0.3 | –0.3 | –0.2 | 0.3 | 2.6 | 2.0 | –0.3 | 1.7 | 1.7 |
| Montenegro | . . . | 3.6 | 0.4 | 3.5 | 4.1 | 2.2 | –0.7 | 1.5 | –0.3 | 2.1 | 2.6 | 1.9 | 1.0 | 1.6 | 2.6 |
| Poland | 3.9 | 3.4 | 2.6 | 4.3 | 3.7 | 0.9 | 0.0 | –0.9 | –0.6 | 1.9 | 2.3 | 2.5 | 0.8 | 1.9 | 2.6 |
| Romania | 19.4 | 5.6 | 6.1 | 5.8 | 3.3 | 4.0 | 1.1 | –0.6 | –1.6 | 1.1 | 3.3 | 2.5 | –0.5 | 2.0 | 3.5 |
| Serbia | 23.5 | 8.1 | 6.1 | 11.1 | 7.3 | 7.7 | 2.1 | 1.4 | 1.1 | 3.4 | 3.0 | 3.0 | 1.5 | 3.6 | 3.0 |
| Turkey | 27.2 | 6.3 | 8.6 | 6.5 | 8.9 | 7.5 | 8.9 | 7.7 | 7.8 | 10.9 | 9.3 | 7.5 | 8.5 | 10.0 | 9.5 |

## Table A7. Emerging Market and Developing Economies: Consumer Prices[1] *(continued)*

*(Annual percent change)*

| | Average | | | | | | | | | Projections | | | End of Period[2] | Projections | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1999–2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2022 | 2016 | 2017 | 2018 |
| **Latin America and the Caribbean[7]** | **6.7** | **4.6** | **4.2** | **5.2** | **4.6** | **4.6** | **4.9** | **5.5** | **5.6** | **4.2** | **3.6** | **3.4** | **4.6** | **4.2** | **3.6** |
| Antigua and Barbuda | 2.0 | –0.6 | 3.4 | 3.5 | 3.4 | 1.1 | 1.1 | 1.0 | –0.5 | 2.4 | 1.2 | 2.0 | –1.1 | 2.5 | 2.0 |
| Argentina[8] | 7.6 | 6.3 | 10.5 | 9.8 | 10.0 | 10.6 | . . . | . . . | . . . | 26.9 | 17.8 | 8.6 | . . . | 22.3 | 16.7 |
| The Bahamas | 2.2 | 1.7 | 1.6 | 3.1 | 1.9 | 0.4 | 1.2 | 1.9 | 0.8 | 2.4 | 2.2 | 2.2 | 0.8 | 2.4 | 2.2 |
| Barbados | 3.5 | 3.6 | 5.8 | 9.4 | 4.5 | 1.8 | 1.8 | –1.1 | 1.3 | 5.0 | 5.8 | 2.7 | 3.2 | 6.7 | 2.4 |
| Belize | 2.5 | –1.1 | 0.9 | 1.7 | 1.2 | 0.5 | 1.2 | –0.9 | 0.6 | 1.8 | 2.3 | 2.0 | 1.1 | 2.4 | 2.3 |
| Bolivia | 4.7 | 3.3 | 2.5 | 9.9 | 4.5 | 5.7 | 5.8 | 4.1 | 3.6 | 3.2 | 5.1 | 5.0 | 4.0 | 4.3 | 5.0 |
| Brazil | 6.8 | 4.9 | 5.0 | 6.6 | 5.4 | 6.2 | 6.3 | 9.0 | 8.7 | 3.7 | 4.0 | 4.0 | 6.3 | 3.6 | 4.0 |
| Chile | 3.7 | 1.5 | 1.4 | 3.3 | 3.0 | 1.9 | 4.4 | 4.3 | 3.8 | 2.3 | 2.7 | 3.0 | 2.8 | 2.4 | 2.9 |
| Colombia | 6.9 | 4.2 | 2.3 | 3.4 | 3.2 | 2.0 | 2.9 | 5.0 | 7.5 | 4.3 | 3.3 | 3.0 | 5.7 | 4.0 | 3.1 |
| Costa Rica | 11.1 | 7.8 | 5.7 | 4.9 | 4.5 | 5.2 | 4.5 | 0.8 | 0.0 | 1.7 | 2.9 | 3.0 | 0.8 | 2.7 | 3.0 |
| Dominica | 2.1 | 0.0 | 2.8 | 1.1 | 1.4 | 0.0 | 0.8 | –0.8 | 0.0 | 0.6 | 1.4 | 2.0 | –0.2 | 1.4 | 1.4 |
| Dominican Republic | 12.8 | 1.4 | 6.3 | 8.5 | 3.7 | 4.8 | 3.0 | 0.8 | 1.6 | 3.0 | 3.3 | 4.0 | 1.7 | 2.9 | 4.2 |
| Ecuador | 19.6 | 5.2 | 3.6 | 4.5 | 5.1 | 2.7 | 3.6 | 4.0 | 1.7 | 0.7 | 0.7 | 1.6 | 1.1 | 0.8 | 0.7 |
| El Salvador | 3.5 | 0.5 | 1.2 | 5.1 | 1.7 | 0.8 | 1.1 | –0.7 | 0.6 | 0.8 | 2.2 | 2.0 | –0.9 | 2.4 | 2.0 |
| Grenada | 2.9 | –0.3 | 3.4 | 3.0 | 2.4 | 0.0 | –1.0 | –0.6 | 1.7 | 2.6 | 2.0 | 1.9 | 0.9 | 3.0 | 1.8 |
| Guatemala | 7.3 | 1.9 | 3.9 | 6.2 | 3.8 | 4.3 | 3.4 | 2.4 | 4.4 | 4.4 | 3.5 | 4.0 | 4.2 | 4.3 | 4.0 |
| Guyana | 6.6 | 3.0 | 4.3 | 4.4 | 2.4 | 1.9 | 0.7 | –0.9 | 0.8 | 2.3 | 2.7 | 3.1 | 1.5 | 2.6 | 2.7 |
| Haiti | 15.3 | 3.4 | 4.1 | 7.4 | 6.8 | 6.8 | 3.9 | 7.5 | 13.4 | 14.7 | 9.0 | 5.0 | 12.5 | 15.3 | 5.0 |
| Honduras | 8.8 | 5.5 | 4.7 | 6.8 | 5.2 | 5.2 | 6.1 | 3.2 | 2.7 | 4.0 | 4.0 | 4.0 | 3.3 | 4.5 | 4.0 |
| Jamaica | 10.6 | 9.6 | 12.6 | 7.5 | 6.9 | 9.4 | 8.3 | 3.7 | 2.3 | 3.4 | 5.2 | 5.4 | 1.7 | 5.0 | 5.5 |
| Mexico | 6.3 | 5.3 | 4.2 | 3.4 | 4.1 | 3.8 | 4.0 | 2.7 | 2.8 | 5.9 | 3.8 | 3.0 | 3.4 | 6.1 | 3.5 |
| Nicaragua | 9.7 | 3.7 | 5.5 | 8.1 | 7.2 | 7.1 | 6.0 | 4.0 | 3.5 | 4.0 | 7.2 | 7.3 | 3.1 | 4.0 | 7.2 |
| Panama | 2.3 | 2.4 | 3.5 | 5.9 | 5.7 | 4.0 | 2.6 | 0.1 | 0.7 | 1.6 | 2.1 | 2.4 | 1.5 | 2.5 | 2.1 |
| Paraguay | 8.6 | 2.6 | 4.7 | 8.3 | 3.7 | 2.7 | 5.0 | 3.1 | 4.1 | 3.5 | 4.0 | 4.0 | 3.9 | 4.0 | 4.0 |
| Peru | 2.6 | 2.9 | 1.5 | 3.4 | 3.7 | 2.8 | 3.2 | 3.5 | 3.6 | 3.2 | 2.3 | 2.0 | 3.2 | 2.7 | 2.5 |
| St. Kitts and Nevis | 3.6 | 2.1 | 0.9 | 5.8 | 0.8 | 1.1 | 0.2 | –2.3 | –0.4 | 1.2 | 1.8 | 2.0 | 0.9 | 1.5 | 2.0 |
| St. Lucia | 3.0 | –0.2 | 3.3 | 2.8 | 4.2 | 1.5 | 3.5 | –1.0 | –3.1 | 0.2 | 0.9 | 1.5 | –3.0 | 1.4 | 1.2 |
| St. Vincent and the Grenadines | 2.9 | 0.4 | 0.8 | 3.2 | 2.6 | 0.8 | 0.2 | –1.7 | –0.2 | 1.7 | 1.4 | 1.5 | 1.0 | 1.9 | 1.5 |
| Suriname | 21.0 | –0.3 | 6.9 | 17.7 | 5.0 | 1.9 | 3.4 | 6.9 | 55.5 | 22.3 | 9.3 | 4.1 | 52.4 | 9.1 | 12.3 |
| Trinidad and Tobago | 5.9 | 7.0 | 10.5 | 5.1 | 9.3 | 5.2 | 5.7 | 4.7 | 3.1 | 3.2 | 3.2 | 3.2 | 3.1 | 3.2 | 3.2 |
| Uruguay | 8.3 | 7.1 | 6.7 | 8.1 | 8.1 | 8.6 | 8.9 | 8.7 | 9.6 | 6.1 | 6.3 | 6.1 | 8.1 | 6.2 | 6.7 |
| Venezuela[8] | 20.5 | 27.1 | 28.2 | 26.1 | 21.1 | 43.5 | 57.3 | 111.8 | 254.4 | 652.7 | 2,349.3 | 4,684.8 | 302.6 | 1,133.0 | 2,529.6 |
| **Middle East, North Africa, Afghanistan, and Pakistan** | **6.4** | **7.3** | **6.6** | **9.2** | **9.8** | **9.2** | **6.8** | **5.7** | **5.1** | **6.8** | **7.7** | **4.9** | **6.2** | **7.5** | **6.5** |
| Afghanistan | . . . | –6.8 | 2.2 | 11.8 | 6.4 | 7.4 | 4.7 | –0.7 | 4.4 | 6.0 | 6.0 | 6.0 | 4.6 | 7.2 | 6.0 |
| Algeria | 2.9 | 5.7 | 3.9 | 4.5 | 8.9 | 3.3 | 2.9 | 4.8 | 6.4 | 5.5 | 4.4 | 4.0 | 7.0 | 5.5 | 4.4 |
| Bahrain | 1.2 | 2.8 | 2.0 | –0.4 | 2.8 | 3.3 | 2.7 | 1.8 | 2.8 | 0.9 | 3.5 | 1.6 | 2.3 | 1.0 | 3.2 |
| Djibouti | 3.2 | 1.7 | 4.0 | 5.1 | 3.7 | 2.4 | 2.9 | 2.1 | 2.7 | 3.0 | 3.0 | 3.0 | 2.4 | 3.0 | 3.0 |
| Egypt | 5.8 | 16.2 | 11.7 | 11.1 | 8.6 | 6.9 | 10.1 | 11.0 | 10.2 | 23.5 | 21.3 | 7.1 | 14.0 | 29.8 | 11.7 |
| Iran | 15.6 | 10.7 | 12.4 | 21.2 | 30.8 | 34.7 | 15.6 | 11.9 | 9.0 | 10.5 | 10.1 | 8.7 | 11.9 | 10.1 | 9.7 |
| Iraq | . . . | –2.2 | 2.4 | 5.6 | 6.1 | 1.9 | 2.2 | 1.4 | 0.4 | 2.0 | 2.0 | 2.0 | –1.0 | 2.0 | 2.0 |
| Jordan | 3.8 | –0.7 | 4.8 | 4.2 | 4.5 | 4.8 | 2.9 | –0.9 | –0.8 | 3.3 | 1.5 | 2.5 | 0.8 | 2.5 | 2.5 |
| Kuwait | 2.8 | 4.6 | 4.5 | 4.9 | 3.2 | 2.7 | 3.1 | 3.7 | 3.5 | 2.5 | 2.7 | 2.7 | 3.5 | 2.5 | 2.7 |
| Lebanon | 2.3 | 1.2 | 4.0 | 5.0 | 6.6 | 4.8 | 1.9 | –3.7 | –0.8 | 3.1 | 2.5 | 2.0 | 3.1 | 3.0 | 2.0 |
| Libya[8] | –0.1 | 2.4 | 2.5 | 15.9 | 6.1 | 2.6 | 2.4 | 9.8 | 27.1 | 32.8 | 32.1 | 23.5 | 29.9 | 35.1 | 29.9 |
| Mauritania | 6.4 | 2.1 | 6.3 | 5.7 | 4.9 | 4.1 | 3.8 | 0.5 | 1.5 | 2.1 | 3.7 | 4.0 | 2.8 | 1.6 | 4.7 |
| Morocco | 1.9 | 1.0 | 1.0 | 0.9 | 1.3 | 1.9 | 0.4 | 1.5 | 1.6 | 0.9 | 1.6 | 2.0 | 1.8 | 1.1 | 1.6 |
| Oman | 2.2 | 3.5 | 3.3 | 4.0 | 2.9 | 1.2 | 1.0 | 0.1 | 1.1 | 3.2 | 3.2 | 3.1 | 1.1 | 3.2 | 3.2 |
| Pakistan | 6.2 | 19.6 | 10.1 | 13.7 | 11.0 | 7.4 | 8.6 | 4.5 | 2.9 | 4.1 | 4.8 | 5.0 | 3.2 | 3.9 | 5.0 |
| Qatar | 6.3 | –4.9 | –2.4 | 2.0 | 1.8 | 3.2 | 3.4 | 1.8 | 2.7 | 0.9 | 4.8 | 2.3 | . . . | . . . | . . . |
| Saudi Arabia | 1.0 | 4.1 | 3.8 | 3.7 | 2.9 | 3.5 | 2.7 | 2.2 | 3.5 | –0.2 | 5.0 | 2.0 | 1.7 | –0.2 | 5.0 |
| Somalia | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . | 2.3 | 2.9 | 2.7 |
| Sudan[9] | 9.1 | 11.3 | 13.0 | 18.3 | 35.4 | 36.5 | 36.9 | 16.9 | 17.8 | 26.9 | 19.0 | 14.0 | 30.5 | 21.0 | 17.0 |
| Syria[10] | 4.1 | 2.8 | 4.4 | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . |
| Tunisia | 2.7 | 3.7 | 3.3 | 3.5 | 5.1 | 5.8 | 4.9 | 4.9 | 3.7 | 4.5 | 4.4 | 3.5 | 4.2 | 4.5 | 4.1 |
| United Arab Emirates | 5.6 | 1.6 | 0.9 | 0.9 | 0.7 | 1.1 | 2.3 | 4.1 | 1.8 | 2.1 | 2.9 | 1.9 | 1.8 | 2.1 | 2.9 |
| Yemen | 11.4 | 3.7 | 11.2 | 19.5 | 9.9 | 11.0 | 8.2 | 39.4 | 5.0 | 20.0 | 29.5 | 9.0 | 22.0 | 23.0 | 24.0 |

## Table A7. Emerging Market and Developing Economies: Consumer Prices[1] *(continued)*

*(Annual percent change)*

| | Average | | | | | | | | | Projections | | | End of Period[2] | Projections | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1999–2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2022 | 2016 | 2017 | 2018 |
| **Sub-Saharan Africa** | **10.5** | **9.8** | **8.1** | **9.4** | **9.3** | **6.6** | **6.3** | **7.0** | **11.3** | **11.0** | **9.5** | **7.8** | **12.5** | **10.4** | **9.2** |
| Angola | 81.6 | 13.7 | 14.5 | 13.5 | 10.3 | 8.8 | 7.3 | 10.3 | 32.4 | 30.9 | 20.6 | 9.5 | 41.9 | 23.4 | 17.6 |
| Benin | 3.1 | 0.4 | 2.2 | 2.7 | 6.7 | 1.0 | –1.1 | 0.3 | –0.8 | 2.0 | 2.1 | 2.0 | –2.7 | 2.2 | 2.0 |
| Botswana | 8.7 | 8.1 | 6.9 | 8.5 | 7.5 | 5.9 | 4.4 | 3.1 | 2.8 | 3.7 | 3.7 | 3.9 | 3.0 | 4.4 | 3.0 |
| Burkina Faso | 2.6 | 0.9 | –0.6 | 2.8 | 3.8 | 0.5 | –0.3 | 0.9 | –0.2 | 1.5 | 2.0 | 2.0 | –1.6 | 2.0 | 2.0 |
| Burundi | 10.0 | 10.6 | 6.5 | 9.6 | 18.2 | 7.9 | 4.4 | 5.6 | 5.5 | 18.0 | 20.2 | 17.7 | 9.5 | 18.6 | 21.5 |
| Cabo Verde | 2.3 | 1.0 | 2.1 | 4.5 | 2.5 | 1.5 | –0.2 | 0.1 | –1.4 | 1.0 | 1.5 | 2.0 | –0.3 | 1.1 | 1.7 |
| Cameroon | 2.4 | 3.0 | 1.3 | 2.9 | 2.4 | 2.1 | 1.9 | 2.7 | 0.9 | 0.7 | 1.1 | 2.0 | 0.3 | 1.2 | 1.1 |
| Central African Republic | 2.9 | 3.5 | 1.5 | 1.2 | 5.9 | 6.6 | 11.6 | 4.5 | 4.6 | 3.8 | 3.7 | 3.0 | 4.7 | 3.6 | 3.6 |
| Chad | 1.6 | 10.1 | –2.1 | 1.9 | 7.7 | 0.2 | 1.7 | 6.8 | –1.1 | 0.2 | 1.9 | 3.0 | –4.9 | 0.7 | 2.3 |
| Comoros | 4.0 | 4.8 | 3.9 | 2.2 | 5.9 | 1.6 | 1.3 | 2.0 | 1.8 | 2.0 | 2.0 | 2.0 | 0.8 | 1.9 | 2.1 |
| Democratic Republic of the Congo | 77.9 | 46.1 | 23.5 | 14.9 | 0.9 | 0.9 | 1.2 | 1.0 | 18.2 | 41.7 | 44.0 | 10.0 | 23.6 | 50.0 | 40.0 |
| Republic of Congo | 2.7 | 4.3 | 0.4 | 1.8 | 5.0 | 4.6 | 0.9 | 2.7 | 3.6 | –0.4 | –1.1 | 2.4 | 0.8 | –1.3 | –0.9 |
| Côte d'Ivoire | 3.0 | 1.0 | 1.4 | 4.9 | 1.3 | 2.6 | 0.4 | 1.2 | 0.7 | 1.0 | 2.0 | 2.0 | 1.1 | 1.5 | 2.0 |
| Equatorial Guinea | 5.0 | 5.7 | 5.3 | 4.8 | 3.4 | 3.2 | 4.3 | 1.7 | 1.4 | 1.7 | 1.8 | 2.1 | 1.6 | 1.7 | 1.9 |
| Eritrea | 16.3 | 33.0 | 11.2 | 3.9 | 6.0 | 6.5 | 10.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 |
| Ethiopia | 10.2 | 8.5 | 8.1 | 33.2 | 24.1 | 8.1 | 7.4 | 10.1 | 7.3 | 8.1 | 8.0 | 7.5 | 6.7 | 9.2 | 7.5 |
| Gabon | 0.7 | 1.9 | 1.4 | 1.3 | 2.7 | 0.5 | 4.5 | –0.1 | 2.1 | 2.5 | 2.5 | 2.5 | 4.1 | 2.5 | 2.5 |
| The Gambia | 6.5 | 4.6 | 5.0 | 4.8 | 4.6 | 5.2 | 6.3 | 6.8 | 7.2 | 8.3 | 7.1 | 4.7 | 7.9 | 7.6 | 6.4 |
| Ghana | 17.7 | 13.1 | 6.7 | 7.7 | 7.1 | 11.7 | 15.5 | 17.2 | 17.5 | 11.8 | 9.0 | 6.0 | 15.4 | 10.0 | 8.0 |
| Guinea | 15.1 | 4.7 | 15.5 | 21.4 | 15.2 | 11.9 | 9.7 | 8.2 | 8.2 | 8.5 | 8.2 | 7.9 | 8.7 | 8.2 | 8.0 |
| Guinea-Bissau | 3.0 | –1.6 | 1.1 | 5.1 | 2.1 | 0.8 | –1.0 | 1.5 | 1.5 | 2.8 | 2.5 | 2.5 | 1.6 | 2.5 | 2.5 |
| Kenya | 6.8 | 10.6 | 4.3 | 14.0 | 9.4 | 5.7 | 6.9 | 6.6 | 6.3 | 8.0 | 5.2 | 5.0 | 6.3 | 5.1 | 5.2 |
| Lesotho | 7.5 | 5.8 | 3.3 | 6.0 | 5.5 | 5.0 | 4.6 | 4.3 | 6.4 | 6.6 | 6.0 | 5.0 | 4.4 | 6.5 | 6.0 |
| Liberia | . . . | 7.4 | 7.3 | 8.5 | 6.8 | 7.6 | 9.9 | 7.7 | 8.8 | 12.8 | 9.9 | 7.1 | 12.5 | 12.4 | 9.1 |
| Madagascar | 10.3 | 9.0 | 9.2 | 9.5 | 5.7 | 5.8 | 6.1 | 7.4 | 6.7 | 7.8 | 6.8 | 5.0 | 7.0 | 7.7 | 6.8 |
| Malawi | 17.4 | 8.4 | 7.4 | 7.6 | 21.3 | 28.3 | 23.8 | 21.9 | 21.7 | 13.0 | 9.6 | 3.9 | 20.0 | 11.1 | 8.3 |
| Mali | 2.2 | 2.2 | 1.3 | 3.1 | 5.3 | –0.6 | 0.9 | 1.4 | –1.8 | 0.2 | 1.2 | 2.2 | –0.8 | 1.0 | 1.4 |
| Mauritius | 6.4 | 2.5 | 2.9 | 6.5 | 3.9 | 3.5 | 3.2 | 1.3 | 1.0 | 4.2 | 5.0 | 3.1 | 2.3 | 5.0 | 4.0 |
| Mozambique | 10.5 | 3.3 | 12.7 | 10.4 | 2.1 | 4.2 | 2.3 | 2.4 | 19.2 | 17.5 | 10.5 | 5.5 | 21.1 | 14.0 | 8.0 |
| Namibia | 7.6 | 9.5 | 4.9 | 5.0 | 6.7 | 5.6 | 5.3 | 3.4 | 6.7 | 6.0 | 5.8 | 5.8 | 7.3 | 6.0 | 5.8 |
| Niger | 2.4 | 4.3 | –2.8 | 2.9 | 0.5 | 2.3 | –0.9 | 1.0 | 0.3 | 1.0 | 2.1 | 2.0 | –2.4 | 2.0 | 2.0 |
| Nigeria | 11.6 | 12.5 | 13.7 | 10.8 | 12.2 | 8.5 | 8.0 | 9.0 | 15.7 | 16.3 | 14.8 | 14.5 | 18.5 | 16.0 | 15.1 |
| Rwanda | 6.8 | 10.3 | 2.3 | 5.7 | 6.3 | 4.2 | 1.8 | 2.5 | 5.7 | 7.1 | 6.0 | 5.0 | 7.3 | 7.0 | 5.0 |
| São Tomé and Príncipe | 15.3 | 17.0 | 13.3 | 14.3 | 10.6 | 8.1 | 7.0 | 5.3 | 5.4 | 4.5 | 5.2 | 3.2 | 5.1 | 5.5 | 5.0 |
| Senegal | 2.3 | –2.2 | 1.2 | 3.4 | 1.4 | 0.7 | –1.1 | 0.1 | 0.9 | 2.1 | 2.2 | 2.2 | 2.1 | 2.0 | 2.2 |
| Seychelles | 6.3 | 31.8 | –2.4 | 2.6 | 7.1 | 4.3 | 1.4 | 4.0 | –1.0 | 2.8 | 2.3 | 3.0 | –0.2 | 3.0 | 3.2 |
| Sierra Leone | 9.8 | 9.2 | 17.8 | 18.5 | 13.8 | 9.8 | 8.3 | 9.0 | 11.5 | 16.9 | 10.6 | 7.7 | 17.4 | 12.0 | 9.5 |
| South Africa | 5.8 | 7.1 | 4.3 | 5.0 | 5.6 | 5.8 | 6.1 | 4.6 | 6.3 | 5.4 | 5.3 | 5.5 | 6.7 | 5.2 | 5.4 |
| South Sudan | . . . | . . . | . . . | . . . | 45.1 | 0.0 | 1.7 | 52.8 | 379.8 | 182.2 | 45.0 | 7.5 | 479.7 | 111.4 | 25.0 |
| Swaziland | 7.4 | 7.4 | 4.5 | 6.1 | 8.9 | 5.6 | 5.7 | 5.0 | 8.0 | 7.0 | 5.4 | 5.5 | 9.0 | 6.5 | 4.4 |
| Tanzania | 6.1 | 12.1 | 7.2 | 12.7 | 16.0 | 7.9 | 6.1 | 5.6 | 5.2 | 5.4 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| Togo | 2.6 | 3.7 | 1.4 | 3.6 | 2.6 | 1.8 | 0.2 | 1.8 | 0.9 | 0.8 | 1.2 | 2.0 | 0.5 | . . . | . . . |
| Uganda | 5.7 | 13.0 | 3.7 | 15.0 | 12.7 | 4.9 | 3.1 | 5.4 | 5.5 | 5.8 | 5.6 | 5.0 | 5.7 | 5.9 | 5.3 |
| Zambia | 18.5 | 13.4 | 8.5 | 8.7 | 6.6 | 7.0 | 7.8 | 10.1 | 17.9 | 6.8 | 7.4 | 8.0 | 7.5 | 5.8 | 8.0 |
| Zimbabwe[11] | –7.4 | 6.2 | 3.0 | 3.5 | 3.7 | 1.6 | –0.2 | –2.4 | –1.6 | 2.5 | 9.5 | 4.0 | –0.9 | 7.0 | 10.0 |

[1]Movements in consumer prices are shown as annual averages.
[2]Monthly year-over-year changes and, for several countries, on a quarterly basis.
[3]For many countries, inflation for the earlier years is measured on the basis of a retail price index. Consumer price index (CPI) inflation data with broader and more up-to-date coverage are typically used for more recent years.
[4]Georgia, Turkmenistan, and Ukraine, which are not members of the Commonwealth of Independent States, are included in the group for reasons of geography and similarity in economic structure.
[5]Starting in 2014 data exclude Crimea and Sevastopol.
[6]Based on Eurostat's harmonized index of consumer prices.
[7]Excludes Argentina and Venezuela.
[8]See country-specific notes for Argentina, Libya, and Venezuela in the "Country Notes" section of the Statistical Appendix.
[9]Data for 2011 exclude South Sudan after July 9. Data for 2012 and onward pertain to the current Sudan.
[10]Data for Syria are excluded for 2011 onward owing to the uncertain political situation.
[11]The Zimbabwe dollar ceased circulating in early 2009. Data are based on IMF staff estimates of price and exchange rate developments in US dollars. IMF staff estimates of US dollar values may differ from authorities' estimates.

## Table A8. Major Advanced Economies: General Government Fiscal Balances and Debt[1]

*(Percent of GDP unless noted otherwise)*

| | Average 1999–2008 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | Projections 2017 | 2018 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Major Advanced Economies** | | | | | | | | | | |
| Net Lending/Borrowing | –3.4 | –7.3 | –6.3 | –4.2 | –3.6 | –3.0 | –3.5 | –3.4 | –2.9 | –2.7 |
| Output Gap[2] | 0.9 | –2.4 | –2.1 | –1.9 | –1.4 | –0.7 | –0.7 | –0.1 | 0.2 | 0.3 |
| Structural Balance[2] | –3.8 | –6.3 | –5.1 | –3.7 | –3.1 | –2.8 | –3.1 | –3.3 | –2.9 | –2.8 |
| **United States** | | | | | | | | | | |
| Net Lending/Borrowing[3] | –3.5 | –9.6 | –7.9 | –4.4 | –4.0 | –3.5 | –4.4 | –4.3 | –3.7 | –4.3 |
| Output Gap[2] | 1.8 | –3.1 | –2.2 | –1.9 | –1.1 | 0.0 | –0.1 | 0.3 | 0.7 | 0.6 |
| Structural Balance[2] | –4.0 | –8.2 | –6.4 | –4.4 | –3.8 | –3.6 | –4.1 | –4.4 | –4.0 | –4.5 |
| Net Debt | 43.2 | 76.8 | 80.2 | 81.6 | 80.8 | 80.2 | 81.3 | 82.5 | 81.1 | 82.8 |
| Gross Debt | 62.6 | 100.0 | 103.4 | 105.4 | 105.1 | 105.2 | 107.1 | 108.1 | 107.8 | 109.6 |
| **Euro Area** | | | | | | | | | | |
| Net Lending/Borrowing | –2.0 | –4.2 | –3.6 | –3.0 | –2.6 | –2.1 | –1.5 | –1.3 | –1.0 | –0.1 |
| Output Gap[2] | 0.9 | –0.5 | –1.9 | –2.8 | –2.4 | –1.9 | –1.3 | –0.5 | 0.0 | 0.6 |
| Structural Balance[2] | –2.5 | –3.9 | –2.1 | –1.3 | –1.1 | –0.9 | –0.8 | –0.9 | –0.9 | –0.4 |
| Net Debt | 54.5 | 68.5 | 72.2 | 74.6 | 74.9 | 73.9 | 73.3 | 71.8 | 70.3 | 62.7 |
| Gross Debt | 67.9 | 86.1 | 89.5 | 91.4 | 91.9 | 90.0 | 89.0 | 87.4 | 85.6 | 76.3 |
| **Germany** | | | | | | | | | | |
| Net Lending/Borrowing | –2.1 | –1.0 | 0.0 | –0.1 | 0.3 | 0.6 | 0.8 | 0.7 | 0.8 | 1.1 |
| Output Gap[2] | 0.1 | 1.0 | 0.5 | –0.3 | 0.1 | 0.1 | 0.4 | 0.8 | 1.0 | 0.8 |
| Structural Balance[2] | –2.2 | –1.3 | –0.2 | 0.1 | 0.5 | 0.6 | 0.6 | 0.3 | 0.2 | 0.7 |
| Net Debt | 50.3 | 58.7 | 58.2 | 57.0 | 53.5 | 50.5 | 48.3 | 45.8 | 43.2 | 33.7 |
| Gross Debt | 62.6 | 78.7 | 79.9 | 77.5 | 74.7 | 70.9 | 68.1 | 65.0 | 61.8 | 50.1 |
| **France** | | | | | | | | | | |
| Net Lending/Borrowing | –2.6 | –5.1 | –4.8 | –4.0 | –3.9 | –3.6 | –3.4 | –3.0 | –3.0 | –0.8 |
| Output Gap[2] | 0.5 | –1.1 | –1.9 | –2.4 | –2.5 | –2.4 | –2.2 | –1.8 | –1.3 | 0.3 |
| Structural Balance[2] | –3.0 | –4.4 | –3.4 | –2.4 | –2.3 | –2.0 | –1.9 | –1.8 | –2.2 | –1.0 |
| Net Debt | 54.6 | 76.9 | 80.6 | 83.5 | 86.1 | 86.9 | 87.8 | 88.5 | 88.7 | 82.9 |
| Gross Debt | 63.1 | 85.2 | 89.5 | 92.3 | 94.9 | 95.6 | 96.3 | 96.8 | 97.0 | 91.2 |
| **Italy** | | | | | | | | | | |
| Net Lending/Borrowing | –2.9 | –3.7 | –2.9 | –2.9 | –3.0 | –2.7 | –2.4 | –2.2 | –1.3 | 0.0 |
| Output Gap[2] | 0.2 | –0.5 | –2.8 | –4.1 | –4.1 | –3.3 | –2.7 | –1.6 | –1.0 | 0.0 |
| Structural Balance[2,4] | –3.6 | –4.1 | –1.5 | –0.6 | –1.1 | –0.9 | –1.1 | –1.4 | –0.8 | 0.0 |
| Net Debt | 94.7 | 106.8 | 111.6 | 116.7 | 118.8 | 119.8 | 120.6 | 121.2 | 119.9 | 109.6 |
| Gross Debt | 102.9 | 116.5 | 123.4 | 129.0 | 131.8 | 132.1 | 132.6 | 133.0 | 131.4 | 120.1 |
| **Japan** | | | | | | | | | | |
| Net Lending/Borrowing | –5.5 | –9.1 | –8.3 | –7.6 | –5.4 | –3.5 | –4.2 | –4.1 | –3.3 | –2.1 |
| Output Gap[2] | –0.8 | –4.6 | –3.7 | –2.2 | –2.6 | –2.1 | –1.8 | –0.9 | –0.7 | –0.7 |
| Structural Balance[2] | –5.5 | –7.5 | –7.1 | –7.1 | –5.1 | –3.9 | –3.8 | –3.9 | –3.2 | –2.0 |
| Net Debt | 64.2 | 117.9 | 120.5 | 117.4 | 119.0 | 118.4 | 119.8 | 120.9 | 120.7 | 114.6 |
| Gross Debt[5] | 165.8 | 230.6 | 236.6 | 240.5 | 242.1 | 238.1 | 239.3 | 240.3 | 240.0 | 233.9 |
| **United Kingdom** | | | | | | | | | | |
| Net Lending/Borrowing | –1.9 | –7.5 | –7.7 | –5.5 | –5.6 | –4.3 | –2.9 | –2.9 | –2.3 | –1.2 |
| Output Gap[2] | 0.8 | –2.6 | –2.6 | –2.1 | –0.7 | –0.2 | –0.1 | –0.1 | –0.2 | 0.0 |
| Structural Balance[2] | –2.5 | –5.4 | –5.7 | –3.9 | –4.8 | –4.1 | –2.8 | –2.8 | –2.2 | –1.2 |
| Net Debt | 34.9 | 73.2 | 76.4 | 77.8 | 79.7 | 80.3 | 80.1 | 80.5 | 80.6 | 76.6 |
| Gross Debt | 39.5 | 81.6 | 85.1 | 86.2 | 88.1 | 89.0 | 89.3 | 89.5 | 89.7 | 85.6 |
| **Canada** | | | | | | | | | | |
| Net Lending/Borrowing | 1.1 | –3.3 | –2.5 | –1.5 | 0.0 | –1.1 | –1.9 | –2.2 | –1.8 | –1.1 |
| Output Gap[2] | 1.6 | –1.0 | –1.3 | –0.9 | –0.5 | –1.2 | –1.5 | –0.2 | 0.4 | 0.1 |
| Structural Balance[2] | 0.3 | –2.8 | –1.8 | –1.0 | 0.0 | –0.5 | –1.1 | –2.1 | –2.1 | –1.2 |
| Net Debt | 34.1 | 27.1 | 28.2 | 29.0 | 27.2 | 25.2 | 27.4 | 24.6 | 22.7 | 14.9 |
| Gross Debt | 75.6 | 81.5 | 84.8 | 85.8 | 85.4 | 91.6 | 92.4 | 89.6 | 87.7 | 79.9 |

Note: The methodology and specific assumptions for each country are discussed in Box A1. The country group composites for fiscal data are calculated as the sum of the US dollar values for the relevant individual countries.

[1]Debt data refer to the end of the year and are not always comparable across countries. Gross and net debt levels reported by national statistical agencies for countries that have adopted the System of National Accounts (SNA) 2008 (Australia, Canada, Hong Kong SAR, United States) are adjusted to exclude unfunded pension liabilities of government employees' defined-benefit pension plans. Fiscal data for the aggregated major advanced economies and the United States start in 2001, and the average for the aggregate and the United States is therefore for the period 2001–07.

[2]Percent of potential GDP.

[3]Figures reported by the national statistical agency are adjusted to exclude items related to the accrual-basis accounting of government employees' defined-benefit pension plans.

[4]Excludes one-time measures based on the authorities' data and, if unavailable, on receipts from the sale of assets.

[5]Includes equity shares; nonconsolidated basis.

## Table A9. Summary of World Trade Volumes and Prices

*(Annual percent change)*

| | Averages | | | | | | | | | | Projections | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1999–2008 | 2009–18 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
| **Trade in Goods and Services** | | | | | | | | | | | | |
| **World Trade[1]** | | | | | | | | | | | | |
| Volume | 6.6 | 3.1 | –10.5 | 12.5 | 7.1 | 2.7 | 3.6 | 3.8 | 2.8 | 2.4 | 4.2 | 4.0 |
| Price Deflator | | | | | | | | | | | | |
| In US Dollars | 4.4 | –1.2 | –10.4 | 5.5 | 11.2 | –1.6 | –0.7 | –1.8 | –13.3 | –4.1 | 3.8 | 2.3 |
| In SDRs | 2.9 | 0.0 | –8.2 | 6.6 | 7.4 | 1.4 | 0.1 | –1.7 | –5.9 | –3.5 | 4.2 | 0.5 |
| **Volume of Trade** | | | | | | | | | | | | |
| Exports | | | | | | | | | | | | |
| Advanced Economies | 5.6 | 2.8 | –11.1 | 12.1 | 6.0 | 2.3 | 3.2 | 4.0 | 3.8 | 2.2 | 3.8 | 3.6 |
| Emerging Market and Developing Economies | 8.8 | 3.8 | –8.0 | 13.7 | 8.6 | 3.5 | 4.8 | 3.2 | 1.8 | 2.5 | 4.8 | 4.5 |
| Imports | | | | | | | | | | | | |
| Advanced Economies | 5.6 | 2.6 | –11.6 | 11.4 | 5.1 | 1.2 | 2.4 | 3.8 | 4.6 | 2.7 | 4.0 | 3.8 |
| Emerging Market and Developing Economies | 9.9 | 4.0 | –9.3 | 14.6 | 11.5 | 5.2 | 5.2 | 4.3 | –0.9 | 2.0 | 4.4 | 4.9 |
| **Terms of Trade** | | | | | | | | | | | | |
| Advanced Economies | –0.5 | 0.3 | 2.5 | –0.9 | –1.6 | –0.7 | 0.9 | 0.3 | 1.9 | 0.9 | –0.4 | 0.2 |
| Emerging Market and Developing Economies | 2.7 | –0.6 | –5.7 | 2.1 | 4.2 | 0.5 | –0.6 | –0.6 | –4.3 | –1.2 | 0.1 | –0.5 |
| **Trade in Goods** | | | | | | | | | | | | |
| **World Trade[1]** | | | | | | | | | | | | |
| Volume | 6.7 | 3.0 | –11.7 | 14.5 | 7.0 | 2.3 | 3.3 | 3.1 | 2.3 | 2.3 | 4.3 | 4.1 |
| Price Deflator | | | | | | | | | | | | |
| In US Dollars | 4.5 | –1.4 | –11.7 | 6.4 | 12.6 | –1.7 | –1.2 | –2.5 | –14.4 | –4.8 | 4.3 | 2.1 |
| In SDRs | 2.9 | –0.3 | –9.5 | 7.6 | 8.8 | 1.3 | –0.5 | –2.4 | –7.1 | –4.2 | 4.7 | 0.4 |
| **World Trade Prices in US Dollars[2]** | | | | | | | | | | | | |
| Manufactures | 1.7 | –0.1 | –1.4 | 2.3 | 4.2 | 2.8 | –3.0 | –0.4 | –2.3 | –5.2 | 1.5 | 1.0 |
| Oil | 22.2 | –6.4 | –36.3 | 27.9 | 31.6 | 1.0 | –0.9 | –7.5 | –47.2 | –15.7 | 17.4 | –0.2 |
| Nonfuel Primary Commodities | 6.2 | –0.7 | –16.0 | 26.6 | 18.0 | –10.1 | –1.4 | –3.9 | –17.5 | –1.8 | 7.1 | 0.5 |
| Food | 5.6 | –0.5 | –15.2 | 12.1 | 20.3 | –2.6 | 0.7 | –4.1 | –17.2 | 2.1 | 3.6 | 1.1 |
| Beverages | 2.4 | –0.1 | 1.6 | 14.1 | 16.6 | –18.6 | –11.9 | 20.7 | –3.1 | –5.0 | –8.7 | 0.6 |
| Agricultural Raw Materials | 1.9 | –0.1 | –17.1 | 33.2 | 22.7 | –12.7 | 1.6 | 2.0 | –13.5 | –5.7 | 2.1 | –2.5 |
| Metal | 11.8 | –1.4 | –19.2 | 48.2 | 13.5 | –16.8 | –4.3 | –10.1 | –23.0 | –5.4 | 20.6 | 1.4 |
| **World Trade Prices in SDRs[2]** | | | | | | | | | | | | |
| Manufactures | 0.2 | 1.1 | 1.0 | 3.3 | 0.7 | 6.0 | –2.2 | –0.4 | 6.1 | –4.5 | 1.9 | –0.7 |
| Oil | 20.3 | –5.3 | –34.8 | 29.3 | 27.2 | 4.1 | –0.1 | –7.5 | –42.7 | –15.1 | 17.8 | –1.9 |
| Nonfuel Primary Commodities | 4.6 | 0.5 | –13.9 | 28.0 | 14.1 | –7.3 | –0.6 | –3.8 | –10.4 | –1.2 | 7.5 | –1.2 |
| Food | 4.0 | 0.7 | –13.1 | 13.3 | 16.2 | 0.4 | 1.5 | –4.0 | –10.2 | 2.8 | 4.0 | –0.6 |
| Beverages | 0.9 | 1.1 | 4.1 | 15.3 | 12.7 | –16.1 | –11.2 | 20.8 | 5.2 | –4.4 | –8.4 | –1.1 |
| Agricultural Raw Materials | 0.4 | 1.1 | –15.1 | 34.6 | 18.5 | –10.0 | 2.4 | 2.0 | –6.1 | –5.1 | 2.4 | –4.1 |
| Metal | 10.1 | –0.3 | –17.2 | 49.8 | 9.7 | –14.3 | –3.5 | –10.1 | –16.4 | –4.8 | 21.1 | –0.3 |
| **World Trade Prices in Euros[2]** | | | | | | | | | | | | |
| Manufactures | –1.1 | 2.2 | 4.2 | 7.3 | –0.6 | 11.3 | –6.1 | –0.5 | 17.1 | –4.9 | –0.4 | –3.2 |
| Oil | 18.8 | –4.3 | –32.7 | 34.3 | 25.5 | 9.3 | –4.1 | –7.6 | –36.8 | –15.4 | 15.2 | –4.3 |
| Nonfuel Primary Commodities | 3.3 | 1.6 | –11.2 | 32.9 | 12.6 | –2.7 | –4.5 | –3.9 | –1.2 | –1.6 | 5.0 | –3.6 |
| Food | 2.7 | 1.8 | –10.4 | 17.7 | 14.7 | 5.4 | –2.5 | –4.1 | –0.9 | 2.4 | 1.7 | –3.1 |
| Beverages | –0.4 | 2.2 | 7.3 | 19.8 | 11.2 | –11.9 | –14.7 | 20.7 | 16.1 | –4.8 | –10.5 | –3.5 |
| Agricultural Raw Materials | –0.9 | 2.2 | –12.5 | 39.8 | 17.0 | –5.5 | –1.7 | 1.9 | 3.6 | –5.5 | 0.1 | –6.5 |
| Metal | 8.7 | 0.8 | –14.6 | 55.5 | 8.3 | –10.0 | –7.3 | –10.2 | –7.8 | –5.2 | 18.4 | –2.8 |

## Table A9. Summary of World Trade Volumes and Prices *(continued)*

*(Annual percent change)*

| | Averages | | | | | | | | | | Projections | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1999–2008 | 2009–18 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
| **Trade in Goods** | | | | | | | | | | | | |
| **Volume of Trade** | | | | | | | | | | | | |
| Exports | | | | | | | | | | | | |
| Advanced Economies | 5.6 | 2.7 | –13.0 | 14.9 | 6.0 | 1.9 | 2.7 | 3.4 | 3.1 | 1.9 | 4.1 | 3.6 |
| Emerging Market and Developing Economies | 8.9 | 3.7 | –8.3 | 15.1 | 7.6 | 3.8 | 4.7 | 2.7 | 1.5 | 2.6 | 4.4 | 4.3 |
| Fuel Exporters | 5.7 | 1.8 | –6.5 | 6.5 | 5.7 | 2.7 | 2.0 | –0.6 | 3.5 | 1.3 | 0.1 | 3.4 |
| Nonfuel Exporters | 10.1 | 4.4 | –9.1 | 18.5 | 8.4 | 4.2 | 5.9 | 4.1 | 0.8 | 3.0 | 5.5 | 4.6 |
| Imports | | | | | | | | | | | | |
| Advanced Economies | 5.7 | 2.4 | –12.7 | 13.1 | 5.3 | 0.3 | 2.1 | 3.5 | 3.7 | 2.3 | 4.5 | 3.9 |
| Emerging Market and Developing Economies | 9.9 | 3.8 | –10.7 | 15.6 | 11.1 | 5.0 | 4.8 | 2.6 | –0.3 | 2.4 | 4.4 | 5.0 |
| Fuel Exporters | 11.4 | 0.5 | –16.0 | 8.0 | 11.6 | 8.2 | 4.0 | 0.7 | –8.0 | –4.4 | 0.4 | 3.2 |
| Nonfuel Exporters | 9.6 | 4.5 | –9.4 | 17.6 | 11.0 | 4.3 | 5.0 | 3.0 | 1.5 | 3.8 | 5.2 | 5.3 |
| **Price Deflators in SDRs** | | | | | | | | | | | | |
| Exports | | | | | | | | | | | | |
| Advanced Economies | 1.7 | –0.3 | –7.4 | 4.3 | 6.4 | –0.3 | 0.3 | –2.0 | –6.1 | –2.2 | 4.0 | 1.2 |
| Emerging Market and Developing Economies | 6.6 | –0.3 | –13.1 | 12.7 | 13.3 | 3.1 | –1.3 | –3.2 | –9.1 | –7.0 | 5.7 | –0.9 |
| Fuel Exporters | 14.6 | –3.1 | –25.9 | 21.6 | 25.6 | 4.5 | –2.4 | –6.7 | –30.0 | –13.1 | 12.8 | –1.2 |
| Nonfuel Exporters | 3.7 | 0.6 | –6.9 | 9.1 | 8.4 | 2.5 | –0.8 | –1.6 | –1.0 | –5.4 | 3.9 | –0.8 |
| Imports | | | | | | | | | | | | |
| Advanced Economies | 2.5 | –0.6 | –10.7 | 6.3 | 8.7 | 1.0 | –0.5 | –2.1 | –7.9 | –3.4 | 4.1 | 0.8 |
| Emerging Market and Developing Economies | 3.7 | 0.4 | –7.2 | 10.8 | 8.3 | 2.6 | –0.7 | –2.7 | –5.2 | –5.8 | 5.6 | –0.4 |
| Fuel Exporters | 3.3 | 0.9 | –2.1 | 8.2 | 6.6 | 3.5 | 0.0 | –2.4 | –3.2 | –3.9 | 3.4 | –0.3 |
| Nonfuel Exporters | 3.8 | 0.2 | –8.4 | 11.4 | 8.7 | 2.4 | –0.9 | –2.8 | –5.6 | –6.2 | 6.1 | –0.5 |
| **Terms of Trade** | | | | | | | | | | | | |
| Advanced Economies | –0.8 | 0.3 | 3.7 | –1.9 | –2.1 | –1.2 | 0.9 | 0.1 | 1.9 | 1.3 | 0.0 | 0.4 |
| Emerging Market and Developing Economies | 2.8 | –0.7 | –6.3 | 1.7 | 4.6 | 0.5 | –0.6 | –0.5 | –4.2 | –1.3 | 0.1 | –0.4 |
| **Regional Groups** | | | | | | | | | | | | |
| Commonwealth of Independent States[3] | 7.6 | –3.2 | –25.8 | 12.8 | 20.7 | 1.8 | –6.6 | –1.5 | –20.0 | –12.1 | 9.1 | –0.4 |
| Emerging and Developing Asia | –1.6 | 0.5 | 2.6 | –6.1 | –2.3 | 1.2 | 0.9 | 2.3 | 8.8 | 0.4 | –2.5 | 0.0 |
| Emerging and Developing Europe | 0.1 | 0.1 | 3.6 | –3.7 | –1.9 | –1.1 | 1.5 | 1.3 | 2.7 | 1.6 | –3.6 | 1.4 |
| Latin America and the Caribbean | 3.7 | –0.8 | –5.4 | 8.6 | 5.6 | –1.3 | –1.4 | –2.4 | –9.0 | 1.8 | –0.2 | –2.6 |
| Middle East, North Africa, Afghanistan, and Pakistan | 9.5 | –3.5 | –17.9 | 7.6 | 13.5 | 0.3 | –0.3 | –4.7 | –26.5 | –6.4 | 6.9 | –0.3 |
| Middle East and North Africa | 10.0 | –3.6 | –18.3 | 7.5 | 13.7 | 0.9 | –0.3 | –4.7 | –27.3 | –7.0 | 7.2 | –0.7 |
| Sub-Saharan Africa | 5.4 | –1.2 | –11.0 | 12.0 | 11.6 | –1.9 | –0.2 | –3.3 | –15.9 | –2.2 | 4.1 | –1.4 |
| **Analytical Groups** | | | | | | | | | | | | |
| **By Source of Export Earnings** | | | | | | | | | | | | |
| Fuel | 10.9 | –4.0 | –24.3 | 12.4 | 17.8 | 1.0 | –2.4 | –4.4 | –27.7 | –9.6 | 9.1 | –1.0 |
| Nonfuel | –0.1 | 0.4 | 1.6 | –2.1 | –0.3 | 0.1 | 0.1 | 1.2 | 4.8 | 0.9 | –2.0 | –0.3 |
| *Memorandum* | | | | | | | | | | | | |
| **World Exports in Billions of US Dollars** | | | | | | | | | | | | |
| Goods and Services | 11,471 | 21,362 | 15,750 | 18,707 | 22,275 | 22,505 | 23,223 | 23,647 | 20,996 | 20,614 | 22,260 | 23,645 |
| Goods | 9,123 | 16,743 | 12,234 | 14,908 | 17,930 | 18,061 | 18,489 | 18,585 | 16,185 | 15,756 | 17,122 | 18,160 |
| Average Oil Price[4] | 22.2 | –6.4 | –36.3 | 27.9 | 31.6 | 1.0 | –0.9 | –7.5 | –47.2 | –15.7 | 17.4 | –0.2 |
| In US Dollars a Barrel | 44.79 | 74.42 | 61.78 | 79.03 | 104.01 | 105.01 | 104.07 | 96.25 | 50.79 | 42.84 | 50.28 | 50.17 |
| Export Unit Value of Manufactures[5] | 1.7 | –0.1 | –1.4 | 2.3 | 4.2 | 2.8 | –3.0 | –0.4 | –2.3 | –5.2 | 1.5 | 1.0 |

[1]Average of annual percent change for world exports and imports.

[2]As represented, respectively, by the export unit value index for manufactures of the advanced economies and accounting for 83 percent of the advanced economies' trade (export of goods) weights; the average of UK Brent, Dubai Fateh, and West Texas Intermediate crude oil prices; and the average of world market prices for nonfuel primary commodities weighted by their 2002–04 shares in world commodity exports.

[3]Georgia, Turkmenistan, and Ukraine, which are not members of the Commonwealth of Independent States, are included in this group for reasons of geography and similarity in economic structure.

[4]Percent change of average of UK Brent, Dubai Fateh, and West Texas Intermediate crude oil prices.

[5]Percent change for manufactures exported by the advanced economies.

## Table A10. Summary of Current Account Balances

*(Billions of US dollars)*

| | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | Projections 2017 | 2018 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Advanced Economies** | **–78.5** | **13.9** | **–29.1** | **28.3** | **238.5** | **251.9** | **325.1** | **361.1** | **390.6** | **368.3** | **388.4** |
| United States | –372.5 | –430.7 | –444.6 | –426.2 | –349.5 | –373.8 | –434.6 | –451.7 | –462.0 | –528.7 | –578.5 |
| Euro Area | –9.3 | 0.4 | –0.8 | 177.1 | 291.3 | 332.3 | 373.3 | 412.7 | 382.7 | 402.9 | 399.8 |
| Germany | 196.7 | 192.3 | 229.7 | 248.9 | 251.8 | 289.7 | 288.5 | 290.4 | 296.0 | 304.3 | 307.6 |
| France | –22.5 | –22.2 | –28.3 | –32.7 | –24.6 | –36.2 | –10.7 | –24.7 | –28.9 | –21.4 | –1.7 |
| Italy | –41.4 | –72.7 | –68.6 | –7.5 | 20.5 | 40.5 | 26.3 | 47.3 | 52.8 | 47.5 | 16.8 |
| Spain | –64.3 | –56.2 | –47.4 | –3.1 | 20.7 | 14.9 | 16.3 | 23.8 | 24.3 | 28.3 | 31.9 |
| Japan | 145.3 | 221.0 | 129.8 | 59.7 | 45.9 | 36.8 | 134.1 | 188.1 | 175.0 | 191.1 | 201.9 |
| United Kingdom | –70.1 | –66.6 | –46.6 | –97.4 | –119.6 | –140.0 | –122.7 | –114.5 | –91.4 | –86.6 | –74.0 |
| Canada | –40.4 | –58.2 | –49.6 | –65.7 | –59.4 | –43.6 | –52.8 | –50.5 | –55.6 | –51.2 | –43.7 |
| Other Advanced Economies[1] | 206.9 | 287.0 | 270.7 | 279.4 | 354.6 | 371.9 | 371.1 | 369.8 | 373.1 | 366.6 | 398.9 |
| **Emerging Market and Developing Economies** | **238.8** | **277.6** | **374.3** | **357.6** | **173.2** | **168.4** | **–51.1** | **–96.2** | **–92.0** | **–147.2** | **–387.2** |
| **Regional Groups** | | | | | | | | | | | |
| Commonwealth of Independent States[2] | 42.9 | 68.5 | 107.3 | 67.6 | 17.3 | 57.0 | 53.0 | –0.2 | 18.1 | 26.8 | 56.1 |
| Russia | 50.4 | 67.5 | 97.3 | 71.3 | 33.4 | 57.5 | 68.8 | 25.5 | 41.5 | 48.4 | 72.6 |
| Excluding Russia | –7.4 | 1.0 | 10.0 | –3.7 | –16.1 | –0.5 | –15.9 | –25.8 | –23.4 | –21.5 | –16.5 |
| Emerging and Developing Asia | 274.3 | 233.4 | 100.2 | 122.3 | 99.4 | 230.9 | 313.1 | 222.7 | 155.8 | 125.1 | –97.4 |
| China | 243.3 | 237.8 | 136.1 | 215.4 | 148.2 | 236.0 | 304.2 | 196.4 | 162.5 | 152.0 | 28.8 |
| India | –38.4 | –47.9 | –76.4 | –87.8 | –32.3 | –26.8 | –22.1 | –15.2 | –33.7 | –40.5 | –95.1 |
| ASEAN-5[3] | 66.1 | 45.4 | 49.4 | 6.4 | –3.6 | 22.3 | 30.8 | 45.9 | 36.9 | 27.9 | –12.1 |
| Emerging and Developing Europe | –53.9 | –86.9 | –119.5 | –81.9 | –72.0 | –59.0 | –35.8 | –32.6 | –45.7 | –52.0 | –70.3 |
| Latin America and the Caribbean | –34.5 | –97.9 | –114.8 | –135.4 | –165.0 | –184.1 | –172.9 | –99.0 | –107.9 | –131.4 | –181.4 |
| Brazil | –26.3 | –75.8 | –77.0 | –74.2 | –74.8 | –104.2 | –59.4 | –23.5 | –29.0 | –39.2 | –52.9 |
| Mexico | –8.6 | –5.6 | –13.2 | –15.8 | –31.1 | –23.1 | –28.8 | –23.0 | –19.8 | –25.2 | –34.2 |
| Middle East, North Africa, Afghanistan, and Pakistan | 36.0 | 170.5 | 413.1 | 412.1 | 331.8 | 190.1 | –116.5 | –128.2 | –60.1 | –54.4 | –5.6 |
| Sub-Saharan Africa | –26.0 | –10.0 | –11.9 | –27.1 | –38.4 | –66.6 | –92.0 | –58.9 | –52.2 | –61.4 | –88.6 |
| South Africa | –8.1 | –5.6 | –9.2 | –20.3 | –21.6 | –18.7 | –14.0 | –9.6 | –9.8 | –11.8 | –15.8 |
| **Analytical Groups** | | | | | | | | | | | |
| **By Source of Export Earnings** | | | | | | | | | | | |
| Fuel | 131.3 | 309.5 | 616.8 | 597.1 | 462.1 | 308.4 | –68.5 | –85.7 | 10.9 | 18.2 | 99.0 |
| Nonfuel | 109.0 | –30.1 | –242.5 | –239.5 | –288.9 | –140.0 | 17.4 | –10.5 | –102.9 | –165.5 | –486.2 |
| Of Which, Primary Products | –2.5 | –9.4 | –26.0 | –61.3 | –76.9 | –50.2 | –52.8 | –40.5 | –48.8 | –55.8 | –81.6 |
| **By External Financing Source** | | | | | | | | | | | |
| Net Debtor Economies | –165.1 | –282.3 | –385.3 | –430.7 | –399.2 | –365.9 | –301.5 | –209.2 | –248.5 | –295.9 | –468.5 |
| **Net Debtor Economies by Debt-Servicing Experience** | | | | | | | | | | | |
| Economies with Arrears and/or Rescheduling during 2012–16 | –27.0 | –19.6 | –31.7 | –46.4 | –48.9 | –34.6 | –43.3 | –49.5 | –35.5 | –33.6 | –55.0 |
| *Memorandum* | | | | | | | | | | | |
| **World** | **160.3** | **291.5** | **345.2** | **385.9** | **411.7** | **420.3** | **274.0** | **264.9** | **298.6** | **221.0** | **1.2** |
| European Union | –19.9 | 2.1 | 78.0 | 203.8 | 300.5 | 310.2 | 359.9 | 359.7 | 404.9 | 432.7 | 431.1 |
| Low-Income Developing Countries | –17.4 | –15.2 | –21.7 | –31.2 | –41.2 | –48.1 | –77.0 | –44.5 | –43.8 | –54.9 | –97.5 |
| Middle East and North Africa | 40.2 | 170.0 | 408.1 | 414.5 | 334.2 | 192.1 | –114.4 | –124.7 | –49.0 | –38.6 | 8.4 |

## Table A10. Summary of Current Account Balances *(continued)*
*(Percent of GDP)*

| | | | | | | | | | Projections | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2022 |
| **Advanced Economies** | **–0.2** | **0.0** | **–0.1** | **0.1** | **0.5** | **0.5** | **0.7** | **0.8** | **0.8** | **0.7** | **0.7** |
| United States | –2.6 | –2.9 | –2.9 | –2.6 | –2.1 | –2.1 | –2.4 | –2.4 | –2.4 | –2.6 | –2.5 |
| Euro Area | –0.1 | 0.0 | 0.0 | 1.4 | 2.2 | 2.5 | 3.2 | 3.5 | 3.1 | 3.0 | 2.6 |
| Germany | 5.7 | 5.6 | 6.1 | 7.0 | 6.7 | 7.4 | 8.5 | 8.3 | 8.1 | 7.7 | 6.9 |
| France | –0.8 | –0.8 | –1.0 | –1.2 | –0.9 | –1.3 | –0.4 | –1.0 | –1.1 | –0.8 | –0.1 |
| Italy | –1.9 | –3.4 | –3.0 | –0.4 | 1.0 | 1.9 | 1.4 | 2.6 | 2.7 | 2.3 | 0.7 |
| Spain | –4.3 | –3.9 | –3.2 | –0.2 | 1.5 | 1.1 | 1.4 | 1.9 | 1.9 | 2.0 | 2.0 |
| Japan | 2.8 | 3.9 | 2.1 | 1.0 | 0.9 | 0.8 | 3.1 | 3.8 | 3.6 | 3.8 | 3.7 |
| United Kingdom | –3.0 | –2.7 | –1.8 | –3.7 | –4.4 | –4.7 | –4.3 | –4.4 | –3.6 | –3.3 | –2.5 |
| Canada | –2.9 | –3.6 | –2.8 | –3.6 | –3.2 | –2.4 | –3.4 | –3.3 | –3.4 | –2.9 | –2.1 |
| Other Advanced Economies[1] | 4.2 | 5.0 | 4.1 | 4.2 | 5.2 | 5.4 | 5.9 | 5.7 | 5.4 | 5.0 | 4.7 |
| **Emerging Market and Developing Economies** | **1.3** | **1.2** | **1.4** | **1.3** | **0.6** | **0.5** | **–0.2** | **–0.3** | **–0.3** | **–0.4** | **–0.9** |
| **Regional Groups** | | | | | | | | | | | |
| Commonwealth of Independent States[2] | 2.5 | 3.2 | 4.0 | 2.4 | 0.6 | 2.1 | 2.8 | 0.0 | 0.9 | 1.3 | 2.2 |
| Russia | 3.8 | 4.1 | 4.7 | 3.2 | 1.5 | 2.8 | 5.0 | 2.0 | 2.8 | 3.2 | 4.0 |
| Excluding Russia | –1.8 | 0.2 | 1.7 | –0.6 | –2.3 | –0.1 | –3.0 | –5.6 | –4.6 | –4.0 | –2.2 |
| Emerging and Developing Asia | 3.4 | 2.4 | 0.9 | 1.0 | 0.7 | 1.5 | 2.0 | 1.4 | 0.9 | 0.7 | –0.4 |
| China | 4.7 | 3.9 | 1.8 | 2.5 | 1.5 | 2.2 | 2.7 | 1.7 | 1.4 | 1.2 | 0.2 |
| India | –2.8 | –2.8 | –4.2 | –4.8 | –1.7 | –1.3 | –1.1 | –0.7 | –1.4 | –1.5 | –2.4 |
| ASEAN-5[3] | 4.9 | 2.7 | 2.6 | 0.3 | –0.2 | 1.1 | 1.5 | 2.1 | 1.6 | 1.1 | –0.3 |
| Emerging and Developing Europe | –3.4 | –5.0 | –6.3 | –4.4 | –3.6 | –2.9 | –2.0 | –1.8 | –2.4 | –2.5 | –2.8 |
| Latin America and the Caribbean | –0.9 | –1.9 | –2.0 | –2.3 | –2.8 | –3.1 | –3.4 | –2.0 | –2.0 | –2.3 | –2.6 |
| Brazil | –1.6 | –3.4 | –2.9 | –3.0 | –3.0 | –4.2 | –3.3 | –1.3 | –1.4 | –1.8 | –2.0 |
| Mexico | –1.0 | –0.5 | –1.1 | –1.3 | –2.5 | –1.8 | –2.5 | –2.2 | –1.7 | –2.0 | –2.2 |
| Middle East, North Africa, Afghanistan, and Pakistan | 1.5 | 6.2 | 12.8 | 12.4 | 9.7 | 5.5 | –3.7 | –4.1 | –1.9 | –1.6 | –0.1 |
| Sub-Saharan Africa | –2.4 | –0.8 | –0.8 | –1.8 | –2.4 | –3.9 | –6.1 | –4.2 | –3.4 | –3.6 | –4.1 |
| South Africa | –2.7 | –1.5 | –2.2 | –5.1 | –5.9 | –5.3 | –4.4 | –3.3 | –2.9 | –3.3 | –3.8 |
| **Analytical Groups** | | | | | | | | | | | |
| **By Source of Export Earnings** | | | | | | | | | | | |
| Fuel | 3.3 | 6.5 | 10.5 | 9.7 | 7.3 | 5.0 | –1.4 | –1.9 | 0.2 | 0.4 | 1.6 |
| Nonfuel | 0.7 | –0.2 | –1.2 | –1.1 | –1.2 | –0.6 | 0.1 | 0.0 | –0.4 | –0.6 | –1.2 |
| Of Which, Primary Products | –0.2 | –0.7 | –1.6 | –3.7 | –4.5 | –3.0 | –3.2 | –2.6 | –2.7 | –3.0 | –3.3 |
| **By External Financing Source** | | | | | | | | | | | |
| Net Debtor Economies | –1.8 | –2.5 | –3.0 | –3.3 | –2.9 | –2.6 | –2.4 | –1.6 | –1.8 | –2.0 | –2.4 |
| **Net Debtor Economies by Debt-Servicing Experience** | | | | | | | | | | | |
| Economies with Arrears and/or Rescheduling during 2012–16 | –4.9 | –3.1 | –4.5 | –6.0 | –6.0 | –4.3 | –5.6 | –6.4 | –4.9 | –4.3 | –4.9 |
| *Memorandum* | | | | | | | | | | | |
| **World** | **0.3** | **0.4** | **0.5** | **0.5** | **0.5** | **0.5** | **0.4** | **0.4** | **0.4** | **0.3** | **0.0** |
| European Union | –0.1 | 0.0 | 0.4 | 1.2 | 1.7 | 1.7 | 2.2 | 2.2 | 2.4 | 2.4 | 2.1 |
| Low-Income Developing Countries | –1.6 | –1.2 | –1.5 | –1.9 | –2.3 | –2.5 | –4.2 | –2.5 | –2.3 | –2.6 | –3.3 |
| Middle East and North Africa | 1.8 | 6.6 | 13.6 | 13.5 | 10.6 | 6.0 | –4.0 | –4.4 | –1.7 | –1.3 | 0.2 |

## Table A10. Summary of Current Account Balances *(continued)*

*(Percent of exports of goods and services)*

| | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | Projections 2017 | 2018 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Advanced Economies** | **–0.8** | **0.1** | **–0.2** | **0.2** | **1.7** | **1.7** | **2.4** | **2.7** | **2.7** | **2.4** | **2.1** |
| United States | –23.5 | –23.2 | –20.9 | –19.2 | –15.2 | –15.7 | –19.2 | –20.5 | –19.7 | –21.5 | –19.5 |
| Euro Area | –0.4 | 0.0 | 0.0 | 5.5 | 8.6 | 9.3 | 11.7 | 12.8 | . . . | . . . | . . . |
| Germany | 15.2 | 13.3 | 13.6 | 15.3 | 14.7 | 16.3 | 18.2 | 18.1 | 17.2 | 16.2 | 13.7 |
| France | –3.4 | –3.1 | –3.4 | –4.1 | –2.9 | –4.2 | –1.4 | –3.3 | –3.6 | –2.6 | –0.2 |
| Italy | –8.4 | –13.5 | –11.1 | –1.3 | 3.3 | 6.4 | 4.8 | 8.5 | 8.9 | 7.3 | 2.1 |
| Spain | –18.9 | –15.3 | –11.0 | –0.8 | 4.7 | 3.3 | 4.1 | 5.8 | 5.4 | 5.7 | 5.2 |
| Japan | 21.7 | 25.4 | 13.9 | 6.5 | 5.5 | 4.3 | 17.1 | 23.2 | 20.3 | 21.3 | 20.2 |
| United Kingdom | –11.2 | –9.7 | –5.9 | –12.3 | –14.8 | –16.6 | –15.5 | –15.4 | –12.0 | –11.0 | –9.0 |
| Canada | –10.4 | –12.4 | –9.1 | –11.9 | –10.7 | –7.7 | –10.8 | –10.7 | –10.6 | –9.0 | –6.5 |
| Other Advanced Economies[1] | 7.8 | 8.8 | 7.0 | 7.1 | 8.7 | 9.1 | 10.2 | 10.3 | 9.7 | 9.0 | 8.2 |
| **Emerging Market and Developing Economies** | **4.3** | **4.0** | **4.5** | **3.9** | **2.0** | **2.1** | **–0.5** | **–1.2** | **–1.2** | **–1.8** | **–3.7** |
| **Regional Groups** | | | | | | | | | | | |
| Commonwealth of Independent States[2] | 8.2 | 10.2 | 12.1 | 7.4 | 1.9 | 6.8 | 9.0 | 0.0 | 3.1 | 4.3 | 7.3 |
| Russia | 14.7 | 15.3 | 17.0 | 12.1 | 5.6 | 10.2 | 17.5 | 7.7 | 10.6 | 11.9 | 14.6 |
| Excluding Russia | –4.1 | 0.5 | 3.2 | –1.1 | –5.3 | –0.2 | –8.2 | –14.8 | –11.6 | –10.1 | –6.1 |
| Emerging and Developing Asia | 12.5 | 8.3 | 2.9 | 3.3 | 2.6 | 5.7 | 8.2 | 6.1 | 3.9 | 3.0 | –1.9 |
| China | 19.5 | 14.8 | 6.8 | 9.9 | 6.3 | 9.6 | 12.9 | 8.9 | 6.9 | 6.2 | 1.0 |
| India | –13.8 | –12.6 | –16.8 | –19.4 | –6.9 | –5.6 | –5.3 | –3.4 | –6.8 | –7.5 | –12.1 |
| ASEAN-5[3] | 10.9 | 6.1 | 5.5 | 0.7 | –0.4 | 2.3 | 3.4 | 5.0 | 3.7 | 2.6 | –0.9 |
| Emerging and Developing Europe | –10.3 | –14.8 | –17.3 | –11.9 | –9.7 | –7.5 | –5.1 | –4.5 | –5.7 | –6.0 | –6.2 |
| Latin America and the Caribbean | –4.3 | –9.7 | –9.2 | –10.7 | –13.1 | –14.9 | –16.1 | –9.5 | –9.5 | –11.1 | –12.3 |
| Brazil | –14.6 | –32.7 | –26.3 | –26.4 | –26.8 | –39.5 | –26.5 | –10.8 | –12.2 | –16.2 | –18.5 |
| Mexico | –3.5 | –1.8 | –3.6 | –4.1 | –7.8 | –5.5 | –7.1 | –5.8 | –4.5 | –5.5 | –5.6 |
| Middle East, North Africa, Afghanistan, and Pakistan | 2.9 | 13.6 | 27.0 | 24.3 | 20.8 | 13.6 | –9.4 | –11.5 | –5.2 | –4.8 | –0.3 |
| Sub-Saharan Africa | –8.6 | –2.6 | –2.4 | –5.7 | –8.0 | –14.7 | –26.6 | –18.8 | –14.9 | –16.5 | –19.1 |
| South Africa | –9.8 | –5.2 | –7.3 | –17.3 | –19.0 | –17.0 | –14.5 | –10.8 | –10.2 | –12.1 | –14.0 |
| **Analytical Groups** | | | | | | | | | | | |
| **By Source of Export Earnings** | | | | | | | | | | | |
| Fuel | 8.7 | 16.5 | 25.2 | 22.5 | 18.3 | 13.6 | –3.6 | –5.5 | 0.6 | 0.8 | 4.9 |
| Nonfuel | 2.8 | –0.6 | –4.1 | –4.0 | –4.6 | –2.2 | 0.3 | –0.2 | –1.6 | –2.5 | –5.7 |
| Of Which, Primary Products | –0.8 | –2.5 | –5.8 | –14.3 | –18.1 | –12.1 | –14.8 | –11.7 | –13.0 | –14.2 | –16.6 |
| **By External Financing Source** | | | | | | | | | | | |
| Net Debtor Economies | –6.9 | –9.5 | –10.7 | –11.8 | –10.6 | –9.6 | –8.9 | –6.2 | –6.6 | –7.4 | –8.8 |
| **Net Debtor Economies by Debt-Servicing Experience** | | | | | | | | | | | |
| Economies with Arrears and/or Rescheduling during 2012–16 | –16.8 | –9.9 | –13.5 | –20.2 | –21.4 | –16.5 | –25.3 | –31.9 | –20.2 | –17.3 | –21.2 |
| *Memorandum* | | | | | | | | | | | |
| **World** | **1.0** | **1.5** | **1.5** | **1.6** | **1.8** | **1.9** | **1.3** | **1.3** | **1.3** | **0.9** | **0.0** |
| European Union | –0.3 | 0.0 | 1.0 | 2.8 | 3.9 | 3.9 | 5.0 | 5.0 | 5.2 | 5.1 | 4.3 |
| Low-Income Developing Countries | –5.9 | –4.1 | –4.6 | –6.5 | –8.0 | –9.1 | –16.0 | –9.3 | –8.1 | –9.2 | –11.3 |
| Middle East and North Africa | 3.4 | 13.9 | 27.3 | 25.0 | 21.4 | 14.0 | –9.4 | –11.5 | –4.3 | –3.6 | 0.6 |

[1]Excludes the G7 (Canada, France, Germany, Italy, Japan, United Kingdom, United States) and euro area countries.
[2]Georgia, Turkmenistan, and Ukraine, which are not members of the Commonwealth of Independent States, are included in this group for reasons of geography and similarity in economic structure.
[3]Indonesia, Malaysia, Philippines, Thailand, Vietnam.

## Table A11. Advanced Economies: Balance on Current Account

*(Percent of GDP)*

| | | | | | | | | | Projections | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2022 |
| **Advanced Economies** | **–0.2** | **0.0** | **–0.1** | **0.1** | **0.5** | **0.5** | **0.7** | **0.8** | **0.8** | **0.7** | **0.7** |
| United States | –2.6 | –2.9 | –2.9 | –2.6 | –2.1 | –2.1 | –2.4 | –2.4 | –2.4 | –2.6 | –2.5 |
| Euro Area[1] | –0.1 | 0.0 | 0.0 | 1.4 | 2.2 | 2.5 | 3.2 | 3.5 | 3.1 | 3.0 | 2.6 |
| Germany | 5.7 | 5.6 | 6.1 | 7.0 | 6.7 | 7.4 | 8.5 | 8.3 | 8.1 | 7.7 | 6.9 |
| France | –0.8 | –0.8 | –1.0 | –1.2 | –0.9 | –1.3 | –0.4 | –1.0 | –1.1 | –0.8 | –0.1 |
| Italy | –1.9 | –3.4 | –3.0 | –0.4 | 1.0 | 1.9 | 1.4 | 2.6 | 2.7 | 2.3 | 0.7 |
| Spain | –4.3 | –3.9 | –3.2 | –0.2 | 1.5 | 1.1 | 1.4 | 1.9 | 1.9 | 2.0 | 2.0 |
| Netherlands | 5.8 | 7.4 | 9.1 | 10.8 | 9.9 | 8.9 | 8.6 | 8.5 | 10.0 | 10.0 | 9.3 |
| Belgium | –1.1 | 1.8 | –1.1 | –0.1 | –0.3 | –0.7 | 0.4 | –0.4 | –0.3 | 0.0 | 0.8 |
| Austria | 2.6 | 2.9 | 1.6 | 1.5 | 2.0 | 2.4 | 1.9 | 1.7 | 2.1 | 2.2 | 2.2 |
| Greece | –12.3 | –11.4 | –10.0 | –3.8 | –2.0 | –1.6 | 0.1 | –0.6 | –0.2 | –0.1 | 0.0 |
| Portugal | –10.4 | –10.1 | –6.0 | –1.8 | 1.6 | 0.1 | 0.1 | 0.7 | 0.4 | 0.3 | –1.4 |
| Ireland | –4.7 | –1.2 | –1.6 | –2.6 | 2.1 | 1.6 | 10.9 | 3.3 | 3.4 | 3.5 | 4.0 |
| Finland | 1.9 | 1.2 | –1.8 | –1.9 | –1.6 | –1.3 | –0.6 | –1.1 | 0.4 | 0.4 | 0.4 |
| Slovak Republic | –3.4 | –4.7 | –5.0 | 0.9 | 1.9 | 1.1 | 0.2 | –0.7 | 0.3 | 0.2 | 1.2 |
| Lithuania | 2.1 | –0.3 | –3.9 | –1.2 | 1.5 | 3.6 | –2.3 | –0.9 | –1.6 | –1.4 | –2.6 |
| Slovenia | –0.6 | –0.1 | 0.2 | 2.1 | 4.4 | 5.8 | 4.4 | 5.2 | 5.0 | 4.9 | 2.7 |
| Luxembourg | 7.2 | 6.7 | 6.0 | 5.9 | 5.6 | 5.0 | 5.1 | 4.7 | 4.7 | 4.9 | 5.5 |
| Latvia | 7.8 | 2.0 | –3.2 | –3.6 | –2.7 | –2.0 | –0.8 | 1.5 | –0.3 | –1.5 | –2.1 |
| Estonia | 2.5 | 1.8 | 1.3 | –2.4 | –0.1 | 1.0 | 2.3 | 1.9 | 1.8 | 1.4 | –2.0 |
| Cyprus | –7.7 | –11.3 | –4.1 | –6.0 | –4.9 | –4.3 | –2.9 | –5.3 | –3.8 | –2.7 | –3.7 |
| Malta | –6.6 | –4.7 | –0.2 | 1.7 | 2.8 | 9.6 | 5.3 | 7.9 | 8.9 | 8.8 | 8.4 |
| Japan | 2.8 | 3.9 | 2.1 | 1.0 | 0.9 | 0.8 | 3.1 | 3.8 | 3.6 | 3.8 | 3.7 |
| United Kingdom | –3.0 | –2.7 | –1.8 | –3.7 | –4.4 | –4.7 | –4.3 | –4.4 | –3.6 | –3.3 | –2.5 |
| Korea | 3.7 | 2.6 | 1.6 | 4.2 | 6.2 | 6.0 | 7.7 | 7.0 | 5.6 | 5.4 | 5.3 |
| Canada | –2.9 | –3.6 | –2.8 | –3.6 | –3.2 | –2.4 | –3.4 | –3.3 | –3.4 | –2.9 | –2.1 |
| Australia | –4.6 | –3.6 | –3.0 | –4.1 | –3.2 | –2.9 | –4.7 | –2.6 | –1.6 | –2.4 | –2.3 |
| Taiwan Province of China | 10.9 | 8.9 | 8.2 | 9.5 | 10.4 | 12.0 | 14.5 | 14.0 | 13.8 | 13.9 | 14.6 |
| Switzerland | 7.4 | 14.8 | 8.0 | 10.4 | 11.5 | 8.7 | 11.4 | 10.5 | 9.9 | 9.4 | 8.6 |
| Sweden | 6.0 | 6.0 | 5.5 | 5.6 | 5.3 | 4.6 | 4.7 | 4.5 | 3.9 | 3.7 | 3.0 |
| Singapore | 16.8 | 23.4 | 22.1 | 17.4 | 16.9 | 19.7 | 18.1 | 19.0 | 19.6 | 19.5 | 16.9 |
| Hong Kong SAR | 9.9 | 7.0 | 5.6 | 1.6 | 1.5 | 1.4 | 3.3 | 4.6 | 3.0 | 3.1 | 3.5 |
| Norway | 10.6 | 10.9 | 12.4 | 12.4 | 10.2 | 11.0 | 8.7 | 5.0 | 5.5 | 5.7 | 6.1 |
| Czech Republic | –2.3 | –3.6 | –2.1 | –1.6 | –0.5 | 0.2 | 0.2 | 1.1 | 0.6 | 0.1 | –1.4 |
| Israel | 3.3 | 3.7 | 2.2 | 0.4 | 3.1 | 4.0 | 4.8 | 3.6 | 4.1 | 3.1 | 3.2 |
| Denmark | 3.5 | 6.6 | 6.6 | 6.3 | 7.8 | 8.9 | 9.2 | 7.9 | 7.3 | 7.0 | 6.2 |
| New Zealand | –2.2 | –2.3 | –2.8 | –3.9 | –3.2 | –3.2 | –3.4 | –2.8 | –3.6 | –3.8 | –3.9 |
| Puerto Rico | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . |
| Macao SAR | 28.2 | 39.4 | 40.9 | 39.3 | 40.2 | 34.2 | 25.4 | 27.4 | 33.0 | 34.5 | 37.0 |
| Iceland | –9.6 | –6.6 | –5.3 | –4.0 | 6.0 | 4.0 | 5.4 | 7.9 | 6.2 | 6.1 | 5.1 |
| San Marino | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . |
| *Memorandum* | | | | | | | | | | | |
| Major Advanced Economies | –0.6 | –0.7 | –0.8 | –0.9 | –0.7 | –0.6 | –0.5 | –0.3 | –0.3 | –0.4 | –0.4 |
| Euro Area[2] | 0.4 | 0.5 | 0.8 | 2.2 | 2.8 | 3.0 | 3.7 | 3.5 | 3.6 | 3.5 | 3.2 |

[1]Data corrected for reporting discrepancies in intra-area transactions.
[2]Data calculated as the sum of the balances of individual euro area countries.

## Table A12. Emerging Market and Developing Economies: Balance on Current Account

*(Percent of GDP)*

| | | | | | | | | | Projections | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2022 |
| **Commonwealth of Independent States[1]** | **2.5** | **3.2** | **4.0** | **2.4** | **0.6** | **2.1** | **2.8** | **0.0** | **0.9** | **1.3** | **2.2** |
| Russia | 3.8 | 4.1 | 4.7 | 3.2 | 1.5 | 2.8 | 5.0 | 2.0 | 2.8 | 3.2 | 4.0 |
| Excluding Russia | –1.8 | 0.2 | 1.7 | –0.6 | –2.3 | –0.1 | –3.0 | –5.6 | –4.6 | –4.0 | –2.2 |
| Armenia | –16.5 | –13.6 | –10.4 | –10.0 | –7.3 | –7.6 | –2.6 | –2.3 | –3.6 | –3.2 | –5.1 |
| Azerbaijan | 23.0 | 28.0 | 26.5 | 21.9 | 16.1 | 13.3 | –0.4 | –3.6 | 1.9 | 2.5 | 5.4 |
| Belarus | –12.5 | –14.5 | –8.2 | –2.8 | –10.0 | –6.6 | –3.3 | –3.6 | –5.3 | –4.6 | –2.5 |
| Georgia | –10.5 | –10.3 | –12.8 | –11.7 | –5.8 | –10.7 | –12.0 | –13.3 | –11.9 | –10.7 | –9.1 |
| Kazakhstan | –3.6 | 0.9 | 5.3 | 0.5 | 0.5 | 2.8 | –2.8 | –6.4 | –5.3 | –3.8 | 0.5 |
| Kyrgyz Republic | 0.9 | –2.2 | –2.9 | 3.7 | –13.3 | –16.0 | –16.0 | –9.7 | –11.6 | –12.0 | –9.7 |
| Moldova | –8.2 | –7.5 | –11.7 | –7.5 | –5.2 | –5.3 | –5.0 | –3.8 | –4.0 | –4.0 | –5.4 |
| Tajikistan | –3.6 | –9.6 | –7.3 | –9.2 | –7.8 | –2.8 | –6.0 | –3.8 | –6.3 | –6.2 | –4.3 |
| Turkmenistan | –16.6 | –12.9 | –0.8 | –0.9 | –7.3 | –6.4 | –14.0 | –21.0 | –15.4 | –14.3 | –11.9 |
| Ukraine[2] | –1.4 | –2.2 | –6.3 | –8.1 | –9.2 | –3.9 | –0.3 | –4.1 | –3.3 | –3.0 | –3.0 |
| Uzbekistan | 2.6 | 6.6 | 5.8 | 1.2 | 2.9 | 1.7 | 0.7 | 0.7 | 0.9 | 0.3 | –2.0 |
| **Emerging and Developing Asia** | **3.4** | **2.4** | **0.9** | **1.0** | **0.7** | **1.5** | **2.0** | **1.4** | **0.9** | **0.7** | **–0.4** |
| Bangladesh | 2.4 | 0.4 | –1.0 | 0.7 | 1.2 | 1.2 | 1.6 | 0.6 | –0.7 | –1.3 | –2.4 |
| Bhutan | –6.3 | –22.2 | –29.8 | –21.5 | –25.4 | –26.4 | –28.3 | –29.1 | –29.4 | –16.6 | 10.0 |
| Brunei Darussalam | 32.3 | 36.6 | 34.7 | 29.8 | 20.9 | 30.7 | 16.0 | 9.6 | 4.8 | –2.1 | 14.1 |
| Cambodia | –9.9 | –9.3 | –5.9 | –8.2 | –13.0 | –9.8 | –9.3 | –8.8 | –8.6 | –8.6 | –8.0 |
| China | 4.7 | 3.9 | 1.8 | 2.5 | 1.5 | 2.2 | 2.7 | 1.7 | 1.4 | 1.2 | 0.2 |
| Fiji | –4.0 | –4.3 | –5.1 | –1.4 | –9.7 | –7.6 | –1.5 | –5.1 | –5.0 | –4.7 | –3.3 |
| India | –2.8 | –2.8 | –4.2 | –4.8 | –1.7 | –1.3 | –1.1 | –0.7 | –1.4 | –1.5 | –2.4 |
| Indonesia | 1.8 | 0.7 | 0.2 | –2.7 | –3.2 | –3.1 | –2.0 | –1.8 | –1.7 | –1.8 | –1.9 |
| Kiribati | –13.3 | –2.2 | –13.5 | –4.5 | 8.4 | 25.1 | 35.2 | 15.4 | –4.6 | –5.9 | –2.9 |
| Lao P.D.R. | –17.0 | –15.6 | –14.3 | –24.9 | –26.7 | –18.3 | –16.5 | –10.6 | –9.6 | –10.9 | –4.8 |
| Malaysia | 15.0 | 10.1 | 10.9 | 5.2 | 3.5 | 4.4 | 3.0 | 2.4 | 2.4 | 2.2 | 1.8 |
| Maldives | –9.6 | –7.3 | –14.8 | –6.6 | –4.3 | –3.2 | –7.3 | –19.6 | –17.2 | –17.0 | –10.3 |
| Marshall Islands | –10.3 | –20.9 | 2.0 | 0.1 | –5.3 | 1.9 | 16.5 | 8.5 | 5.9 | 4.5 | –0.7 |
| Micronesia | –19.0 | –15.4 | –18.8 | –13.4 | –10.1 | 1.2 | 4.2 | 3.2 | 3.4 | 3.0 | 2.9 |
| Mongolia | –6.0 | –13.0 | –26.5 | –27.4 | –25.4 | –11.5 | –4.0 | –6.3 | –4.9 | –8.7 | –4.1 |
| Myanmar | –1.2 | –1.1 | –1.8 | –4.0 | –4.9 | –3.3 | –5.2 | –5.9 | –6.6 | –6.6 | –6.4 |
| Nauru | 63.8 | 46.3 | 26.1 | 38.1 | 18.8 | –13.5 | –9.5 | 1.7 | 0.7 | –1.3 | 2.1 |
| Nepal | 4.2 | –2.4 | –1.0 | 4.8 | 3.3 | 4.5 | 5.0 | 6.3 | –0.4 | –0.7 | –1.9 |
| Palau | –9.9 | –9.0 | –11.8 | –11.2 | –11.6 | –15.0 | –7.7 | –10.3 | –12.1 | –14.4 | –12.3 |
| Papua New Guinea | –8.3 | –20.4 | –24.0 | –36.1 | –31.3 | 2.9 | 19.8 | 20.1 | 18.6 | 17.3 | 16.5 |
| Philippines | 5.0 | 3.6 | 2.5 | 2.8 | 4.2 | 3.8 | 2.5 | 0.2 | –0.1 | –0.3 | –1.0 |
| Samoa | –4.9 | –7.0 | –4.3 | –6.3 | –0.4 | –8.1 | –3.0 | –6.1 | –5.7 | –5.0 | –4.0 |
| Solomon Islands | –21.9 | –32.9 | –8.3 | 1.7 | –3.4 | –4.3 | –3.0 | –3.9 | –5.0 | –5.0 | –6.0 |
| Sri Lanka | –0.4 | –1.9 | –7.1 | –5.8 | –3.4 | –2.5 | –2.4 | –2.4 | –2.5 | –2.3 | –2.0 |
| Thailand | 7.9 | 3.4 | 2.5 | –0.4 | –1.2 | 3.7 | 8.1 | 11.5 | 10.1 | 8.1 | 2.9 |
| Timor-Leste | 40.4 | 42.0 | 41.4 | 41.0 | 42.3 | 27.0 | 7.7 | –19.3 | –5.6 | –15.9 | –17.0 |
| Tonga | –19.7 | –19.0 | –16.8 | –12.3 | –8.3 | –10.7 | –14.7 | –12.8 | –13.5 | –13.6 | –11.4 |
| Tuvalu | 6.9 | –42.2 | –63.6 | –36.4 | –22.3 | –23.1 | –27.0 | –34.0 | –37.7 | –39.0 | –27.8 |
| Vanuatu | –7.9 | –5.4 | –8.1 | –6.5 | –3.3 | –0.3 | –10.5 | –3.7 | –14.4 | –13.6 | –4.7 |
| Vietnam | –6.5 | –3.8 | 0.2 | 6.0 | 4.5 | 4.9 | –0.1 | 4.1 | 1.3 | 1.4 | 0.0 |
| **Emerging and Developing Europe** | **–3.4** | **–5.0** | **–6.3** | **–4.4** | **–3.6** | **–2.9** | **–2.0** | **–1.8** | **–2.4** | **–2.5** | **–2.8** |
| Albania | –15.9 | –11.3 | –13.2 | –10.1 | –9.3 | –10.8 | –8.6 | –7.6 | –9.2 | –8.2 | –6.2 |
| Bosnia and Herzegovina | –6.4 | –6.1 | –9.5 | –8.7 | –5.3 | –7.4 | –5.5 | –4.5 | –4.3 | –4.2 | –4.9 |
| Bulgaria | –8.3 | –1.7 | 0.3 | –0.9 | 1.3 | 0.1 | –0.1 | 4.2 | 2.5 | 1.9 | –0.4 |
| Croatia | –5.1 | –1.1 | –0.7 | 0.0 | 1.0 | 2.1 | 4.8 | 2.6 | 3.8 | 3.0 | 0.5 |
| Hungary | –0.8 | 0.3 | 0.7 | 1.8 | 3.8 | 2.1 | 3.4 | 5.5 | 4.8 | 4.2 | 1.4 |
| Kosovo | –9.2 | –11.6 | –12.7 | –5.8 | –3.6 | –7.0 | –8.5 | –9.8 | –11.0 | –11.3 | –10.0 |
| FYR Macedonia | –6.8 | –2.0 | –2.5 | –3.2 | –1.6 | –0.5 | –2.1 | –3.1 | –2.3 | –2.5 | –3.1 |
| Montenegro | –27.9 | –22.7 | –17.6 | –18.5 | –14.5 | –15.2 | –13.3 | –19.0 | –20.2 | –21.2 | –14.0 |
| Poland | –4.1 | –5.4 | –5.2 | –3.7 | –1.3 | –2.1 | –0.6 | –0.2 | –1.0 | –1.2 | –2.2 |
| Romania | –4.8 | –5.1 | –4.9 | –4.8 | –1.1 | –0.7 | –1.2 | –2.3 | –3.0 | –2.9 | –2.9 |
| Serbia | –6.2 | –6.4 | –8.6 | –11.5 | –6.1 | –6.0 | –4.7 | –4.0 | –4.0 | –3.9 | –3.7 |
| Turkey | –1.8 | –5.8 | –8.9 | –5.5 | –6.7 | –4.7 | –3.7 | –3.8 | –4.6 | –4.6 | –3.8 |

## Table A12. Emerging Market and Developing Economies: Balance on Current Account *(continued)*

*(Percent of GDP)*

| | | | | | | | | | Projections | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2022 |
| **Latin America and the Caribbean** | **–0.9** | **–1.9** | **–2.0** | **–2.3** | **–2.8** | **–3.1** | **–3.4** | **–2.0** | **–2.0** | **–2.3** | **–2.6** |
| Antigua and Barbuda | –13.8 | –14.5 | –10.3 | –14.8 | –15.1 | 2.0 | 6.8 | 0.2 | 1.4 | –0.8 | –0.1 |
| Argentina | 2.2 | –0.4 | –1.0 | –0.4 | –2.1 | –1.5 | –2.7 | –2.7 | –3.6 | –3.7 | –4.3 |
| The Bahamas | –10.3 | –10.1 | –14.1 | –17.1 | –16.9 | –21.9 | –13.6 | –12.9 | –17.8 | –14.0 | –7.1 |
| Barbados | –6.6 | –5.7 | –12.6 | –9.0 | –8.9 | –9.9 | –6.5 | –4.6 | –3.3 | –3.0 | –2.7 |
| Belize | –4.9 | –2.5 | –1.1 | –1.2 | –4.6 | –7.5 | –9.9 | –9.4 | –8.0 | –6.6 | –4.9 |
| Bolivia | 4.3 | 3.9 | 0.3 | 7.2 | 2.4 | 1.7 | –5.7 | –5.7 | –4.7 | –4.8 | –4.4 |
| Brazil | –1.6 | –3.4 | –2.9 | –3.0 | –3.0 | –4.2 | –3.3 | –1.3 | –1.4 | –1.8 | –2.0 |
| Chile | 1.9 | 1.4 | –1.7 | –4.0 | –4.1 | –1.7 | –1.9 | –1.4 | –2.3 | –2.8 | –3.5 |
| Colombia | –2.0 | –3.0 | –2.9 | –3.1 | –3.3 | –5.2 | –6.4 | –4.3 | –3.8 | –3.6 | –2.9 |
| Costa Rica | –1.8 | –3.2 | –5.3 | –5.1 | –4.8 | –4.9 | –4.3 | –3.2 | –3.9 | –4.0 | –4.1 |
| Dominica | –22.7 | –15.9 | –14.1 | –17.3 | –9.8 | –7.2 | –1.9 | 0.8 | –6.2 | –7.3 | 0.2 |
| Dominican Republic | –4.8 | –7.5 | –7.5 | –6.4 | –4.1 | –3.3 | –2.0 | –1.5 | –1.6 | –2.6 | –3.6 |
| Ecuador | 0.5 | –2.3 | –0.5 | –0.2 | –1.0 | –0.5 | –2.1 | 1.4 | –0.7 | –1.6 | –1.6 |
| El Salvador | –1.5 | –2.5 | –4.8 | –5.4 | –6.5 | –4.8 | –3.6 | –2.0 | –1.0 | –2.1 | –4.4 |
| Grenada | –24.3 | –23.7 | –23.6 | –21.1 | –23.2 | –4.4 | –3.8 | –3.2 | –7.1 | –6.3 | –5.0 |
| Guatemala | 0.7 | –1.4 | –3.4 | –2.6 | –2.5 | –2.1 | –0.3 | 1.0 | 0.5 | –0.2 | –2.5 |
| Guyana | –9.1 | –9.6 | –13.0 | –11.6 | –13.3 | –9.6 | –5.7 | 0.4 | –2.0 | –1.1 | 3.6 |
| Haiti | –1.9 | –1.5 | –4.3 | –5.7 | –6.6 | –8.5 | –3.1 | –0.9 | –1.1 | –0.9 | 0.3 |
| Honduras | –3.8 | –4.3 | –8.0 | –8.6 | –9.6 | –7.0 | –5.5 | –3.8 | –4.0 | –4.2 | –4.4 |
| Jamaica | –11.0 | –8.0 | –12.2 | –11.1 | –9.2 | –7.5 | –3.2 | –2.2 | –2.7 | –3.0 | –3.0 |
| Mexico | –1.0 | –0.5 | –1.1 | –1.3 | –2.5 | –1.8 | –2.5 | –2.2 | –1.7 | –2.0 | –2.2 |
| Nicaragua | –8.5 | –8.9 | –11.9 | –10.7 | –10.9 | –7.1 | –9.0 | –8.6 | –8.4 | –8.4 | –10.2 |
| Panama | –0.8 | –10.8 | –13.2 | –10.5 | –9.8 | –13.7 | –7.3 | –5.7 | –5.1 | –3.3 | –2.8 |
| Paraguay | 3.0 | –0.3 | 0.4 | –2.0 | 1.7 | –0.4 | –1.1 | 1.7 | 1.1 | 0.4 | 0.5 |
| Peru | –0.5 | –2.4 | –1.9 | –2.7 | –4.4 | –4.4 | –4.8 | –2.7 | –1.5 | –1.6 | –2.3 |
| St. Kitts and Nevis | –25.2 | –20.4 | –13.0 | –7.6 | –11.1 | –4.9 | –9.7 | –11.4 | –12.8 | –11.1 | –10.9 |
| St. Lucia | –10.8 | –14.7 | –16.9 | –12.2 | –9.8 | 3.3 | 6.8 | –1.9 | –0.5 | –3.6 | –0.2 |
| St. Vincent and the Grenadines | –29.2 | –30.6 | –29.4 | –27.6 | –30.9 | –25.7 | –14.9 | –15.8 | –14.7 | –13.6 | –11.3 |
| Suriname | 2.9 | 14.9 | 9.8 | 3.3 | –3.8 | –7.9 | –16.4 | –2.8 | 9.4 | 6.1 | 1.1 |
| Trinidad and Tobago | 8.6 | 18.8 | 16.8 | 13.1 | 20.5 | 15.1 | 3.9 | –11.3 | –9.0 | –8.4 | –7.0 |
| Uruguay | –1.2 | –1.8 | –2.7 | –5.1 | –5.0 | –4.5 | –2.1 | –0.1 | –0.4 | –0.8 | –1.5 |
| Venezuela | 0.2 | 1.9 | 4.9 | 0.8 | 2.0 | 2.3 | –6.6 | –1.6 | –0.4 | –1.3 | –1.6 |
| **Middle East, North Africa, Afghanistan, and Pakistan** | **1.5** | **6.2** | **12.8** | **12.4** | **9.7** | **5.5** | **–3.7** | **–4.1** | **–1.9** | **–1.6** | **–0.1** |
| Afghanistan | 41.5 | 29.2 | 26.7 | 10.8 | 0.3 | 5.7 | 3.0 | 7.1 | 4.7 | 1.6 | –3.8 |
| Algeria | 0.3 | 7.5 | 9.9 | 5.9 | 0.4 | –4.4 | –16.5 | –16.5 | –13.0 | –10.8 | –6.7 |
| Bahrain | 2.4 | 3.0 | 8.8 | 8.4 | 7.4 | 4.6 | –2.4 | –4.7 | –4.6 | –4.2 | –3.1 |
| Djibouti | –6.6 | 2.8 | –13.1 | –18.8 | –23.3 | –25.1 | –31.8 | –30.4 | –21.0 | –18.2 | –17.3 |
| Egypt | –3.8 | –1.9 | –2.5 | –3.6 | –2.2 | –0.8 | –3.6 | –6.0 | –5.9 | –3.8 | –2.2 |
| Iran | 2.2 | 4.4 | 10.4 | 6.0 | 6.7 | 3.2 | 2.4 | 4.1 | 5.1 | 5.9 | 6.2 |
| Iraq | –11.5 | 1.6 | 10.9 | 5.1 | 1.1 | 2.6 | –6.5 | –8.7 | –6.3 | –6.7 | –0.6 |
| Jordan | –5.2 | –7.1 | –10.3 | –15.2 | –10.4 | –7.3 | –9.1 | –9.3 | –8.4 | –8.3 | –6.2 |
| Kuwait | 26.7 | 31.8 | 42.9 | 45.5 | 39.9 | 33.4 | 3.5 | –4.5 | –0.6 | –1.4 | –1.0 |
| Lebanon | –11.9 | –20.3 | –15.4 | –24.0 | –26.7 | –26.4 | –18.7 | –18.6 | –18.0 | –16.8 | –15.6 |
| Libya[3] | 18.5 | 21.1 | 9.9 | 29.9 | 0.0 | –78.4 | –52.6 | –22.4 | 1.8 | 9.8 | –0.5 |
| Mauritania | –13.4 | –8.2 | –5.0 | –24.1 | –22.0 | –27.3 | –19.7 | –14.9 | –14.2 | –9.6 | –7.9 |
| Morocco | –5.4 | –4.4 | –7.6 | –9.3 | –7.6 | –5.9 | –2.1 | –4.4 | –4.0 | –2.9 | –1.0 |
| Oman | –1.0 | 8.3 | 13.0 | 10.1 | 6.6 | 5.8 | –15.5 | –18.6 | –14.3 | –13.2 | –6.1 |
| Pakistan | –5.5 | –2.2 | 0.1 | –2.1 | –1.1 | –1.3 | –1.0 | –1.7 | –4.0 | –4.9 | –3.0 |
| Qatar | 6.5 | 19.1 | 31.1 | 33.2 | 30.4 | 24.0 | 8.4 | –4.9 | 2.3 | 1.0 | 1.0 |
| Saudi Arabia | 4.9 | 12.7 | 23.6 | 22.4 | 18.1 | 9.8 | –8.7 | –4.3 | 0.6 | 0.4 | 1.6 |
| Somalia | . . . | . . . | . . . | . . . | –4.8 | –6.3 | –7.2 | –10.1 | –11.1 | –10.7 | –10.0 |
| Sudan[4] | –9.6 | –2.1 | –0.4 | –9.3 | –8.7 | –7.1 | –8.0 | –5.6 | –1.9 | –2.0 | –1.5 |
| Syria[5] | –2.9 | –2.8 | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . |
| Tunisia | –2.8 | –4.8 | –7.4 | –8.3 | –8.4 | –9.1 | –8.9 | –9.0 | –8.7 | –8.4 | –6.2 |
| United Arab Emirates | 3.1 | 4.2 | 12.6 | 19.7 | 19.0 | 13.3 | 4.7 | 2.4 | 2.1 | 2.1 | 3.7 |
| Yemen | –10.1 | –3.4 | –3.0 | –1.7 | –3.1 | –1.7 | –5.5 | –5.6 | –2.3 | –2.4 | –3.2 |

## Table A12. Emerging Market and Developing Economies: Balance on Current Account *(continued)*

*(Percent of GDP)*

| | | | | | | | | | Projections | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2022 |
| **Sub-Saharan Africa** | **–2.4** | **–0.8** | **–0.8** | **–1.8** | **–2.4** | **–3.9** | **–6.1** | **–4.2** | **–3.4** | **–3.6** | **–4.1** |
| Angola | –10.0 | 9.1 | 12.6 | 12.0 | 6.7 | –3.0 | –10.0 | –5.1 | –4.8 | –4.5 | –4.1 |
| Benin | –8.3 | –8.2 | –7.3 | –7.4 | –7.4 | –8.6 | –8.4 | –7.2 | –8.7 | –7.1 | –6.2 |
| Botswana | –6.3 | –2.6 | 3.1 | 0.3 | 8.9 | 15.4 | 7.8 | 11.7 | 4.5 | 2.8 | 3.9 |
| Burkina Faso | –4.7 | –2.2 | –1.5 | –7.0 | –11.3 | –8.0 | –8.0 | –6.8 | –7.2 | –7.1 | –6.7 |
| Burundi | 1.7 | –12.2 | –14.4 | –18.6 | –19.3 | –18.5 | –17.7 | –13.1 | –12.4 | –11.8 | –9.5 |
| Cabo Verde | –14.6 | –12.4 | –16.3 | –12.6 | –4.9 | –9.1 | –5.0 | –3.7 | –6.1 | –6.0 | –5.4 |
| Cameroon | –3.5 | –2.8 | –3.0 | –3.6 | –3.9 | –4.3 | –4.1 | –3.6 | –3.6 | –3.5 | –1.7 |
| Central African Republic | –9.1 | –10.2 | –7.6 | –4.6 | –3.0 | –5.6 | –9.0 | –9.1 | –9.7 | –6.5 | –5.1 |
| Chad | –8.2 | –8.5 | –5.8 | –7.8 | –9.1 | –8.9 | –12.3 | –9.2 | –2.0 | –2.8 | –3.1 |
| Comoros | –6.9 | –0.2 | –4.9 | –7.3 | –8.3 | –8.0 | 0.4 | –10.1 | –9.5 | –11.3 | –13.1 |
| Democratic Republic of the Congo | –6.1 | –10.5 | –5.2 | –4.6 | –5.2 | –4.8 | –3.9 | –3.4 | –4.6 | –2.1 | –2.0 |
| Republic of Congo | –14.1 | 7.8 | –3.2 | 17.7 | 1.7 | –11.6 | –42.9 | –70.1 | –15.9 | 2.5 | –5.0 |
| Côte d'Ivoire | 6.6 | 1.9 | 10.4 | –1.2 | –1.4 | 1.4 | –0.6 | –1.1 | –2.9 | –2.8 | –2.5 |
| Equatorial Guinea | –9.7 | –20.2 | –5.7 | –1.1 | –2.5 | –4.3 | –17.7 | –10.5 | –8.0 | –7.4 | –4.7 |
| Eritrea | –7.6 | –5.6 | 0.6 | 2.3 | –0.1 | 0.6 | –2.2 | –0.1 | 0.7 | 0.3 | –1.2 |
| Ethiopia | –6.7 | –1.4 | –2.5 | –6.9 | –5.9 | –6.4 | –11.6 | –9.9 | –8.3 | –7.4 | –6.4 |
| Gabon | 4.4 | 14.9 | 21.0 | 17.6 | 7.0 | 7.3 | –5.7 | –10.2 | –9.3 | –6.7 | 1.5 |
| The Gambia | –12.5 | –0.7 | –12.3 | –7.9 | –10.2 | –10.8 | –15.0 | –8.9 | –9.4 | –12.0 | –12.0 |
| Ghana | –5.5 | –8.6 | –9.0 | –11.7 | –11.9 | –9.5 | –7.7 | –6.7 | –5.8 | –5.4 | –4.3 |
| Guinea | –5.7 | –6.4 | –18.4 | –20.0 | –12.5 | –13.4 | –15.4 | –31.9 | –25.0 | –21.4 | –11.8 |
| Guinea-Bissau | –5.8 | –8.3 | –1.3 | –8.4 | –5.0 | 0.6 | 2.0 | 0.9 | 0.1 | –0.6 | –1.2 |
| Kenya | –4.4 | –5.9 | –9.2 | –8.4 | –8.8 | –10.4 | –6.8 | –5.2 | –6.1 | –7.0 | –7.3 |
| Lesotho | 1.5 | –8.4 | –12.9 | –8.2 | –5.5 | –5.2 | –4.8 | –7.7 | –8.5 | –9.4 | –13.2 |
| Liberia | –23.2 | –32.0 | –27.4 | –21.5 | –30.1 | –26.9 | –35.2 | –24.7 | –26.7 | –31.3 | –22.4 |
| Madagascar | –21.1 | –9.7 | –6.9 | –6.9 | –5.9 | –0.3 | –1.9 | 0.8 | –4.7 | –5.3 | –4.0 |
| Malawi | –10.2 | –8.6 | –8.6 | –9.3 | –8.4 | –8.4 | –9.5 | –13.5 | –9.1 | –8.1 | –7.4 |
| Mali | –10.8 | –10.7 | –5.1 | –2.2 | –2.9 | –4.7 | –5.3 | –7.1 | –7.0 | –5.6 | –5.7 |
| Mauritius | –7.4 | –10.3 | –13.8 | –7.3 | –6.3 | –5.7 | –4.9 | –4.4 | –5.8 | –6.2 | –0.3 |
| Mozambique | –10.9 | –16.1 | –25.3 | –44.7 | –42.9 | –38.2 | –40.3 | –38.2 | –25.6 | –45.8 | –114.1 |
| Namibia | –1.5 | –3.5 | –3.0 | –5.7 | –4.0 | –10.8 | –12.6 | –14.0 | –7.3 | –6.6 | –6.0 |
| Niger | –24.4 | –19.8 | –22.3 | –14.7 | –15.0 | –15.4 | –18.0 | –15.5 | –18.6 | –18.3 | –14.1 |
| Nigeria | 4.7 | 3.6 | 2.6 | 3.8 | 3.7 | 0.2 | –3.2 | 0.7 | 1.9 | 1.0 | 0.7 |
| Rwanda | –7.0 | –7.2 | –7.4 | –11.2 | –8.7 | –11.8 | –13.4 | –14.4 | –10.2 | –11.2 | –8.0 |
| São Tomé and Príncipe | –24.7 | –22.9 | –27.7 | –21.9 | –13.8 | –21.9 | –13.0 | –6.2 | –10.2 | –9.9 | –7.8 |
| Senegal | –6.7 | –4.4 | –8.0 | –10.9 | –10.5 | –9.0 | –7.5 | –5.3 | –5.1 | –5.2 | –5.7 |
| Seychelles | –14.8 | –19.4 | –23.0 | –21.1 | –11.9 | –23.1 | –18.6 | –18.4 | –15.6 | –14.6 | –14.4 |
| Sierra Leone | –13.3 | –22.7 | –65.0 | –31.8 | –17.5 | –18.2 | –17.4 | –19.7 | –21.1 | –18.5 | –15.1 |
| South Africa | –2.7 | –1.5 | –2.2 | –5.1 | –5.9 | –5.3 | –4.4 | –3.3 | –2.9 | –3.3 | –3.8 |
| South Sudan | . . . | . . . | 18.2 | –15.9 | –3.9 | –1.6 | –7.2 | 4.7 | 1.7 | –12.7 | –4.5 |
| Swaziland | –11.2 | –8.6 | –6.9 | 3.3 | 5.3 | 3.4 | 10.8 | 0.7 | –1.1 | 0.2 | 1.3 |
| Tanzania | –7.6 | –7.7 | –10.8 | –11.6 | –10.6 | –10.1 | –8.5 | –5.6 | –5.6 | –6.5 | –6.7 |
| Togo | –5.6 | –6.3 | –8.0 | –7.5 | –13.2 | –9.9 | –11.1 | –9.7 | –8.3 | –7.3 | –4.3 |
| Uganda | –5.7 | –8.0 | –10.0 | –6.8 | –7.0 | –8.5 | –7.1 | –4.3 | –5.6 | –7.2 | –3.6 |
| Zambia | 6.0 | 7.5 | 4.7 | 5.4 | –0.6 | 2.1 | –3.9 | –4.4 | –3.6 | –2.8 | –0.4 |
| Zimbabwe[6] | –13.7 | –12.5 | –20.1 | –12.9 | –15.6 | –15.1 | –9.3 | –4.1 | –3.6 | –0.8 | –1.9 |

[1]Georgia, Turkmenistan, and Ukraine, which are not members of the Commonwealth of Independent States, are included in this group for reasons of geography and similarity in economic structure.
[2]Starting in 2014 data exclude Crimea and Sevastopol.
[3]See country-specific notes for Libya in the "Country Notes" section of the Statistical Appendix.
[4]Data for 2011 exclude South Sudan after July 9. Data for 2012 and onward pertain to the current Sudan.
[5]Data for Syria are excluded for 2011 onward owing to the uncertain political situation.
[6]The Zimbabwe dollar ceased circulating in early 2009. Data are based on IMF staff estimates of price and exchange rate developments in US dollars. IMF staff estimates of US dollar values may differ from authorities' estimates.

## Table A13. Summary of Financial Account Balances

*(Billions of US dollars)*

| | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | Projections 2017 | Projections 2018 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Advanced Economies** | | | | | | | | | | |
| Financial Account Balance | 12.8 | –96.7 | –210.1 | –122.3 | 235.8 | 380.5 | 440.8 | 470.5 | 389.0 | 367.2 |
| Direct Investment, Net | 303.6 | 341.0 | 358.7 | 112.4 | 165.9 | 167.3 | 74.4 | –180.7 | 204.7 | 152.7 |
| Portfolio Investment, Net | –376.4 | –745.2 | –900.7 | –201.8 | –360.8 | –152.2 | –20.0 | 428.9 | 272.0 | 179.6 |
| Financial Derivatives, Net | –94.1 | –118.2 | 0.7 | –92.2 | 33.5 | –34.5 | –24.2 | 67.5 | 17.1 | 26.4 |
| Other Investment, Net | –287.2 | 63.9 | –44.8 | –215.1 | 245.1 | 263.9 | 183.5 | 55.7 | –235.9 | –62.6 |
| Change in Reserves | 469.6 | 352.9 | 349.8 | 273.2 | 153.1 | 134.9 | 226.6 | 97.8 | 128.9 | 72.9 |
| **United States** | | | | | | | | | | |
| Financial Account Balance | –239.4 | –446.4 | –525.6 | –448.9 | –404.0 | –326.8 | –333.2 | –377.7 | –460.6 | –528.7 |
| Direct Investment, Net | 151.5 | 85.8 | 173.1 | 126.9 | 104.7 | 101.2 | –195.0 | –167.8 | –17.2 | –109.6 |
| Portfolio Investment, Net | 18.5 | –620.8 | –226.3 | –498.3 | –30.7 | –120.8 | –53.6 | –196.7 | –319.6 | –421.5 |
| Financial Derivatives, Net | –44.8 | –14.1 | –35.0 | 7.1 | 2.2 | –54.3 | –25.2 | 15.8 | –16.2 | –23.8 |
| Other Investment, Net | –416.9 | 100.9 | –453.4 | –89.0 | –477.1 | –249.4 | –53.0 | –31.0 | –107.4 | 26.2 |
| Change in Reserves | 52.3 | 1.8 | 15.9 | 4.5 | –3.1 | –3.6 | –6.3 | 2.1 | –0.2 | 0.0 |
| **Euro Area** | | | | | | | | | | |
| Financial Account Balance | 31.6 | –20.1 | –66.0 | 179.3 | 437.3 | 336.2 | 332.4 | 396.4 | . . . | . . . |
| Direct Investment, Net | 41.6 | 84.3 | 130.3 | 58.2 | 36.8 | 81.3 | 263.1 | 199.9 | . . . | . . . |
| Portfolio Investment, Net | –347.0 | –66.8 | –349.6 | –177.3 | –169.6 | 43.7 | 135.5 | 526.4 | . . . | . . . |
| Financial Derivatives, Net | 15.7 | –4.4 | 5.5 | 38.9 | 42.1 | 60.8 | 100.3 | 25.0 | . . . | . . . |
| Other Investment, Net | 262.9 | –46.9 | 133.5 | 240.6 | 521.8 | 144.6 | –178.2 | –372.0 | . . . | . . . |
| Change in Reserves | 58.4 | 13.7 | 14.3 | 19.0 | 6.2 | 5.8 | 11.7 | 17.1 | . . . | . . . |
| **Germany** | | | | | | | | | | |
| Financial Account Balance | 184.4 | 123.7 | 167.7 | 194.3 | 300.0 | 316.3 | 259.6 | 260.5 | 296.0 | 304.3 |
| Direct Investment, Net | 43.0 | 60.6 | 10.3 | 33.6 | 26.0 | 96.6 | 59.9 | 23.8 | 60.1 | 53.8 |
| Portfolio Investment, Net | 119.2 | 154.1 | –51.4 | 66.8 | 209.6 | 175.0 | 217.9 | 230.4 | 224.4 | 251.0 |
| Financial Derivatives, Net | –7.5 | 17.6 | 39.8 | 30.9 | 31.8 | 42.3 | 29.2 | 36.1 | 38.0 | 38.5 |
| Other Investment, Net | 17.4 | –110.7 | 165.1 | 61.1 | 31.4 | 5.6 | –45.0 | –31.7 | –26.5 | –39.0 |
| Change in Reserves | 12.4 | 2.1 | 3.9 | 1.7 | 1.2 | –3.3 | –2.4 | 1.9 | 0.0 | 0.0 |
| **France** | | | | | | | | | | |
| Financial Account Balance | –30.7 | –34.2 | –74.6 | –48.0 | –19.2 | –10.3 | –13.5 | –22.7 | –26.9 | –19.3 |
| Direct Investment, Net | 70.3 | 34.3 | 19.8 | 19.4 | –13.9 | 47.2 | –2.6 | 1.4 | 5.6 | 10.1 |
| Portfolio Investment, Net | –328.7 | –155.0 | –333.7 | –50.6 | –79.3 | –23.8 | 51.5 | 40.7 | 29.6 | 31.1 |
| Financial Derivatives, Net | 23.6 | –34.8 | –19.4 | –18.4 | –22.3 | –31.8 | 12.0 | 15.1 | 19.3 | 24.3 |
| Other Investment, Net | 212.0 | 105.1 | 240.3 | –3.6 | 98.2 | –2.9 | –82.4 | –82.1 | –83.7 | –87.3 |
| Change in Reserves | –5.5 | 7.7 | –7.7 | 5.2 | –1.9 | 1.0 | 8.0 | 2.2 | 2.3 | 2.5 |
| **Italy** | | | | | | | | | | |
| Financial Account Balance | –51.8 | –111.2 | –89.6 | –13.1 | 16.9 | 58.2 | 30.4 | 70.7 | 50.9 | 47.5 |
| Direct Investment, Net | –0.2 | 21.3 | 17.2 | 6.8 | 0.9 | 3.1 | 3.0 | –6.2 | 3.1 | 10.6 |
| Portfolio Investment, Net | –53.1 | 58.4 | 15.9 | –31.3 | –17.5 | –4.7 | 99.3 | 170.3 | 42.9 | 40.7 |
| Financial Derivatives, Net | –6.9 | 6.6 | –10.1 | 7.5 | 4.0 | –4.8 | 3.7 | 3.5 | 3.4 | 2.5 |
| Other Investment, Net | –0.4 | –198.9 | –113.9 | 2.1 | 27.5 | 65.9 | –76.2 | –95.7 | 1.4 | –6.3 |
| Change in Reserves | 8.8 | 1.4 | 1.3 | 1.9 | 2.0 | –1.3 | 0.6 | –1.3 | 0.0 | 0.0 |

## Table A13. Summary of Financial Account Balances *(continued)*
*(Billions of US dollars)*

| | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | Projections 2017 | Projections 2018 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Spain** | | | | | | | | | | |
| Financial Account Balance | –72.8 | –58.9 | –43.4 | 0.5 | 41.6 | 14.0 | 24.8 | 29.6 | 29.9 | 34.4 |
| Direct Investment, Net | 2.7 | –1.9 | 12.8 | –27.2 | –24.6 | 10.7 | 32.6 | 23.5 | 24.1 | 25.3 |
| Portfolio Investment, Net | –69.6 | –46.6 | 43.1 | 53.7 | –83.6 | –13.5 | 11.2 | 52.3 | –17.2 | –15.7 |
| Financial Derivatives, Net | 8.4 | –11.4 | 2.9 | –10.7 | 1.4 | 0.2 | –1.4 | –3.2 | 0.0 | 0.0 |
| Other Investment, Net | –20.4 | 0.0 | –116.2 | –18.2 | 147.8 | 11.6 | –23.3 | –52.1 | 23.0 | 24.8 |
| Change in Reserves | 6.0 | 1.1 | 13.9 | 2.8 | 0.7 | 5.1 | 5.6 | 9.1 | 0.0 | 0.0 |
| **Japan** | | | | | | | | | | |
| Financial Account Balance | 168.8 | 247.3 | 158.4 | 53.9 | –4.3 | 58.9 | 178.6 | 266.7 | 171.6 | 187.7 |
| Direct Investment, Net | 61.2 | 72.5 | 117.8 | 117.5 | 144.7 | 118.6 | 131.0 | 134.6 | 121.7 | 126.0 |
| Portfolio Investment, Net | 211.7 | 147.9 | –162.9 | 28.8 | –280.6 | –42.2 | 131.5 | 282.2 | 198.0 | 191.0 |
| Financial Derivatives, Net | –10.5 | –11.9 | –17.1 | 6.7 | 58.1 | 34.0 | 17.7 | –16.7 | –8.2 | –8.5 |
| Other Investment, Net | –120.9 | –5.5 | 43.4 | –61.1 | 34.8 | –60.1 | –106.7 | –127.7 | –149.9 | –131.2 |
| Change in Reserves | 27.2 | 44.3 | 177.3 | –37.9 | 38.7 | 8.5 | 5.1 | –5.7 | 10.0 | 10.5 |
| **United Kingdom** | | | | | | | | | | |
| Financial Account Balance | –45.4 | –46.8 | –37.6 | –83.7 | –122.9 | –129.5 | –102.7 | –147.3 | –92.9 | –88.4 |
| Direct Investment, Net | –61.0 | –10.1 | 53.4 | –34.9 | –11.2 | –193.4 | –115.2 | –267.5 | 5.1 | 0.0 |
| Portfolio Investment, Net | –48.5 | 21.3 | 11.4 | 338.3 | –86.8 | –204.4 | –415.8 | –256.1 | 0.0 | 0.0 |
| Financial Derivatives, Net | –45.5 | –39.4 | 4.8 | –58.6 | 18.1 | –1.0 | –48.6 | 35.9 | –8.0 | –0.2 |
| Other Investment, Net | 100.6 | –28.0 | –115.1 | –340.6 | –50.7 | 257.5 | 444.7 | 331.5 | –102.1 | –100.9 |
| Change in Reserves | 9.0 | 9.4 | 7.9 | 12.1 | 7.8 | 11.7 | 32.2 | 8.8 | 12.1 | 12.6 |
| **Canada** | | | | | | | | | | |
| Financial Account Balance | –41.6 | –58.3 | –49.4 | –62.7 | –56.9 | –43.5 | –53.4 | –47.8 | –55.6 | –51.2 |
| Direct Investment, Net | 16.9 | 6.3 | 12.5 | 12.8 | –12.0 | 1.4 | 25.5 | 35.3 | 10.5 | 11.5 |
| Portfolio Investment, Net | –91.0 | –109.9 | –104.3 | –63.8 | –27.1 | –26.2 | –35.8 | –114.6 | –47.3 | –53.3 |
| Financial Derivatives, Net | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . |
| Other Investment, Net | 22.3 | 41.4 | 34.3 | –13.4 | –22.5 | –24.0 | –51.6 | 25.9 | –18.7 | –9.3 |
| Change in Reserves | 10.2 | 3.9 | 8.1 | 1.7 | 4.7 | 5.3 | 8.5 | 5.6 | 0.0 | 0.0 |
| **Other Advanced Economies**[1] | | | | | | | | | | |
| Financial Account Balance | 149.9 | 286.5 | 287.5 | 248.5 | 372.4 | 368.8 | 371.2 | 345.1 | 364.0 | 357.0 |
| Direct Investment, Net | 21.9 | 93.9 | –6.7 | –35.1 | 25.5 | –9.8 | –85.5 | –55.4 | –91.8 | –82.5 |
| Portfolio Investment, Net | –108.0 | –51.4 | 38.9 | 138.8 | 130.9 | 185.4 | 318.3 | 246.4 | 235.9 | 239.1 |
| Financial Derivatives, Net | 17.7 | –17.9 | 41.1 | –28.8 | –28.7 | –21.9 | –17.4 | –0.2 | –14.5 | –14.0 |
| Other Investment, Net | –114.0 | –17.3 | 89.3 | –101.8 | 144.2 | 108.1 | –21.7 | 83.7 | 128.7 | 170.1 |
| Change in Reserves | 332.5 | 279.3 | 125.1 | 274.7 | 101.3 | 106.3 | 175.9 | 69.7 | 103.5 | 46.1 |
| **Emerging Market and Developing Economies** | | | | | | | | | | |
| Financial Account Balance | 66.4 | 135.7 | 240.4 | 118.7 | 24.1 | 18.9 | –266.9 | –419.9 | –128.6 | –137.5 |
| Direct Investment, Net | –326.4 | –452.7 | –531.6 | –484.3 | –482.8 | –412.0 | –341.0 | –272.6 | –217.5 | –189.8 |
| Portfolio Investment, Net | –85.9 | –224.4 | –149.9 | –241.0 | –160.1 | –115.4 | 112.3 | –10.0 | –71.0 | –19.0 |
| Financial Derivatives, Net | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . |
| Other Investment, Net | –44.3 | –23.8 | 169.2 | 411.7 | 79.8 | 409.4 | 472.5 | 353.0 | 283.6 | 44.3 |
| Change in Reserves | 524.4 | 835.6 | 748.0 | 431.0 | 589.5 | 128.4 | –515.8 | –479.6 | –112.0 | 39.1 |

## Table A13. Summary of Financial Account Balances *(continued)*

*(Billions of US dollars)*

| | | | | | | | | | Projections | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
| **Regional Groups** | | | | | | | | | | |
| **Commonwealth of Independent States**[2] | | | | | | | | | | |
| Financial Account Balance | 28.7 | 75.5 | 100.7 | 50.1 | –8.4 | 12.0 | 54.2 | 0.6 | 22.2 | 30.1 |
| Direct Investment, Net | –15.5 | –8.5 | –15.2 | –27.6 | –3.7 | 19.2 | 0.5 | –36.0 | –9.6 | –4.0 |
| Portfolio Investment, Net | –6.1 | –14.2 | 17.9 | 3.5 | –0.2 | 28.8 | 12.0 | –2.1 | –5.8 | –1.9 |
| Financial Derivatives, Net | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . |
| Other Investment, Net | 36.4 | 36.0 | 64.3 | 42.6 | 17.6 | 72.8 | 41.3 | 28.0 | 12.4 | 6.2 |
| Change in Reserves | 10.6 | 60.5 | 31.9 | 30.1 | –22.5 | –114.1 | –6.9 | 10.2 | 24.8 | 29.5 |
| **Emerging and Developing Asia** | | | | | | | | | | |
| Financial Account Balance | 214.2 | 148.4 | 65.2 | 9.7 | 32.9 | 147.6 | 86.7 | –26.0 | 161.7 | 131.8 |
| Direct Investment, Net | –114.6 | –225.0 | –277.3 | –221.9 | –273.2 | –205.2 | –141.1 | –21.9 | 7.5 | 44.3 |
| Portfolio Investment, Net | –67.0 | –91.3 | –58.0 | –115.6 | –64.7 | –123.9 | 82.7 | 41.5 | 27.1 | 41.7 |
| Financial Derivatives, Net | . . . | 0.2 | –0.3 | 1.5 | –2.0 | 0.4 | –1.5 | –10.2 | –10.8 | –11.3 |
| Other Investment, Net | –63.2 | –97.5 | –28.7 | 207.1 | –78.4 | 281.0 | 462.5 | 345.0 | 234.3 | 54.6 |
| Change in Reserves | 461.6 | 563.0 | 431.3 | 139.4 | 450.7 | 195.1 | –316.1 | –380.3 | –95.9 | 2.9 |
| **Emerging and Developing Europe** | | | | | | | | | | |
| Financial Account Balance | –51.4 | –89.1 | –107.1 | –65.4 | –61.7 | –42.5 | –8.8 | –13.0 | –39.9 | –36.9 |
| Direct Investment, Net | –30.6 | –26.7 | –39.8 | –27.5 | –25.8 | –32.5 | –34.0 | –28.0 | –27.0 | –32.2 |
| Portfolio Investment, Net | –10.1 | –45.8 | –53.5 | –70.0 | –40.0 | –19.3 | 24.7 | –5.0 | –34.0 | –14.1 |
| Financial Derivatives, Net | 0.9 | 0.0 | 1.6 | –2.9 | –1.4 | 0.3 | –1.7 | 0.1 | 0.0 | 0.1 |
| Other Investment, Net | –42.5 | –52.5 | –30.1 | 7.3 | –13.0 | 9.2 | 12.6 | –3.6 | 9.4 | –4.6 |
| Change in Reserves | 31.0 | 35.9 | 14.6 | 27.8 | 18.5 | –0.2 | –10.4 | 23.6 | 11.7 | 14.0 |
| **Latin America and the Caribbean** | | | | | | | | | | |
| Financial Account Balance | –36.0 | –119.9 | –127.7 | –148.9 | –192.7 | –201.8 | –189.2 | –108.4 | –112.4 | –124.9 |
| Direct Investment, Net | –73.5 | –112.3 | –148.0 | –154.2 | –150.2 | –137.6 | –133.6 | –140.2 | –127.6 | –129.5 |
| Portfolio Investment, Net | –26.0 | –96.8 | –110.5 | –87.6 | –103.3 | –110.0 | –60.0 | –50.9 | –51.7 | –44.0 |
| Financial Derivatives, Net | –2.5 | 0.6 | 5.5 | 2.3 | 1.4 | 4.4 | 1.5 | –1.3 | –0.5 | –0.4 |
| Other Investment, Net | 11.6 | –2.0 | 15.6 | 31.6 | 47.4 | 2.3 | 32.0 | 64.0 | 54.5 | 34.0 |
| Change in Reserves | 54.4 | 90.7 | 109.8 | 59.0 | 11.9 | 39.2 | –29.2 | 19.9 | 12.8 | 15.0 |
| **Middle East, North Africa, Afghanistan, and Pakistan** | | | | | | | | | | |
| Financial Account Balance | –41.5 | 121.8 | 319.2 | 286.4 | 308.0 | 180.6 | –130.4 | –204.6 | –107.7 | –81.8 |
| Direct Investment, Net | –63.6 | –48.9 | –21.6 | –25.6 | –8.8 | –28.8 | –2.5 | –9.5 | –20.8 | –22.4 |
| Portfolio Investment, Net | 31.7 | 24.1 | 73.3 | 57.1 | 70.4 | 131.0 | 67.8 | 20.1 | 9.3 | 7.7 |
| Financial Derivatives, Net | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . |
| Other Investment, Net | 16.1 | 60.5 | 129.4 | 100.3 | 118.0 | 62.0 | –56.9 | –72.5 | –30.5 | –41.6 |
| Change in Reserves | –25.7 | 86.1 | 138.1 | 154.7 | 128.2 | 16.0 | –139.2 | –143.1 | –66.0 | –25.9 |
| **Sub-Saharan Africa** | | | | | | | | | | |
| Financial Account Balance | –47.6 | –1.0 | –9.9 | –13.2 | –54.0 | –77.1 | –79.3 | –68.5 | –52.5 | –55.8 |
| Direct Investment, Net | –28.5 | –31.2 | –29.7 | –27.4 | –21.0 | –27.0 | –30.3 | –37.0 | –39.9 | –46.0 |
| Portfolio Investment, Net | –8.5 | –0.4 | –19.2 | –28.4 | –22.3 | –22.1 | –15.0 | –13.7 | –15.9 | –8.3 |
| Financial Derivatives, Net | –0.2 | –0.2 | –1.7 | –1.7 | –0.8 | –1.5 | –0.4 | 0.9 | 0.0 | 0.0 |
| Other Investment, Net | –2.7 | 31.6 | 18.8 | 22.8 | –11.8 | –18.0 | –19.0 | –7.9 | 3.5 | –4.3 |
| Change in Reserves | –7.6 | –0.5 | 22.2 | 19.8 | 2.7 | –7.7 | –14.0 | –9.9 | 0.6 | 3.6 |

## Table A13. Summary of Financial Account Balances *(continued)*

*(Billions of US dollars)*

| | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | Projections 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Analytical Groups** | | | | | | | | | | |
| **By Source of Export Earnings** | | | | | | | | | | |
| **Fuel** | | | | | | | | | | |
| Financial Account Balance | 17.3 | 257.2 | 516.6 | 453.6 | 366.7 | 224.0 | –79.3 | –163.2 | –43.8 | –10.0 |
| Direct Investment, Net | –53.7 | –25.6 | –21.1 | –25.7 | 13.0 | 10.6 | 7.9 | –26.1 | –14.3 | –8.7 |
| Portfolio Investment, Net | 11.0 | 20.3 | 87.0 | 47.2 | 78.1 | 162.4 | 80.1 | 19.0 | 12.2 | 15.7 |
| Financial Derivatives, Net | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . |
| Other Investment, Net | 104.9 | 146.5 | 254.5 | 196.0 | 175.4 | 152.8 | 15.4 | 4.7 | 8.6 | –8.2 |
| Change in Reserves | –48.1 | 114.2 | 194.9 | 234.7 | 99.8 | –107.1 | –190.0 | –161.2 | –50.7 | –9.0 |
| **Nonfuel** | | | | | | | | | | |
| Financial Account Balance | 51.5 | –119.9 | –276.2 | –335.0 | –342.7 | –205.1 | –187.6 | –256.7 | –84.8 | –127.6 |
| Direct Investment, Net | –270.1 | –424.8 | –510.5 | –458.6 | –495.7 | –422.6 | –348.9 | –246.5 | –203.2 | –181.0 |
| Portfolio Investment, Net | –97.1 | –244.7 | –236.9 | –288.1 | –238.2 | –277.8 | 32.1 | –29.0 | –83.3 | –34.7 |
| Financial Derivatives, Net | . . . | 0.5 | 5.8 | –1.0 | –2.7 | 3.6 | –2.0 | –10.5 | –11.3 | –11.7 |
| Other Investment, Net | –149.3 | –170.0 | –85.3 | 215.7 | –95.6 | 256.6 | 457.2 | 348.4 | 275.0 | 52.5 |
| Change in Reserves | 572.8 | 720.4 | 553.1 | 196.2 | 489.7 | 235.5 | –325.8 | –318.4 | –61.3 | 48.1 |
| **By External Financing Source** | | | | | | | | | | |
| **Net Debtor Economies** | | | | | | | | | | |
| Financial Account Balance | –187.7 | –287.9 | –392.2 | –427.8 | –430.5 | –375.8 | –282.7 | –225.4 | –235.8 | –265.6 |
| Direct Investment, Net | –196.3 | –222.9 | –283.7 | –283.0 | –281.3 | –289.0 | –281.8 | –297.2 | –287.7 | –311.6 |
| Portfolio Investment, Net | –61.4 | –212.2 | –182.8 | –202.3 | –179.2 | –198.4 | –40.3 | –52.7 | –103.6 | –61.7 |
| Financial Derivatives, Net | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . |
| Other Investment, Net | –73.8 | –86.0 | –63.5 | –51.3 | –28.3 | –10.7 | 38.4 | 41.4 | 70.3 | 35.8 |
| Change in Reserves | 149.1 | 233.5 | 135.1 | 109.7 | 60.2 | 117.3 | 2.8 | 95.5 | 97.1 | 84.4 |
| **Net Debtor Economies by Debt-Servicing Experience** | | | | | | | | | | |
| **Economies with Arrears and/or Rescheduling during 2012–16** | | | | | | | | | | |
| Financial Account Balance | –19.9 | –11.7 | –25.2 | –47.4 | –49.5 | –27.7 | –39.4 | –50.3 | –31.1 | –28.6 |
| Direct Investment, Net | –20.7 | –21.6 | –22.5 | –25.8 | –25.0 | –18.2 | –25.4 | –25.5 | –23.2 | –26.5 |
| Portfolio Investment, Net | 14.1 | –11.2 | 1.0 | –1.4 | –10.1 | –0.4 | 1.7 | –0.9 | –14.1 | –7.2 |
| Financial Derivatives, Net | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . |
| Other Investment, Net | 0.1 | 9.1 | 6.9 | –0.7 | –11.7 | 1.8 | –20.9 | –21.9 | 4.3 | –6.7 |
| Change in Reserves | –13.1 | 12.2 | –10.2 | –21.4 | –2.1 | –10.5 | 5.4 | –1.5 | 2.2 | 12.3 |
| *Memorandum* | | | | | | | | | | |
| **World** | | | | | | | | | | |
| Financial Account Balance | 79.1 | 38.9 | 30.3 | –3.7 | 259.9 | 399.4 | 174.0 | 50.6 | 260.4 | 229.7 |

Note: The estimates in this table are based on individual countries' national accounts and balance of payments statistics. Country group composites are calculated as the sum of the US dollar values for the relevant individual countries. Some group aggregates for the financial derivatives are not shown because of incomplete data. Projections for the euro area are not available because of data constraints.

[1]Excludes the G7 (Canada, France, Germany, Italy, Japan, United Kingdom, United States) and euro area countries.

[2]Georgia, Turkmenistan, and Ukraine, which are not members of the Commonwealth of Independent States, are included in this group for reasons of geography and similarity in economic structure.

## Table A14. Summary of Net Lending and Borrowing

*(Percent of GDP)*

| | Averages | | | | | | | | Projections | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | Average |
| | 1999–2008 | 2003–10 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019–22 |
| **Advanced Economies** | | | | | | | | | | | |
| Net Lending and Borrowing | –0.8 | –0.7 | 0.0 | 0.1 | 0.5 | 0.5 | 0.6 | 0.7 | 0.8 | 0.7 | 0.7 |
| Current Account Balance | –0.8 | –0.7 | –0.1 | 0.1 | 0.5 | 0.5 | 0.7 | 0.8 | 0.8 | 0.7 | 0.7 |
| Savings | 22.4 | 21.5 | 21.0 | 21.4 | 21.6 | 22.2 | 22.5 | 22.0 | 22.0 | 22.0 | 22.3 |
| Investment | 23.0 | 22.2 | 21.1 | 21.0 | 20.9 | 21.2 | 21.2 | 20.9 | 21.1 | 21.3 | 21.6 |
| Capital Account Balance | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | –0.1 | 0.0 | 0.0 | 0.0 | 0.0 |
| **United States** | | | | | | | | | | | |
| Net Lending and Borrowing | –4.5 | –4.5 | –2.9 | –2.6 | –2.1 | –2.1 | –2.4 | –2.4 | –2.4 | –2.6 | –2.6 |
| Current Account Balance | –4.5 | –4.5 | –2.9 | –2.6 | –2.1 | –2.1 | –2.4 | –2.4 | –2.4 | –2.6 | –2.6 |
| Savings | 18.3 | 16.7 | 15.7 | 17.7 | 18.3 | 19.3 | 19.4 | 18.0 | 17.5 | 17.4 | 17.7 |
| Investment | 22.4 | 21.2 | 18.5 | 19.4 | 19.8 | 20.1 | 20.4 | 19.7 | 19.8 | 20.0 | 20.3 |
| Capital Account Balance | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Euro Area** | | | | | | | | | | | |
| Net Lending and Borrowing | –0.1 | 0.1 | 0.1 | 1.5 | 2.4 | 2.6 | 3.1 | 3.4 | . . . | . . . | . . . |
| Current Account Balance | –0.2 | –0.1 | 0.0 | 1.4 | 2.2 | 2.5 | 3.2 | 3.5 | 3.1 | 3.0 | 2.8 |
| Savings | 23.1 | 22.6 | 22.4 | 22.3 | 22.4 | 22.9 | 23.7 | 23.8 | 24.2 | 24.3 | 24.6 |
| Investment | 22.8 | 22.3 | 21.5 | 20.1 | 19.6 | 19.9 | 20.0 | 20.3 | 20.6 | 20.8 | 21.3 |
| Capital Account Balance | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.1 | –0.1 | 0.0 | . . . | . . . | . . . |
| **Germany** | | | | | | | | | | | |
| Net Lending and Borrowing | 2.7 | 5.0 | 6.1 | 7.0 | 6.7 | 7.5 | 8.5 | 8.4 | 8.1 | 7.7 | 7.1 |
| Current Account Balance | 2.7 | 5.0 | 6.1 | 7.0 | 6.7 | 7.4 | 8.5 | 8.3 | 8.1 | 7.7 | 7.1 |
| Savings | 23.5 | 24.6 | 27.2 | 26.3 | 26.2 | 27.0 | 27.7 | 27.5 | 27.6 | 27.3 | 27.2 |
| Investment | 20.9 | 19.6 | 21.1 | 19.3 | 19.5 | 19.5 | 19.1 | 19.2 | 19.4 | 19.6 | 20.1 |
| Capital Account Balance | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **France** | | | | | | | | | | | |
| Net Lending and Borrowing | 1.5 | 0.2 | –0.9 | –1.2 | –0.8 | –1.2 | –0.4 | –0.9 | –1.0 | –0.7 | –0.1 |
| Current Account Balance | 1.5 | 0.1 | –1.0 | –1.2 | –0.9 | –1.3 | –0.4 | –1.0 | –1.1 | –0.8 | –0.2 |
| Savings | 23.8 | 22.6 | 22.2 | 21.4 | 21.4 | 21.5 | 22.3 | 22.0 | 22.1 | 22.3 | 22.9 |
| Investment | 22.4 | 22.5 | 23.2 | 22.6 | 22.3 | 22.7 | 22.8 | 23.0 | 23.3 | 23.0 | 23.0 |
| Capital Account Balance | 0.0 | 0.0 | 0.1 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| **Italy** | | | | | | | | | | | |
| Net Lending and Borrowing | –0.5 | –1.5 | –2.9 | –0.1 | 0.9 | 2.1 | 1.6 | 2.4 | 2.6 | 2.3 | 1.5 |
| Current Account Balance | –0.6 | –1.6 | –3.0 | –0.4 | 1.0 | 1.9 | 1.4 | 2.6 | 2.7 | 2.3 | 1.4 |
| Savings | 20.6 | 19.5 | 17.5 | 17.5 | 17.9 | 18.9 | 18.8 | 19.6 | 19.6 | 19.6 | 19.3 |
| Investment | 21.2 | 21.1 | 20.5 | 17.9 | 17.0 | 17.0 | 17.3 | 17.0 | 16.9 | 17.3 | 17.9 |
| Capital Account Balance | 0.1 | 0.1 | 0.1 | 0.2 | 0.0 | 0.2 | 0.2 | –0.1 | –0.1 | 0.0 | 0.1 |
| **Spain** | | | | | | | | | | | |
| Net Lending and Borrowing | –5.3 | –6.0 | –2.8 | 0.3 | 2.2 | 1.6 | 2.0 | 2.1 | 2.3 | 2.4 | 2.4 |
| Current Account Balance | –6.1 | –6.6 | –3.2 | –0.2 | 1.5 | 1.1 | 1.4 | 1.9 | 1.9 | 2.0 | 2.0 |
| Savings | 22.3 | 21.7 | 18.7 | 19.8 | 20.2 | 20.5 | 21.4 | 22.3 | 22.5 | 22.8 | 22.8 |
| Investment | 28.4 | 28.4 | 21.9 | 20.0 | 18.7 | 19.4 | 20.1 | 20.4 | 20.6 | 20.8 | 20.9 |
| Capital Account Balance | 0.7 | 0.6 | 0.4 | 0.5 | 0.6 | 0.5 | 0.7 | 0.2 | 0.4 | 0.4 | 0.4 |
| **Japan** | | | | | | | | | | | |
| Net Lending and Borrowing | 3.0 | 3.5 | 2.1 | 0.9 | 0.7 | 0.7 | 3.0 | 3.7 | 3.5 | 3.7 | 3.7 |
| Current Account Balance | 3.2 | 3.6 | 2.1 | 1.0 | 0.9 | 0.8 | 3.1 | 3.8 | 3.6 | 3.8 | 3.7 |
| Savings | 28.5 | 27.3 | 24.2 | 23.6 | 24.1 | 24.6 | 27.0 | 27.2 | 27.0 | 27.3 | 27.6 |
| Investment | 25.3 | 23.7 | 22.1 | 22.7 | 23.2 | 23.9 | 23.9 | 23.3 | 23.4 | 23.5 | 23.9 |
| Capital Account Balance | –0.1 | –0.1 | 0.0 | 0.0 | –0.1 | 0.0 | –0.1 | –0.1 | –0.1 | –0.1 | –0.1 |
| **United Kingdom** | | | | | | | | | | | |
| Net Lending and Borrowing | –2.2 | –2.3 | –1.8 | –3.7 | –4.4 | –4.7 | –4.3 | –4.5 | –3.6 | –3.3 | –2.8 |
| Current Account Balance | –2.1 | –2.3 | –1.8 | –3.7 | –4.4 | –4.7 | –4.3 | –4.4 | –3.6 | –3.3 | –2.7 |
| Savings | 15.9 | 14.9 | 14.1 | 12.4 | 12.0 | 12.7 | 13.0 | 12.6 | 13.4 | 13.6 | 14.6 |
| Investment | 18.1 | 17.2 | 15.8 | 16.0 | 16.4 | 17.3 | 17.2 | 17.0 | 17.0 | 16.8 | 17.3 |
| Capital Account Balance | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | –0.1 | –0.1 | –0.1 | –0.1 | –0.1 |

## Table A14. Summary of Net Lending and Borrowing *(continued)*

*(Percent of GDP)*

| | Averages 1999–2008 | Averages 2003–10 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | Projections 2017 | Projections 2018 | Projections Average 2019–22 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Canada** | | | | | | | | | | | |
| Net Lending and Borrowing | 1.4 | 0.1 | –2.5 | –3.6 | –3.2 | –2.4 | –3.4 | –3.3 | –3.4 | –2.9 | –2.3 |
| Current Account Balance | 1.4 | 0.1 | –2.8 | –3.6 | –3.2 | –2.4 | –3.4 | –3.3 | –3.4 | –2.9 | –2.3 |
| Savings | 23.1 | 22.9 | 21.4 | 21.3 | 21.7 | 22.2 | 20.4 | 19.6 | 19.9 | 20.5 | 21.2 |
| Investment | 21.7 | 22.7 | 24.2 | 24.9 | 24.9 | 24.7 | 23.8 | 22.9 | 23.3 | 23.4 | 23.5 |
| Capital Account Balance | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Other Advanced Economies[1]** | | | | | | | | | | | |
| Net Lending and Borrowing | 3.7 | 4.1 | 4.2 | 4.2 | 5.3 | 5.2 | 5.7 | 5.6 | 5.2 | 4.9 | 4.7 |
| Current Account Balance | 3.8 | 4.2 | 4.1 | 4.2 | 5.2 | 5.4 | 5.9 | 5.7 | 5.4 | 5.0 | 4.8 |
| Savings | 29.8 | 30.2 | 30.7 | 30.4 | 30.5 | 30.7 | 31.1 | 30.5 | 30.7 | 30.4 | 30.0 |
| Investment | 25.8 | 25.8 | 26.2 | 26.1 | 25.2 | 25.2 | 24.9 | 24.7 | 25.3 | 25.3 | 25.2 |
| Capital Account Balance | –0.1 | 0.0 | 0.1 | 0.0 | 0.1 | –0.1 | –0.2 | –0.1 | –0.2 | –0.1 | –0.1 |
| **Emerging Market and Developing Economies** | | | | | | | | | | | |
| Net Lending and Borrowing | 2.4 | 2.9 | 1.5 | 1.3 | 0.7 | 0.6 | 0.0 | –0.2 | –0.2 | –0.3 | –0.6 |
| Current Account Balance | 2.4 | 2.8 | 1.4 | 1.3 | 0.6 | 0.5 | –0.2 | –0.3 | –0.3 | –0.4 | –0.7 |
| Savings | 28.7 | 31.4 | 33.6 | 33.4 | 32.8 | 33.0 | 32.7 | 32.0 | 31.7 | 31.5 | 31.4 |
| Investment | 26.6 | 28.8 | 32.2 | 32.4 | 32.4 | 32.6 | 33.0 | 32.3 | 32.0 | 31.9 | 32.0 |
| Capital Account Balance | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| **Regional Groups** | | | | | | | | | | | |
| **Commonwealth of Independent States[2]** | | | | | | | | | | | |
| Net Lending and Borrowing | 6.6 | 5.0 | 4.1 | 2.2 | 0.6 | 0.6 | 2.8 | 0.0 | 0.9 | 1.3 | 2.0 |
| Current Account Balance | 7.0 | 5.3 | 4.0 | 2.4 | 0.6 | 2.1 | 2.8 | 0.0 | 0.9 | 1.3 | 2.0 |
| Savings | 27.7 | 26.9 | 28.6 | 27.4 | 24.7 | 25.0 | 26.3 | 26.0 | 25.6 | 26.5 | 26.2 |
| Investment | 20.9 | 21.5 | 24.5 | 25.0 | 24.0 | 22.8 | 23.2 | 25.5 | 24.3 | 24.9 | 23.8 |
| Capital Account Balance | –0.4 | –0.3 | 0.0 | –0.2 | 0.0 | –1.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Emerging and Developing Asia** | | | | | | | | | | | |
| Net Lending and Borrowing | 3.5 | 4.1 | 0.9 | 1.0 | 0.8 | 1.6 | 2.0 | 1.4 | 1.0 | 0.7 | 0.1 |
| Current Account Balance | 3.4 | 4.0 | 0.9 | 1.0 | 0.7 | 1.5 | 2.0 | 1.4 | 0.9 | 0.7 | 0.0 |
| Savings | 37.0 | 41.5 | 43.9 | 43.7 | 43.0 | 43.6 | 42.6 | 41.1 | 40.5 | 39.8 | 38.5 |
| Investment | 34.0 | 37.7 | 42.9 | 42.6 | 42.3 | 42.1 | 40.6 | 39.7 | 39.6 | 39.2 | 38.5 |
| Capital Account Balance | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Emerging and Developing Europe** | | | | | | | | | | | |
| Net Lending and Borrowing | –4.6 | –5.1 | –5.5 | –3.4 | –2.5 | –1.6 | –0.7 | –1.1 | –1.7 | –1.6 | –2.1 |
| Current Account Balance | –4.9 | –5.5 | –6.3 | –4.4 | –3.6 | –2.9 | –2.0 | –1.8 | –2.4 | –2.5 | –2.7 |
| Savings | 19.6 | 19.6 | 20.4 | 20.5 | 21.5 | 22.1 | 22.9 | 22.6 | 22.5 | 22.6 | 22.7 |
| Investment | 24.2 | 25.1 | 26.6 | 24.9 | 25.0 | 24.9 | 24.7 | 24.2 | 24.8 | 25.0 | 25.3 |
| Capital Account Balance | 0.3 | 0.4 | 0.8 | 0.9 | 1.1 | 1.3 | 1.3 | 0.6 | 0.7 | 0.9 | 0.6 |
| **Latin America and the Caribbean** | | | | | | | | | | | |
| Net Lending and Borrowing | –0.4 | 0.2 | –1.9 | –2.3 | –2.7 | –3.1 | –3.3 | –2.0 | –1.9 | –2.3 | –2.5 |
| Current Account Balance | –0.5 | 0.1 | –2.0 | –2.3 | –2.8 | –3.1 | –3.4 | –2.0 | –2.0 | –2.3 | –2.5 |
| Savings | 19.9 | 20.9 | 20.3 | 19.8 | 19.0 | 18.0 | 18.6 | 17.7 | 17.7 | 17.5 | 18.3 |
| Investment | 20.5 | 21.0 | 22.2 | 22.3 | 22.3 | 21.8 | 22.5 | 20.0 | 19.7 | 19.8 | 20.8 |
| Capital Account Balance | 0.1 | 0.1 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Middle East, North Africa, Afghanistan, and Pakistan** | | | | | | | | | | | |
| Net Lending and Borrowing | 8.0 | 8.8 | 12.8 | 11.9 | 9.9 | 6.2 | –3.5 | –4.0 | –1.8 | –1.6 | –0.5 |
| Current Account Balance | 8.3 | 9.3 | 12.8 | 12.4 | 9.7 | 5.5 | –3.7 | –4.1 | –1.9 | –1.6 | –0.7 |
| Savings | 34.3 | 36.4 | 39.5 | 37.9 | 36.1 | 32.9 | 24.8 | 23.7 | 25.2 | 25.4 | 27.0 |
| Investment | 26.4 | 27.8 | 26.7 | 25.9 | 26.0 | 26.8 | 28.1 | 27.2 | 26.8 | 26.6 | 26.7 |
| Capital Account Balance | 0.2 | 0.2 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | –0.1 | 0.1 | 0.1 | 0.1 |
| **Sub-Saharan Africa** | | | | | | | | | | | |
| Net Lending and Borrowing | 1.9 | 2.3 | –0.3 | –0.6 | –1.8 | –3.4 | –5.6 | –3.7 | –3.0 | –3.2 | –3.6 |
| Current Account Balance | 0.7 | 0.8 | –0.8 | –1.8 | –2.4 | –3.9 | –6.1 | –4.2 | –3.4 | –3.6 | –4.0 |
| Savings | 19.0 | 20.3 | 18.7 | 18.2 | 17.5 | 17.1 | 14.2 | 14.8 | 15.3 | 15.3 | 15.8 |
| Investment | 18.4 | 19.4 | 19.3 | 19.9 | 19.9 | 20.8 | 19.9 | 18.6 | 18.7 | 18.9 | 19.7 |
| Capital Account Balance | 1.2 | 1.5 | 0.6 | 1.2 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.4 | 0.4 |

## Table A14. Summary of Net Lending and Borrowing *(continued)*
*(Percent of GDP)*

| | Averages | | | | | | | | Projections | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1999–2008 | 2003–10 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | Average 2019–22 |
| **Analytical Groups** | | | | | | | | | | | |
| **By Source of Export Earnings** | | | | | | | | | | | |
| **Fuel** | | | | | | | | | | | |
| Net Lending and Borrowing | 9.3 | 9.7 | 10.5 | 9.3 | 7.3 | 4.6 | –1.3 | –1.8 | 0.3 | 0.3 | 1.3 |
| Current Account Balance | 9.7 | 10.0 | 10.5 | 9.7 | 7.3 | 5.0 | –1.4 | –1.9 | 0.2 | 0.4 | 1.2 |
| Savings | 33.6 | 33.9 | 35.8 | 34.5 | 31.9 | 29.8 | 26.0 | 24.4 | 25.4 | 25.4 | 26.2 |
| Investment | 24.4 | 24.4 | 25.2 | 25.3 | 24.9 | 25.0 | 27.6 | 25.9 | 24.7 | 24.4 | 24.1 |
| Capital Account Balance | 0.0 | 0.0 | 0.0 | –0.1 | 0.0 | –0.7 | –0.1 | –0.1 | 0.1 | 0.1 | 0.1 |
| **Nonfuel** | | | | | | | | | | | |
| Net Lending and Borrowing | 0.6 | 1.0 | –1.0 | –0.9 | –1.0 | –0.4 | 0.2 | 0.1 | –0.3 | –0.5 | –0.9 |
| Current Account Balance | 0.4 | 0.8 | –1.2 | –1.1 | –1.2 | –0.6 | 0.1 | 0.0 | –0.4 | –0.6 | –1.0 |
| Savings | 27.4 | 30.7 | 33.0 | 33.2 | 33.0 | 33.8 | 34.0 | 33.3 | 32.9 | 32.6 | 32.2 |
| Investment | 27.2 | 30.0 | 34.0 | 34.2 | 34.2 | 34.3 | 34.0 | 33.4 | 33.3 | 33.2 | 33.3 |
| Capital Account Balance | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 |
| **By External Financing Source** | | | | | | | | | | | |
| **Net Debtor Economies** | | | | | | | | | | | |
| Net Lending and Borrowing | –1.1 | –1.1 | –2.8 | –3.0 | –2.6 | –2.3 | –2.0 | –1.5 | –1.6 | –1.8 | –2.1 |
| Current Account Balance | –1.4 | –1.5 | –3.0 | –3.3 | –2.9 | –2.6 | –2.4 | –1.6 | –1.8 | –2.0 | –2.2 |
| Savings | 21.7 | 23.1 | 23.4 | 22.8 | 22.4 | 22.5 | 22.5 | 22.6 | 22.5 | 22.6 | 23.1 |
| Investment | 23.3 | 24.7 | 26.3 | 26.1 | 25.2 | 25.1 | 24.8 | 24.2 | 24.3 | 24.6 | 25.4 |
| Capital Account Balance | 0.3 | 0.3 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 | 0.2 | 0.2 | 0.2 | 0.2 |
| **Net Debtor Economies by Debt-Servicing Experience** | | | | | | | | | | | |
| **Economies with Arrears and/or Rescheduling during 2012–16** | | | | | | | | | | | |
| Net Lending and Borrowing | –0.4 | –1.3 | –3.9 | –5.3 | –5.6 | –3.8 | –5.1 | –6.2 | –4.6 | –4.0 | –4.4 |
| Current Account Balance | –0.9 | –1.9 | –4.5 | –6.0 | –6.0 | –4.3 | –5.6 | –6.4 | –4.9 | –4.3 | –4.7 |
| Savings | 20.7 | 20.8 | 16.4 | 14.8 | 13.3 | 14.0 | 12.2 | 12.2 | 13.9 | 15.4 | 16.8 |
| Investment | 22.1 | 22.7 | 20.5 | 20.5 | 19.3 | 18.2 | 17.8 | 18.5 | 19.0 | 19.9 | 21.7 |
| Capital Account Balance | 0.5 | 0.6 | 0.5 | 0.7 | 0.4 | 0.5 | 0.4 | 0.1 | 0.3 | 0.3 | 0.2 |
| *Memorandum* | | | | | | | | | | | |
| **World** | | | | | | | | | | | |
| Net Lending and Borrowing | 0.0 | 0.3 | 0.6 | 0.6 | 0.6 | 0.6 | 0.4 | 0.4 | 0.4 | 0.3 | 0.1 |
| Current Account Balance | 0.0 | 0.2 | 0.5 | 0.5 | 0.5 | 0.5 | 0.4 | 0.4 | 0.4 | 0.3 | 0.1 |
| Savings | 24.0 | 24.3 | 25.6 | 26.0 | 26.0 | 26.4 | 26.5 | 25.8 | 25.8 | 25.8 | 26.1 |
| Investment | 23.9 | 24.1 | 25.1 | 25.3 | 25.3 | 25.6 | 25.8 | 25.3 | 25.4 | 25.5 | 26.0 |
| Capital Account Balance | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

Note: The estimates in this table are based on individual countries' national accounts and balance of payments statistics. Country group composites are calculated as the sum of the US dollar values for the relevant individual countries. This differs from the calculations in the April 2005 and earlier issues of the *World Economic Outlook,* in which the composites were weighted by GDP valued at purchasing power parities as a share of total world GDP. The estimates of gross national savings and investment (or gross capital formation) are from individual countries' national accounts statistics. The estimates of the current account balance, the capital account balance, and the financial account balance (or net lending/net borrowing) are from the balance of payments statistics. The link between domestic transactions and transactions with the rest of the world can be expressed as accounting identities. Savings ($S$) minus investment ($I$) is equal to the current account balance ($CAB$) ($S - I = CAB$). Also, net lending/net borrowing ($NLB$) is the sum of the current account balance and the capital account balance ($KAB$) ($NLB = CAB + KAB$). In practice, these identities do not hold exactly; imbalances result from imperfections in source data and compilation as well as from asymmetries in group composition due to data availability.

[1]Excludes the G7 (Canada, France, Germany, Italy, Japan, United Kingdom, United States) and euro area countries.

[2]Georgia, Turkmenistan, and Ukraine, which are not members of the Commonwealth of Independent States, are included in this group for reasons of geography and similarity in economic structure.

## Table A15. Summary of World Medium-Term Baseline Scenario

| | Averages | | | | Projections | | Averages | |
|---|---|---|---|---|---|---|---|---|
| | 1999–2008 | 2009–18 | 2015 | 2016 | 2017 | 2018 | 2015–18 | 2019–22 |
| | | | | *Annual Percent Change* | | | | |
| **World Real GDP** | **4.2** | **3.4** | **3.4** | **3.2** | **3.6** | **3.7** | **3.5** | **3.7** |
| Advanced Economies | 2.5 | 1.4 | 2.2 | 1.7 | 2.2 | 2.0 | 2.0 | 1.7 |
| Emerging Market and Developing Economies | 6.2 | 5.0 | 4.3 | 4.3 | 4.6 | 4.9 | 4.5 | 5.0 |
| *Memorandum* | | | | | | | | |
| Potential Output | | | | | | | | |
| Major Advanced Economies | 2.1 | 1.3 | 1.4 | 1.4 | 1.5 | 1.5 | 1.4 | 1.5 |
| **World Trade, Volume**[1] | **6.6** | **3.1** | **2.8** | **2.4** | **4.2** | **4.0** | **3.4** | **3.9** |
| Imports | | | | | | | | |
| Advanced Economies | 5.6 | 2.6 | 4.6 | 2.7 | 4.0 | 3.8 | 3.8 | 3.5 |
| Emerging Market and Developing Economies | 9.9 | 4.0 | –0.9 | 2.0 | 4.4 | 4.9 | 2.6 | 5.0 |
| Exports | | | | | | | | |
| Advanced Economies | 5.6 | 2.8 | 3.8 | 2.2 | 3.8 | 3.6 | 3.4 | 3.4 |
| Emerging Market and Developing Economies | 8.8 | 3.8 | 1.8 | 2.5 | 4.8 | 4.5 | 3.4 | 4.4 |
| Terms of Trade | | | | | | | | |
| Advanced Economies | –0.5 | 0.3 | 1.9 | 0.9 | –0.4 | 0.2 | 0.6 | 0.0 |
| Emerging Market and Developing Economies | 2.7 | –0.6 | –4.3 | –1.2 | 0.1 | –0.5 | –1.5 | 0.0 |
| **World Prices in US Dollars** | | | | | | | | |
| Manufactures | 1.7 | –0.1 | –2.3 | –5.2 | 1.5 | 1.0 | –1.3 | 1.2 |
| Oil | 22.2 | –6.4 | –47.2 | –15.7 | 17.4 | –0.2 | –15.0 | 1.4 |
| Nonfuel Primary Commodities | 6.2 | –0.7 | –17.5 | –1.8 | 7.1 | 0.5 | –3.4 | –0.5 |
| **Consumer Prices** | | | | | | | | |
| Advanced Economies | 2.2 | 1.4 | 0.3 | 0.8 | 1.7 | 1.7 | 1.1 | 2.0 |
| Emerging Market and Developing Economies | 7.6 | 5.1 | 4.7 | 4.3 | 4.2 | 4.4 | 4.4 | 4.0 |
| **Interest Rates** | | | | *Percent* | | | | |
| Real Six-Month LIBOR[2] | 1.5 | –0.7 | –0.6 | –0.3 | –0.3 | 0.2 | –0.3 | 1.1 |
| World Real Long-Term Interest Rate[3] | 2.1 | 0.8 | 1.3 | 0.4 | –0.1 | 0.2 | 0.5 | 0.5 |
| **Current Account Balances** | | | | *Percent of GDP* | | | | |
| Advanced Economies | –0.8 | 0.4 | 0.7 | 0.8 | 0.8 | 0.7 | 0.8 | 0.7 |
| Emerging Market and Developing Economies | 2.4 | 0.5 | –0.2 | –0.3 | –0.3 | –0.4 | –0.3 | –0.7 |
| **Total External Debt** | | | | | | | | |
| Emerging Market and Developing Economies | 32.3 | 28.0 | 28.5 | 29.7 | 29.5 | 28.8 | 29.1 | 27.6 |
| **Debt Service** | | | | | | | | |
| Emerging Market and Developing Economies | 9.4 | 9.9 | 12.3 | 10.7 | 10.2 | 9.7 | 10.7 | 9.5 |

[1]Data refer to trade in goods and services.
[2]London interbank offered rate on US dollar deposits minus percent change in US GDP deflator.
[3]GDP-weighted average of 10-year (or nearest-maturity) government bond rates for Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States.

# WORLD ECONOMIC OUTLOOK SELECTED TOPICS

## World Economic Outlook Archives

| | |
|---|---|
| World Economic Outlook: Financial Systems and Economic Cycles | September 2006 |
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| World Economic Outlook: Gaining Momentum? | April 2017 |
| World Economic Outlook: Seeking Sustainable Growth: Short-term Recovery, Long-term Challenges | October 2017 |

## I. Methodology—Aggregation, Modeling, and Forecasting

| | |
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| Measuring Inequality: Conceptual, Methodological, and Measurement Issues | October 2007, Box 4.1 |
| New Business Cycle Indices for Latin America: A Historical Reconstruction | October 2007, Box 5.3 |
| Implications of New PPP Estimates for Measuring Global Growth | April 2008, Appendix 1.1 |
| Measuring Output Gaps | October 2008, Box 1.3 |
| Assessing and Communicating Risks to the Global Outlook | October 2008, Appendix 1.1 |
| Fan Chart for Global Growth | April 2009, Appendix 1.2 |
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| Fiscal Balance Sheets: The Significance of Nonfinancial Assets and Their Measurement | October 2014, Box 3.3 |
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| World Growth Projections over the Medium Term | October 2016, Box 1.1 |

## II. Historical Surveys



## III. Economic Growth—Sources and Patterns

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| How Much Do Global Prices Matter for Food Inflation? | October 2016, Box 3.3 |
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## V. Fiscal Policy

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| The Changing Housing Cycle and the Implications for Monetary Policy | April 2008, Chapter 3 |
| Is There a Credit Crunch? | April 2008, Box 1.1 |
| Assessing Vulnerabilities to Housing Market Corrections | April 2008, Box 3.1 |
| Financial Stress and Economic Downturns | October 2008, Chapter 4 |
| The Latest Bout of Financial Distress: How Does It Change the Global Outlook? | October 2008, Box 1.1 |
| Policies to Resolve Financial System Stress and Restore Sound Financial Intermediation | October 2008, Box 4.1 |

## VII. Labor Markets, Poverty, and Inequality



## VIII. Exchange Rate Issues

## IX. External Payments, Trade, Capital Movements, and Foreign Debt

## X. Regional Issues



## XI. Country-Specific Analyses



## XII. Special Topics

# IMF EXECUTIVE BOARD DISCUSSION OF THE OUTLOOK, OCTOBER 2017

*The following remarks were made by the Chair at the conclusion of the Executive Board's discussion of the* Fiscal Monitor*,* Global Financial Stability Report*, and* World Economic Outlook *on September 21, 2017.*

Executive Directors broadly shared the assessment of global economic prospects and risks. They observed that global activity has strengthened further and is expected to rise steadily into next year. The pickup is broad based across countries, driven by investment and trade. Nevertheless, the recovery is not complete, with medium-term global growth remaining modest, especially in advanced economies and fuel exporters. In most advanced economies, inflation remains subdued amid weak wage growth, while slow productivity growth and worsening demographic profiles weigh on medium-term prospects. Meanwhile, several emerging markets and developing economies continue to adjust to a range of factors, including lower commodity revenues.

Directors noted that, while risks are broadly balanced in the near term, medium-term risks remain skewed to the downside, with rising financial vulnerabilities. These include the possibility of a sudden tightening of global financial conditions, a rapid increase in private sector debt in key emerging market economies, low bank profitability and pockets of still-elevated nonperforming loan ratios, and policy uncertainty about financial deregulation. Directors also pointed to risks associated with inward-looking policies, rising geopolitical tensions, and weather-related factors.

Given this landscape, Directors underscored the continued importance of employing a range of policy tools, in a comprehensive, consistent, and well-communicated manner, to secure the recovery and improve medium-term prospects. They recognized that major central banks have made every effort to communicate their monetary normalization policies to markets. The cyclical upturn in economic activity provides a window of opportunity to accelerate critical structural reforms, increase resilience, and promote inclusiveness.

Directors stressed that a cooperative multilateral framework remains vital for amplifying the mutual benefits of national policies and minimizing any cross-border spillovers. Common challenges include maintaining the rules-based, open trading system; preserving the resilience of the global financial system; avoiding competitive races to the bottom in taxation and financial regulation; and further strengthening the global financial safety net. Multilateral cooperation is also essential to tackle various noneconomic challenges, among which are refugee flows, cyberthreats and, as most Directors highlighted, mitigating and adapting to climate change. Concerted effort is also needed to reduce excess global imbalances, through a recalibration of policies with a view to achieving their domestic objectives as well as strengthening prospects for strong, sustainable, and balanced global growth. In this context, as a few Directors emphasized, the IMF also has a role to play by continuing to strengthen its multilateral analysis of external imbalances and exchange rates.

Directors agreed that continued accommodative monetary policy is still needed in countries with low core inflation, consistent with central banks' mandates. Fiscal policy should gear toward long-term sustainability, avoid procyclicality, and promote inclusive growth. At the same time, fiscal policy should be as growth friendly as possible, using space, where available, to support productivity and growth-enhancing structural reforms. In many cases, policymakers should prioritize rebuilding buffers, improving medium-term debt dynamics, and enhancing resilience. Efforts to raise potential output should be prioritized based on country-specific circumstances, including increasing the supply of labor, upgrading skills and human capital, investing in infrastructure, and lowering product and labor market distortions. Social safety nets remain important to protect those adversely affected by technological progress and other structural transformation.

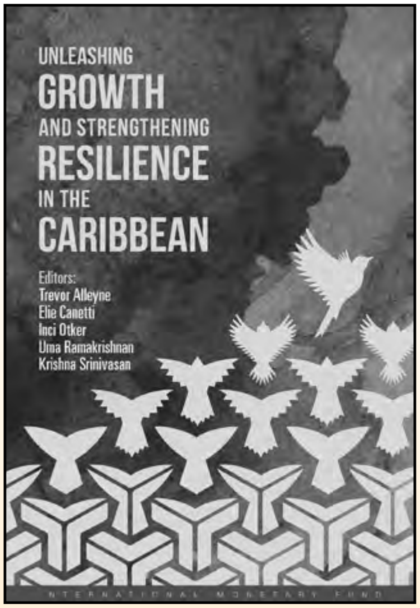
Directors noted that income disparities among countries have narrowed, but inequality has increased in some economies. They saw a role that well-designed fiscal policies can play in achieving redistributive objectives without necessarily undermining growth and incentives to work. Directors generally concurred that there may be scope for strengthening means-testing of transfers in many countries and for increasing the progressivity of taxation in some others. Most Directors noted that any consideration of a universal basic income would have to be weighed carefully against a host of country-specific factors—including existing social safety schemes, financing modalities, fiscal cost, and social preferences, as well as its impact on incentives to work—which, in the view of many Directors, raised questions about its attractiveness and practicality. Directors emphasized that improving education and health care is key to reducing inequality and enhancing social mobility over time.

Directors underlined the continued need for emerging market and developing economies to bolster economic and financial resilience to external shocks, including through enhanced macroprudential policy frameworks and exchange rate flexibility. They noted that a common challenge across these economies is how to speed up their convergence toward living standards in advanced economies. While priorities differ across countries, many need to improve governance, infrastructure, education, and access to health care. In several countries, policies should also facilitate greater labor force participation, reduce barriers to entry into product markets, and enhance the efficiency of credit allocation.

Directors observed that the global financial system continues to strengthen, and market confidence has improved generally. They recognized the substantial progress made in resolving weak banks in many advanced economies, while a majority of systemic institutions are adjusting business models and restoring profitability. However, a prolonged period of monetary accommodation could lead to further increases in asset valuations and a buildup of leverage in the nonfinancial sector that could signal higher risks to financial stability. These developments call for continued vigilance about household debt ratios and investors' exposure to market and credit risks. In this context, Directors stressed the need to calibrate the path of normalization of monetary policies carefully, implement macro- and microprudential measures as needed, and address remaining legacy problems.

Directors noted a generally subdued outlook for commodity prices. They encouraged low-income developing countries that are commodity exporters to continue improving revenue mobilization and strengthening debt management, while safeguarding social outlays and capital expenditures. Countries with more diversified export bases should further strengthen fiscal positions and foreign exchange buffers. Across all low-income developing countries, an overarching challenge is to maintain progress toward their Sustainable Development Goals.

# Highlights from IMF Publications

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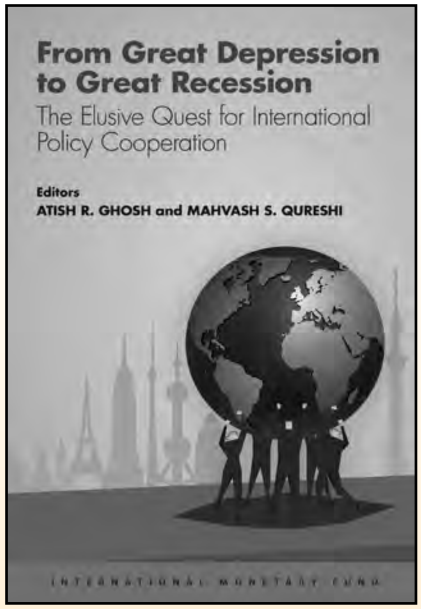


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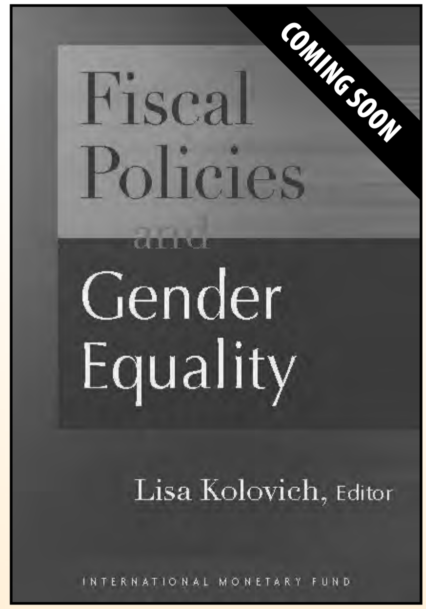


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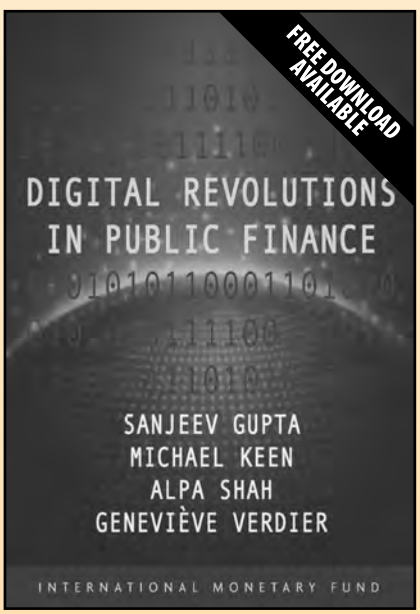


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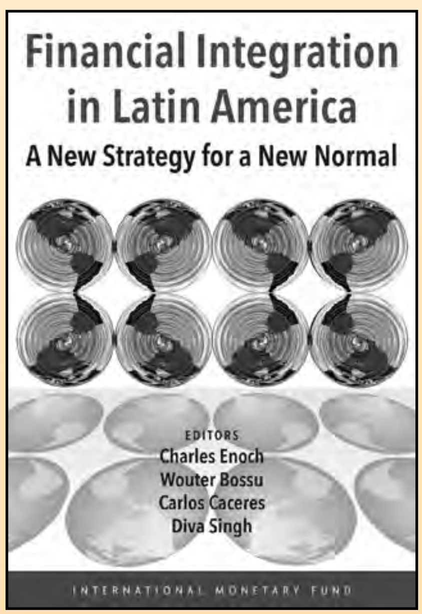


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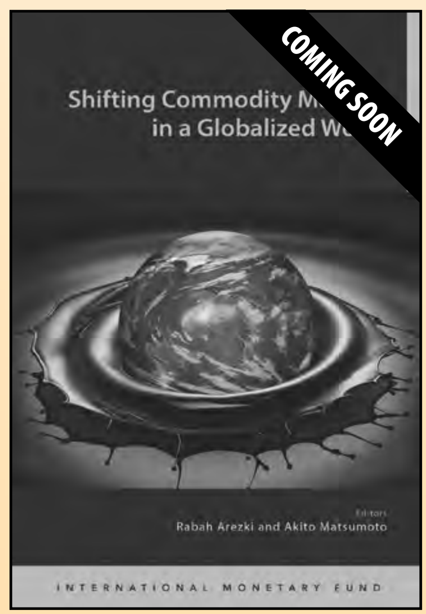


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