CHAPTER 3

IS IT TIME FOR AN INFRASTRUCTURE PUSH? THE MACROECONOMIC EFFECTS OF PUBLIC INVESTMENT

This chapter finds that increased public infrastructure investment raises output in both the short and long term, particularly during periods of economic slack and when investment efficiency is high. This suggests that in countries with infrastructure needs, the time is right for an infrastructure push: borrowing costs are low and demand is weak in advanced economies, and there are infrastructure bottlenecks in many emerging market and developing economies. Debt-financed projects could have large output effects without increasing the debt-to-GDP ratio, if clearly identified infrastructure needs are met through efficient investment.

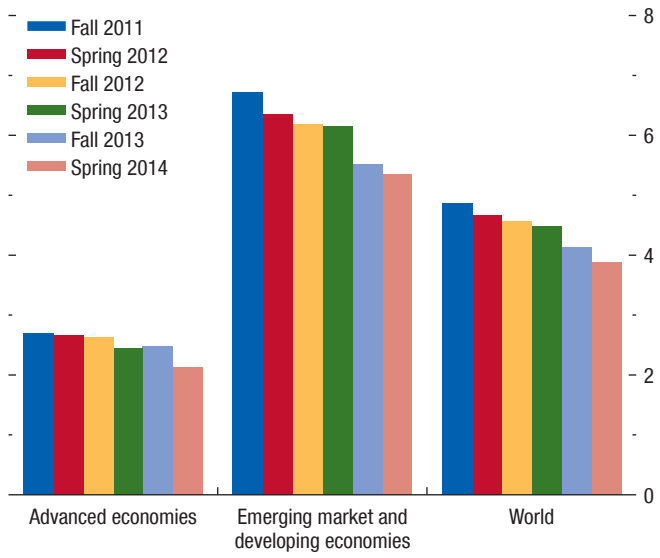
Five years after the global financial crisis, the global recovery continues but remains weak. In many advanced economies there is still substantial economic slack, and inflation remains too low in the euro area. Robust demand momentum has not yet taken hold, despite prolonged accommodative monetary policy, slowing in the pace of fiscal consolidation, and improvements in financial conditions. As noted in Chapter 1, there are now worries that demand will remain persistently weak—a possibility that has been described as "secular stagnation" (Summers 2013; Teulings and Baldwin 2014).

In emerging market economies the concerns are of a different nature. After a sharp rebound following the crisis, growth rates in the last few years have fallen not only below the postcrisis peak of 2010–11, but also below levels seen in the decade before the crisis. The persistent nature of the deceleration in output suggests that structural factors may be at work (Cubeddu and others 2014), and the serial disappointments in growth have led to a ratcheting down of medium-term growth forecasts (Figure 3.1). Although many factors are likely to be playing a role, one frequently expressed concern is inadequate infrastructure. In many emerging market economies, including Brazil, India, Russia, and South Africa, infrastructure bottlenecks are not just a medium-term worry but have been flagged as a constraint even on near-term growth. In low-income countries, deficiencies in the availability of infrastructure remain glaring and are often cited as an impediment to long-term development.[1]

Given these concerns and the current environment of low government borrowing costs—real interest rates are expected to remain lower than precrisis levels for the foreseeable future (see Chapter 3 of the April 2014 *World Economic Outlook*)—might this be a good time to increase public infrastructure investment? In

Figure 3.1. WEO Medium-Term Growth Projections
(Percent change)

Serial disappointments in emerging market growth rates have led to a ratcheting down of medium-term growth forecasts.



Source: IMF staff estimates.
Note: Economy groups are defined in Appendix 3.1. Medium-term growth projections are five-year-ahead growth forecasts.

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[1]See for example Calderón and Servén 2008; Foster and Briceño-Garmendia 2010; Fujita 2012; G20 Development Working Group 2011; and U.S. International Trade Commission 2009.

advanced economies an increase in infrastructure investment could provide a much-needed fillip to demand, and it is one of the few remaining policy levers available to support growth, given already accommodative monetary policy. In developing economies it could help address existing and nascent infrastructure bottlenecks. And in all economies it would help boost medium-term output, as higher infrastructure capital stocks expand productive capacity. As the Group of Twenty (G20) finance ministers and central bank governors stated in their communiqué from Sydney in February, higher infrastructure investment "is crucial for the global economy's transition to stronger growth."[2]

There are also arguments against such a push. Many advanced economies have little fiscal space available given still-high debt-to-GDP ratios and the need for further consolidation. Financing risks could increase with expected normalization of some key central banks' monetary policies. There are open questions about the size of the public investment multipliers and the long-term returns on public capital, both of which play a role in determining how public-debt-to-GDP ratios will evolve in response to higher public investment. Japan in the 1990s is often cited as a cautionary tale (Box 3.1). In all economies, but in developing economies in particular, inefficiencies in the public investment process are of concern: there is no shortage of anecdotes of increased government investment that produced few measurable benefits (see World Bank 1994; Pritchett 2000; Caselli 2005; and Warner 2014).

To assess appropriately the benefits and costs of increasing public investment in infrastructure, it is critical to determine what macroeconomic impact public investment will have. This chapter examines the following questions:

- How have public capital and investment evolved over time? How does infrastructure provision vary across groups of countries and types of infrastructure?
- What are the macroeconomic effects of public investment? To what extent does it raise output, both in the short and the long term? Does it increase the public-debt-to-GDP ratio if it is debt financed? How do these effects vary with key characteristics of the economy, such as the degree of economic slack, the efficiency of public investment, and the way the investment is financed?
- What do these findings suggest for infrastructure investment? Is this a good time to raise infrastructure investment? How do fiscal institutions and rules shape the evolution of public investment?

To address these questions, this chapter presents stylized facts on the provision of public and infrastructure capital. Since measures of infrastructure investment and the stock of infrastructure capital are not available for a wide range of countries, the evolution of public investment and the stock of public capital are used as proxy measures.[3] This is supplemented by physical measures of infrastructure, such as kilometers of roads and kilowatts of power generation capacity. The chapter then examines the historical evidence on the macroeconomic effects of public investment. Using a novel empirical strategy, the chapter offers new evidence on the effects of public investment changes on output and debt in advanced economies. It also presents evidence on their effects in emerging market and developing economies. To complement the empirical analysis, the chapter employs model simulations to explore additional issues, such as the role of monetary policy and the productivity of public capital. The chapter's main findings are as follows:

- The stock of public capital (a proxy for infrastructure capital) as a share of output has declined significantly over the past three decades across advanced, emerging market, and developing economies. In emerging market economies and low-income countries, infrastructure provision per capita is still a fraction of that in advanced economies. In some advanced economies, there are signs that aging infrastructure and insufficient maintenance and investment are affecting the quality of the existing infrastructure stock.
- Increased public investment raises output, both in the short term because of demand effects and in the long term as a result of supply effects. But these effects vary with a number of mediating factors, including (1) the degree of economic slack and monetary accommodation, (2) the efficiency of public investment, and (3) how public investment is financed. When there is economic slack and monetary accommodation, demand effects are stronger, and the public-debt-to-GDP ratio may actually decline. If the efficiency of the public investment process is relatively low—so that project selection

[2]The communiqué is available on the G20 website: https://www.g20.org/official_resources/library.

[3]Public capital and infrastructure capital are closely related: a significant component of the public capital stock in most countries consists of infrastructure, and the public sector was and continues to be its main provider. The two tend to be strongly correlated; see the stylized facts presented in the chapter.

and execution are poor and only a fraction of the amount invested is converted into productive public capital stock—increased public investment leads to more limited long-term output gains.

- For economies with clearly identified infrastructure needs and efficient public investment processes and where there is economic slack and monetary accommodation, there is a strong case for increasing public infrastructure investment. Moreover, evidence from advanced economies suggests that an increase in public investment that is debt financed could have larger output effects than one that is budget neutral, with both options delivering similar declines in the public-debt-to-GDP ratio. This should not, however, be interpreted as a blanket recommendation for a debt-financed public investment increase in all advanced economies, as adverse market reactions—which might occur in some countries with already-high debt-to-GDP ratios or where returns to infrastructure investment are uncertain—could raise financing costs and further increase debt pressure.
- Many emerging market and low-income economies have a pressing need for additional infrastructure to support economic development. But increasing public investment may lead to limited output gains, if efficiency in the investment process is not improved. Historically, there has been much wider variation in the macroeconomic response to public investment in emerging market and developing economies than in advanced economies. Model-based simulations suggest that public investment raises output in emerging market and developing economies, but at the cost of higher public-debt-to-GDP ratios, because of the general absence of economic slack and the relatively low efficiency of such investment. Thus, negative fiscal consequences should be carefully weighed against the broader social gains from increased public investment. For those emerging market and developing economies where infrastructure bottlenecks are constraining growth, the gains from alleviating these bottlenecks could be large.
- Increasing investment efficiency is critical to mitigating the possible trade-off between higher output and higher public-debt-to-GDP ratios. Thus a key priority in many economies, particularly in those with relatively low efficiency of public investment, should be to raise the quality of infrastructure investment by improving the public investment process. This could involve, among other reforms, better project appraisal and selection that identifies and targets infrastructure bottlenecks, including through centralized independent reviews, rigorous cost-benefit analysis, risk costing, and zero-based budgeting principles, and improved project execution.[4]
- Improvements in fiscal institutions and some fiscal rules could help protect public investment during periods of fiscal consolidation.

For many economies, given the large expected infrastructure investment needs over the coming years, facilitating increased private financing and provision of infrastructure will be very important—it is in fact one of the G20's top priorities.[5] The analysis of public versus private infrastructure provision is beyond the scope of this chapter, but as a burgeoning literature on the subject has noted, facilitating increased private financing and provision of infrastructure could help ease fiscal constraints, generate efficiency gains, and increase investment returns (see for example Chapter 3 of the October 2014 *Regional Economic Outlook: Sub-Saharan Africa;* European Investment Bank 2010; Arezki and others, forthcoming; OECD 2014; and World Bank, forthcoming). However, public-private partnerships can also be used to bypass spending controls, and governments can end up bearing most of the risk involved and facing potentially large fiscal costs over the medium to long term. Therefore, as the April 2014 *Fiscal Monitor* emphasizes, it is critical that countries maintain maximum standards of fiscal transparency when using public-private partnerships for infrastructure provision.[6]

The Economics of Infrastructure: A Primer

This section discusses the basic economics of infrastructure in order to set the stage for the remainder of the chapter. It discusses the role of infrastructure in the economy, how it differs from other types of capital, and the channels through which stepped-up infrastructure investment can affect economic activity, both in the short and long term.

Infrastructure refers to the basic structures that facilitate and support economic activity. In this chapter the term is used to denote what economists refer to

[4]A forthcoming IMF policy paper (IMF, forthcoming) explores the extent and sources of inefficiency in the planning and management of public investment projects and discusses policy options in these areas.

[5]See https://www.g20.org/g20_priorities/g20_2014_agenda/investment_and_infrastructure. For a discussion on financing future infrastructure needs, see World Economic Forum 2010 and McKinsey Global Institute 2013.

[6]For an in-depth discussion of the considerations that can guide public investment and public-private partnerships, see Hemming and others 2006; Akitoby, Hemming, and Schwartz 2007; and the April 2014 *Fiscal Monitor*.

as "core" infrastructure—roads and other transportation facilities, power generation and other utilities, and communications systems. Transport networks connect producers and consumers to markets, utilities provide essential inputs such as power and water for both production and consumption, and communications networks facilitate the exchange and dissemination of information and knowledge. As such, infrastructure is an indispensable input in an economy's production, one that is highly complementary to other, more conventional inputs such as labor and noninfrastructure capital. Indeed, it is hard to imagine any production process in any sector of the economy that does not rely on infrastructure. Conversely, inadequacies in infrastructure are quickly felt—in some countries, power outages, insufficient water supply, and decrepit or nonexistent roads adversely affect people's quality of life and present significant barriers to the operation of firms.

A few key characteristics distinguish infrastructure from other types of capital. First, infrastructure investments are often large, capital-intensive projects that tend to be "natural monopolies"—it is often more cost-effective for services to be provided by a single entity. Second, they tend to have significant up-front costs, but the benefits or returns accrue over very long periods of time, often many decades; this longevity (and the associated difficulty of ascertaining adequate returns over such a long horizon) can pose a challenge to private financing and provision. Third, infrastructure investments have the potential to generate positive externalities, so that the social return to a project can exceed the private returns it can generate for the operator.[7] This can lead to underprovision of needed investments. For these reasons, infrastructure has historically been provided by the public sector, public-private partnerships, or regulated private entities.

In deciding which infrastructure projects to undertake, governments must carefully weigh broader social returns against funding costs and fiscal consequences, recognizing that infrastructure projects are not undertaken primarily to boost revenues. Certain infrastructure projects may have a high social return, but costs might not be recouped through user charges and prices or through increased tax revenue from higher activity. Such situations generate a trade-off between positive social benefits on the one hand and negative fiscal consequences on the other.

[7]The benefits of constructing a new bridge, for example, spill over to the rest of the road network of which it is a part, and households and firms become more productive because of the improved transport network.

Increasing the flow of infrastructure services could be achieved by stepping up investment in new infrastructure projects (such as building new roads), but also by boosting operation and maintenance spending (such as filling potholes in existing roads), which reduces the rate of capital depreciation and extends the lifetime of installed infrastructure. Despite evidence of high rates of return, operations and maintenance spending is often neglected in favor of building new infrastructure (Rioja 2013), and is sometimes one of the first budget items to be pared back in times of fiscal pressure (Adam and Bevan 2014). But reducing maintenance expenditure is not equivalent to true fiscal savings from a longer-term perspective: potholes that are not filled today will have to be filled eventually, possibly at a higher cost.

An increase in public infrastructure investment affects the economy in two ways. In the short term it boosts aggregate demand through the short-term fiscal multiplier, similar to other government spending, and also by potentially crowding in private investment, given the highly complementary nature of infrastructure services. The size of the fiscal multiplier can vary with the state of the economy. Government investment also adds to the stock of public debt if the government borrows to finance additional spending. Whether debt rises as a share of GDP in the short term depends on the size of the fiscal multiplier and the elasticity of revenues to output. GDP may rise by more than debt initially, and the resulting higher tax revenue may offset some of the increased spending on public investment.

Over time, there is also a supply-side effect of public infrastructure investment as the productive capacity of the economy increases with a higher infrastructure capital stock. The efficiency of investment is central to determining how large this supply-side effect will be (see Box 3.2). Inefficiencies in the investment process, such as poor project selection, implementation, and monitoring, can result in only a fraction of public investment translating into productive infrastructure, limiting the long-term output gains.

The extent to which increases in public capital can raise potential output is a key factor in determining the evolution of the debt-to-GDP ratio over the medium and long term. In particular, if short-term multipliers, public investment efficiency, and the elasticity of output to public capital are sufficiently high, an increase in public investment can be "self-financing" in that it leads to a reduction in the debt-to-GDP ratio.[8]

[8]See Appendix 3.2 for further elaboration on this conceptual framework.

Public and Infrastructure Capital and Investment: Where Do We Stand?

This section documents how public and infrastructure capital and investment have evolved over the past four decades. Public capital and infrastructure capital are closely related: a significant component of the public capital stock in most countries consists of infrastructure, and the public sector was and continues to be its main provider.[9] However, there are differences: public capital can include noninfrastructure components (such as machinery and equipment, inventories, valuables, and land), and infrastructure can also be provided by the private sector or government-owned enterprises. Since measures of infrastructure investment and the stock of infrastructure capital are not available for a wide range of countries, the stylized facts here use the evolution of public investment and the stock of public capital as a proxy measure (Box 3.3 discusses issues with the measurement of the public capital stock).[10] This approach is supplemented by looking at physical measures of infrastructure, such as kilometers of roads and kilowatts of power generation capacity.

The stock of public capital, which reflects to a large extent the availability of infrastructure, has declined significantly as a share of output over the past three decades across advanced, emerging market, and developing economies (Figure 3.2). In advanced economies, this reflects primarily a trend decline in public investment from about 4 percent of GDP in the 1980s to 3 percent of GDP at present.[11]

In emerging market economies and low-income countries, sharply higher public investment in the late 1970s and early 1980s significantly raised public capital stocks, but since then public capital relative to GDP has also fallen.[12] Higher public investment rates in the past decade have stemmed the decline. Public capital stocks relative to GDP tend to be higher in developing economies than in advanced economies because of the higher investment rates and lower GDP levels in the former. However, when one adjusts for the efficiency of public investment (Box 3.2), which tends to be lower in developing economies, the estimated stock of public capital is significantly reduced (dashed lines in Figure 3.2; see also Dabla-Norris and others 2012; Gupta and others 2014; and Chapter 2 of the April 2014 *Fiscal Monitor*). And in per capita terms, these economies still have only a fraction of the public capital available in advanced economies (Figure 3.2, panel 5). The large variation in public capital stocks per person is mirrored by the availability of physical infrastructure per person (Figure 3.3).[13] Power generation capacity per person in emerging market economies is one-fifth the level in advanced economies, and in low-income countries it is only one-eighth the level in emerging markets. The discrepancy in road kilometers per person is similarly large.

Even in some advanced economies, in which measures of the quantity of infrastructure appear high relative to those in the rest of the world, there are deficiencies in the quality of the existing infrastructure stock.[14] Business executives' assessment of the overall quality of infrastructure has been declining for the United States and Germany (Figure 3.4, panel 1), reflecting largely the perceived deterioration in the quality of roads and highways (panel 2). As the American Society of Civil Engineers (2013) notes, 32 percent of major roads in the United States are now in poor or mediocre condition, and the U.S. Federal Highway Administration estimates that between $124 billion and $146 billion annually in capital investment will be needed for substantial improvement in conditions and performance—considerably more than the current

[9]Over the past two decades, private participation in infrastructure via public-private partnerships has been on the rise. In the aggregate, however, public infrastructure investment still dwarfs private, as infrastructure investment via public-private partnerships is still less than a tenth of public investment in advanced economies and less than a quarter of public investment in emerging market and developing economies.

[10]Direct measures of public capital—more formally known as government nonfinancial assets—are available for a handful of economies only, and even these estimates are often based on different coverage and methods. As a result, the public capital series used here, taken from the April 2014 *Fiscal Monitor*, are constructed by cumulating government investment spending, assuming some initial value of public capital and depreciation rates (see the April 2014 *Fiscal Monitor* and Kamps 2006 for details).

[11]Although the decline in the stock of public capital in advanced economies may partially reflect an increasing role of the private sector in the provision of infrastructure (such as energy and telecommunications), the stock of private capital and the level of private investment as a share of output have also declined over the past three decades.

[12]Figure 3.12 shows the evolution of public capital stocks in emerging markets and in low-income countries separately. Both follow the same general pattern of rising in the late 1970s and early 1980s and declining thereafter, though the rise and decline have been sharper in low-income countries.

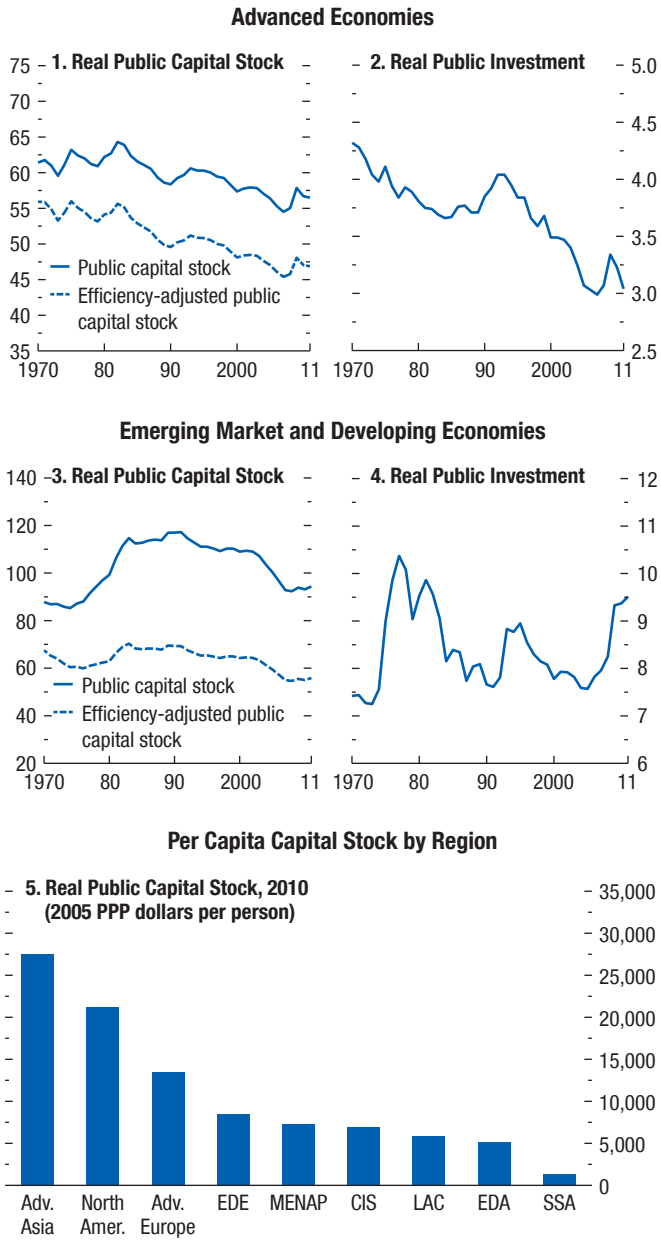
[13]Public capital stock per capita and physical infrastructure per capita (as measured by a synthetic index of power, roads, and telephones) are highly correlated. The cross-country correlation over the period 2005–11 is about 0.77, and a 1 percent higher stock of public capital per person corresponds to a 0.73 percent higher stock of infrastructure per person (Figure 3.3, panel 4).

[14]In addition, the evidence presented by Abiad and others (forthcoming) seems to suggest that the quantity of infrastructure in several advanced economies is also becoming increasingly inadequate.

Figure 3.2. Evolution of Public Capital Stock and Public Investment

(Percent of GDP, PPP weighted, unless noted otherwise)

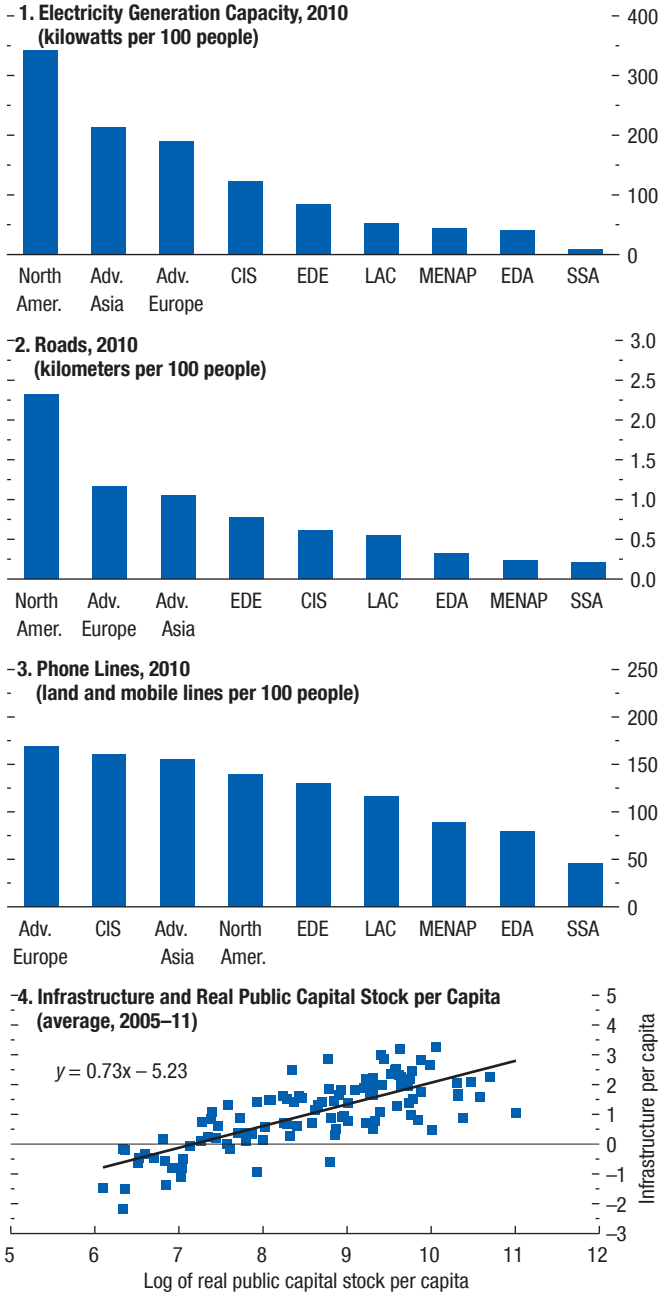
The stock of public capital has declined substantially as a share of output over the past three decades across advanced, emerging market, and developing economies. In per capita terms, non–advanced economies still have only a fraction of the public capital available in advanced economies.



Sources: IMF, Fiscal Monitor database; and IMF staff calculations.
Note: Adv. Asia = advanced Asia; Adv. Europe = advanced Europe; CIS = Commonwealth of Independent States; EDA = emerging and developing Asia; EDE = emerging and developing Europe; LAC = Latin America and the Caribbean; MENAP = Middle East; North Africa, Afghanistan, and Pakistan; North Amer. = North America; PPP = purchasing power parity; SSA = sub-Saharan Africa. Economy groups are defined in Appendix 3.1.

Figure 3.3. Physical Measures of Infrastructure

The large variation in public capital stocks per person is mirrored in the availability of physical infrastructure per person. Public capital stock per capita and physical infrastructure per capita are highly correlated.



Sources: IMF, Fiscal Monitor database; World Bank, World Development Indicators; and IMF staff calculations.
Note: Adv. Asia = advanced Asia; Adv. Europe = advanced Europe; CIS = Commonwealth of Independent States; EDA = emerging and developing Asia; EDE = emerging and developing Europe; LAC = Latin America and the Caribbean; MENAP = Middle East, North Africa, Afghanistan, and Pakistan; North Amer. = North America; SSA = sub-Saharan Africa. Economy groups are defined in Appendix 3.1. The infrastructure measure used in panel 4 is the principal component of electricity generation capacity, roads, and phone lines per capita.

$100 billion spent annually on capital improvements at all government levels.

Figure 3.4 also illustrates the heterogeneity of the state of infrastructure. Although the decline in the perceived quality of infrastructure in the United States and Germany is evident, a similar decline is not apparent in other Group of Seven economies—for example, in Canada, France, Japan, and the United Kingdom. Italy's infrastructure quality seems to be on the rise, albeit from relatively low levels. This heterogeneity should not be surprising and presents an important caveat: individual countries have differing infrastructure needs, and increased infrastructure investment should be considered only if there is a documented need and an economic payoff.

The Macroeconomic Effects of Public Investment

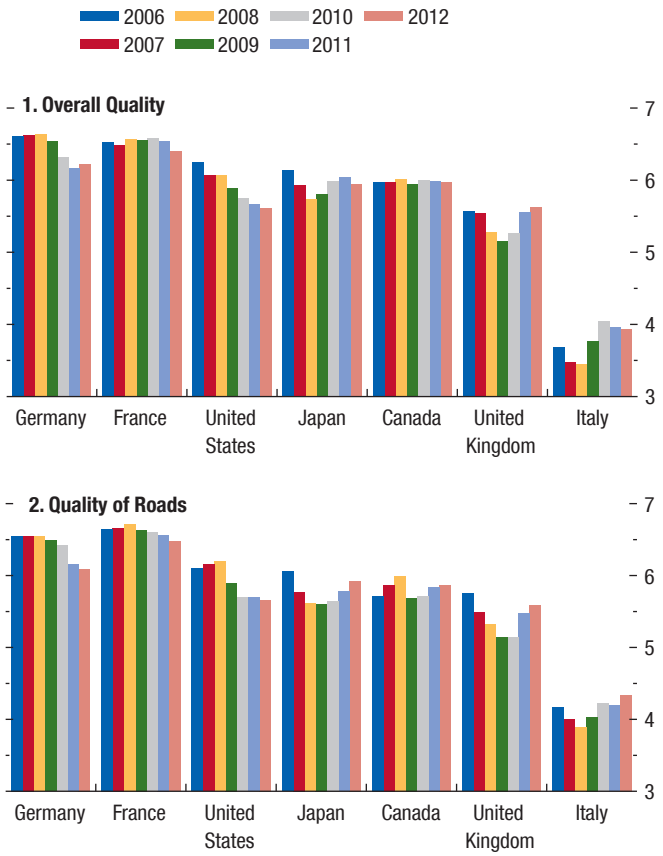
In order to assess the benefits and costs of additional public infrastructure investment properly, policymakers need a clear picture of the macroeconomic implications of such investment.

As discussed earlier in the chapter, an increase in public infrastructure investment affects output both in the short term, by boosting aggregate demand through the fiscal multiplier and potentially crowding in private investment, and in the long term, by expanding the productive capacity of the economy with a higher infrastructure stock. The macroeconomic response is shaped by various factors, including the degree of economic slack and monetary accommodation in the short term and efficiency of public investment in the long term. This section examines whether these theoretical predictions regarding the macroeconomic effects are borne out in the data. In contrast to the large body of literature that has focused on estimating the long-term elasticity of output to public and infrastructure capital using a production function approach,[15] the analysis here adopts a novel empirical strategy that allows estimation of both the short- and medium-term effects of public investment on a range of macroeconomic variables. Specifically, it isolates shocks to public investment that can plausibly be deemed exogenous to macroeconomic conditions and traces out the evolution of output, the public-debt-to-GDP ratio, and private investment in the aftermath of these shocks.

[15]See Romp and de Haan 2007; Straub 2011; and Bom and Ligthart, forthcoming, for a survey of the literature.

Figure 3.4. Quality of Infrastructure in G7 Economies
(Scale, 1–7; higher score indicates better infrastructure)

In some advanced economies, there are signs of deteriorating quality in the existing infrastructure stock.



Sources: World Economic Forum, Global Competitiveness Report survey; and IMF staff calculations.
Note: The G7 comprises Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States.

Since data on public infrastructure investment are not widely available, the empirical analysis examines the macroeconomic effects of total public investment, which may include investment in noninfrastructure items. To the extent that the productivity-enhancing effects of other public investments are lower than those for core infrastructure investment (see for example Bom and Ligthart, forthcoming), the estimates in the chapter present a lower bound on the long-term effects of public infrastructure investment.

The empirical analysis is complemented by model simulations for both advanced and developing economies, which helps identify the role of additional factors, such as monetary policy, investment efficiency, and productivity of public infrastructure capital.

An Empirical Exercise for Advanced Economies

The analysis begins by assessing the macroeconomic impact of public investment shocks in advanced economies, using the approach of Auerbach and Gorodnichenko (2012, 2013). In this approach, public investment shocks are identified as the forecast error of public investment spending relative to GDP. This procedure overcomes the problem of fiscal foresight (Forni and Gambetti 2010; Leeper, Richter, and Walker 2012; Leeper, Walker, and Yang 2013; Ben Zeev and Pappa 2014), because it aligns the economic agents' and the econometrician's information sets. Two econometric specifications are used. The first establishes whether these unanticipated shocks have significant effects on macroeconomic variables such as output, public-debt-to-GDP ratios, and private investment. The second is used to analyze whether these effects vary with the state of the economy, public investment efficiency, and the way higher public investment is financed (that is, whether it is debt financed or budget neutral).[16]

The analysis shows that public investment shocks have statistically significant and long-lasting effects on output (Figure 3.5, panel 1). An unanticipated 1 percentage point of GDP increase in investment spending increases the level of output by about 0.4 percent in the same year and by 1.5 percent four years after the shock. Using the sample average of government investment as a percentage of output (about 3 percent of GDP), this implies short- and medium-term investment spending multipliers of about 0.4 and 1.4, respectively. These multipliers are consistent with other estimates reported in the literature (see Coenen and others 2012 and literature cited therein).[17] The results are also robust to different time samples and when public investment shocks are isolated from other government spending shocks, as well as from unexpected changes in output.[18]

The point estimates in panel 2 of the figure show that higher public investment spending typically reduces the debt-to-GDP ratio both in the short term (by about 0.9 percentage point of GDP) and in the medium term (by about 4 percentage points of GDP), but the decline in debt is statistically significant only in the short term. There is no statistically significant effect on private investment as a share of GDP (panel 3). The latter finding suggests the crowding in of private investment, as the level of private investment rises in tandem with the higher GDP as a result of the increase in public investment.

The macroeconomic effects of public investment shocks are very different across economic regimes (Figure 3.6, panels 1 through 4).[19] During periods of low growth, a public investment spending shock increases the level of output by about 1½ percent in the same year and by 3 percent in the medium term, but during periods of high growth the long-term effect is not statistically significantly different from zero.[20] Public investment shocks also bring about a reduction in the public-debt-to-GDP ratio during periods of low growth because of the much bigger boost in output. During periods of high growth, the point estimates suggest a rise in public debt, though the wide confidence intervals imply that these are not statistically significantly different from zero.[21]

In addition, the macroeconomic effects of public investment shocks are substantially stronger in coun-

[16]See Appendix 3.2 for details.

[17]These results are qualitatively similar if one estimates the impact of simple changes in public investment as a share of GDP instead of using forecast errors; see Appendix 3.2.

[18]A potential concern, for example, is that public investment shocks may respond to output growth surprises: public investment could be accelerated when unexpected growth provides funds, for example, or slowed when growth disappointments decrease revenues. In data from 17 advanced economies over the period 1985–2013, public investment innovations are only weakly correlated with output growth surprises (correlation –0.11). Moreover, purifying public investment shocks by removing the portion explained by growth surprises delivers results that are very similar to and not statistically significantly different from those reported in the baseline (see Appendix 3.2).

[19]Economic regimes are identified as periods of very low growth (recessions) and very high growth (significant expansions). Periods of very low (high) growth identified in this analysis correspond to periods of large negative (positive) output gaps: during periods of very low (high) growth, the output gap varies between –0.4 and –7.2 (–1.1 and 8.5) percent of potential output, with an average output gap of –3.7 (3.5) percent. Using the output gap instead of growth rates to identify economic regimes gives qualitatively similar results. In particular, during periods of large negative output gaps, the short-term multiplier is 0.6 and is statistically significant, but when output gaps are large and positive, the output effect of public investment is 0.2 and not statistically significant.

[20]This finding is consistent with a growing literature that explores the effect of fiscal policy during recessions and expansions (see Auerbach and Gorodnichenko 2012; Blanchard and Leigh 2013; and IMF 2013 and the literature cited therein).

[21]One possibility is that these results are driven by the fact that these shocks occur in periods of economic recovery. However, no statistically significant correlation is found between the measure of investment spending shocks used and the economic regime. In particular, the correlation between investment spending shocks and the economic regime (or the change in the economic regime) is –0.01 (0.01).

tries with a high degree of public investment efficiency, both in the short and in the medium term (Figure 3.6, panels 5 through 8). In countries with high efficiency of public investment, a public investment spending shock increases the level of output by about 0.8 percent in the same year and by 2.6 percent four years after the shock. But in countries with low efficiency of public investment, the output effect is about 0.2 percent in the same year and about 0.7 percent in the medium term. As a result, although public investment shocks are found to lead to a significant medium-term reduction in the debt-to-GDP ratio (about 9 percentage points four years after the shock) in countries with high public investment efficiency, they tend to increase the debt-to-GDP ratio (albeit not in a statistically significant manner) in countries with low public investment efficiency.

The output effects are larger when public investment shocks are debt financed than when they are budget neutral (Figure 3.6, panels 9 to 12).[22] In particular, although a debt-financed public investment shock of 1 percentage point of GDP increases the level of output by about 0.9 percent in the same year and by 2.9 percent four years after the shock, the short- and medium-term output effects of a budget-neutral public investment shock are not statistically significantly different from zero. The larger short- and medium-term output multipliers for debt-financed shocks imply that the reduction in the debt-to-GDP ratio is similar in the two types of shocks.

It is possible that increasing debt-financed public investment in countries with debt that is already high may increase sovereign risk and financing costs if the productivity of the investment is in doubt (possibly because of poor project selection), which in turn could lead to further debt accumulation, exacerbating debt sustainability concerns.[23] Within the sample of 17 advanced economies employed in the estimation, the empirical evidence suggests that historically, debt-financed public investment shocks have not led to increases in funding costs, as proxied by sovereign real

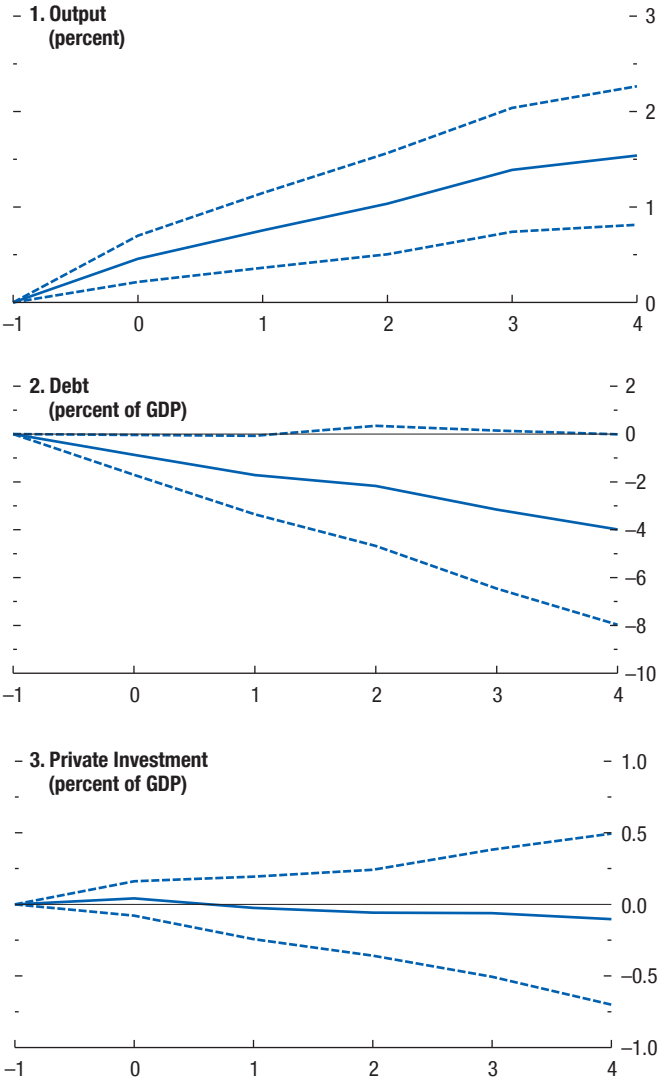
[22]Budget-neutral public investment shocks are identified as those in which the difference between the shocks to other components of the government budget and public investment shocks is greater than or equal to zero.

[23]Empirical evidence for emerging markets suggests that debt-financed public spending is associated with higher and more volatile sovereign risk spreads than tax-financed spending (Akitoby and Stratmann 2008). For further discussion of the links between public debt, public investment, and growth, see Ostry, Ghosh, and Espinoza 2014.

Figure 3.5. Effect of Public Investment in Advanced Economies

(Years on x-axis)

Public investment shocks have a statistically significant and long-lasting effect on output. They also typically reduce the debt-to-GDP ratio, though the decline in debt is statistically significant only in the short term. The level of private investment rises in tandem with GDP.

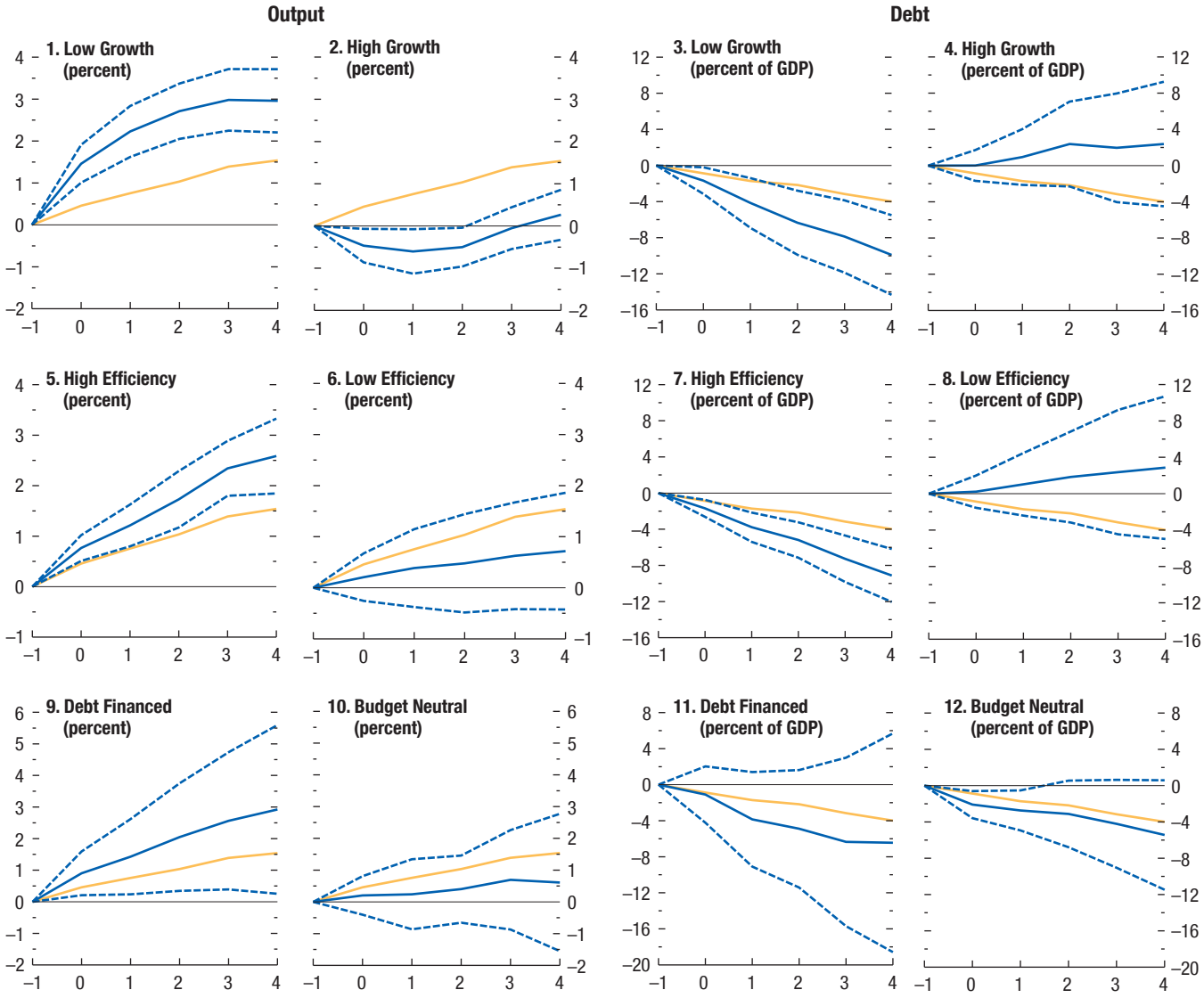


Source: IMF staff calculations.
Note: $t = 0$ is the year of the shock; dashed lines denote 90 percent confidence bands. Shock represents an exogenous 1 percentage point of GDP increase in public investment spending.

Figure 3.6. Effect of Public Investment in Advanced Economies: Role of Economic Conditions, Efficiency, and Mode of Financing

(Years on x-axis)

The effects of public investment on output and debt tend to be stronger when there is economic slack, when public investment efficiency is high, and when public investment is debt financed.



Source: IMF staff calculations.

Note: $t = 0$ is the year of the shock; dashed lines denote 90 percent confidence bands. Solid yellow lines represent the baseline result. See the text and Appendix 3.2 for the definition of high and low growth, high and low efficiency, and debt financed versus budget neutral. Shock represents an exogenous 1 percentage point of GDP increase in public investment spending.

interest rates. Moreover, an examination of whether the effects of public investment shocks on debt and output depend on the initial level of public debt yields no evidence that historically, the effects of public investment differ materially according to the initial public-debt-to-GDP ratio. This may, however, be a result of lower debt-to-GDP ratios in advanced economies during most of the sample period.

An Empirical Exercise for Developing Economies

The empirical strategy used for the sample of advanced economies requires forecasts of public investment, which are not available over a long time span for economies that are not members of the Organisation for Economic Co-operation and Development. Given this data limitation, three different approaches are used that provide complementary evidence on the macroeconomic effects of public investment in developing economies.[24]

The first approach is to examine episodes of public investment booms and trace the evolution of key macroeconomic variables in the aftermath of large and sustained increases in public investment. The goal of this exercise is simply to establish the stylized facts about the macroeconomic conditions surrounding booms, rather than to estimate the causal effect of major pushes in infrastructure investments. Estimating the causal impact of booms is confounded by the fact that whether a country undergoes an investment boom and when a boom occurs are not exogenous to the country's macroeconomic conditions. For example, a shock that raises expected growth (for example, a sustained terms-of-trade boom or discovery of natural resources) may prompt governments to invest in infrastructure now, inducing a positive correlation between output and investment. Nevertheless, examining these large investment booms is a useful exercise for two reasons. First, a number of low-income countries have considerably stepped up government investment in recent years as a way to jump-start their economies in the face of weak external demand and infrastructure bottlenecks. Second, there are various theoretical reasons for such large investment drives to have different consequences relative to the average impact of public investment shocks that is picked up by the other two strategies.[25] This analysis follows Warner (2014) in identifying investment booms as a sustained and significant increase in the government investment ratio. Once the initial year of the investment boom is identified, the evolution of key macroeconomic variables is traced in the period following the start of the public investment push.

The historical experience with public investment booms paints a similar picture to the estimated macroeconomic impacts of public investment in advanced economies (Figure 3.7). About 120 public investment booms in the sample are identified, the vast majority of them in emerging market and developing economies. These booms are characterized by large and sustained increases in government investment spending: public investment as a share of GDP rises by about 7 percentage points of GDP in the first years of the boom. During this period, the level of output continuously increases, stabilizing after the fifth year at a level about 8 percent higher than in the year before the boom. This suggests a public investment multiplier of about 1–1.3.[26]

The analysis also traces the evolution of public debt after the beginning of a boom. The estimates' standard errors are large, but there is no evidence of an increase in the debt-to-GDP ratio in the aftermath of a boom. If anything, the negative point estimates suggest a relative decline in public debt as a share of output five years after the beginning of the boom. However, as shown in Appendix 3.2, the declining public debt ratio is driven by investment booms in commodity-exporting economies, in which stepped-up government investment could well have coincided with natural resource windfalls for public revenues.

The second approach to examining the macroeconomic consequences of public investment in developing countries is inspired by Corsetti, Meier, and Müller (2012). The empirical strategy relies on the idea that significant parts of government spending (investment in particular) are likely determined by past information and cannot easily respond to current economic conditions.[27] Thus, one can estimate a fiscal policy

[24]Details of these methodologies can be found in Appendix 3.2.

[25]Complementarities between different infrastructure projects and public and private investment may lead to disproportionate gains from coordinated pushes in infrastructure—the main hypothesis behind "big push" theories of development. On the other hand, large scaling up of public investment may result in the implementation of inframarginal projects and thus have lower-than-average impact (Warner 2014).

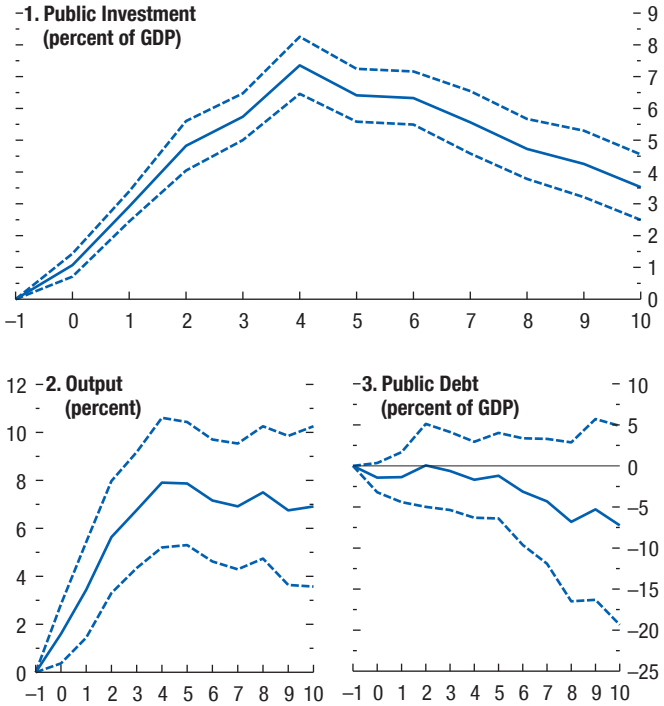
[26]These findings are somewhat different from those in the recent study by Warner (2014), who analyzes the growth impacts of public investment booms in a smaller set of low-income countries.

[27]In principle, this assumption can be violated for two reasons. First, public investment can automatically respond to cyclical conditions. This, however, should not pose a problem, because automatic stabilizers operate mostly via revenues and social spending. Second,

Figure 3.7. Output and Public Debt in the Aftermath of Public Investment Booms

(Years on x-axis)

Public investment booms in emerging market and developing economies are associated with higher output.

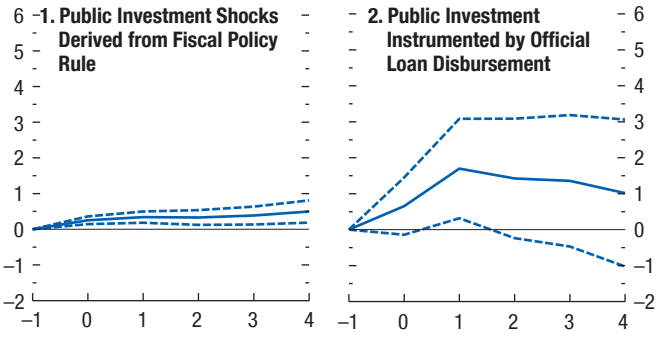


Source: IMF staff calculations.
Note: $t = 0$ is the beginning of a public investment boom; dashed lines denote 90 percent confidence bands. See Appendix 3.2 for a definition of public investment booms.

Figure 3.8. Effect of Public Investment on Output in Emerging Market and Developing Economies

(Percent; years on x-axis)

Various empirical approaches suggest that public investment shocks in emerging market and developing economies have a positive effect on output, albeit with a much wider variation in responses than in advanced economies.



Sources: IMF staff calculations, drawing on Corsetti, Meier, and Müller 2012; Kraay 2012, forthcoming; and Eden and Kraay 2014.
Note: $t = 0$ is the year of the shock; dashed lines denote 90 percent confidence bands. Shock represents an exogenous 1 percentage point of GDP increase in public investment spending.

rule for public investment and from this obtain a series of exogenous shocks to public investment.[28] The estimated policy shocks are then used to trace the dynamic effects of public investment on output.

The third approach builds on recent work by Kraay (2012, forthcoming) and Eden and Kraay (2014) and applies primarily to low-income countries. In many of these countries, loans from official creditors such as the World Bank and other multilateral and bilateral aid agencies finance a significant fraction of government spending. The disbursements of these loans and the spending they finance are spread out over many years following the approval of the loans. Hence, part of the fluctuation in government investment is predetermined, as it reflects loan approvals in previous years. If one assumes that loan approval decisions made by creditors do not anticipate future macroeconomic shocks that affect output, this predetermined component of spending can be used as an instrument for total government investment to identify the causal impact of public investment on output.

These two approaches suggest that public investment may have a positive effect on output (Figure 3.8). The estimated effects are substantially smaller using the fiscal policy rule methodology, though they are more precisely estimated (panel 1). The contemporaneous effect of a 1 percentage point of GDP increase in public investment is a 0.25 percent increase in output, which gradually increases to about 0.5 percent four years after the shock. The Eden and Kraay (2014) methodology yields larger but much more imprecisely estimated

discretionary public investment spending can occur in response to output conditions. As discussed in Corsetti, Meier, and Müller 2012, the relevance of this concern relates to the precise definition of contemporaneous feedback effects. Although it is typically assumed in the literature that government spending does not react to changes in economic activity within a given quarter (Blanchard and Perotti 2002), whether it may respond in a period longer than a quarter is an open question. Recent evidence for advanced economies (Beetsma, Giuliodori, and Klaassen 2009; Born and Müller 2012), however, suggests that the restriction that government spending not respond to economic conditions within a year cannot be rejected.

[28]This identification strategy is very similar to the structure embedded in fiscal policy vector autoregression. The fiscal policy rule links the change in government investment to its lags, lagged growth, current and lagged public indebtedness, and expectations of the next year's growth.

coefficients, with the effect of a public investment shock of about 1 percent four years after the shock (panel 2). The wide confidence bands preclude rejection of the null hypothesis that the two methodologies lead to identical estimates of the effect of public investment on output. The estimated medium-term multiplier is between 0.5 and 0.9, slightly lower than the multiplier estimated for advanced economies.

A Model-Based Approach

The empirical approaches in the preceding sections assess the short- and medium-term macroeconomic effects of public investment. But they are not well suited to estimating the effects of public investment shocks over longer periods (for example, more than 10 years), nor can they fully address issues that are relevant today but have little historical precedent, such as the zero floor on nominal interest rates in many advanced economies and the current environment of very low real interest rates (see Chapter 3 of the April 2014 *World Economic Outlook*).[29] Therefore, to complement the empirical analysis, this section looks at the macroeconomic effects of public investment shocks using dynamic general-equilibrium models. An additional advantage of relying on model simulations is that in these models, public investment shocks are strictly exogenous and no identification assumptions are needed.

Simulations for advanced and emerging market economies use the IMF's Globally Integrated Monetary and Fiscal model.[30] Simulations for low-income countries are based on the model of Buffie and others (2012), which captures aspects pertinent to low-income countries, such as low public investment efficiency, absorptive capacity issues, and limited access to international and domestic borrowing (see Box 3.4).

A critical input in the model-based analysis is the elasticity of output to public capital. There is now a substantial literature, triggered by the seminal contributions of Aschauer (1989), that estimates the long-term elasticity of output to public capital. A cursory reading of the literature reveals estimates ranging widely, from large and positive to slightly negative. However, a recent meta-analysis by Bom and Ligthart (forthcoming) of 68 of these studies shows that much of the variation in estimates can be attributed to differences in research design, including how public infrastructure capital is defined, what output measure is used, whether capital is installed at the national level or by state and local governments, the econometric specification and sample coverage, and whether endogeneity and nonstationarity are properly addressed. Controlling for these factors, Bom and Ligthart come up with a much narrower range for the estimated output elasticity of public capital (Table 3.1). In particular, they suggest that the elasticity of core infrastructure installed by a national government is 0.17. This is the estimated elasticity that is assumed in the simulations in this chapter.[31]

Table 3.1. Elasticity of Output to Public Capital

	All Public Capital	Core Infrastructure Capital
Installed by National Government	0.122	0.170
Installed by Subnational Government	0.145	0.193

Source: Bom and Ligthart, forthcoming.

Model simulations for advanced economies

Since the global financial crisis, policy rates in the largest advanced economies have been near zero and are expected to remain at this level in the near term because of still-large output gaps (see Chapter 1). The effects of public investment shocks under these conditions are examined through a simulation of the macroeconomic response of output, the public-debt-to-GDP ratio, and private investment to a 1 percent of GDP increase in public investment, assuming that monetary policy rates stay close to zero for two years.[32] The results of this simulation suggest that a 1 percent of GDP permanent increase in public investment increases output by about 2 percent in the same year. Output declines in the third year after the shock as monetary policy normalizes, then increases to 2.5 per-

[29]Japan's experience with public investment in the 1990s is perhaps the most relevant historical example; for details, see Box 3.1.

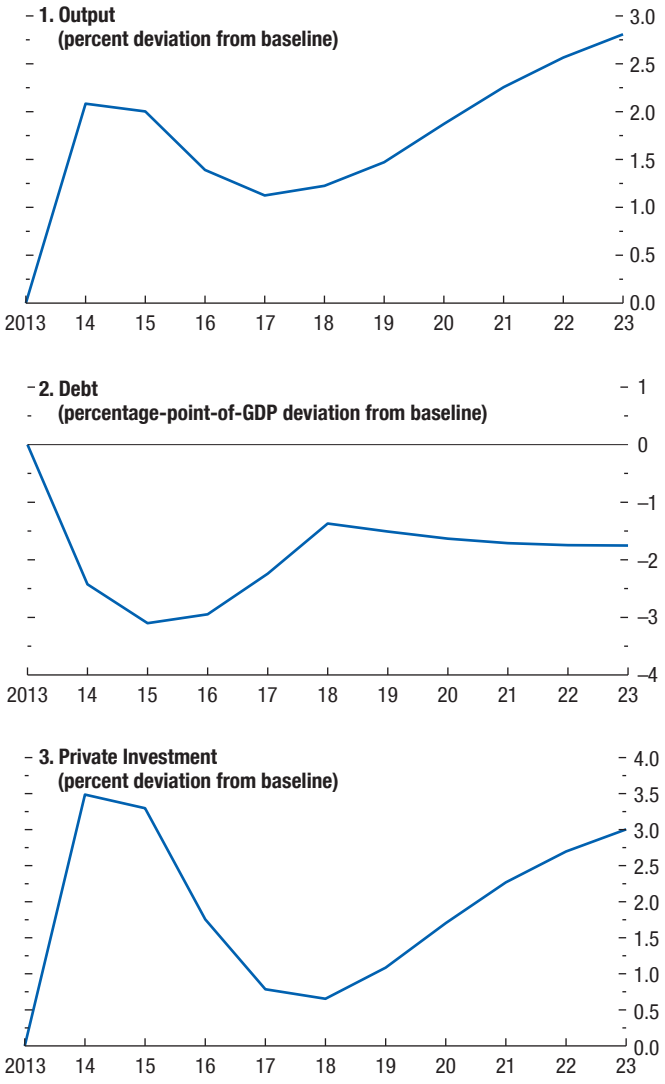
[30]For a detailed description of the model, see Kumhof and Laxton 2007 and Kumhof, Muir, and Mursula 2010.

[31]Panels 5 and 6 of Figure 3.10 illustrate how different assumptions regarding the elasticity of output to public capital affect the results.

[32]There are two main reasons to assume that policy rates stay near zero for two years. First, such an assumption is in line with market expectations about policy rates for most large advanced economies. Second, in the model, the only way the central bank can stabilize output and inflation is by cutting nominal interest rates. When the option of cutting interest rates is removed for a longer period—for example, three or more years—the model generates unstable macroeconomic dynamics, which complicates the computation of simulation results.

Figure 3.9. Model Simulations: Effect of Public Investment in Advanced Economies in the Current Scenario

When monetary policy in advanced economies is accommodative, public investment shocks have a substantial short-term effect on output, bringing about a decline in the public-debt-to-GDP ratio.



Source: IMF staff estimates.
Note: Shock represents an exogenous 1 percentage point of GDP increase in public investment spending.

cent over the long term because of the resulting higher stock of public capital (Figure 3.9, panel 1). Similarly, private investment increases both in the short and in the long term (Figure 3.9, panel 3). The large output effects imply that the debt-to-GDP ratio declines, by about 3 percentage points of GDP three years after the shock, after which it increases somewhat, stabilizing at about 1.5 percentage points of GDP below the baseline five years after the shock.[33]

How different would the results be under normal conditions of less slack and an immediate monetary policy response to the increase in public investment? In this case, the short-term output effects would be much smaller. As a result, the debt-to-GDP ratio would eventually rise, stabilizing at a level 1.5 percentage points of GDP higher than the baseline (Figure 3.10, panels 1 and 2). These results are broadly consistent with the empirical evidence in the previous subsections.

These simulations implicitly assume that public investment is fully efficient, that is, that each dollar invested translates into productive public capital. However, it is likely that in countries with a lower degree of investment efficiency, the resulting output effects are smaller. The simulations presented in Figure 3.10, panels 3 and 4, confirm and quantify these results. In countries with a lower degree of investment efficiency, a 1 percentage point of GDP increase in public investment increases output by about 2.2 percent in the long term, compared with about 2.8 percent in countries where public investment is fully efficient. As a result, in countries with a low degree of investment efficiency, the debt-to-GDP ratio would decline less than in countries with full investment efficiency.

Model simulations for developing economies

Are the macroeconomic effects of public investment in emerging market economies and low-income countries similar to those in advanced economies? As previously illustrated, a central factor currently at work in advanced economies (but currently not present in developing economies) is substantial economic slack and very accommodative monetary

[33]The public investment shock is debt financed for the first five years. The debt-to-GDP ratio is stabilized and general transfers adjust to satisfy the fiscal rule afterward. The model needs to include a fiscal rule to ensure that it generates stable macroeconomic dynamics. Note, however, that given the large output effects, general transfers end up at a level higher than what prevailed in the absence of the shock.

policy. Another important difference between these two groups is that public investment efficiency in advanced economies is typically higher than that in emerging market and low-income economies (Box 3.2). Because of these two factors, a public investment shock of similar size leads to considerably lower long-term output effects in emerging market economies and low-income countries than in advanced economies (Figure 3.11 and Box 3.4). This phenomenon also has implications for public debt dynamics. The model simulations suggest that increased public investment may be self-financing under current conditions in advanced economies (in the sense that the public-debt-to-GDP ratio does not rise), but higher public investment would mean a higher public-debt-to-GDP ratio in emerging market economies and low-income countries.

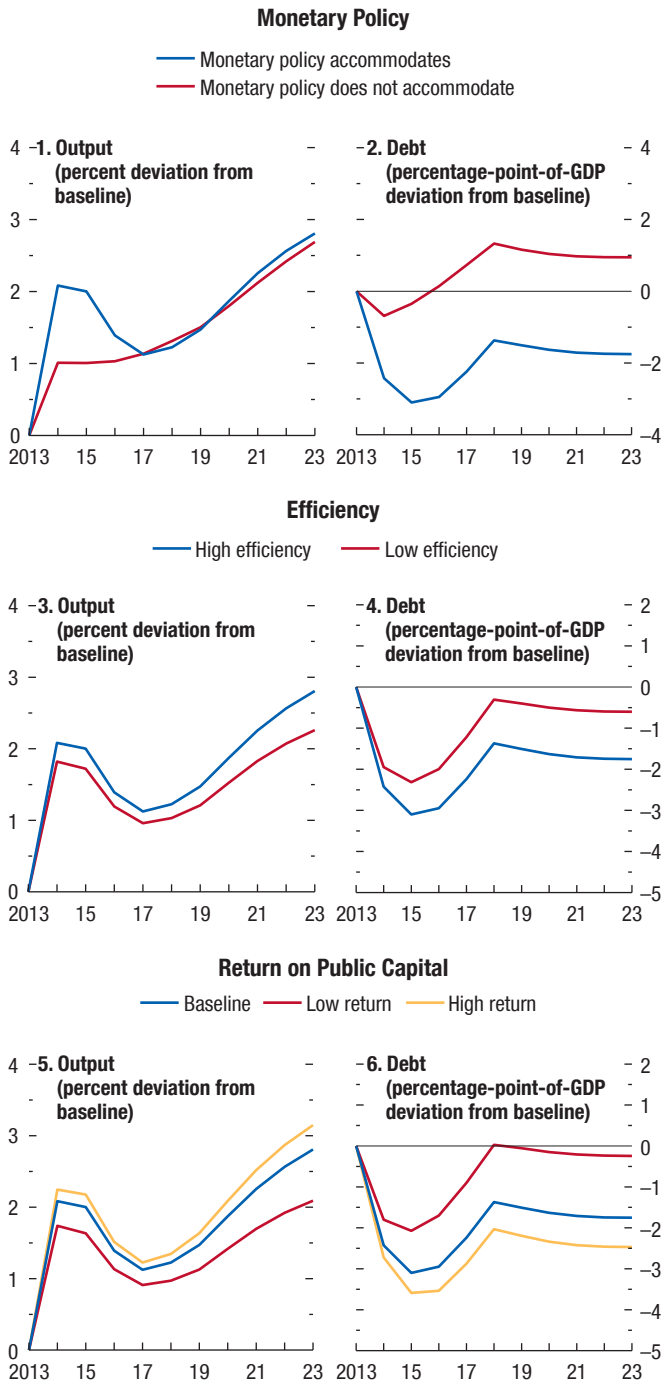
Summary and Policy Implications

Is now a good time for an infrastructure push? This chapter documents a substantial decline in public capital as a share of output over the past three decades across advanced, emerging market, and developing economies. It also notes that, in per capita terms, infrastructure provision in emerging market economies and low-income countries is still only a fraction of what it is in advanced economies. As for the macroeconomic impact of increased public investment, the chapter finds that such investment raises output in both the short and long term. It also finds that these effects vary with a number of mediating factors, and these are fundamental to teasing out the chapter's policy implications.

For economies with clearly identified infrastructure needs and efficient public investment processes and where there is economic slack and monetary accommodation, there is a strong case for increasing public infrastructure investment. Moreover, evidence from advanced economies suggests that an increase in public investment that is debt financed would have larger output effects than an increase that is budget neutral, with both options delivering similar declines in the debt-to-GDP ratio. Current conditions present an opportunity to increase public investment, for those economies where the aforementioned conditions hold. The increased public investment would provide a much-needed boost to demand in the short term and would also help raise potential output in the long term. These conclusions should not, however, be interpreted as a

Figure 3.10. Model Simulations: Effect of Public Investment in Advanced Economies—Role of Monetary Policy, Efficiency, and Return on Public Capital

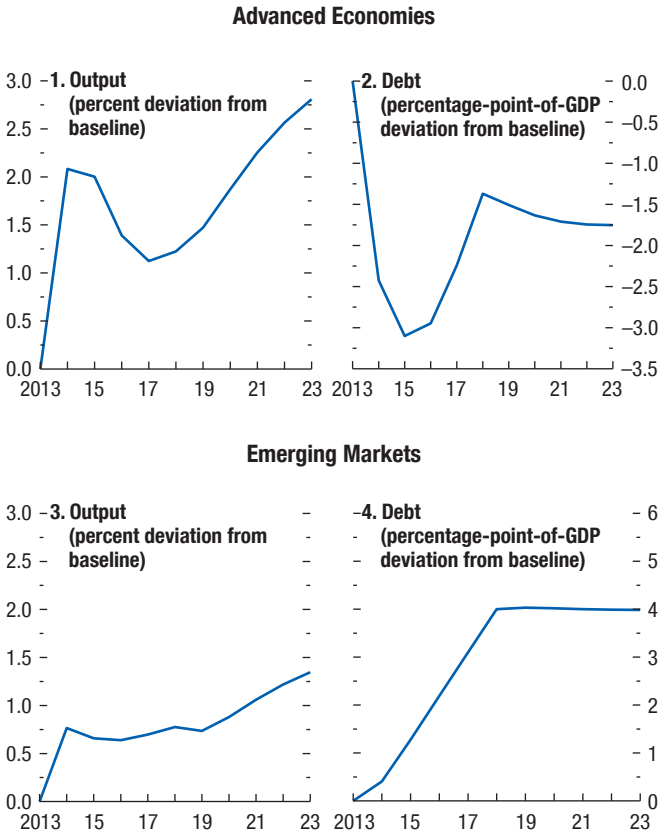
If monetary policy is not accommodative, the short-run output impact of public investment shocks is smaller. Differences in public investment efficiency and return on public capital will also shape the macroeconomic response.



Source: IMF staff estimates.
Note: Shock represents an exogenous 1 percentage point of GDP increase in public investment spending.

Figure 3.11. Model Simulations: Effect of Public Investment in Advanced Economies and Emerging Markets

The response of output to public investment shocks is smaller in emerging market economies, because the lack of slack implies an immediate monetary policy response, and because public investment efficiency is relatively lower.



Source: IMF staff estimates.
Note: Economy groups are defined in Appendix 3.1. Shock represents an exogenous 1 percentage point of GDP increase in public investment spending.

blanket recommendation for a debt-financed public investment increase across all economies. Adverse market reactions—which could occur in some countries with already-high debt-to-GDP ratios or where returns to infrastructure investment are uncertain—could raise financing costs and further increase debt pressure.

But if infrastructure needs are indeed pressing and investment may be self-financing for some economies—in the sense that the public-debt-to-GDP ratio may not rise as a result of investment—why is public investment in advanced economies at a three-decade low? The reason is that in practice, public investment decisions frequently are not guided by economic rationale. This can cut both ways—inefficient and unproductive projects are often pursued by politicians and line ministries when they should not be, and some productive projects (and importantly, maintenance) are forgone when they should be given priority. Regarding the latter, Box 3.5 illustrates how improvements in fiscal institutions and some fiscal rules seem to help preserve public investment during periods of fiscal consolidation.

For many emerging market economies and low-income countries, there is a pressing need for additional infrastructure to support economic development. But increasing public investment may lead to limited output gains, if efficiency in the investment process is not improved. Historically, there has been much wider variation in the macroeconomic effects of public investment, and the empirical estimates of the macroeconomic effects of public investment are as a result much less precise. Model-based simulations suggest that public investment does raise output in both the short and long term, but at the cost of rising public-debt-to-GDP ratios because of the general absence of economic slack and the relatively low efficiency of such investment. Thus, negative fiscal consequences should be carefully weighed against the broader social gains from increased public investment. For those emerging market and developing economies where infrastructure bottlenecks are constraining growth, the gains from alleviating these bottlenecks could be large.

Increasing investment efficiency is critical to mitigating the possible trade-off between higher output and higher public debt. Thus a key priority in many economies, particularly in those with relatively low efficiency of public investment, should be to raise the quality of infrastructure investment by improving the public investment process (Box 3.2). Improvement could involve, among other reforms, better project appraisal and selection that identifies and targets infrastructure bottlenecks, including through centralized independent reviews, rigorous cost-benefit analysis, risk costing, and zero-based budgeting principles. As the April 2014 *Fiscal Monitor* notes, only half of the increase in government investment in emerging market and developing economies during 1980–2012 translated into productive capital; it also finds that reducing all inefficiencies in public investment by 2030 would provide the same boost to the capital stock as increasing government investment by 5 percentage points of GDP in emerging market economies and by 14 percentage points of GDP in low-income countries.

Appendix 3.1. Data Sources and Country Groupings

Country Groups

The members of the economy groupings used in the chapter's analyses are shown in Table 3.2. These include 36 advanced economies, as listed in Table B of the Statistical Appendix, 94 emerging market economies, and 59 low-income developing countries. The latter two groups comprise the 153 economies categorized as a single group under the term "emerging market and developing economies" in Table E of the Statistical Appendix.

Data Sources

The primary data sources for this chapter are the *World Economic Outlook* (WEO), the Organisation for Economic Co-operation and Development (OECD), and the April 2014 *Fiscal Monitor*. All data sources used in the analysis are listed in Table 3.3. For indicators with multiple sources, 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).

Appendix 3.2. The Macroeconomic Effects of Public Investment

Conceptual Framework

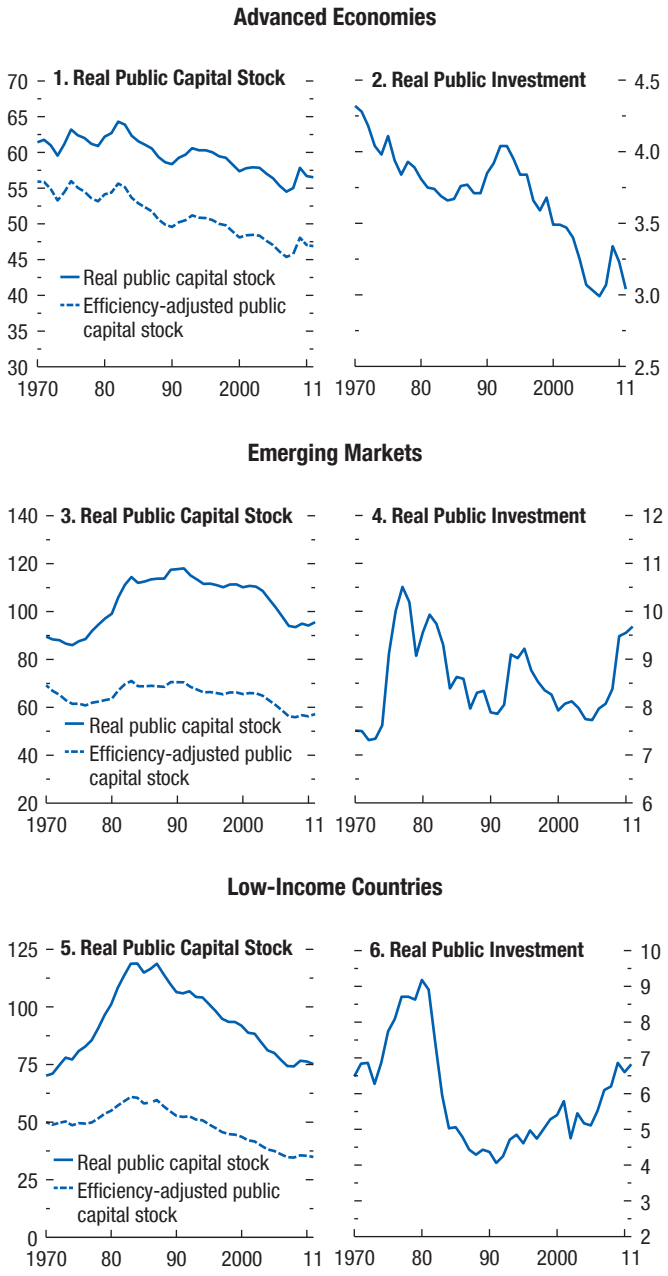
What are the effects of public investment on output and the debt-to-GDP ratio? Following Delong and Summers (2012), this section presents a highly stylized framework for assessing the effect of public investment on output and the debt-to-GDP ratio and for evaluating under which conditions an increase in public investment is self-financing.

In the short term, an increase in public investment boosts aggregate demand through the short-term fiscal multiplier. This increase in government spending will also affect the debt-to-GDP ratio, which may increase or decrease depending on the size of the fiscal multiplier and on the elasticity of revenues to output. More formally, in the short term (one year), an increase in public investment as a share of potential GDP (Δi) leads to a change in the debt-to-potential-GDP ratio (Δd) given by

$$\Delta d = (1 - \mu\tau)\Delta i, \qquad (3.1)$$

in which μ is the fiscal multiplier and τ is the marginal tax rate.

Figure 3.12. Evolution of Public Capital Stock and Public Investment
(Percent of GDP, purchasing-power-parity weighted)



Sources: IMF, Fiscal Monitor database; and IMF staff calculations.
Note: Economy groups are defined in the text.

Table 3.2. Economy Group Composition

Advanced Economies		
Australia	Hong Kong SAR	Norway
Austria	Iceland	Portugal
Belgium	Ireland	San Marino
Canada	Israel	Singapore
Cyprus	Italy	Slovak Republic
Czech Republic	Japan	Slovenia
Denmark	Korea	Spain
Estonia	Latvia	Sweden
Finland	Luxembourg	Switzerland
France	Malta	Taiwan Province of China
Germany	Netherlands	United Kingdom
Greece	New Zealand	United States
Emerging Market Economies		
Albania	Grenada	Philippines
Algeria	Guatemala	Poland
Angola	Guyana	Qatar
Antigua and Barbuda	Hungary	Romania
Argentina	India	Russia
Armenia	Indonesia	Samoa
Azerbaijan	Iran	Saudi Arabia
The Bahamas	Iraq	Serbia
Bahrain	Jamaica	Seychelles
Barbados	Jordan	South Africa
Belarus	Kazakhstan	Sri Lanka
Belize	Kosovo	St. Kitts and Nevis
Bosnia and Herzegovina	Kuwait	St. Lucia
Botswana	Lebanon	St. Vincent and the Grenadines
Brazil	Libya	Suriname
Brunei Darussalam	Lithuania	Swaziland
Bulgaria	FYR Macedonia	Syria
Cabo Verde	Malaysia	Thailand
Chile	Maldives	Timor-Leste
China	Marshall Islands	Tonga
Colombia	Mauritius	Trinidad and Tobago
Costa Rica	Mexico	Tunisia
Croatia	Micronesia	Turkey
Dominica	Montenegro	Turkmenistan
Dominican Republic	Morocco	Tuvalu
Ecuador	Namibia	Ukraine
Egypt	Oman	United Arab Emirates
El Salvador	Pakistan	Uruguay
Equatorial Guinea	Palau	Vanuatu
Fiji	Panama	Venezuela
Gabon	Paraguay	
Georgia	Peru	
Low-Income Developing Countries		
Afghanistan	Guinea	Niger
Bangladesh	Guinea-Bissau	Nigeria
Benin	Haiti	Papua New Guinea
Bhutan	Honduras	Rwanda
Bolivia	Kenya	São Tomé and Príncipe
Burkina Faso	Kiribati	Senegal
Burundi	Kyrgyz Republic	Sierra Leone
Cambodia	Lao P.D.R.	Solomon Islands
Cameroon	Lesotho	South Sudan
Central African Republic	Liberia	Sudan
Chad	Madagascar	Tajikistan
Comoros	Malawi	Tanzania
Democratic Republic of the Congo	Mali	Togo
Republic of Congo	Mauritania	Uganda
Côte d'Ivoire	Moldova	Uzbekistan
Djibouti	Mongolia	Vietnam
Eritrea	Mozambique	Yemen
Ethiopia	Myanmar	Zambia
The Gambia	Nepal	Zimbabwe
Ghana	Nicaragua	

Table 3.3. Data Sources

Indicator	Source
Electricity Generation Capacity	Calderón, Moral-Benito, and Servén 2014; Canning 2007; World Bank, World Development Indicators Database
General Government Gross Debt	Abbas and others 2010; IMF, World Economic Outlook Database
Gross Domestic Product (constant prices)	IMF, World Economic Outlook Database; World Bank, World Development Indicators Database
Gross Domestic Product (current prices)	IMF, World Economic Outlook Database; World Bank, World Development Indicators Database
Gross Domestic Product Forecast (constant prices)	IMF, World Economic Outlook Database
Overall Quality of Infrastructure	World Economic Forum, *Global Competitiveness Report*
Population	IMF, World Economic Outlook Database; World Bank, World Development Indicators Database
Predicted Disbursement of Loans	Kraay, forthcoming
Private Gross Fixed Capital Formation (PPP-adjusted, 2005 U.S. dollars)	IMF, Fiscal Monitor Database (April 2014)
Public Gross Fixed Capital Formation (PPP-adjusted, 2005 U.S. dollars)	IMF, Fiscal Monitor Database (April 2014)
Quality of Roads	World Economic Forum, *Global Competitiveness Report*
Real Public Capital Stock (PPP-adjusted, 2005 U.S. dollars)	IMF, Fiscal Monitor Database (April 2014)
Roads	Calderón, Moral-Benito, and Servén 2014; World Bank, World Development Indicators Database; International Road Federation, World Road Statistics
Telephone Lines	Calderón, Moral-Benito, and Servén 2014; World Bank, World Development Indicators Database
Trade-Weighted Terms of Trade	April 2013 *World Economic Outlook,* Chapter 4
OECD countries	
Gross Domestic Product (constant prices)	OECD Statistics and Projections Database
Gross Domestic Product Forecast (constant prices)	OECD Statistics and Projections Database
Government Spending (constant prices)	OECD Statistics and Projections Database
Government Spending Forecast (constant prices)	OECD Statistics and Projections Database
Government Fiscal Balance	OECD Statistics and Projections Database
Government Fiscal Balance Forecast	OECD Statistics and Projections Database
Private Consumption (constant prices)	OECD Statistics and Projections Database
Private Consumption Forecast (constant prices)	OECD Statistics and Projections Database
Private Gross Fixed Capital Formation (constant prices)	OECD Statistics and Projections Database
Private Gross Fixed Capital Formation Forecast (constant prices)	OECD Statistics and Projections Database
Public Gross Fixed Capital Formation (constant prices)	OECD Statistics and Projections Database
Public Gross Fixed Capital Formation Forecast (constant prices)	OECD Statistics and Projections Database
General Government Gross Debt	IMF, World Economic Outlook Database

Note: OECD = Organisation for Economic Co-operation and Development; PPP = purchasing power parity.

Over time, the short-term increase in public investment will affect the debt-to-GDP ratio by affecting its annual debt-financing burden, which is equal to the difference between the real government borrowing rate (r) and the GDP growth rate (g) times the initial change in the debt-to-GDP ratio:

$$(r - g)\Delta d = (r - g)(1 - \mu\tau)\Delta i. \quad (3.2)$$

Whether this additional financing burden will lead to an increase in the debt-to-GDP ratio in the long term will depend on the parameters of equation (3.2) but also crucially on the elasticity of output to public capital. In particular, in the long term, an increase in public investment will lead to an increase in potential output (Y), which will generate long-term future tax dividends:

$$\tau\Delta Y = \tau\varepsilon y_0\Delta i, \quad (3.3)$$

in which ε is the long-term elasticity of output to public capital and y_0 is the initial output-to-public-capital

ratio.[34] Equations (3.2) and (3.3) imply together that if short-term multipliers and the elasticity of output to public capital are sufficiently large, such that

$$(r - g)(1 - \mu\tau) - \tau\varepsilon y_o \leq 0,$$

then at the margin, an increase in public investment will be self-financing.

Empirical Analysis for Advanced Economies

Baseline approach

The analysis in this section assesses the macroeconomic impact of public investment shocks, applying the statistical approach used by Auerbach and Gorodnichenko (2012, 2013). In this approach, shocks are identified as unanticipated changes in public investment; public investment forecasts are used to compute unanticipated innovations. This procedure overcomes the problem of fiscal foresight (see Forni and Gambetti 2010; Leeper, Richter, and Walker 2012; Leeper, Walker, and Yang 2013; and Ben Zeev and Pappa 2014), because it aligns the economic agents' and the econometrician's information sets.[35]

Two econometric specifications are used, first to establish the macroeconomic impact of public investment shocks and then to determine whether the effects vary with the state of the economy and with the degree of public investment efficiency. In the first specification, the *average* response of real GDP, the debt-to-GDP ratio, and private investment as a share of GDP are estimated. The statistical method follows the approach proposed by Jordà (2005) to estimate impulse-response functions. This approach has been advocated by Stock and Watson (2007) and Auerbach and Gorodnichencko (2013), among others, as a flexible alternative that does not impose the dynamic restrictions embedded in vector autoregression (autoregressive distributed-lag) specifications and is particularly suited to estimating nonlinearities in the dynamic response. The first regression specification is estimated as follows:

$$y_{i,t+k} - y_{i,t} = \alpha_i^k + \gamma_t^k + \beta^k FE_{i,t} + \varepsilon_{i,t}^k, \qquad (3.4)$$

in which y is the log of output (debt-to-GDP ratio and private-investment-to-output ratio); α_i are country fixed effects, included to take account of differences in countries' growth rates; γ_t are time fixed effects, included to take account of global shocks such as shifts in oil prices or the global business cycle; and *FE* is the forecast error of public investment as a share of GDP, computed as the difference between actual and forecast series.

In the second specification, the response is allowed to vary with the state of the economy and with the degree of public investment efficiency. The second regression specification is estimated as follows:

$$y_{i,t+k} - y_{i,t} = \alpha_i^k + \gamma_t^k + \beta_1^k G(z_{it}) FE_{i,t} + \beta_2^k (1 - G(z_{it})) FE_{i,t} + \varepsilon_{i,t}^k, \qquad (3.5)$$

with

$$G(z_{it}) = \frac{\exp(-\gamma z_{it})}{1 + \exp(-\gamma z_{it})}, \ \gamma > 0,$$

in which z is an indicator of the state of the economy (or degree of public investment efficiency) normalized to have zero mean and unit variance. The indicator of the state of the economy considered in the analysis is GDP growth,[36] and the measure of investment efficiency is from the World Economic Forum's *Global Competitiveness Report* and was also used in the April 2014 *Fiscal Monitor*.

Equations (3.4) and (3.5) are estimated for each k = 0, . . . , 4. Impulse-response functions are computed using the estimated coefficients β^k, and the confidence bands associated with the estimated impulse-response functions are obtained using the estimated standard errors of the coefficients β^k, based on clustered robust standard errors.

The macroeconomic series used in the analysis come from the OECD's Statistics and Projections database, which covers an unbalanced sample of 17 OECD economies (Australia, Belgium, Canada, Denmark, Finland, France, Germany, Iceland, Japan, Korea, Netherlands, New Zealand, Norway, Sweden, Switzerland, United Kingdom, United States) over the period

[34]For simplicity of formulation, the depreciation rate is assumed to be zero.

[35]Leeper, Richter, and Walker (2012) demonstrate the potentially serious econometric problems that result from fiscal foresight. They show that when agents foresee changes in fiscal policy, the resulting time series have nonfundamental representations.

[36]As in Auerbach and Gorodnichenko 2013, γ = 1.5 is used for the analysis of recessions and expansions, γ = 1.0 for the role of public investment efficiency. The results do not qualitatively change for different values of gamma greater than zero. Similar results are obtained when the output gap is used to identify the state of the economy. The main reasons for identifying the state of economy using GDP growth instead of the output gap are that the latter is unobservable and its estimates are highly uncertain and subject to substantial and frequent revisions.

1985–2013. The forecasts of investment spending used in the analysis are those reported in the fall issue of the OECD's *Economic Outlook* for the same year.[37] As a robustness check, the forecasts of the spring issue of the same year and the fall issue of the previous year are alternatively used. The results show that the response functions are almost identical and not statistically significantly different from that reported in the baseline (Table 3.4, columns 2 and 3).

A problem in the identification of public investment shocks is that they may be endogenous to output growth surprises. Indeed, whereas automatic stabilizers operate mostly via revenues and social spending, discretionary public investment spending can occur in response to output conditions. Inspection of the data, however, shows that the public investment innovations identified are only weakly correlated (about –0.11) with output growth surprises. Moreover, the results obtained by separating public investment shocks from output growth innovations are almost identical and not statistically significantly different from those reported in the baseline (Table 3.4, column 4).

[37]The macroeconomic series from the OECD's Statistics and Projections database are available for a much longer period relative to *World Economic Outlook* forecasts. See Vogel 2007 and Lenain 2002 for an assessment of OECD forecasts and a comparison with forecasts prepared by the private sector. The size of the shock varies between –4.6 and 1.2 percentage points of GDP, with an average (median) of about –0.3 (–0.1) percentage point of GDP.

Another possible problem in identifying public investment shocks is a potential systematic bias in the forecasts concerning economic variables other than public investment, with the result that the forecast errors for public investment are correlated with those for other macroeconomic variables. To address this concern, the measure of public investment shocks has been regressed on the forecast errors of other components of government spending, private investment, and private consumption. The results, presented in column (5) of Table 3.4, show that the response functions are almost identical and not statistically significantly different from that reported in the baseline.

Whether public investment has a different macroeconomic impact depending on whether the public investment shocks are positive or negative is also assessed, using the following econometric specification:

$$y_{i,t+k} - y_{i,t} = \alpha_i^k + \gamma_t^k + \beta^{k+} D_{it} FE_{i,t} + \beta^{k-}(1 - D_{it}) FE_{i,t} + \varepsilon_{i,t}^k, \quad (3.6)$$

with

$D_{it} = 1$ if $FE_{it} > 0$, and 0 otherwise.

The results of this exercise show that although the output effect is typically larger for positive investment shocks than for negative ones, the difference is not statistically significant (Table 3.4, columns 6 and 7).

Table 3.4. Effect of Public Investment on Output in Advanced Economies: Robustness Checks

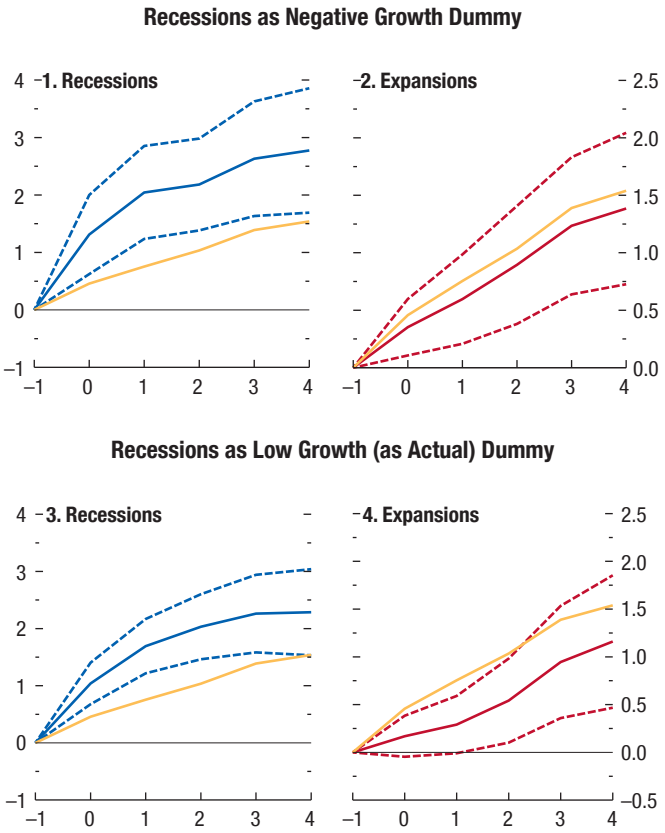
	Baseline	April Forecast	Previous October Forecast	Purging Public Investment Forecast Errors of Forecast Errors in: Growth	Purging Public Investment Forecast Errors of Forecast Errors in: Demand Components[1]	Positive Shocks	Negative Shocks
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Impact of Public Investment Shock on Output at k =							
0	0.457	0.264	0.332	0.418	0.502	1.013	0.316
	(0.147)	(0.160)	(0.118)	(0.147)	(0.143)	(0.447)	(0.181)
1	0.755	0.581	0.697	0.702	0.844	1.240	0.584
	(0.238)	(0.216)	(0.216)	(0.241)	(0.264)	(0.619)	(0.309)
2	1.035	0.966	1.004	0.993	1.241	1.576	0.888
	(0.322)	(0.270)	(0.288)	(0.323)	(0.339)	(0.763)	(0.431)
3	1.389	1.099	1.124	1.354	1.625	1.706	1.242
	(0.394)	(0.349)	(0.330)	(0.393)	(0.405)	(0.754)	(0.547)
4	1.539	1.318	1.219	1.507	1.864	1.459	1.393
	(0.441)	(0.402)	(0.383)	(0.439)	(0.489)	(0.715)	(0.617)

Source: IMF staff calculations.

Note: $k = 0$ is the year of the public investment shock, measured by the public investment forecast error. Standard errors (in parentheses) are corrected for heteroscedasticity and clustered at the country level. The sample includes 17 Organisation for Economic Co-operation and Development economies for the 1985–2013 period. All regressions include a full set of country and year fixed effects.

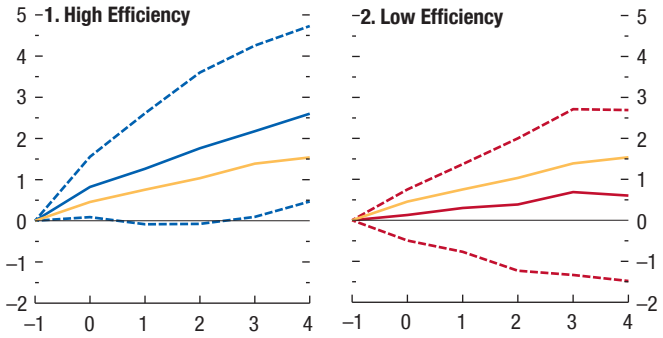
[1]Demand components include private consumption, investment, and government consumption.

Figure 3.13. Effect of Public Investment Shocks on Output, Recessions versus Expansions: Robustness Checks
(Percent; years on x-axis)



Source: IMF staff calculations.
Note: $t = 0$ is the year of the shock; dashed lines denote 90 percent confidence bands. Blue lines represent recessions; red lines represent expansions; yellow lines represent the baseline. Shock represents an exogenous 1 percentage point of GDP increase in public investment spending.

Figure 3.14. Effect of Public Investment Shocks on Output, High versus Low Efficiency: Robustness Checks
(Percent; years on x-axis)



Source: IMF staff calculations.
Note: $t = 0$ is the year of the shock; dashed lines denote 90 percent confidence bands. Blue lines represent high efficiency; red lines represent low efficiency; yellow lines represent the baseline. Shock represents an exogenous 1 percentage point of GDP increase in public investment spending.

The results presented in this section show that the short-term effects of investment spending shocks are larger in recessions than in expansions. This finding is robust to different specifications (interacting the shock with a recession dummy instead of a transition function of the state of the economy) and definitions of recessions (recessions defined as periods of negative growth or when growth is below the 2013 OECD average GDP growth) (Figure 3.13). Although these results may be driven simply by the fact that these shocks occur in periods of economic recovery, no statistically significant correlation is found between the measure of investment spending shocks used in this study and the state of the economy. In particular, the correlation between investment spending shocks and the state of the economy (change in the state of economy) is –0.01 (0.01). Similarly, no statistically significant correlation is found between the measure of investment spending shocks used here and the degree of investment efficiency. This suggests that the result that macroeconomic effects are larger in countries with higher investment efficiency is not driven by the fact that investment spending shocks tend to occur more frequently and to be larger in countries with higher degrees of public investment efficiency.[38] Finally, these results are also robust to different measures of public investment efficiency, such as the one presented in Box 3.3 (Figure 3.14).

Alternative approach

As an alternative approach, the dynamic macroeconomic impact of changes in public investment (as a share of GDP) is estimated. The results, depicted in panel 1 of Figure 3.15, show that changes in public investment have statistically significant and long-lasting effects on output. In particular, a 1 percentage point of GDP increase in investment spending increases the level of output by about 1.2 percent in the same year and by 1.3 percent after four years. If the sample period average response of government spending to output (about 3 percentage points of GDP) is used,

[38]In particular, the correlation between investment spending shocks and the degree of efficiency is –0.11.

the short- and medium-term investment spending multipliers are about 1.2 and 1.3, respectively.

A 1 percentage point of GDP increase in investment spending is found to reduce the debt-to-GDP ratio in the short term (by about 1.2 percentage points of GDP), but the medium-term effect is surrounded by large uncertainty and not statistically significantly different from zero (Figure 3.15, panel 2). There is no statistically significant effect on private investment as a share of GDP (Figure 3.15, panel 3).

The results are qualitatively similar when changes in public investment are instrumented with fiscal-spending-based consolidations and expansions identified using the narrative approach (Chapter 3 of the April 2011 *World Economic Outlook*).[39]

Empirical Analysis for Developing Economies

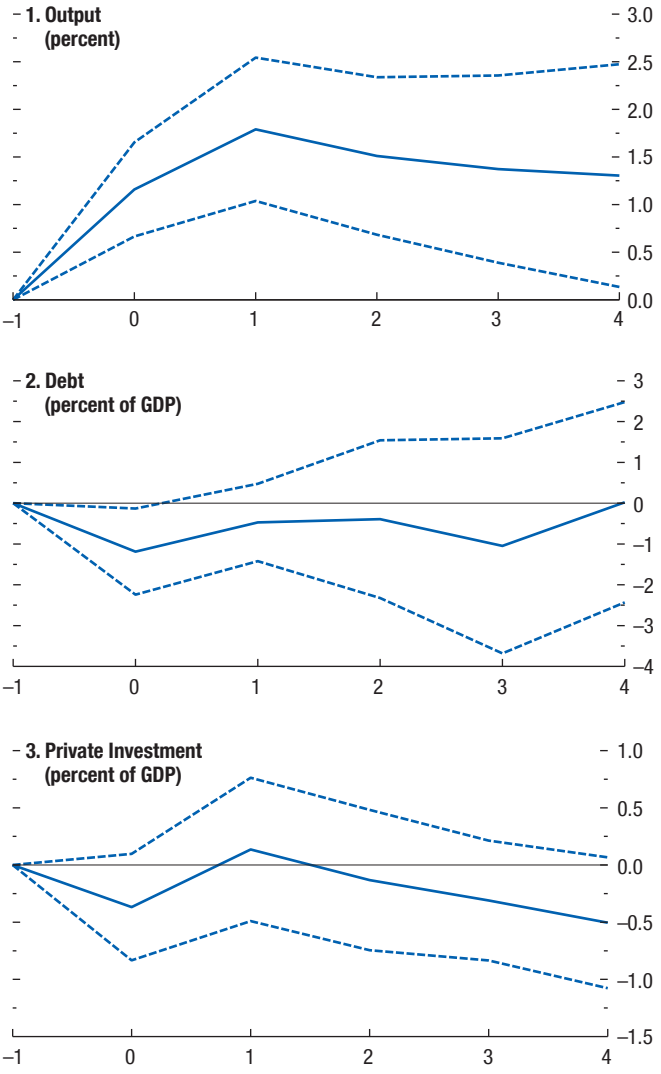
The empirical strategy that is applied for the sample of advanced economies requires forecasts of public investment, which are not available over a long time span for non-OECD economies. Given these data limitations, three different approaches are undertaken that provide complementary evidence on the macroeconomic effects of public investment in developing economies.

First approach: Investment booms

The first approach employed here is to examine episodes of public investment booms and trace the evolution of key macroeconomic variables in the aftermath of large and sustained increases in public investment. Investment booms are identified, following Warner (2014), as a sustained and significant increase in the government investment ratio. Using historical series of real public investment as a share of GDP from the April 2014 *Fiscal Monitor,* the beginning of a boom is identified as the point at which

- The difference between the five-year-forward average public-investment-to-GDP ratio and the five-year-backward average public-investment-to-GDP ratio exceeds the 80th percentile of such differences for a particular country for at least three consecutive years. This ensures that (1) this is a relatively large change in investment for the specific country and (2) the increase in investment is sustained over a period of time.
- The difference between the five-year-forward average public-investment-to-GDP ratio and five-year-backward average public-investment-to-GDP ratio exceeds a certain absolute threshold, which is set

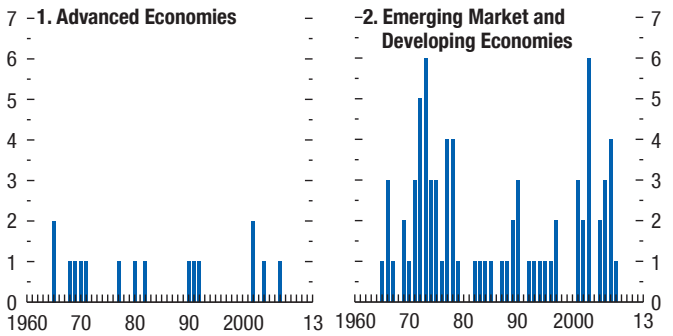
Figure 3.15. Effect of Changes in Public Investment in Advanced Economies
(Years on x-axis)



Source: IMF staff estimates.
Note: $t = 0$ is the year of the shock; dashed lines denote 90 percent confidence bands. Shock represents a 1 percentage point of GDP increase in public investment spending.

[39]These narrative measures are identified as those motivated by reasons unrelated to economic activity and are found to have statistically significant effects on public investment. Compared with the approach described in the previous section, this approach has one major shortcoming, in that the vast majority of the identified exogenous shocks are positive (that is, fiscal consolidations) and are motivated by debt reduction and therefore may be endogenous to debt-to-GDP ratios. In particular, out of 206 episodes, 161 are fiscal consolidations, and only 45 are fiscal expansions.

Figure 3.16. Distribution of Public Investment Booms over Time
(Number of countries)



Source: IMF staff calculations.

at 3 percentage points of GDP for non–advanced economies and 1 percentage point of GDP for advanced economies, where public investment ratios are significantly lower (see Figure 3.2).

Figure 3.16 presents the distribution of the beginning of public investment booms identified by this statistical procedure across time and for advanced and emerging market and developing economies. The vast majority of booms studied took place in emerging market and developing economies, with only a handful in advanced economies. Public investment booms are concentrated in the 1970s, when there was also a substantial buildup in the public capital stock in emerging market and developing economies, as well as in the mid-2000s, when public investment rates picked up again in this group of countries (see Figure 3.2).

Once the initial year of the investment boom has been identified, the evolution of key macroeconomic variables in the period following the public investment push is traced, using the estimation equation

$$y_{i,t+k} - y_{i,t} = \alpha_i^k + \gamma_t^k + \beta^k \, Boom_{i,t} + \varepsilon_{i,t}^k, \qquad (3.7)$$

in which y is the log of real output (the evolution of public investment as a share of GDP is also examined, as well as the debt-to-GDP ratio); α_i are country fixed effects, to account for different growth rates and levels of public investment across countries; γ_t are time fixed effects that control for global shocks such as shifts in commodity prices and global recessions; and $Boom_{i,t}$ is an indicator variable that equals one in the year the boom begins and zero otherwise. Separate regressions are estimated for each $k = \{0,9\}$. The coefficients β^k trace the impulse-response function of the level of the dependent variable of interest at time $t + k$ to a public investment boom that began at time t.

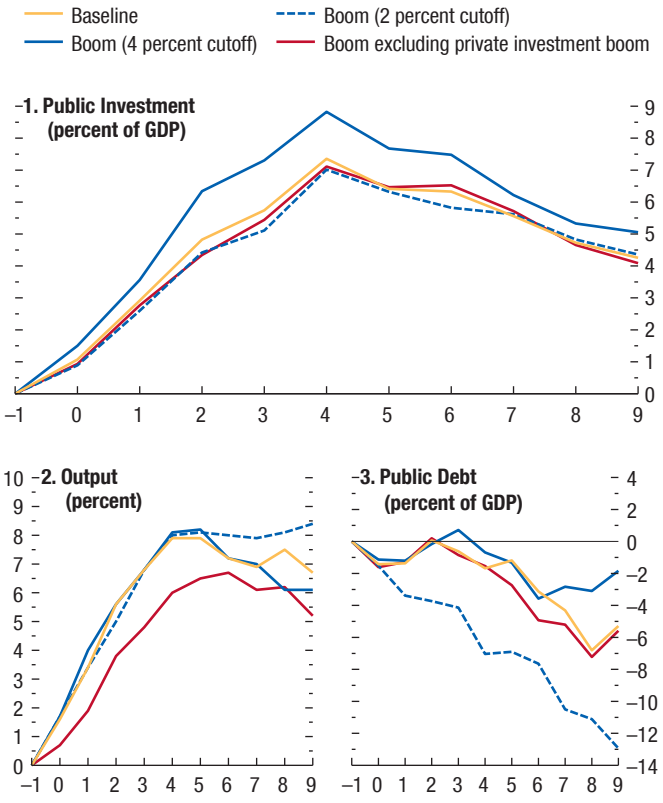
Estimating the causal impact of booms is confounded by the fact that whether a country undergoes an investment boom and when a boom occurs are not exogenous to the country's macroeconomic conditions. For example, anticipation of high growth in the future (such as from a sustained terms-of-trade boom or discovery of natural resources) may prompt governments to invest in infrastructure now, leading to overestimation of the causal impact of investment. Alternatively, public investment may be ratcheted up during times of economic slack in the hope of providing a boost to growth, which could potentially bias the estimated impact downward. The goal of this exercise is simply to establish the stylized facts around public investment booms, without claiming that the patterns observed are caused by the boom.

Figure 3.17 depicts the evolution of public investment, output, and public debt in the 10 years following the beginning of a boom using the study's baseline definition of a boom (as described earlier and presented in Figure 3.7), as well as several robustness checks. Namely, the sensitivity of the patterns to using alternative cutoffs for the absolute change in public investment in identifying the booms is examined. Although the baseline is built on an absolute difference between the five-year-forward and five-year-backward moving average of at least 3 percent for emerging market and developing economies and 1 percent for advanced economies, uniform cutoffs of 2 percent and 4 percent are also considered. Using a 2 percent cutoff for defining a boom increases the number of booms identified to 134; with the 4 percent cutoff, 89 booms are identified.

Given the poor availability of data on the breakdown of total investment into public and private, some of the data on real government investment that are used are imputed from the total investment series, potentially conflating the roles of the public and private sectors. As an additional robustness check, the series on public and private investment for each of the 122 booms identified in the baseline are examined, and booms prior to and during which there is a high degree of comovement between the public and private investment series are excluded.[40] This procedure

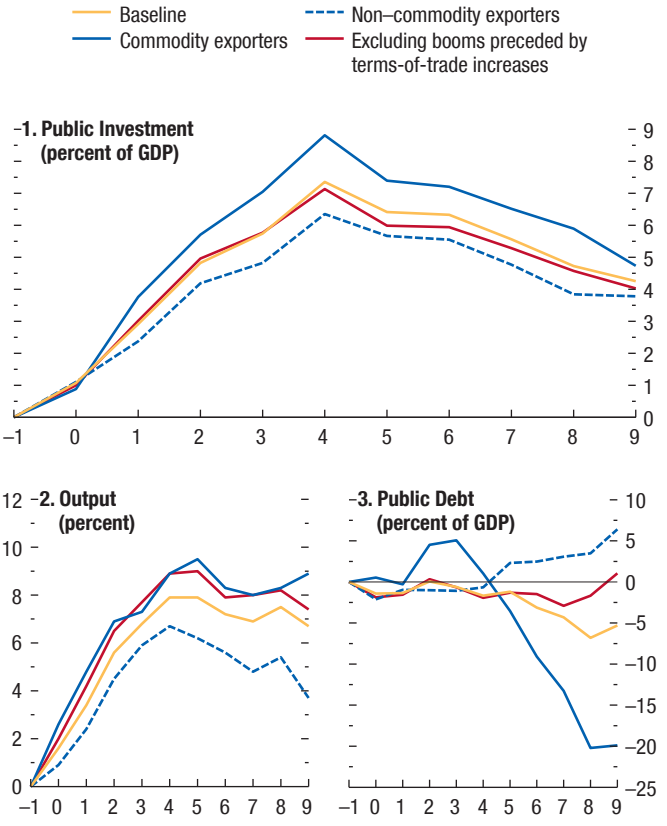
[40] This methodology constitutes a rather conservative method of defining public investment booms, as it likely excludes cases in which the patterns in total investment reflect primarily the behavior of public investment and cases in which there is strong complemen-

Figure 3.17. Output and Public Debt in the Aftermath of Public Investment Booms: Robustness Checks
(Years on x-axis)



Source: IMF staff calculations.
Note: $t = 0$ is the beginning of a public investment boom. See text for a definition of public investment booms.

Figure 3.18. Output and Public Debt in the Aftermath of Public Investment Booms: Role of Natural Resources
(Years on x-axis)



Source: IMF staff calculations.
Note: $t = 0$ is the beginning of a public investment boom. See text for a definition of public investment booms.

reduces the number of booms to 101. The red lines in Figure 3.17 depict the evolution of the macroeconomic variables following the 101 booms identified in this manner. Across all these alternative definitions of a boom, the same patterns are observed: there is a sustained increase in the level of output in the years following the beginning of a public investment boom, with no evidence of a rise in public indebtedness.

Finally, the extent to which these findings might simply reflect the experience of economies that benefit from favorable terms-of-trade shocks or natural resource discoveries and ratchet up public investment in response to these growth-enhancing events is examined. The sample of economies is split into commodity (including fuel) exporters and non–commodity exporters. The investment booms identified in the sample of commodity exporters are clearly larger in magnitude and are associated with a larger increase in output (Figure 3.18). Perhaps not surprisingly, this is precisely the set of countries that drive the negative point estimates on the evolution of the public-debt-to-GDP ratio following booms. In the non–commodity exporters, public investment booms are followed by a small and statistically nonsignificant increase in public debt. Finally, zeroing in on booms that are not coincidental to or preceded by favorable terms of trade yields results very similar to the baseline (red lines in Figure 3.18). Booms associated with favorable terms of trade are defined as those for which the five-year average (that is, from $t - 4$ to t, in which t is the beginning of the boom) of the deviation of the trade-weighted terms of trade from their long-term historical average exceeds the 80th percentile.

tarity between public and private investment. On the latter, see Eden and Kraay 2014.

Second approach: Exogenous public investment shocks

The second approach is inspired by Perotti (1999) and Corsetti, Meier, and Müller (2012). The empirical strategy relies on the idea that significant portions of government spending (and especially investment) are likely determined by past information and cannot easily respond to current economic conditions. Thus, a fiscal policy rule can be estimated for public investment and a series of exogenous shocks to public investment obtained from the residuals of this estimation. The policy shocks are then used to trace the dynamic effects of public investment on output.

The first step of this approach consists of estimating an annual time series of public investment innovations. The change in public investment (as a share of GDP) is assumed to follow a simple rule that relates it to its own lag, current and past debt-to-GDP ratios, past output growth, and expectations about current economic activity (proxied by the *World Economic Outlook* growth forecasts):[41]

$$\Delta i_{i,t} = \alpha_i + \gamma_t + \beta \Delta i_{i,t-1} + \delta_0 d_{i,t} + \delta_1 d_{i,t-1} + \theta g_{i,t-1} + \mu E_{i,t-1}(g_{i,t}) + \varepsilon_{i,t}, \quad (3.8)$$

in which $i_{i,t}$ denotes public investment as a share of GDP; α_i and γ_t indicate country and time fixed effects, respectively; d is the debt-to-GDP ratio; g denotes output growth; $E(g)$ denotes expectation about current economic activity; and ε represents the measure of public investment shocks.

The identifying assumption is that there is no two-way contemporaneous interdependence between change in investment and output growth. In principle, this assumption can be violated in two ways. First, public investment can *automatically* respond to cyclical conditions. This, however, should not pose a problem, because automatic stabilizers operate mostly through revenues and social spending. Second, discretionary public investment spending can occur in response to output conditions. As Corsetti, Meier, and Müller (2012) discuss, the relevance of this concern relates to the precise definition of contemporaneous feedback effects. Although it is typically assumed in the literature that government spending does not react to changes in economic activity within a given quarter (Blanchard and Perotti 2002), whether it might respond in a period longer than a quarter is an open question. Recent evidence for advanced economies (Beetsma, Giuliodori, and Klaassen 2009; Born and Müller 2012), however, suggests that the restriction that government spending not respond to economic conditions within one year cannot be rejected.

The second step consists of estimating the impact of these innovations ($\hat{e}_{i,t}$) on macroeconomic outcomes, as described in equation (3.4). Since estimating the public investment rule requires forecasts of the next year's growth, the estimation sample is restricted to the post-1990 period, when such forecasts become available for emerging market and developing economies. The results are based on a sample of 77 emerging market economies and 51 low-income countries.

In the baseline specification, the top and bottom 1 percent of shocks are trimmed from the public investment shock series. Including the entire sample leads to smaller and statistically nonsignificant point estimates of the effect of public investment on output. Trimming the top and bottom 5 percent of shocks yields larger and more statistically significant point estimates (Table 3.5).

Third approach: Instrumental variables

The third strategy builds on recent work by Kraay (2012, forthcoming) and Eden and Kraay (2014). In many low-income countries, loans from official creditors (such as the World Bank and other multilateral and bilateral aid agencies) finance a significant fraction of government spending. The disbursements of these loans and the spending they finance are spread out over many years following the approval of the loans. Hence, part of the fluctuation in government investment is predetermined, because the fluctuation reflects loan approval decisions made in previous years. If it is assumed that loan approval decisions by creditors do not anticipate future macroeconomic shocks that matter for output, this predetermined component of spending can be used as an instrument for total government investment to identify the causal impact of public investment on output.

Kraay's (forthcoming) series on predicted disbursements of loans (excluding loans approved in the current year) is employed as the instrument for public investment.[42] Using loan-level data from the Debtor

[41]The growth forecasts used in the analysis are those reported in the spring issue of the *World Economic Outlook* for the same year. As a robustness check, the forecasts of the fall issue of the same year and the spring issue of the previous year are alternatively used.

[42]Kraay (forthcoming) employs the predicted disbursements of official loans as an instrument for total government spending, whereas Eden and Kraay (2014) use it as an instrument for public investment, to tease out the short-term multiplier of public investment in a set of 52 low-income countries. The work discussed in this appendix builds on these studies by examining both the short- and

Table 3.5. Effect of Public Investment on Output in Emerging Market and Developing Economies: Public Investment Shocks Derived from a Fiscal Policy Rule

	Baseline[1]		Full Sample		Top and Bottom 5 Percent of Shocks Trimmed	
k	Coefficient	SE	Coefficient	SE	Coefficient	SE
	(1)	(2)	(3)	(4)	(5)	(6)
–1	0	0	0	0	0	0
0	0.252	(0.066)	0.144	(0.074)	0.324	(0.100)
1	0.340	(0.096)	0.193	(0.086)	0.571	(0.142)
2	0.331	(0.126)	0.187	(0.100)	0.567	(0.191)
3	0.384	(0.152)	0.225	(0.119)	0.728	(0.238)
4	0.497	(0.189)	0.239	(0.174)	1.010	(0.313)

Note: Columns (1), (3), and (5) present the estimated coefficients on the public investment shock from a series of regression estimates for each k in {0,4}. Standard errors (SEs) of the estimated coefficients, which are shown in columns (2), (4), and (6), are corrected for heteroscedasticity and clustered at the country level. There are 128 economies in the sample, with data from 1990–2013. All regressions include a full set of country and year fixed effects. $k = 0$ is the year of the shock.

[1]In the baseline specification, the top and bottom 1 percent of public investment shocks are trimmed.

Reporting System database maintained by the World Bank, Kraay (forthcoming) constructs loan-level predicted disbursements by applying to each initial loan commitment the average disbursement profile across all other loans issued by the same creditor in the same decade to all countries in the same geographical region as the actual borrower. These predicted loan-level disbursements of previously approved loans are then aggregated at the country-year level.[43] These series are available for the 1970–2010 period.

Because the identification strategy requires a strong correlation between public investment and predicted disbursements of loans, the sample is restricted to countries where disbursements from official creditors constitute an important source of financing. Namely, following Kraay (forthcoming), only countries whose disbursements of loans from official creditors equal on average at least 1 percent of GDP over 1970–2010 are included. This results in a regression sample covering 95 countries for which data on both public investment and official creditors' loan disbursements are available.

The following series of regressions is then estimated using two-stage least squares:

$$y_{i,t+k} - y_{i,t} = \alpha_i^k + \gamma_t^k + \beta^k X_{i,t} + \varepsilon_{i,t}^k, \qquad (3.9)$$

in which y is the log of real output; α_i are country fixed effects; γ_t are time fixed effects; and $X_{i,t}$ is the change in public investment as a share of GDP, instrumented with the change in predicted disbursements of previously approved loans. Equations are estimated for each $k = \{0,4\}$. The coefficients β^k trace the impulse-response function of the level of output at time $t + k$ to a change in public investment at time t.

Table 3.6 reports the estimated coefficients β^k based on equation (3.9). Panel 1 presents the first-stage regression results, and panel 2 reports the two-stage least-squares estimates of the response of output to change in public investment instrumented by the change in predicted loan disbursements. The results from three different samples are presented: all economies for which there are data, in column (1); only countries in which disbursements of loans from official creditors average at least 10 percent of total government spending, in column (2); and only countries eligible for support from the World Bank's International Development Agency, in column (3).

Across all three samples of economies, the effects of public investment on output are rather imprecisely estimated. The estimated coefficient is statistically significant at conventional levels only for the year following the change in investment. This could be a result of the rather weak first stage—the *F*-statistics are smaller than 10 in all three samples (Staiger and Stock 1997)—or could simply reflect the wide variety of experiences with public investment in developing economies.

medium-term effects of public investment on output and studying these effects in a larger sample of countries.

[43]See Kraay, forthcoming, for details on the data and construction of the instrument.

Table 3.6. Effect of Public Investment on Output in Emerging Market and Developing Economies: Public Investment Instrumented by Predicted Official Loan Disbursement

	Baseline	High-Disbursement Countries	IDA
	(1)	(2)	(3)
1. First Stage: Dependent Variable—Change in Public Investment as Percent of GDP			
Change in Predicted Disbursements	0.146	0.170	0.122
	(0.063)	(0.070)	(0.063)
First-Stage *F*-Statistic	3.705	5.344	7.217
Number of Observations	3,245	2,294	1,864
Number of Countries	95	66	58
2. Two-Stage Least Squares: Dependent Variable—Output Growth			
Impact of Change in Public Investment on Output at k =			
0	0.655	0.716	0.765
	(0.484)	(0.418)	(0.641)
1	1.700	1.691	1.801
	(0.841)	(0.748)	(1.146)
2	1.425	1.570	1.396
	(1.009)	(0.912)	(1.329)
3	1.359	1.700	1.156
	(1.112)	(1.017)	(1.534)
4	1.018	1.548	0.438
	(1.243)	(1.112)	(1.675)

Source: IMF staff calculations.

Note: $k = 0$ is the year of the change in public investment instrumented by the change in predicted loan disbursement. Panel (1) reports ordinary least-squares estimates of the first-stage regression of change in public investment on change in predicted loan disbursements. Panel (2) shows the two-stage least-squares estimates of the effect of change in public investment on real output from a series of regressions estimated for each k in {0,4}. Standard errors (in parentheses) are corrected for heteroscedasticity and clustered at the country level. Data are from 1970–2010. All regressions include a full set of country and year fixed effects. Results from three different samples are presented in columns (1), (2), and (3)—respectively, the full set of countries, only countries where disbursements of loans from official creditors average at least 10 percent of total government spending, and only countries eligible for International Development Association (IDA) support.

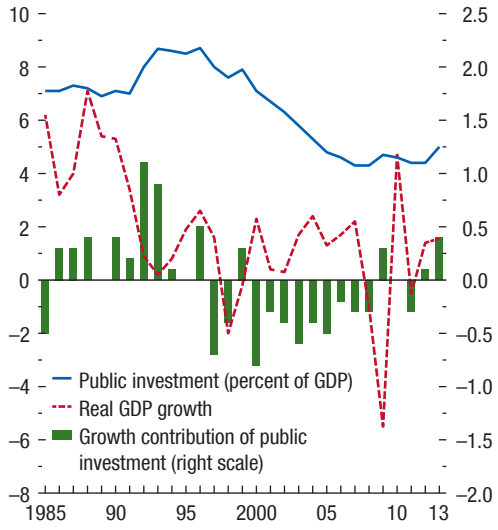
Box 3.1. Public Investment in Japan during the Lost Decade

Public investment in Japan is sometimes criticized as having contributed to the country's large debt increase and for failing to stimulate growth during the so-called Lost Decade. But there is reason for skepticism about such claims. To shed light on this debate, this box revisits Japan's experience with public investment.

It is true that Japan briskly increased public investment in the early 1990s, but the increase was unwound after just a few years to finance higher social security spending for a rapidly aging population. In particular, after the bursting of the bubble economy in the early 1990s, the government increased public investment spending by 1½ percent of GDP, with such spending reaching a peak of 8.6 percent in 1996. After that, the ratio of public investment to GDP steadily declined, picking up only recently in the aftermath of the global financial crisis, the 2011 earthquake, and the start of Abenomics (Figure 3.1.1). In the 20 years after 1992, the last year in which Japan recorded a fiscal surplus, social spending increased by 10.6 percent of GDP, and public investment declined by 2.3 percent of GDP.

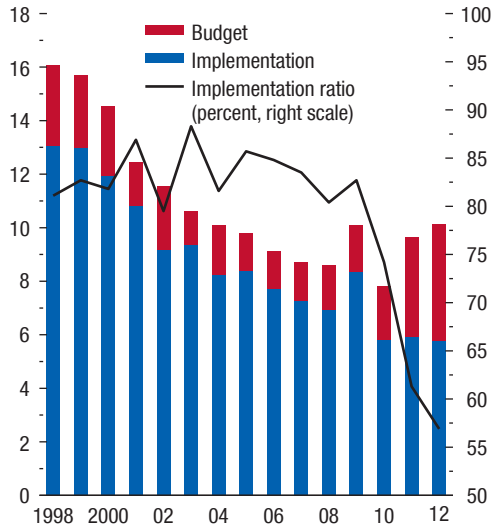
The author of this box is Ikuo Saito.

Figure 3.1.1. Japan: Public Investment and Growth
(Percent, unless noted otherwise)



Source: Economic and Social Research Institute, Japan.

Figure 3.1.2. Japan: Budget and Implementation of Public Investment
(Trillions of yen)



Source: Ministry of Finance, Japan.
Note: Budgeted amounts include carryover from previous years.

Not only was there this decline in investment throughout the late 1990s and the first decade of the 2000s, which has perhaps been less well remembered than the fast rise in the early 1990s, but announcements of investment plans have regularly exceeded their implementation. The ratio of public investment plans to actual implementation was 80–85 percent between 1998 and 2009, after which it dropped as resources for many planned projects shifted to recovery from a series of earthquakes that culminated with the historic 2011 event (Figure 3.1.2). This partial implementation may also help explain the gap between the perceived and actual growth of public investment.

However, the perception that the ability of public investment to stimulate activity has been on a declining trend is more accurate (see, for example, Auerbach and Gorodnichenko 2014). According to a macroeconomic model of the Japanese economy produced by the Economic and Social Research Institute—an arm of Japan's Cabinet Office—the short-term public investment multiplier declined from 1.31 in 1998 to

Box 3.1 *(continued)*

1.14 in 2011. Potential reasons for this decline include balance sheet adjustments (in the wake of the global financial crisis) that may have reduced the public investment multiplier, a lack of coordination between fiscal and monetary policies, reduced availability of highly productive projects, and cross subsidization among projects (Syed, Kang, and Tokuoka 2009).[1]

In sum, the frequent claim that Japan's public investment has been wasted does not fully withstand careful examination. It is true that Japan's public investment has recently faced greater challenges, as indicated by a lower multiplier effect since 1998. But given the great burst of activity in the early 1990s, the actual decline in the volume of public investment relative to GDP since the late 1990s, combined with the sharply reduced implementation of projects after 2009, may have combined to produce a misleadingly heightened perception that Japan's investment has been ineffective.

[1]Because projects with different profitability rates are tracked within the same account, a less productive infrastructure project can sometimes be cross subsidized by a more lucrative project.

Box 3.2. Improving the Efficiency of Public Investment

To be efficient, public investment must meet two conditions: it must be allocated to projects with the highest ratio of benefits to costs, and its aggregate level must align with fiscal sustainability. Efficiency entails not only the proper allocation of investment to sectors, but also the production of public assets at the lowest possible cost. When public investment is inefficient, higher levels of spending may simply lead to larger budget deficits, without increasing the quantity or quality of roads, schools, and other public assets that can help support economic growth.

One method for assessing the efficiency of public investment is to estimate "efficiency frontiers."[1] If a country has higher-quality infrastructure than other countries with a similar or greater level of capital stock, it is on the efficiency frontier. The further a country is from the efficiency frontier, the lower its efficiency score. Applying this approach, Albino-War and others (forthcoming) find that, on average, emerging market and developing economies are 10–20 percent less efficient than advanced economies (Figure 3.2.1).[2] The averages mask substantial differences within each group, however, indicating a global potential for improvement.

Examining the quality of public investment management can help identify the underlying causes of these inefficiencies. For example, the Public Investment Management Index assigns country scores for the four phases of public investment management: project appraisal, selection and budgeting, implementation, and ex post evaluation (Dabla-Norris and others 2012). These scores indicate that emerging market economies generally perform better than low-income countries (Figure 3.2.2).

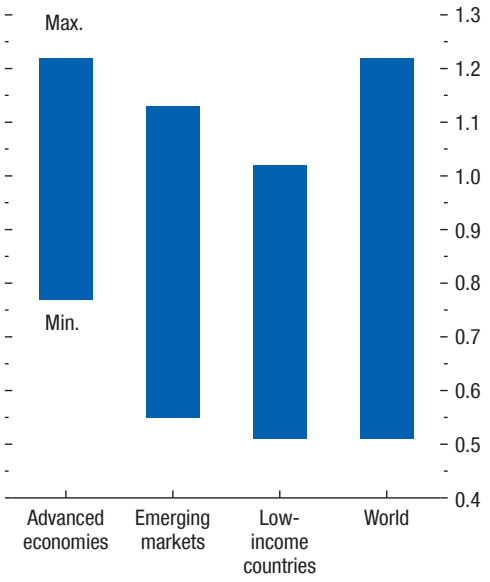
But problems are evident in advanced economies as well. Common challenges include weak strategic guidance, budget planning, and project appraisal (including a failure to undertake cost-benefit analysis systematically); poor project selection and budgeting because of rigidities in the sectoral allocation of investment and fragmented decision making regarding capital and current budgets and investment; completion delays and cost overruns from overly optimistic cost estimates and inadequate cost controls; and a lack of interim and ex post project evaluation.

Well-designed institutional arrangements for public investment decision making and management can help improve the efficiency of public investment (IMF, forthcoming). For example, project appraisal can be strengthened by instituting a centralized, independent review process to ensure robust estimates of the costs, benefits, and risks of potential projects, as has been done in Australia, Chile, Korea, and Norway.

Both project appraisal and project selection can be strengthened by preparing investment budgets from a zero base, as in the United Kingdom, to ensure that

Figure 3.2.1. Public Efficiency Measured by Efficiency Frontiers

(Efficiency scores, infrastructure quality)



Sources: Albino-War and others, forthcoming; Dabla-Norris and others 2012; and IMF staff calculations.

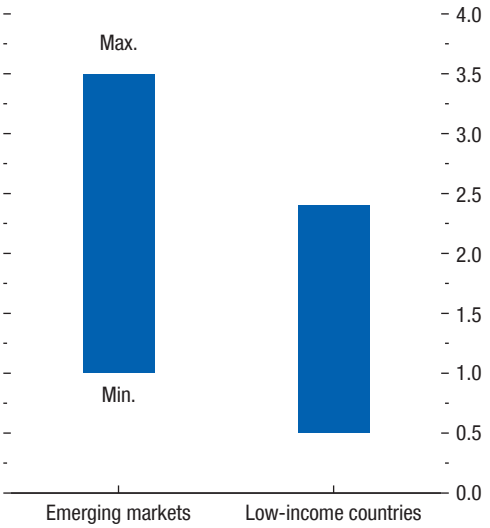
The authors of this box are Carlos Mulas Granados, Bahrom Shukurov, and SeokHyun Yoon.

[1]Estimation of the efficiency frontier involves comparing an indicator of public infrastructure quantity (the input) to an indicator of public infrastructure quality (the output). Quantity is the sum of past public investment, adjusted for depreciation, per capita. Quality is the "overall quality of infrastructure" indicator from the World Economic Forum's *Global Competitiveness Report*.

[2]As a proxy for the private sector's provision of infrastructure, the estimates include GDP per capita as an input. The results are not greatly affected by adding this control (the correlation coefficient of the efficiency scores with and without GDP per capita as an input is 0.89).

Box 3.2 *(continued)*

Figure 3.2.2. Public Investment Management Index Scores in Emerging Markets and Low-Income Countries



Sources: Albino-War and others, forthcoming; Dabla-Norris and others 2012; and IMF staff calculations.
Note: The Public Investment Management Index is an index of public investment efficiency composed of 17 indicators grouped into four stages of the public investment management cycle: project appraisal, selection, implementation, and evaluation. See Dabla- Norris and others 2012 for details.

new capital expenditure targets those sectors with the highest returns rather than those that have previously benefited from substantial investment. Planning current and capital expenditure within a medium-term budget framework can also ensure that investments are sustainable and that maintenance spending is fully taken into account, as is done, for example, in Australia, Chile, Ethiopia, Ireland, and Korea.

Project implementation can be improved by providing for explicit contingencies within the budget in anticipation of cost overruns and to avoid overcommitting the budget to new projects, as in Denmark and the United Kingdom. Finally, project evaluation can be strengthened by undertaking more systematic assessments of whether projects are on time, are within budget, and deliver their expected outputs, as is done, for example, in Chile and Korea.

Box 3.3. Fiscal Balance Sheets: The Significance of Nonfinancial Assets and Their Measurement

What assets constitute the stock of public capital in various economies? Answering this question requires data on the stock of nonfinancial assets within the framework of a balance sheet that covers all levels of government or the public sector.[1]

In a macroeconomic statistics balance sheet, a distinction is made between nonfinancial assets, financial assets, liabilities, and net worth. The standard breakdown of nonfinancial assets as applied in the analytical framework for government finance statistics is shown in Table 3.3.1.

A recent IMF working paper (Bova and others 2013) looks at the size, composition, and management of government-owned nonfinancial assets across 32 advanced and emerging market economies. It finds that nonfinancial assets comprise mainly structures (such as roads and buildings) and, when valued, land and subsoil assets. These assets have increased in value over time, primarily because of higher property and commodity prices, and in large part are owned by subnational governments. However, their levels as a percentage of GDP differ widely across countries (Figure 3.3.1).

Although data compilation is often a first step toward more effective asset management, the availability of internationally comparable data on nonfinancial assets is limited, and some countries report only subcategories. Moreover, some countries report data only for the central government rather than for general government or the public sector. Achieving a full, global picture of governments' balance sheets will require broader data coverage and the resolution of differences in accounting methods.

The authors of this box are Rob Dippelsman, Gary Jones, Kara Rideout, and Florina Tanase.

[1]The IMF's *Government Finance Statistics Manual 2001* (GFSM 2001) and its update, the *Government Finance Statistics Manual 2014* (GFSM 2014), provide guidance on compiling such information.

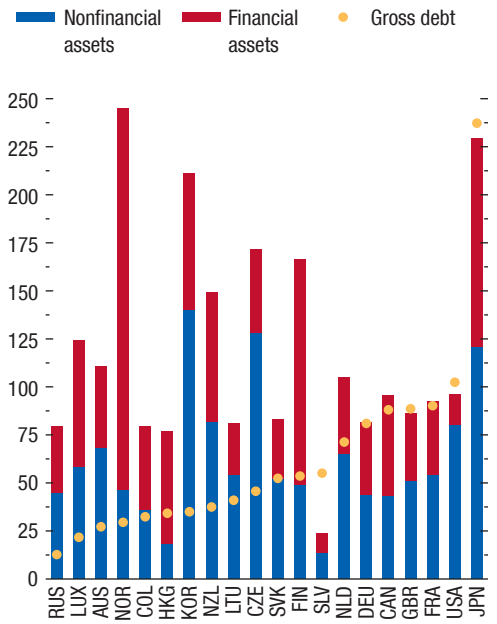
Table 3.3.1. Summary Classification of Nonfinancial Assets

61	Nonfinancial assets		
611	Fixed assets	612	Inventories
6111	Buildings and structures	613	Valuables
61111	Dwellings	614	Nonproduced assets
61112	Buildings other than dwellings	6141	Land
61113	Other structures	6142	Mineral and energy resources
61114	Land improvements	6143	Other naturally occurring assets
6112	Machinery and equipment	61431	Noncultivated biological resources
61121	Transport equipment	61432	Water resources
61122	Machinery and equipment other than transport equipment	61433	Other natural resources
6113	Other fixed assets	6144	Intangible nonproduced assets
61131	Cultivated biological resources	61441	Contracts, leases, and licenses
61132	Intellectual property products	61442	Goodwill and marketing assets
6114	Weapons systems		

Source: IMF, *Government Finance Statistics Manual 2001*.

Figure 3.3.1. General Government Assets and Liabilities, 2012

(Percent of GDP)



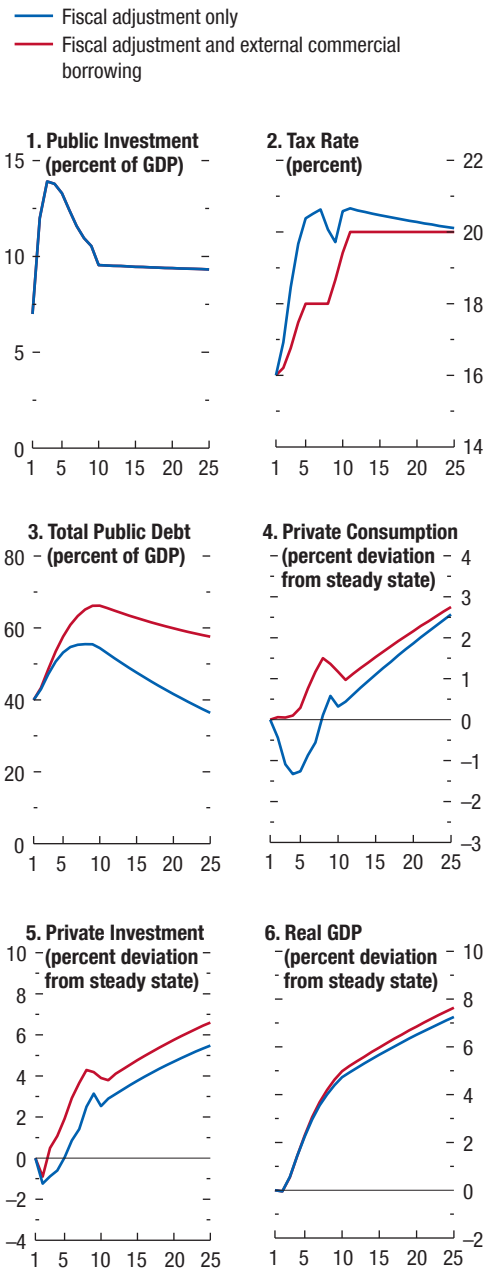
Sources: IMF, *Government Finance Statistics Yearbook;* Organisation for Economic Co-operation and Development; and IMF staff calculations.
Note: Data labels in the figure use International Organization for Standardization country codes.

Box 3.4. The Macroeconomic Effects of Scaling Up Public Investment in Developing Economies

Scaling up public investment can spur economic advancement in developing economies, but it can also involve some major macroeconomic challenges and trade-offs regarding growth and debt sustainability. This box discusses some of these benefits and challenges, paying particular attention to some factors that shape the effects on growth and debt sustainability. The effects of investment depend not only on the rate of return of public capital (relative to the cost of funding), but also on the type of financing, the efficiency of public investment, the response of the private sector, and the authorities' ability to implement fiscal adjustment and manage debt. To illustrate the discussion, the box uses the Debt, Investment, and Growth model developed by Buffie and others (2012), which is calibrated to capture aspects pertinent to low-income countries, such as low public investment efficiency, limited absorptive capacity, and limited access to international and domestic borrowing.[1]

Figure 3.4.1 presents the macroeconomic effect of scaling up public investment in low-income countries. In particular, it assumes that the public-investment-to-GDP ratio increases from the current level of about 7 percent of GDP to 14 percent of GDP in about three years and then stabilizes at about 9 percent of GDP. The results of the simulation show that such an increase can generate substantially greater output over the long term (by about 7 percent after 25 years), but it can also raise the debt-to-GDP ratio in the short to medium term, even though part of the scaling up is financed with concessional loans and grants (blue lines in the figure). In the absence of nonconcessional external borrowing, taxes must increase sharply in the short to medium term, leading to a crowding out of private investment and consumption. The more ambitious and front-loaded the increase in public investment, the larger the increase in taxes and its associated effects tend to be.

Figure 3.4.1. Role of Type of Financing in Scaling Up Public Investment in Low-Income Countries
(Years on x-axis)



Source: IMF staff estimates.

The author of this box is Felipe Zanna.

[1]The Debt, Investment, and Growth model is a real, dynamic, open economy framework with several production sectors that use public capital as an input; it allows for different financing strategies (external concessional, external commercial, domestic) and various fiscal rules that respond to debt paths. In the model, efficiency is set to 0.5—that is, 1 dollar of public investment can translate into 0.5 dollar of public capital—a ratio in line with estimates in Pritchett 2000. See also Dabla-Norris and others 2012. The return to public capital is calibrated to 25 percent, which is close to values provided by Foster and Briceño-Garmendia (2010) and Dalgaard and Hansen (2005).

Box 3.4 *(continued)*

Nonconcessional external borrowing can help bridge financing gaps and smooth difficult macroeconomic adjustments in the short to medium term. With more borrowing, debt-to-GDP ratios can be expected to increase for some time, but this additional financing can help ease the fiscal adjustment and prevent the crowding out of private consumption and investment (Figure 3.4.1). These gains from additional nonconcessional debt should, however, be balanced against the risks associated with this type of financing. Policymakers may put off necessary tax increases and expenditure cuts while continuing to borrow on nonconcessional terms, thus potentially saddling the country with a high ratio of debt to GDP.

Resource-rich developing economies may have additional resources to finance investment increases, but they also face additional challenges. Natural resources provide a valuable opportunity to invest those resources domestically to speed up development (see Collier and others 2010 and van der Ploeg and Venables 2011). Resource-rich economies should design mechanisms to prevent boom-bust cycles. They can do so by incorporating in their plans the implications of the volatility of resource prices and the exhaustibility of reserves, as well as by establishing a resource fund.[2] Such economies should also be cautious about borrowing in advance (before resource revenues materialize) to start investment programs.[3]

The macroeconomic effect of increasing public investment hinges on countries' structural characteristics, especially the efficiency of such investment. In particular, in countries with high investment efficiency, more public investment may lead to significant growth effects and a decline in the debt-to-GDP ratio in the long term (after 25 years). In countries with low investment efficiency, however, it may lead to low growth dividends and unsustainable debt dynamics (Figure 3.4.2).

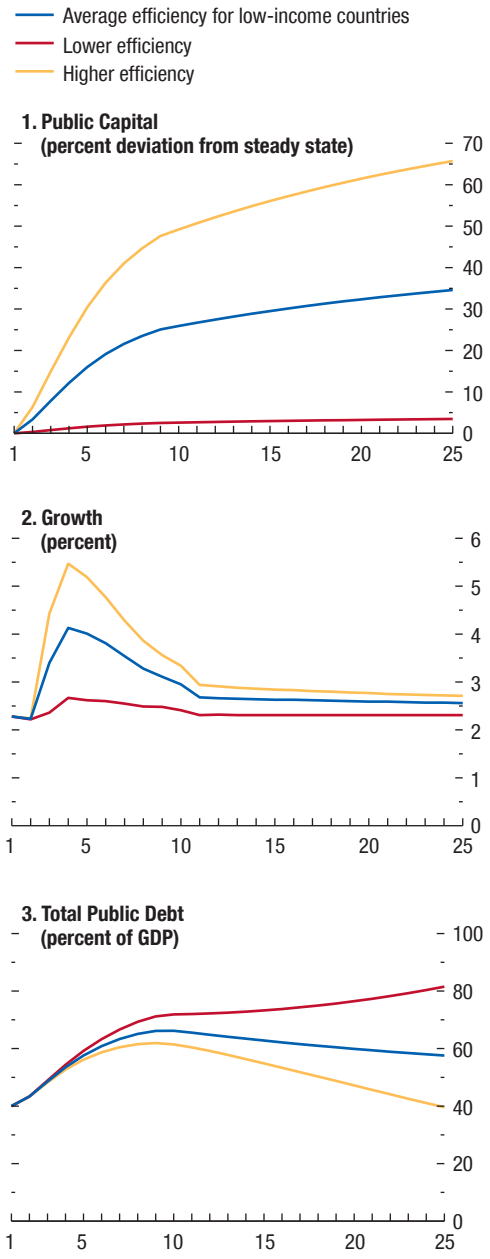
Overall, reaping the growth and development benefits of greater public investment while minimizing the risks to debt sustainability in developing economies will require policymakers to improve public investment efficiency, debt management capacity, and fiscal flexibility.

[2]A resource fund works as a fiscal buffer mechanism that saves resource revenues in boom times that can be drawn down to support investment spending during periods of low resource revenues. See Berg and others 2013 and Melina, Yang, and Zanna 2014.

[3]In the 1970s era of soaring commodity prices, many developing economies used their natural resources as collateral for loans to undertake ambitious projects. When prices plummeted in the 1980s, these economies suffered debt crises (Gelb 1988; Manzano and Rigobón 2007).

Figure 3.4.2. Role of Improving Public Investment Efficiency in Low-Income Countries

(Years on x-axis)



Source: IMF staff estimates.

Box 3.5. Fiscal Institutions, Rules, and Public Investment

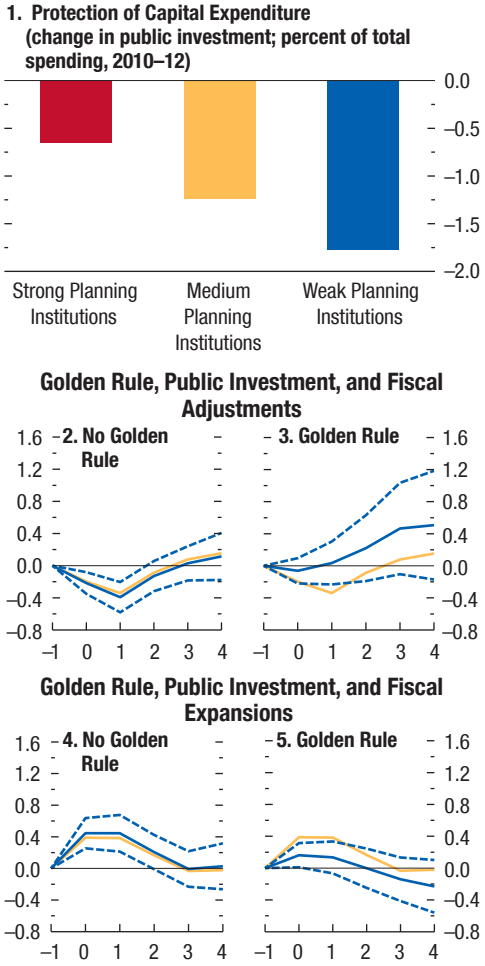
Budget institutions affect fiscal policy outcomes and shape the composition of the budget, including the share of resources devoted to investment spending. For example, stronger planning institutions have been associated with smaller cuts in public investment over the past four years (Figure 3.5.1, panel 1, and IMF 2014).

Budget rules also affect public investment spending, especially in the case of the so-called golden rule of public finance. This rule calls for excluding net investment spending from the budget balance against which implicit or explicit fiscal discipline targets are applied. The idea behind the rule is that a government, like a private company, should not attribute to one year the full cost of projects expected to generate gains over several years.

Several arguments have been advanced in favor of the golden rule.[1] First, financing investment out of current revenue may conflict with other spending objectives of policy authorities or with institutional or political constraints. Under such conditions, amending the budget constraint with a golden rule may allow a rise in productive investment, which adds to the stock of public capital and raises output. Second, the golden rule takes into account that borrowing to finance productive public investment could pay for itself over the longer term, both through user fees and through higher tax revenues resulting from higher output. Third, spreading the costs of public investment over time promotes intergenerational equity, shifting part of the cost of investment to future beneficiaries. Finally, if public investment is productive, a balanced current budget is consistent with a positive, steady-state ratio of public debt to GDP and with optimal fiscal policy.

The golden rule can also entail significant budgetary and economic development risks (see for example Balassone and Franco 2000 and Buiter 2001). First, in the presence of excess demand, public investment should be part of the fiscal adjustment required to bring domestic absorption into line with resource availability. Second, investments carry no guarantee of success, and even public investments that significantly boost economic growth may not reduce budgetary pressures if the tax base is limited or tax enforcement is weak. Third, freeing public investment from fiscal constraints may

Figure 3.5.1. Fiscal Policies and Public Investment



Source: IMF staff calculations.
Note: Panel 1 presents averages of scores on four dimensions: clear and transparent medium-term fiscal objectives, medium-term budget frameworks, performance orientation of the budget, and intergovernmental fiscal arrangements. Countries are categorized into one of three groups (strong, medium, weak) based on their average score in each of these four subgroups. Countries that scored in the top third overall are categorized as "strong," those in the middle third "medium," and those in the bottom third "weak." See IMF 2014. For panels 2 through 5, $t = 0$ is the year of the shock, dashed lines denote 90 percent confidence bands, and solid yellow lines represent the baseline result. See note 2 in the text for a list of countries that had or currently have a golden rule.

The authors of this box are Davide Furceri and Carlos Mulas Granados.

[1]See for example Fitoussi and Creel 2002 and Blanchard and Giavazzi 2004.

Box 3.5 *(continued)*

discriminate against desirable forms of private involvement in infrastructure, such as when it brings efficiency to the investment, and it may bias spending toward physical capital and sacrifice current expenditure on human capital such as health and education spending. Finally and importantly, the golden rule may induce creative accounting that excludes some current spending from fiscal targets by classifying it as investment. Strong institutional capacity is therefore needed to ensure that adopting the golden rule achieves its objective without raising fiscal risks. Moreover, in countries with serious concerns about debt sustainability, implementing the golden rule may simply not be feasible because there are few alternatives to focusing on the overall balance.

Has the golden rule been effective in protecting public investment from fiscal contractions? A novel database, the IMF's Fiscal Rules Dataset, facilitates an empirical investigation of this question for a set of 56 economies, including 6 with the golden rule in place at some point during 1985–2013.[2]

The way the golden rule shapes how fiscal adjustments affect public investment as a share of GDP is estimated using the following empirical specification:

$$y_{i,t+k} - y_{i,t} = \alpha_i^k + \gamma_t^k + \beta_1^K GR_{i,t} FA_{i,t} + \beta_2^K (1 - GR_{i,t}) FA_{i,t} + \delta GR_{i,t} + \vartheta X_{i,t} + \varepsilon_{i,t}^k, \quad (3.5.1)$$

in which y is public investment as share of GDP; α_i are country fixed effects; γ_t are time fixed effects; $GR_{i,t}$ is a dummy variable that equals one when country i has in place a golden rule in year t; X is a vector of control variables, including lags of output growth and debt-to-GDP ratio; and FA is a dummy that equals one for the starting year t of the fiscal adjustment in each country i and zero otherwise. Fiscal consolidation (expansion) episodes are identified as two-year periods in which the cyclically adjusted primary-balance-to-GDP ratio improves (deteriorates) in each year and the cumulative improvement (deterioration) is equivalent to at least 2 percent of GDP (Alesina and Ardagna 2012).

The results (Figure 3.5.1) show that the golden rule has helped preserve public investment following periods of fiscal contraction (while having no statistically significant effect following periods of fiscal expansion). In particular, although public investment declined by about 0.4 percentage point of GDP on average one year after a consolidation episode in countries with no golden rule in place, the decline in investment was significantly smaller in countries with a golden rule. These results have to be interpreted with caution, however, because causality is difficult to establish. The results are robust to the inclusion of a broader sample of 18 countries with rules that fully or partially exclude public investment from the ceiling.

In recent years, a number of advanced economies have improved the design of their fiscal rules by adopting so-called second-generation fiscal rules, which allow for greater flexibility to accommodate shocks while maintaining the government's commitment to medium- and long-term fiscal sustainability (IMF 2014). The European countries with the largest economies (France, Germany, Italy, United Kingdom) have taken steps to enshrine their fiscal rules in law. Other advanced economies, including Australia, Canada, Japan, and Korea, have more clearly specified their fiscal policy objectives and rules without embedding them in law.

Fiscal rules are also increasingly supported by more comprehensive and binding medium-term expenditure frameworks. Since 2010, Germany, Italy, and the United Kingdom have strengthened their medium-term budget frameworks by either improving their institutional coverage or tightening multiyear expenditure limits.

[2]The database covers 56 advanced, emerging market, and developing economies, of which 9 had a golden rule in place at some point between 1985 and 2013 (Brazil, Costa Rica, Germany, Japan, Kosovo, Liberia, Malaysia, Pakistan, United Kingdom). Database limitations for Kosovo, Liberia, and Malaysia restrict the present analysis of golden-rule countries to the remaining 6.

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CHAPTER 4

ARE GLOBAL IMBALANCES AT A TURNING POINT?

Global current account ("flow") imbalances have narrowed significantly since their peak in 2006, and their configuration has changed markedly in the process. The imbalances that used to be the main concern—the large deficit in the United States and surpluses in China and Japan—have more than halved. But some surpluses, especially those in some European economies and oil exporters, remain large, and those in some advanced commodity exporters and major emerging market economies have since moved to deficit. This chapter argues that the reduction of large flow imbalances has diminished systemic risks to the global economy. Nevertheless, two concerns remain. First, the nature of the flow adjustment—mostly driven by demand compression in deficit economies or growth differentials related to the faster recovery of emerging market economies and commodity exporters after the Great Recession—has meant that in many economies, narrower external imbalances have come at the cost of increased internal imbalances (high unemployment and large output gaps). The contraction in these external imbalances is expected to last as the decrease in output due to lowered demand has likely been matched by a decrease in potential output. However, there is some uncertainty about the latter, and there is the risk that flow imbalances will widen again. Second, since flow imbalances have shrunk but not reversed, net creditor and debtor positions ("stock imbalances") have widened further. In addition, weak growth has contributed to increases in the ratio of net external liabilities to GDP in some debtor economies. These two factors make some of these economies more vulnerable to changes in market sentiment. To mitigate these risks, debtor economies will ultimately need to improve their current account balances and strengthen growth performance. Stronger external demand and more expenditure switching (from foreign to domestic goods and services) would help on both accounts. Policy measures to achieve both stronger and more balanced growth in the major economies, including in surplus economies with available policy space, would also be beneficial.

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Introduction

A worrying trend in the run-up to the global financial crisis was the widening of current account imbalances in some of the world's largest economies. The concerns were fourfold: first, that some of the imbalances reflected domestic distortions, from large public deficits in some economies to excessive private saving in others, correction of which was in individual economies' self-interest; second, that some of the imbalances might be reflecting intentional distortions, such as unfair trade practices or exchange rate policies, with adverse implications for trade partners; third, that a reduction in the U.S. current account deficit would likely require a slowdown in U.S. domestic demand growth, which—absent stronger demand elsewhere—would weaken global growth; and fourth, that the economies with large deficits and growing external liabilities, most notably the United States, might suffer an abrupt loss of confidence and financing, leading to massive disruptions of the international monetary and financial systems.[1]

A decade later, where do we stand?

Flow imbalances—current account surpluses and deficits—have narrowed markedly, and inasmuch as they reflected domestic distortions, this narrowing has benefited both the economies suffering from them and the system as a whole. In addition, imbalances—especially deficits—have become less concentrated, so the risks of a sudden reversal (or the consequences thereof) are likely to have diminished. Two issues remain, however. How much of the narrowing is temporary and how much is permanent? And how worried should we be that net foreign asset positions have continued to diverge because flow imbalances have only narrowed rather than reversed?

Consensus on these issues has yet to emerge. Some view the large global imbalances of the mid-2000s as a past phenomenon, unlikely to return; others, how-

[1]See, for example, the September 2006 *World Economic Outlook,* as well as IMF 2007 and its discussion by the IMF Executive Board (https://www.imf.org/external/np/sec/pn/2007/pn0797.htm).

ever, are more skeptical that the adjustment that has taken place will prove durable, and they urge greater policy action to address the remaining imbalances.[2] These opposing perspectives (and their accompanying policy prescriptions) suggest that there is a need to better understand the mechanics of adjustment and the extent to which the domestic and international distortions that underlay the precrisis imbalances have been addressed.

This chapter thus assesses whether global imbalances remain—or might again become—a matter of concern. To do so, it traces the evolution of global imbalances before and after the global financial crisis and seeks to answer the following key questions:

- How has the distribution of flow imbalances changed over time as they have narrowed? Has the narrowing been due more to expenditure changing or to expenditure switching from foreign to domestic goods and services? Will imbalances widen again as output gaps are closed?
- How have stock imbalances evolved? What are the underlying forces, and what are the likely future dynamics?

The main findings are as follows:

- With the narrowing of systemic current account balances, the configuration of global imbalances has shifted markedly since their peak in 2006. The imbalances that were the main concern at the time—the large deficit of the United States and the large surpluses of China and Japan—have all decreased by at least half relative to world GDP. At the same time, though not the original focus of concerns about global imbalances, the unsustainability of some large European deficits became apparent, and these economies have been undergoing often painful external adjustment.
- Beyond these major changes, the pattern of surpluses and deficits has changed in other ways. Some major emerging market economies and a few advanced commodity exporters have moved from surplus to deficit. The surpluses of oil exporters and those of European surplus economies, however, remain quite large.
- Corrective movements in real effective exchange rates (currency depreciations for deficit economies, appreciations for surplus economies) have played a surprisingly limited role overall, and hence so has expenditure switching.[3] Much of the recent adjustment in flow imbalances has therefore been driven by the reduction in demand in deficit economies after the global financial crisis or by growth differentials related to the faster recovery of emerging market economies and commodity exporters after the Great Recession. Factors that may have worked against anticipated exchange rate realignment include changes in investor sentiment (for example, safe haven flows after the crisis) and the fact that the euro area includes economies with both large precrisis deficits and large precrisis surpluses. Also, other shocks (such as increased energy production in the United States and the decline of energy production in Japan following the 2011 earthquake) would have implied reductions in the absolute size of current account balances for given exchange rates.
- The decrease in output due to lowered demand has been largely matched by a decrease in potential output. Thus, even without expenditure switching, much of the narrowing of the imbalances in deficit economies should be seen as permanent. However, the size of output gaps is highly uncertain, including in some euro area deficit economies, and therefore so is the future path of current account balances.
- Stock imbalances have not decreased—on the contrary, they have widened—mainly because of continued flow imbalances, coupled with low growth in several advanced economies. Some large debtor economies thus remain vulnerable to changes in market sentiment, highlighting continued possible systemic risks, though the status of the U.S. dollar as a reserve currency seems, if anything, more secure now than in 2006.

The chapter proceeds by first documenting the reduction in global imbalances since 2006 and examin-

[2]Eichengreen (2014) argues that global imbalances are over because neither the United States (the largest deficit economy in 2006) nor China (the largest surplus economy in 2006) will return to precrisis growth and spending patterns. Lane and Milesi-Ferretti (2012) find that although current account imbalances have been corrected, the external adjustment has been unbalanced, relying mostly on a reduction in demand in deficit economies. El-Erian (2012) warns of complacency, arguing that although global imbalances have narrowed, there remains a need to implement policy changes to address the remaining domestic and international distortions that underlie global imbalances.

[3]The September 2006 *World Economic Outlook*, for instance, argued that a "gradual and orderly unwinding of imbalances" was the most likely outcome, with a sustained depreciation of the U.S. dollar in real terms and a real effective exchange rate appreciation in surplus economies. Obstfeld and Rogoff (2005) noted that any significant improvement in the U.S. trade balance would typically involve a large depreciation of the U.S. dollar in real terms.

ing their changing constellation during that period. It then examines the mechanics of the adjustments that took place and considers whether global imbalances could widen again with a pickup in global growth. Finally, the chapter addresses the dynamics of stock imbalances, considers how both stock and flow imbalances are likely to evolve, and offers conclusions.

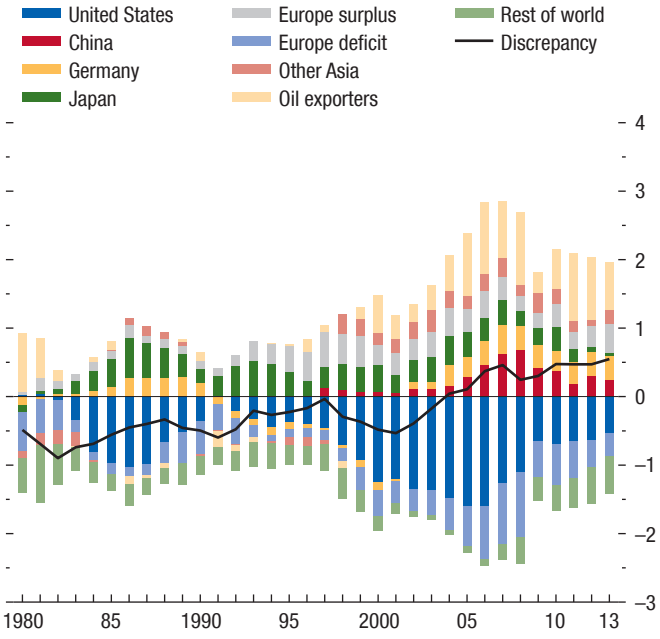
Narrowing the Bulge: The Evolution of Flow Imbalances

At the level of an individual country, there is no presumption that the current account should be balanced, and there may be good economic reasons to run current account surpluses or deficits. Large deficits—and associated large net foreign financial liabilities—however, expose the country to the risks of a sudden cessation in financing or the rolling over of those liabilities. If the economy is systemically important, a "sudden stop" of such financing could have wider repercussions. Large surpluses present fewer risks, but they can be problematic from a multilateral perspective if they are driven by export-led growth strategies or if they arise in a world of deficient aggregate demand—as has been the case since the global financial crisis. Indeed, distortions may be transmitted globally through surpluses and deficits if they occur in large economies, undermining the efficient operation of the international monetary system. And the more concentrated the imbalances, the greater the risks to the global economy. The configuration of current account imbalances in the mid-2000s, with large deficits for the United States and large surpluses for China and Japan, is widely understood to have met those criteria for systemic risk. This section documents the evolution of global imbalances since 2006, without passing judgment (yet) on the desirability of their dynamics.

Current account imbalances have narrowed substantially since their peak eight years ago, shortly before the global financial crisis (Figure 4.1). At that time, the sum of the absolute values of current account balances across all economies peaked at 5.6 percent of world GDP. Global imbalances subsequently shrank by almost one-third in 2009 at the height of the global recession. They rebounded somewhat in 2010 but have narrowed again since, declining to about 3.6 percent in 2013. Likewise, from 2006 through 2013, the aggregate imbalance of the top 10 deficit economies dropped by nearly half as a percentage of world GDP, from 2.3 percent to 1.2 percent (Table 4.1), and the corresponding value for the top 10 surplus economies dropped by one-fourth, from 2.1 percent to 1.5 percent.

Figure 4.1. Global Current Account ("Flow") Imbalances
(Percent of world GDP)

Current account imbalances have narrowed substantially since their peak eight years ago, and their configuration has changed markedly.



Source: IMF staff calculations.
Note: Oil exporters = Algeria, Angola, Azerbaijan, Bahrain, Bolivia, Brunei Darussalam, Chad, Republic of Congo, Ecuador, Equatorial Guinea, Gabon, Iran, Iraq, Kazakhstan, Kuwait, Libya, Nigeria, Norway, Oman, Qatar, Russia, Saudi Arabia, South Sudan, Timor-Leste, Trinidad and Tobago, Turkmenistan, United Arab Emirates, Venezuela, Yemen; Other Asia = Hong Kong SAR, India, Indonesia, Korea, Malaysia, Philippines, Singapore, Taiwan Province of China, Thailand. European economies (excluding Germany and Norway) are sorted into surplus or deficit each year by the signs (positive or negative, respectively) of their current account balances.

The constellation of deficits and surpluses also changed by 2013 (Table 4.1; Figures 4.2 and 4.3). On the deficit side, the large U.S. deficit shrank by half in dollar terms and by almost two-thirds as a percentage of world GDP. European economies with large deficits—though not the focus of initial concerns about imbalances—moved as a whole to a small surplus (Greece, Italy, Poland, Portugal, and Spain). Deficits in some advanced commodity exporters (Australia and Canada) rose, and those of some major emerging market economies (Brazil, India, Indonesia, Mexico, and Turkey), some of which had run surpluses in 2006,

Table 4.1. Largest Deficit and Surplus Economies, 2006 and 2013

2006				2013			
	Billions of U.S. Dollars	Percent of GDP	Percent of World GDP		Billions of U.S. Dollars	Percent of GDP	Percent of World GDP
1. Largest Deficit Economies							
United States	–807	–5.8	–1.60	United States	–400	–2.4	–0.54
Spain	–111	–9.0	–0.22	United Kingdom	–114	–4.5	–0.15
United Kingdom	–71	–2.8	–0.14	Brazil	–81	–3.6	–0.11
Australia	–45	–5.8	–0.09	Turkey	–65	–7.9	–0.09
Turkey	–32	–6.0	–0.06	Canada	–59	–3.2	–0.08
Greece	–30	–11.3	–0.06	Australia	–49	–3.2	–0.07
Italy	–28	–1.5	–0.06	France	–37	–1.3	–0.05
Portugal	–22	–10.7	–0.04	India	–32	–1.7	–0.04
South Africa	–14	–5.3	–0.03	Indonesia	–28	–3.3	–0.04
Poland	–13	–3.8	–0.03	Mexico	–26	–2.1	–0.03
Total	**–1,172**		**–2.3**	**Total**	**–891**		**–1.2**
2. Largest Surplus Economies							
China	232	8.3	0.46	Germany	274	7.5	0.37
Germany	182	6.3	0.36	China	183	1.9	0.25
Japan	175	4.0	0.35	Saudi Arabia	133	17.7	0.18
Saudi Arabia	99	26.3	0.20	Switzerland	104	16.0	0.14
Russia	92	9.3	0.18	Netherlands	83	10.4	0.11
Netherlands	63	9.3	0.13	Korea	80	6.1	0.11
Switzerland	58	14.2	0.11	Kuwait	72	38.9	0.10
Norway	56	16.4	0.11	United Arab Emirates	65	16.1	0.09
Kuwait	45	44.6	0.09	Qatar	63	30.9	0.08
Singapore	37	25.0	0.07	Taiwan Province of China	58	11.8	0.08
Total	**1,039**		**2.1**	**Total**	**1,113**		**1.5**

Source: IMF, World Economic Outlook database.

moved up to occupy the remaining top 10 spots.[4] Overall, the concentration of deficits also fell dramatically: in dollar terms, the top 5 economies in 2006 accounted for 80 percent of the global deficit; in 2013, the top 5 accounted for less than 65 percent of the (reduced) total.

On the other side, China's surplus almost halved in relation to world GDP, putting it second to that of Germany. Also especially notable is Japan, nearly tied for second place in 2006 but absent from the top 10 in 2013. Major factors behind the decline of China's surplus were sharply higher investment, expansionary fiscal policy in response to the global financial crisis, booms in credit and asset prices, and lower external demand—all of which were reflected in substantial nominal and real effective exchange rate appreciation. Japan's trade balance moved into deficit for the first time since 1980, in part because of higher energy imports after the Great East Japan earthquake, the disruption to exports after the earthquake as well as the Thai floods, and increased public spending since the crisis. The surpluses of some European economies (Germany, Netherlands, Switzerland), by contrast, together with those of oil exporters, remained large.[5] Although Norway and Russia (and Singapore) dropped out of the top 10, Qatar and the United Arab Emirates joined that group, along with the Republic of Korea and Taiwan Province of China. The share of the top 5 economies in the global dollar surplus barely changed, with those economies accounting for about half the total.

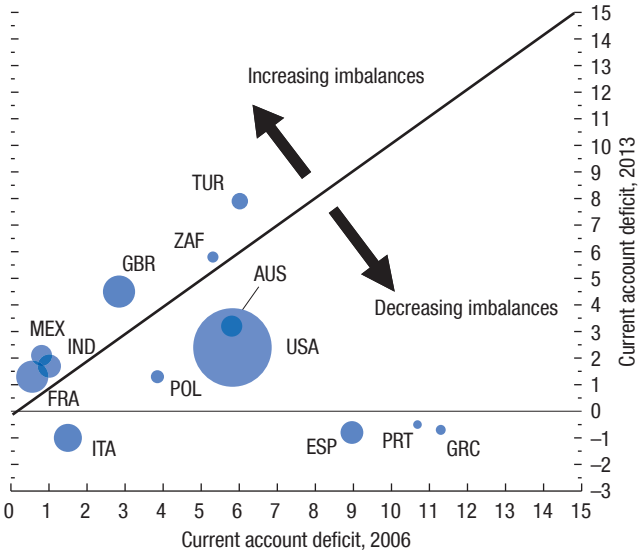
Therefore, in the most recent picture, the overall constellation of global imbalances looks quite different than that in 2006. What brought about this change and whether the narrowing of the imbalances is likely to persist are the subjects of the next two sections.

[4]See Chapter 1 of the October 2014 *Global Financial Stability Report,* which focuses on the growth of U.S. dollar corporate liabilities and private sector leverage in these emerging market economies, underlining that in most cases, the larger debtor positions have not been accompanied by larger fixed investments and higher growth.

[5]For at least some oil exporters, current account surpluses are insufficient from an intergenerational equity perspective.

Figure 4.2. Largest Deficit Economies, 2006 and 2013
(Percent of GDP)

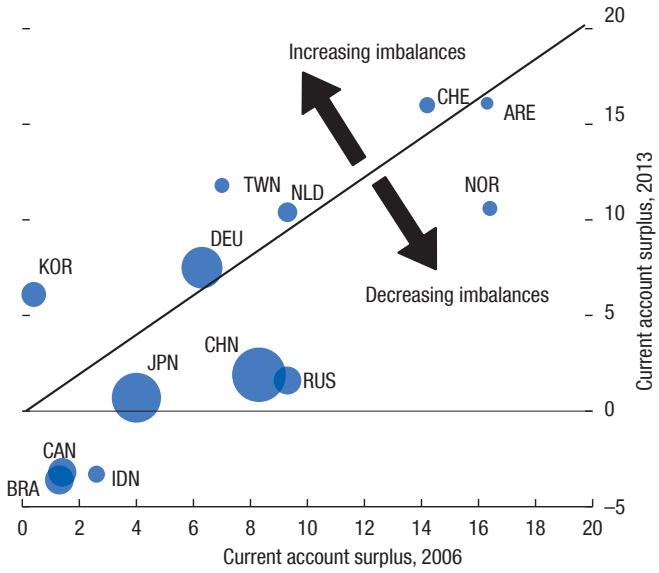
The large U.S. deficit shrank by more than half as a percent of its own GDP between 2006 and 2013. The largest European deficit economies also moved as a whole to a small surplus.



Source: IMF staff estimates.
Note: Size of bubble is proportional to the share of the economy in world GDP. Data labels in the figure use International Organization for Standardization country codes.

Figure 4.3. Largest Surplus Economies, 2006 and 2013
(Percent of GDP)

The large current account surpluses in China and Japan fell substantially as a percentage of national GDP between 2006 and 2013. A number of northern European and advanced Asian economies were running even greater surpluses by 2013, while some major emerging market economies moved from surpluses to deficits.



Source: IMF staff estimates.
Note: Size of bubble is proportional to the share of the economy in world GDP. Data labels in the figure use International Organization for Standardization country codes. Kuwait, Qatar, and Saudi Arabia are outliers and are not shown.

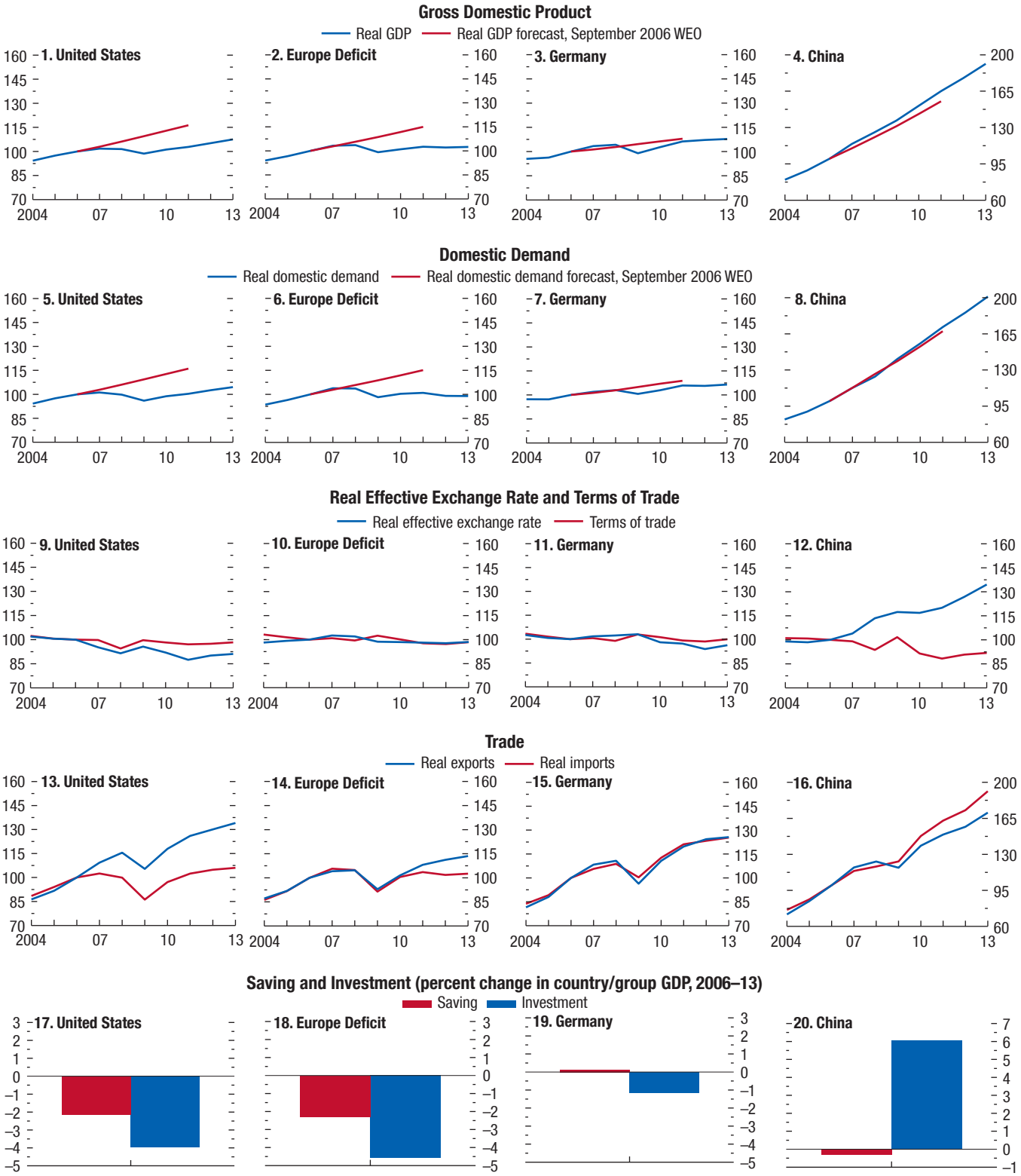
The Mechanics of the Adjustment

In principle, external adjustment can take place through changes in aggregate expenditure or changes in its composition. In practice, adjustment in deficit economies often takes place through expenditure reduction. That is certainly the case for the 2006–13 period (see, for example, Lane and Milesi-Ferretti 2014). This has meant that the squeeze in external (flow) imbalances was accompanied by a substantial widening of internal imbalances, that is, greater economic slack (to the extent that the declines in output in deficit economies have been cyclical, driven only by temporarily low demand). In a number of deficit economies, mostly advanced, the adjustment took place amid the typical legacy of financial crisis: a downshift in the path of output relative to precrisis trends (approximated by the medium-term output forecasts from the October 2006 *World Economic Outlook*).

The panels in Figure 4.4—which show a number of key variables for the main individual deficit and surplus economies established in Table 4.1, as well as for various groups of economies—highlight the downshift in output for the United States and European deficit economies. The output contractions were highly synchronized across advanced economies, in deficit and surplus economies alike, as were the declines in output paths. Nevertheless, the output contractions and downshifts were typically smaller, relatively speaking, in surplus economies, which experienced only mild financial crises, if any, and were mostly hit by spillovers. In China and other emerging market economies, output remained close to precrisis trends.

If the reduction in demand and output in deficit economies was the main mechanism for the post-2006 adjustment in global imbalances (and trade spillovers one of the transmission mechanisms), one would expect to see a relatively stronger export contraction in major surplus economies. This was indeed the case in China and oil exporters, and to a lesser extent in Japan, where exports contracted more than imports. The relatively stronger economic conditions in surplus

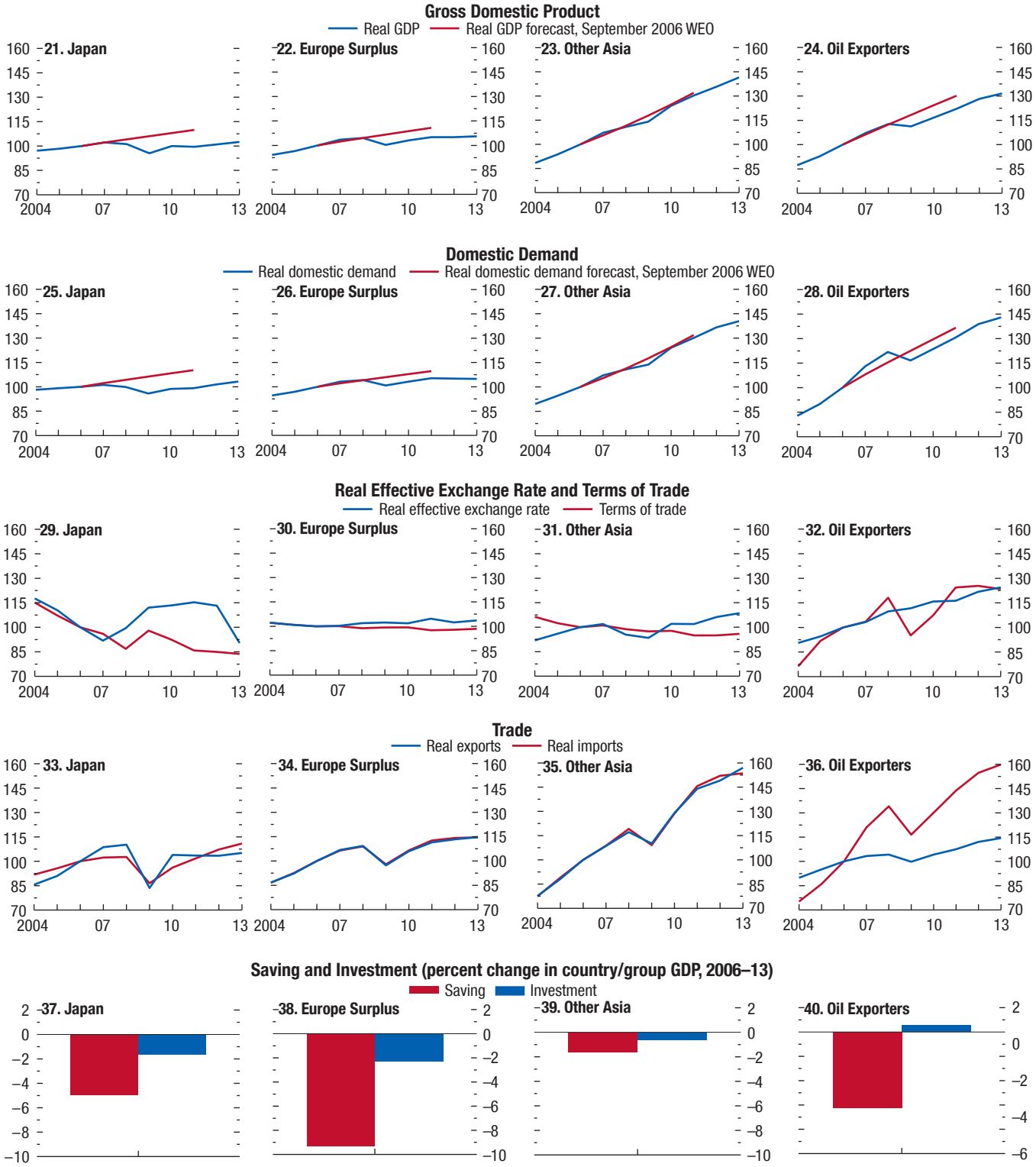
Figure 4.4. Key Indicators of External Adjustment, 2006 Episode
(Index, 2006 = 100 unless noted otherwise)



Source: IMF staff calculations.
Note: Europe deficit = Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, France, Greece, Hungary, Iceland, Ireland, Italy, Kosovo, Latvia, Lithuania, FYR Macedonia, Malta, Montenegro, Poland, Portugal, Romania, Serbia, Slovak Republic, Slovenia, Spain, Turkey, United Kingdom; Europe surplus = Austria, Belgium,

Figure 4.4. Key Indicators of External Adjustment, 2006 Episode *(continued)*

(Index, 2006 = 100 unless noted otherwise)



Denmark, Finland, Luxembourg, Netherlands, Sweden, Switzerland; Other Asia = Hong Kong SAR, India, Indonesia, Korea, Malaysia, Philippines, Singapore, Taiwan Province of China, Thailand; Oil exporters = Algeria, Angola, Azerbaijan, Bahrain, Bolivia, Brunei Darussalam, Chad, Republic of Congo, Ecuador, Equatorial Guinea, Gabon, Iran, Iraq, Kazakhstan, Kuwait, Libya, Nigeria, Norway, Oman, Qatar, Russia, Saudi Arabia, South Sudan, Timor-Leste, Trinidad and Tobago, Turkmenistan, United Arab Emirates, Venezuela, Yemen.

economies thus broadly led to some demand rebalancing between deficit and surplus economies.

Weak domestic demand mainly reflected a sharp contraction in investment expenditure in most economies, but more so for deficit economies than for those in surplus. This, in turn, helped narrow the current account imbalances of advanced deficit economies (for example, the United States and a number of European deficit economies) and at the same time improved the financial net lending and borrowing positions of households and nonfinancial corporations. Although aggregate investment also fell in advanced surplus economies (for example, Japan and several northern European economies), this decline was more than offset by a reduction in aggregate saving, which led to an overall narrowing of their surpluses.[6] In contrast, China, the largest surplus economy in 2006, experienced a significant increase in investment, which, compounded by a small decline in national saving, resulted in a substantial narrowing of its current account surplus.[7]

Such rebalancing continued because many surplus economies, emerging market economies in particular, recovered faster from the global financial crisis than advanced economies in deficit. The sources of the differential reflected not only macroeconomic policy stimulus, notably in China, but also strong capital inflows, the rebound in commodity markets, and gains in terms of trade, which also boosted domestic demand.

These growth differentials supported further demand rebalancing, leading to relatively faster growth of import volumes and a rising divergence of the path for export volume from that for import volume. Current account surpluses declined, with some major emerging market economies experiencing current account reversals. Oil exporters were the main exception; their current account balances improved with higher oil prices, notwithstanding rapid import growth. The flip side to the rising terms of trade for commodity exporters was terms-of-trade losses in commodity importers, including in deficit economies; all else equal, the terms-of-trade losses lowered the improvements in external current accounts in nominal terms or as a percentage of GDP.

Real currency appreciation in some surplus economies and depreciation in some deficit economies suggest that some expenditure switching has taken place in the recent narrowing of imbalances. Currency appreciation in China, commodity exporters, and emerging market economies stands out on the surplus side; dollar depreciation has helped in the United States. In contrast, there has been little real appreciation in Japan or depreciation in European deficit and European surplus economies. This underscores how pegged currencies and downward nominal rigidities in a number of stressed deficit economies, notably in the euro area, have constrained the relative price adjustment needed for the reallocation of resources between tradables and nontradables. The CPI-based real effective exchange rate measure used in the analysis may, however, understate the impact of changes in relative prices on the current account relative to other measures, such as relative unit labor costs. Unfortunately, unit-labor-cost-based real effective exchange rates are available only for a relatively limited set of (mostly advanced) economies.

The relationship between a country's 2006 current account balance and the subsequent growth in domestic demand relative to that of its trading partners is positive and statistically significant (Figure 4.5). That is, economies with surpluses (deficits) experienced faster (slower) demand growth compared with their partners. The same is true of the subsequent change in the value of currencies (Figure 4.6): economies with surpluses (deficits) experienced real appreciations (depreciations) relative to their trading partners.

Although both expenditure reduction and expenditure switching have been at play, the subsequent adjustment in current account balances has been more strongly related to changes in relative domestic demand (Figure 4.7) than to changes in the real effective exchange rate (Figure 4.8). More formal analysis is afforded by a panel regression of the annual change in the current account (as a share of GDP) on the change in aggregate demand relative to that in trading partners, changes in the real effective exchange rate, and changes in the terms of trade. The regression yields statistically significant coefficients with the expected sign for all explanatory variables.[8] The R^2 of

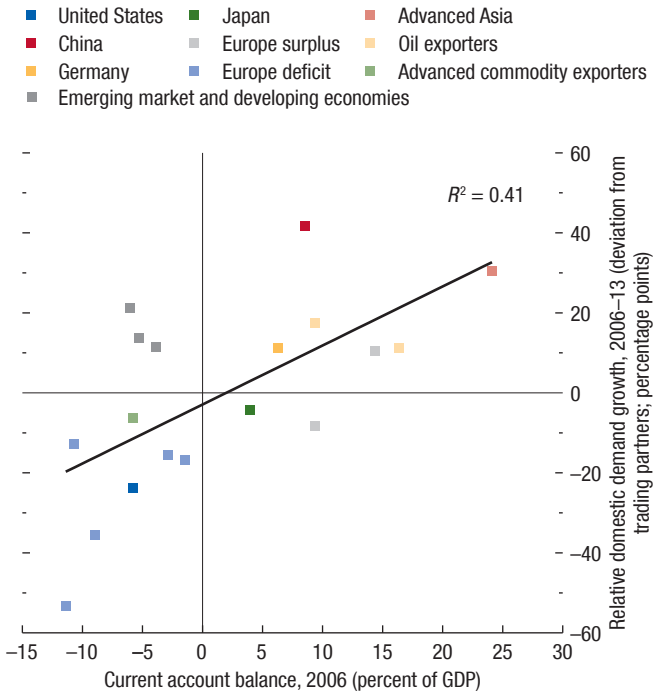
[6]Germany was the exception, with a relatively larger decrease in overall investment relative to saving, leaving it as the only large surplus economy to experience a widening of its surplus.

[7]Much of the increase in the investment-to-GDP ratio (5.5 percentage points) took place during the period 2006–09. The saving rate also increased during this period, partly offsetting the impact on the current account surplus, which fell by 3.5 percentage points. Since 2009 the saving rate has declined and the investment-to-GDP ratio has increased modestly, with a further 2.8 percentage point adjustment in the current account.

[8]The panel consists of 64 economies for the period 1970–2013; see Appendix 4.2 for details. The real effective exchange rate is potentially endogenous to the current account, which tends to bias the coefficient downward, so the finding of a statistically significant negative coefficient is despite, not because of, any endogeneity bias.

Figure 4.5. Growth of Domestic Demand Relative to Trading Partners versus 2006 Current Account

Economies with surpluses (deficits) in 2006 typically experienced faster (slower) domestic demand growth relative to that of their trading partners between 2006 and 2013.

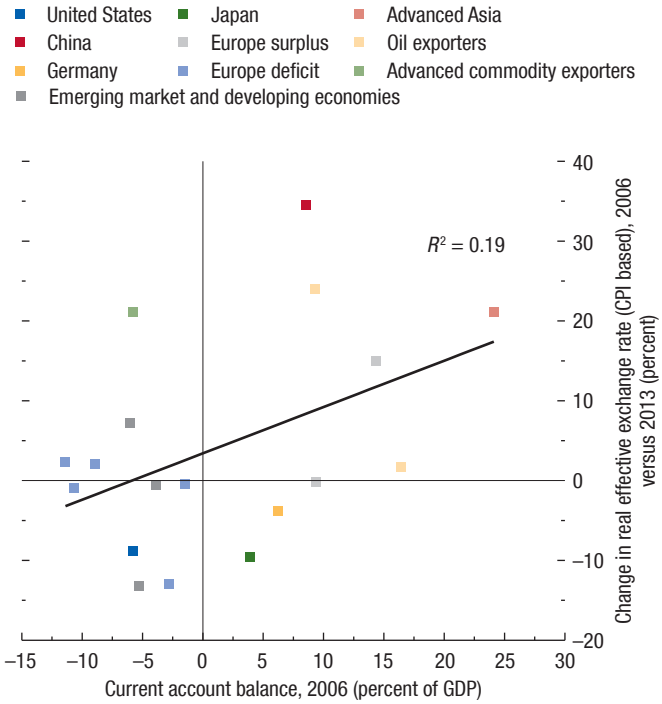


Source: IMF staff calculations.
Note: The deviation of domestic demand growth from that of trading partners is calculated as the difference between the deviation of real domestic demand growth (2006–13) from its preadjustment trend (1996–2003) and the deviation of domestic demand growth in trading partners (2006–13) from its preadjustment trend (1996–2003). Advanced commodity exporters = Australia; Advanced Asia = Singapore; Emerging market and developing economies = Poland, South Africa, Turkey; Europe deficit = Greece, Italy, Portugal, Spain, United Kingdom; Europe surplus = Netherlands, Switzerland; Oil exporters = Norway, Russia.

Figure 4.6. Change in Real Effective Exchange Rate (CPI Based) versus 2006 Current Account

(Percent)

Economies with surpluses (deficits) in 2006 typically experienced real appreciations (depreciations) relative to that of their trading partners between 2006 and 2013.



Source: IMF staff calculations.
Note: CPI = consumer price index. Advanced commodity exporters = Australia; Advanced Asia = Singapore; Emerging market and developing economies = Poland, South Africa, Turkey; Europe deficit = Greece, Italy, Portugal, Spain, United Kingdom; Europe surplus = Netherlands, Switzerland; Oil exporters = Norway, Russia.

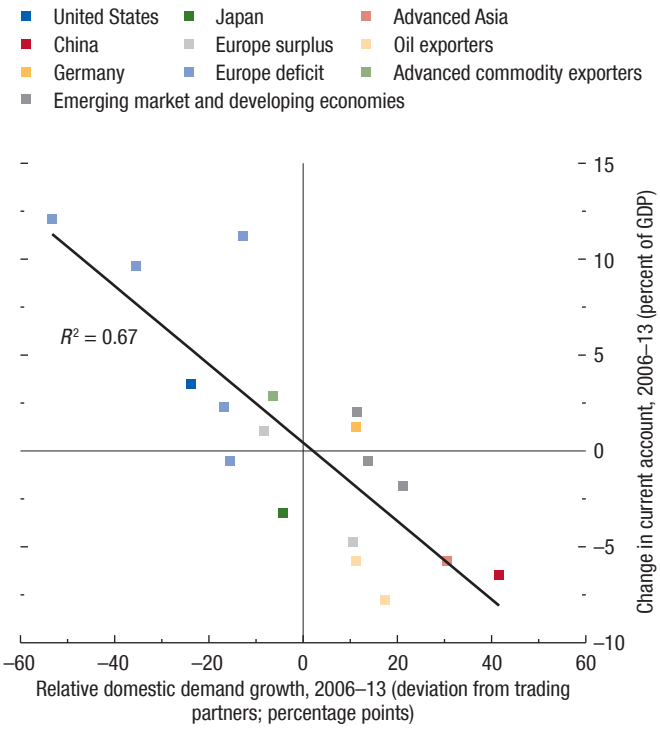
the regression (including lags of all explanatory variables) is 0.41; dropping the aggregate demand terms lowers it to 0.10, but dropping the real effective exchange rate term lowers it only to 0.39. In other words, the real effective exchange rate, though statistically significant, adds little to the explanatory power of the regression. For the 2007–13 period, the relative importance of the demand terms is even more apparent: the (implied) R^2 of the full model for this period is 0.51; without the demand terms it is 0.02, and without the real effective exchange rate term, it is 0.51. The importance of expenditure reduction in the recent adjustment can also be gauged by comparing the implied 2013 level of aggregate (surplus and deficit) global imbalances with, and without, the effect of the real effective exchange rate movement; the latter is higher by only 0.4 percent of world GDP, while the overall reduction in imbalances for the 64 economies in the sample was 2.7 percent of world GDP.

The limited explanatory power of the real effective exchange rate in the current account adjustment reflects a number of factors beyond the generally dominant role of demand changes in a global crisis context. Structural and institutional factors limited real effective exchange rate adjustment in some cases, notably within the euro area.[9] In the case of the United States and Japan, shocks to domestic energy production may

[9]On implications of the nominal exchange rate regime for the persistence of current account imbalances, see Ghosh, Qureshi, and Tsangarides 2014.

Figure 4.7. Changes in Domestic Demand and Current Account

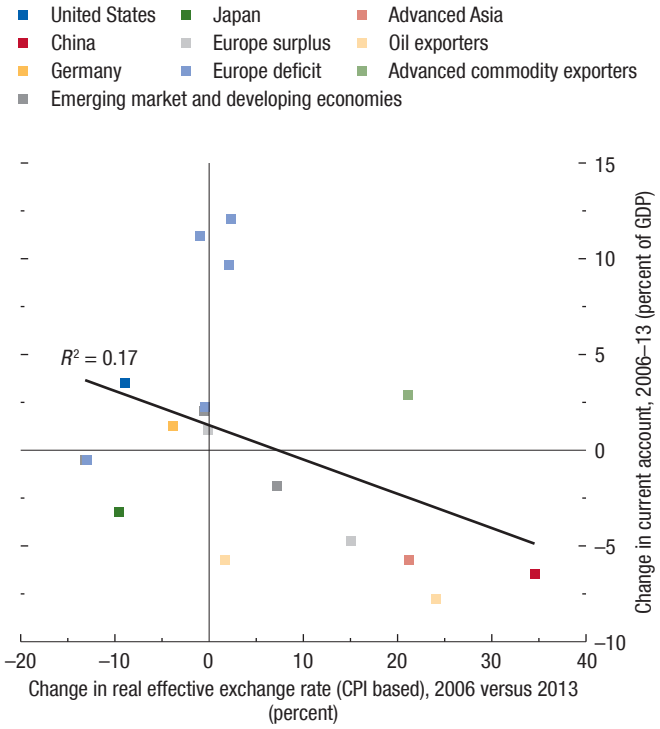
Expenditure reduction played an important role in current account adjustment between 2006 and 2013. Economies with a larger (smaller) contraction in domestic demand relative to that of their trading partners typically experienced a larger (smaller) improvement in their current account balances.



Source: IMF staff calculations.
Note: Advanced commodity exporters = Australia; Advanced Asia = Singapore; Emerging market and developing economies = Poland, South Africa, Turkey; Europe deficit = Greece, Italy, Portugal, Spain, United Kingdom; Europe surplus = Netherlands, Switzerland; Oil exporters = Norway, Russia.

Figure 4.8. Changes in Real Effective Exchange Rate and Current Account

Expenditure switching also was at work in current account adjustment between 2006 and 2013. Economies with depreciated (appreciated) currencies typically experienced an improvement (deterioration) in their current account balances.



Source: IMF staff calculations.
Note: CPI = consumer price index. Advanced commodity exporters = Australia; Advanced Asia = Singapore; Emerging market and developing economies = Poland, South Africa, Turkey; Europe deficit = Greece, Italy, Portugal, Spain, United Kingdom; Europe surplus = Netherlands, Switzerland; Oil exporters = Norway, Russia.

have weakened the relation between exchange rate changes and current account adjustment. In the case of the United States, for example, increased production of tight oil led to current account improvements, while the underlying equilibrium exchange rate likely appreciated. Finally, changes in investor sentiment have sometimes worked against real effective exchange rate realignment, including, for example, in the case of safe haven flows.

The 2006–13 episode is not, of course, the first time that global imbalances have contracted: previous occasions include 1974 and 1986. The latter provides an instructive contrast with the current instance (Box 4.1): the real effective exchange rate pictures were broadly similar, with the yen appreciating substantially in real effective terms in that episode while the dollar depreciated. No other currencies changed notably in real effective terms. In the former West Germany, for example, real appreciation began only with reunification in 1990. If anything, the reach of exchange rate changes has been broader in the current episode, with the currencies of major emerging market economies and commodity exporters also appreciating.

The main difference between these adjustment episodes is in the growth environment. Whereas in 1986 the narrowing of imbalances took place in the context of growth rotating above preadjustment trends, the narrowing in the current instance has occurred in the context of the global financial crisis, with likely permanent losses in output levels and, in some cases, even

lower trend growth. Not surprisingly, demand reduction has contributed more to the recent narrowing than in 1986, and expenditure switching correspondingly less.

Juxtaposing the external adjustment of the worst-affected East Asian crisis economies in the late 1990s with that of four of the euro area economies most severely affected by the recent crises provides another useful comparison (Box 4.2). Massive and sustained real depreciations, together with a supportive external environment, allowed the East Asian economies to benefit from expenditure switching. By contrast, the four stressed euro area economies during the current episode have experienced only limited expenditure switching so far: the adjustment of relative prices through internal devaluation has been gradual and more painful, hurting their growth prospects (see, for instance, Tressel and others 2014).[10] The narrowing of global imbalances during the current episode is thus bracketed by the two extremes of the East Asian and the euro area experiences.

Overall, the limited role of exchange rate adjustments in the narrowing of imbalances has meant that that process has entailed high economic and social costs—most notably, high rates of unemployment and large output gaps—partly because resources were not quickly reallocated between tradables and nontradables sectors. However, it has also allowed for substantial adjustment without disruptive exchange rate adjustments to the major reserve currencies (most notably, the dollar) that some feared before the global financial crisis. In the process, the distortions underlying the large imbalances up to about 2006, that is, asset price bubbles and credit booms in many advanced economies, have also largely corrected—though others may have emerged, including because of the expansionary policies that the crisis has engendered.

The Durability of the Adjustment

How lasting is the observed narrowing of current account imbalances likely to be? There are two elements to this question. Mechanically, as activity recovers and output gaps start to close, domestic demand will rebound in deficit economies; the concern is that without sufficient expenditure switching, this rebound could lead to a renewed widening of external imbalances.[11] Going beyond such mechanics, it is worth asking whether the policy and other distortions that underlie global imbalances have diminished, especially because—other than the risk of a sudden stop—it is these distortions that carry implications for multilateral welfare. Moreover, inasmuch as policy and other distortions do not—or should not—reappear, the extent to which they have diminished speaks to the durability of the observed adjustment.

Output Gaps and Imbalances

Whether global imbalances will, in the absence of further expenditure switching, again expand as the recovery gets under way is closely linked to the issue of whether output declines in deficit economies since the global financial crisis have been largely cyclical or structural. Experience from past financial crises suggests that potential output often declines and the country never recovers its precrisis growth path (see Cerra and Saxena 2008), but it is extraordinarily difficult to arrive at a definitive judgment—especially in regard to what happens after a far-reaching global financial crisis.

To determine the sensitivity of estimates of the extent to which the observed narrowing of flow imbalances will reverse as output gaps close, Figure 4.9 presents different scenarios using alternative assumptions about output gaps, estimates of which are subject to sizable uncertainty.[12] Between 2006 and 2013, global imbalances shrank by some 2.8 percent of world GDP.[13] In a counterfactual scenario, mechanically setting the estimated 2013 output gaps from the *World Economic Outlook* (WEO) for the Group of Twenty economies to zero and comparing the cycli-

[10]See Berger and Nitsch 2014 and Ghosh, Qureshi, and Tsangarides 2014 for evidence that imbalances within the euro area became more persistent with the adoption of the euro.

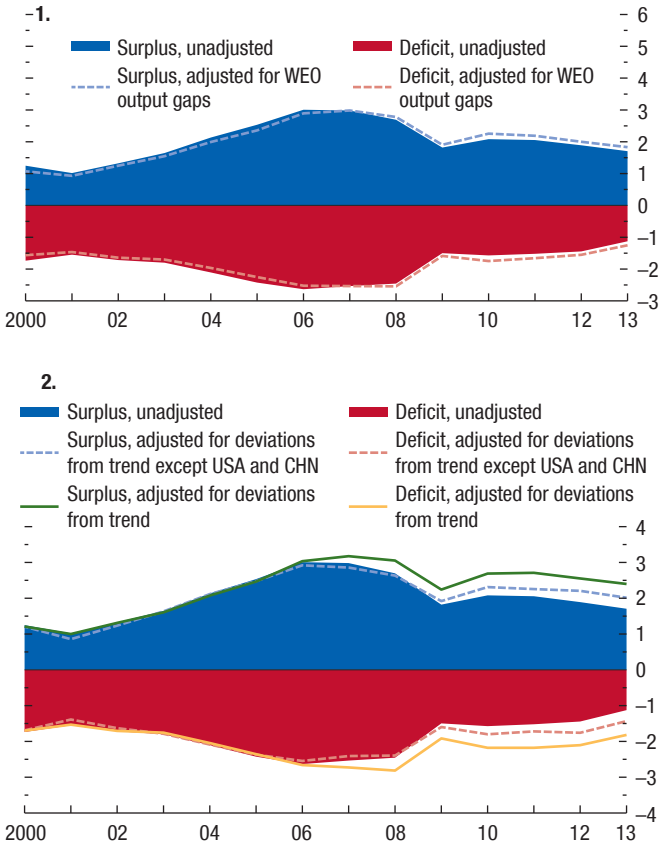
[11]As noted previously, in the aggregate, real effective exchange rate movements have played only a minor role in the adjustment process to date—though there are some important individual exceptions; for instance, China's real effective exchange rate has appreciated by some 30 percent since 2007.

[12]This analysis was undertaken by Vladimir Klyuev and Joong Shik Kang; see Appendix 4.4 and Kang and Klyuev, forthcoming, for details.

[13]The sensitivity analysis is based on alternative assumptions about the output gaps of the Group of Twenty economies. Both in 2006 and in 2013, these economies accounted for more than three-quarters of global deficits and about one-half of global surpluses. The four largest economies—China, Germany, Japan, and the United States—accounted for 60 percent of total deficits and 40 percent of total surpluses in 2006 and 35 percent of total deficits and 31 percent of total surpluses in 2013.

Figure 4.9. Current Account Balances, Cyclically Adjusted and Unadjusted
(Percent of world GDP)

The narrowing of current account imbalances since 2006 is likely to be long lasting, as cyclical factors appear to have played a relatively minor role. Even in the worst-case scenario, which results from estimating output gaps as the difference between the actual level of output in 2013 and the 2013 level extrapolated using precrisis trends, the current account narrowing amounts to around 1½ percent of world GDP (which is almost half the adjustment without cyclical factors).



Source: IMF staff calculations.
Note: Countries are classified as deficit or surplus based on their 2006 position. The trend is estimated in log of real GDP over the period 1998–2005. CHN = China; USA = United States.

cally adjusted global imbalance in 2013 with the actual level in 2006 yields a narrowing of 2.6 percent of world GDP (Figure 4.9, panel 1).[14] The implication is that virtually all of the narrowing of global imbalances observed to date should be durable and should not reverse as output gaps close.

[14]Economies are classified as surplus or deficit based on their positions in 2006. Therefore, the adjustment of global imbalances reported in this section differs somewhat from that reported elsewhere in this chapter, where economies are classified as surplus or deficit according to their position each year.

This surprisingly modest estimate for the cyclical component of the global imbalances derives from the synchronicity of output gaps across economies (because it is the difference in output gaps that matters) and from the fact that the output gaps themselves are (relatively) small. In particular, in the WEO data, the economies that saw the greatest declines in output relative to precrisis trends also experienced the largest slowdowns in potential output growth, compressing the range of output gaps.

An alternative view is that an economy's capacity to produce cannot simply be destroyed in a financial crisis, whereas a sharp increase in uncertainty, pessimistic expectations, disruption of financing, and other factors could lead to large, but still temporary, decreases in demand. An extreme version of this view is that the full extent of the deviation of output from the 2013 level that would be implied by precrisis trends represents the output gap. Applying this alternative assumption naturally gives significantly larger cyclically adjusted global imbalances for 2013: a deficit of 1.8 percent of world GDP and a surplus of 2.3 percent of world GDP, for a total imbalance of 4.1 percent of world GDP (Figure 4.9, panel 2). The improvement in global imbalances since 2006 would then amount to only 1.5 percent of world GDP. Thus, in this scenario, almost half of the observed adjustment could be undone as output gaps close.

It turns out, however, that it is mainly the U.S. economy that is critical to this calculation. The WEO output gap for the United States in 2013 is 3.8 percent, whereas the trend-based alternative would imply a gap of 10.7 percent, which seems implausible and is hard to reconcile with, for example, improving labor market indicators. Returning to the WEO gap for the United States (keeping all others at their trend deviation gaps) in the counterfactual simulation, or returning to the WEO gaps for both the United States and China, restores the narrowing in the cyclically adjusted global imbalances since 2006 to about 2 percent of world GDP (Figure 4.9, panel 2).

Keeping in mind the sizable uncertainty surrounding estimates of output gaps (notably but not only for the euro area), this suggests that even under extreme assumptions about the size of output gaps, one-half of the observed shrinkage in global imbalances would remain as these gaps close; a more plausible gap assumption for the United States alone would mean that two-thirds should endure.

Distortions and Imbalances

Concerns about global imbalances go beyond just their magnitude: from the outset, a key issue in debates has been the extent to which observed imbalances are manifestations of underlying policy distortions. A complementary approach to assessing the durability of the correction to date is therefore to ask whether the underlying distortions have diminished in the intervening years.

To this end, this section compares observed cyclically adjusted current account balances[15] with those predicted using the IMF's External Balance Assessment (EBA) framework, which is an empirical model of current account determination. Put differently, the residuals from the EBA regression, also known in this context as "current account gaps," can be considered an indicator of the proportion of current account balances that cannot be explained by a country's macroeconomic fundamentals. They are thus a measure of excessive imbalances reflective of underlying distortions and possibly systemic risks.[16] Three important caveats bear emphasizing. First, determining globally consistent measures of current account gaps remains difficult and is model specific. To the extent that the EBA model omits certain unobserved fundamentals, the residual imputes their effect to distortions. Second, some of the variables in the regression are policy variables, which need not necessarily be at desirable or sustainable settings. Although the EBA model in its operational form explicitly corrects for deviations between actual and desirable policies ("policy gaps"), time series of "desirable" policy settings are not available for historical data; in the exercise that follows, therefore, the 2013 estimates of desirable policy settings are applied to 2006 as well.[17] Third, even for 2013, IMF staff assessments of current account gaps (provided in the IMF's *External Sector Report*) draw on the EBA-based current account gaps (and in most cases are very similar to them) but also reflect staff judgment.

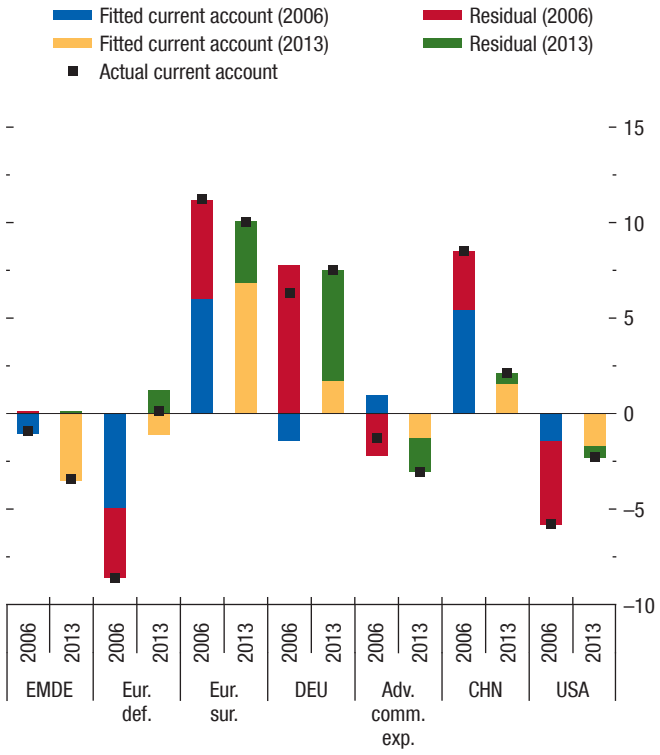
Figure 4.10 reports the fitted and actual values of the current account for the major economies and country groups identified in Figure 4.1, where the regression uses actual policy settings (so the residual abstracts from the effect on the current account of divergences of policies from their desirable values and implicitly captures only nonpolicy distortions).[18]

Figure 4.11 (panel 1) provides a more direct comparison of the residuals over time: bubbles (whose

Figure 4.10. Largest Deficit and Surplus Economies: Current Account Gaps

(Percent of GDP, EBA fitted)

"Current account gaps"—the difference (marked as "residual") between actual current account balances and those predicted using the IMF's External Balance Assessment framework—in the largest deficit and surplus economies shrank between 2006 and 2013.



Source: IMF staff calculations.
Note: Adv. comm. exp. = Advanced commodity exporters (Australia, Canada); CHN = China; DEU = Germany; EBA = External Balance Assessment; EMDE = emerging market and developing economies (Brazil, India, Indonesia, Mexico, South Africa, Turkey); Eur. def. = Europe deficit (Greece, Poland, Portugal, Spain); Eur. sur. = Europe surplus (Netherlands, Switzerland); USA = United States. The country groups are averaged using market weights.

[15]In what follows, "cyclically adjusted" refers to the WEO output gaps, not the trend deviation output gaps, which were used only for the alternative scenario for the counterfactual analysis earlier in the chapter.

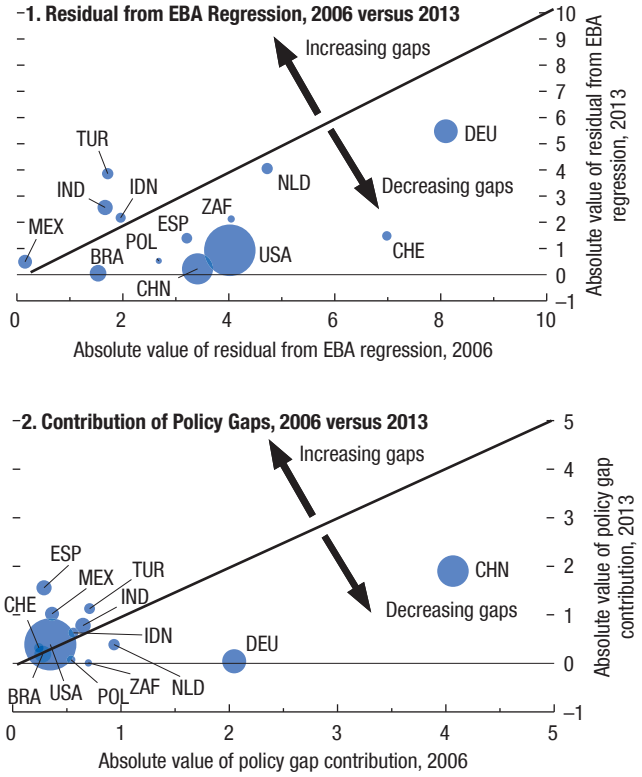
[16]These arguments are developed by Blanchard and Milesi-Ferretti (2012).

[17]Policy gaps or distortions are deviations of actual policy stances (that is, fiscal balances, health spending, foreign exchange intervention, private credit, and capital controls) from their desirable or appropriate levels (as determined by IMF country desks). At the same time, to ensure global consistency, domestic policies are considered relative to foreign policies.

[18]The EBA methodology has been developed by the IMF's Research Department to provide current account and exchange rate assessments for a number of economies from a multilateral perspective. The EBA framework has been operational only since 2011, so data on desirable policies for 2006 are not available. The EBA exercise does not cover Middle Eastern oil exporters, so these economies are not included in this analysis.

Figure 4.11. Understanding Changes in Distortions Using External Balance Assessment Regressions, 2006 versus 2013

Current account gaps fell between 2006 and 2013 for the largest and systemically most important economies. This suggests that underlying distortions and global risks also shrank. The contribution of policy gaps in most economies either narrowed or remained roughly unchanged, with the exception of a few emerging market economies. The latter implies that the current account gaps for these economies were larger than reported.



Source: IMF staff estimates.
Note: EBA = External Balance Assessment. Size of bubbles is proportional to the share of the economy in world GDP. Points below the 45-degree line indicate a smaller estimated residual in 2013 than in 2006; points above, a larger residual. Optimal policies are available only for 2013 and are assumed to be the same for 2006. Data labels in the figure use International Organization for Standardization country codes.

magnitude is proportional to the country's share of world GDP) that lie below the 45-degree line indicate a smaller current account gap in 2013 than in 2006. The general picture that emerges from the analysis is that current account gaps tended to decrease between 2006 and 2013 for the largest and systemically most important economies. As such, underlying distortions and global risks also became smaller. However, they did not disappear. In particular, whereas the current account gaps for China, European deficit economies, and the United States were close to zero in 2013, they remained elevated for European surplus economies, including Germany.

The residuals above exclude the estimated effects of policy gaps, which are shown separately in Figure 4.11, panel 2. For a few (mostly emerging market) economies, the estimated effect of policy gaps on current account imbalances is larger in 2013 than it was in 2006. Adding these policy gaps to the residuals would therefore widen the current account gaps for these economies. In most cases, however, the net contribution of policy gaps to current account gaps either remained roughly constant or diminished between 2006 and 2013.

What policies were behind these improvements in the larger economies? In the United States, despite some improvement in the cyclically adjusted fiscal balance, since it is the difference in the balance relative to other trading partners that matters, the fiscal variable actually results in a slight widening of the policy gap between 2006 and 2013.[19] A more telling improvement relates to excesses in the financial sector, which both the bust phase of the boom-bust cycle and tighter regulation have helped reduce.[20] The net change in the U.S. policy gap between 2006 and 2013, therefore, is roughly a wash—and the bubble for the United States in Figure 4.11 (panel 2) lies on the 45-degree line. In China, the policy improvement is captured by slower accumulation of foreign exchange reserves and some relaxation of capital controls, which are the counterparts to the substantial real effective exchange rate appreciation. The policy gap therefore shrinks significantly. Not all of the narrowing of the current account surplus is necessarily benign, however. Rather than a decline in saving, much of the change in China's current account between 2006 and 2013 comes through an increase in the already-high rate of investment, exacerbating concerns about allocative efficiency and financial stability and raising questions about its sus-

[19]The U.S. fiscal balance (relative to trading partners) improved through 2009, then deteriorated between 2010 and 2013, implying little difference between snapshots of 2006 and 2013.

[20]In the EBA regression, most excesses are captured by the residual ("distortions") rather than policy variables such as the quality of financial regulation (which is difficult to quantify in a statistical analysis). The only policy variable proxying such excesses is the growth of the ratio of credit to GDP. This is why the bulk of the improvement in the current account gap for the United States shows up in the regression residual rather than in the effect of the policy gap variable. It is also why it would not be appropriate to make too sharp a distinction between "policy distortions" and "other distortions" in the analysis.

tainability. For Germany, the net impact of the policy gap shrinks because the effect of lower excessive credit growth (that is, credit growth greater than the rate of GDP growth) more than offsets the tightening of the fiscal balance (relative to trading partners), which itself contributes to widening Germany's current account surplus.

Although such analysis can never be definitive (being highly dependent on the model used to identify "fundamentals"), it does suggest that policy and other distortions have diminished along with the observed narrowing of flow imbalances during the past few years. The improvement in global imbalances thus is not only quantitative but rather represents, from a multilateral perspective, a qualitative improvement in welfare.[21] Nevertheless, the European deficit economies' adjustment difficulties, which have resulted in massive import compression, unemployment, and economic dislocation, point to greater scope for surplus economies—especially, though not exclusively, those in the region—to rebalance their economies and switch expenditure toward foreign-produced goods. Moreover, the conclusion that reduced policy and other distortions have narrowed global imbalances is somewhat at odds with the finding in the preceding section that lower demand, largely matched by a decrease in potential output, has been responsible for much of the observed narrowing of global imbalances. These two observations may be reconciled to the extent that potential output was artificially high as a result of distortions—or (what amounts to the same thing) that output was above potential (including because of distortions in the financial sector), and the global financial crisis both resolved the distortions and lowered demand, bringing it more in line with potential output. This can only be a partial explanation, however, so the role of policy improvements and lower distortions in accounting for the narrower flow imbalances is likely to be limited.[22]

[21]This is not to suggest, of course, that no distortions remain. The *2014 Pilot External Sector Report* (IMF 2014) discusses a variety of policies to further align current account balances with underlying fundamentals.

[22]The low goods and services price inflation in the run-up to the global financial crisis suggests that output is unlikely to have been much above potential since, in that case, the low observed inflation would have meant that all of the excess demand was falling only on imported goods. Although (for instance) the United States indeed had a large current account deficit, it seems implausible that the excess demand would have fallen exclusively on imported goods.

The Stock Dimension of Imbalances

Going beyond flow analysis, the external balance sheet of a country—its international investment position in the balance of payments statistics—is another important dimension in global imbalances (see, for example, Obstfeld 2012a, 2012b). Economies with large net liability positions, in particular, may become vulnerable to disruptive external financial market conditions, including, in the extreme case, the sudden drying up of external financing (sudden stops) (see, for example, Catão and Milesi-Ferretti 2013).[23] Both in the global financial crisis and during the subsequent euro area crisis, such vulnerabilities played a prominent role, as a number of economies experienced sovereign debt problems, sudden stops, or both.

Comparing the 10 largest debtors and 10 largest creditors in 2006 and 2013 reveals striking inertia in these rankings (Table 4.2)—especially compared with those for current account balances (Table 4.1). This inertia exists because net foreign asset stocks are typically slow-moving variables. There is also some overlap between the top 10 list for flow imbalances and that for stock imbalances—which is to be expected, given the two-way feedback between the current account and net foreign asset dynamics (surpluses cumulate into rising stocks; higher net foreign assets generate more factor income, contributing to larger surpluses). The other striking fact about global stock imbalances—again, in contrast to flow imbalances—is that they continued to grow during the period 2006–13 (Figure 4.12), with little discernible change in pace after 2006, the year in which flow imbalances peaked. Moreover, they became, if anything, more concentrated on the debtor side, with the share of the top 5 economies rising from 55 percent of world output in 2006 to 60 percent in 2013. The trend of international financial integration has not been reversed, as might have been expected following the global financial crisis (Figure 4.13).

What explains the widening stock imbalances? When these imbalances are measured as a percentage of GDP, there can be three reasons for wider net foreign asset positions. The first is continued flow imbalances. Even a narrowing of these imbalances, as occurred during the period under consideration, is not enough, all else equal, for a decrease in stock imbal-

[23]Flow imbalances are sometimes taken as indicating potential distortions of current policy settings, whereas stock imbalances reflect past policies; stock imbalances may, however, be relevant for current vulnerabilities.

Table 4.2. Largest Debtor and Creditor Economies (Net Foreign Assets and Liabilities), 2006 and 2013[1]

2006				2013			
	Billions of U.S. Dollars	Percent of GDP	Percent of World GDP		Billions of U.S. Dollars	Percent of GDP	Percent of World GDP
1. Largest Debtor Economies							
United States	–1,973	–14.2	–3.92	United States	–5,698	–34.0	–7.64
Spain	–862	–69.7	–1.71	Spain	–1,400	–103.1	–1.88
United Kingdom	–762	–30.6	–1.51	Brazil[2]	–750	–33.4	–1.01
Australia	–462	–59.2	–0.92	Italy	–739	–35.6	–0.99
Italy	–453	–24.1	–0.90	Australia	–746	–49.6	–1.00
Brazil[2]	–349	–32.1	–0.69	France	–578	–20.6	–0.77
Mexico[2]	–346	–35.8	–0.69	India[2]	–479	–25.5	–0.64
Greece	–237	–90.4	–0.47	Mexico[2]	–445	–35.3	–0.60
Turkey[2]	–206	–39.0	–0.41	Turkey[2]	–409	–49.8	–0.55
India[2]	–178	–18.8	–0.35	Poland	–380	–73.5	–0.51
Total	**–5,829**		**–11.6**	**Total**	**–11,624**		**–15.6**
2. Largest Creditor Economies							
Japan	1,793	41.2	3.56	Japan	3,056	62.4	4.10
Germany	782	26.9	1.55	China[2]	1,686	17.8	2.26
Hong Kong SAR	535	276.4	1.06	Germany	1,678	46.2	2.25
Saudi Arabia[2]	513	136.4	1.02	Saudi Arabia[2]	1,063	142.1	1.43
Taiwan Province of China[3]	504	134.0	1.00	Switzerland	939	144.3	1.26
Switzerland	495	122.3	0.98	Taiwan Province of China[3]	933	190.9	1.25
China[2]	476	17.0	0.94	Hong Kong SAR	767	280.1	1.03
Singapore[2]	371	251.0	0.74	Norway[4]	732	142.8	0.98
United Arab Emirates[2]	312	140.4	0.62	Kuwait[2]	652	353.0	0.87
Kuwait[2]	210	206.7	0.42	Singapore[2]	637	213.9	0.85
Total	**5,991**		**11.9**	**Total**	**12,144**		**16.3**

Sources: IMF, World Economic Outlook database; External Wealth of Nations Mark II data set (Lane and Milesi-Ferretti 2007); and Lane and Milesi-Ferretti 2012.
[1]The External Wealth of Nations Mark II data set (Lane and Milesi-Ferretti 2007) used in this analysis excludes gold holdings from foreign exchange reserves.
[2]IMF staff estimates for these economies may differ from the international investment position, where reported.
[3]National sources.
[4]IMF staff estimates for 2013.

ances. What would be required for such a decrease would be a reversal of flows (from deficit to surplus or vice versa) that is sustained: one year of surplus after several years of deficits will typically not suffice. Indeed, there is a strong relationship (R^2 = 0.73, and t-statistic of 13.6) between the change in net foreign assets between 2006 and 2013 and the current account balances accumulated during the same period (Figure 4.14). On average (and in most of the top 10 cases), continued current account deficits in debtor economies played the main role in the widening stocks of net foreign liabilities as a percentage of GDP (Table 4.3). Similarly, for creditors, continued current account surpluses explain much of the widening stocks of net foreign assets.

Second, valuation effects can change asset positions independently of flow imbalances. Such changes had some effect on net foreign asset positions between 2006 and 2013, albeit in most cases less than those from cumulative current account balances or economic growth for the largest debtors and creditors (Table 4.3).[24] Notable exceptions were Belgium, Canada, Finland, Greece, South Africa, and the United Kingdom, where valuation changes were the dominant factor behind the improvement in their net foreign asset positions—and in the United Kingdom's case, knocked it out of the largest 10 debtors in 2013 (Table 4.2).

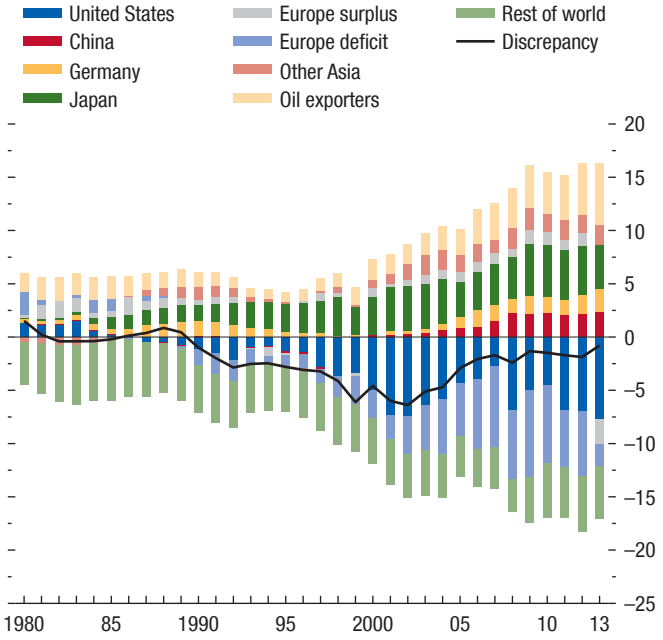
The sources of valuation changes are complex and depend on the country's initial international investment position (creditor or debtor) and the composition of its gross assets and liabilities (fixed income, equity).[25] In general, asset prices increased

[24]See Appendix 4.1.

[25]A panel regression of 60 economies from 2006 to 2013 suggests that creditor economies made fewer valuation gains (as a share of their initial stock position) compared with debtor economies. At the same time, nominal depreciation in debtor economies appears to have increased valuation gains for these economies (because it

Figure 4.12. Global Net Foreign Assets ("Stock") Imbalances
(Percent of world GDP)

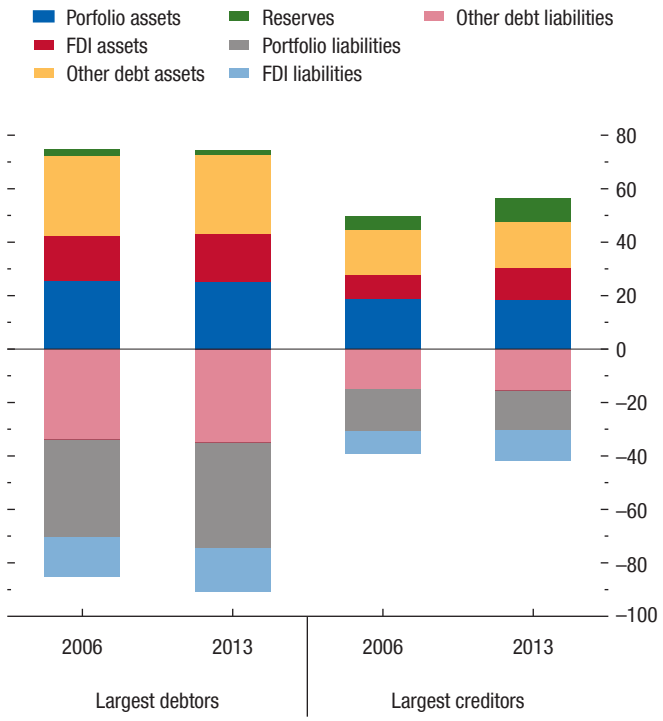
Stock imbalances continued to grow between 2006 and 2013 despite the narrowing in flow imbalances. This reflects the fact that to reduce the former, a sustained reversal in the latter is needed.



Source: IMF staff calculations.
Note: Oil exporters = Algeria, Angola, Azerbaijan, Bahrain, Bolivia, Brunei Darussalam, Chad, Republic of Congo, Ecuador, Equatorial Guinea, Gabon, Iran, Iraq, Kazakhstan, Kuwait, Libya, Nigeria, Norway, Oman, Qatar, Russia, Saudi Arabia, South Sudan, Timor-Leste, Trinidad and Tobago, Turkmenistan, United Arab Emirates, Venezuela, Yemen; Other Asia = Hong Kong SAR, India, Indonesia, Korea, Malaysia, Philippines, Singapore, Taiwan Province of China, Thailand. European economies (excluding Germany and Norway) are sorted into surplus or deficit each year by the signs (positive or negative, respectively) of their current account balances.

Figure 4.13. Gross Foreign Assets and Liabilities
(Percent of world GDP)

Gross assets and liabilities of the largest debtors and creditors continued to expand between 2006 and 2013, with no reversal in the trend of international financial integration following the global financial crisis.



Sources: External Wealth of Nations Mark II data set (Lane and Milesi-Ferretti 2007); and Lane and Milesi-Ferretti 2012.
Note: FDI = foreign direct investment. Portfolio is both equity and debt portfolio stocks, and other debt is financial derivatives and other (including bank) investments.

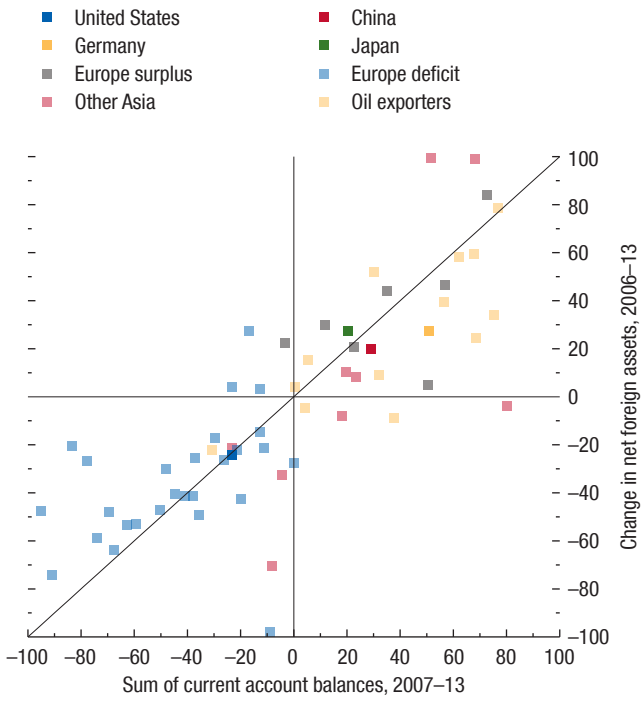
between 2006 and 2013: both equity and bond prices rose with the substantial decline in long-term interest rates, which, all else equal, should benefit net creditors relative to net debtors (and thus widen imbalances). Conversely, the drastic downward revision of economic prospects for most large debtor economies after the global financial crisis lowered the value of assets located in these economies. Although this implies a negative wealth effect for a particular country, it also means a lower value of its foreign liabilities, implying a capital gain. The United States was unique in this regard: despite the country being a major debtor and having experienced a large downward revision in its growth prospects, the value of U.S. assets rose because of safe haven concerns, implying a capital loss on its international investment position.

Third, growth effects can also lead to higher imbalances as a share of GDP, as in the case of public debt (Table 4.3). Economic growth was also important, with the effects up to roughly one-third the size of those from cumulative current account balances, and with the opposite sign. For creditor economies, GDP growing ahead of net foreign assets lowered net foreign asset ratios, whereas in debtor economies, this contributed to lower net foreign liability ratios. In euro area debtor economies, however,

reduced the value of their liabilities, namely, the assets located in the country), which could have helped stabilize their net foreign asset positions. Although these variables are statistically significant in the panel regression, year-by-year cross-sectional regressions yield no systematic relationship between them. Data on the currency composition of external balance sheets are limited and hence are not examined.

Figure 4.14. Adjustment in Net Foreign Assets versus Current Account Balance
(Percent of average GDP)

Current account balances were typically the main driver of changes in net foreign asset positions between 2006 and 2013 with R^2 of 0.73, as suggested by the closely clustered observations around the diagonal.



Source: IMF staff calculations.
Note: Europe deficit = Albania, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, France, Greece, Hungary, Ireland, Italy, Kosovo, Latvia, Lithuania, FYR Macedonia, Moldova, Poland, Portugal, Romania, Serbia, Slovak Republic, Slovenia, Spain, Turkey, Ukraine, United Kingdom; Europe surplus = Austria, Belgium, Denmark, Finland, Netherlands, Sweden, Switzerland; Oil exporters = Algeria, Angola, Bahrain, Ecuador, Iran, Kazakhstan, Nigeria, Oman, Russia, Turkmenistan, United Arab Emirates, Uzbekistan, Yemen; Other Asia = Hong Kong SAR, India, Indonesia, Korea, Malaysia, Philippines, Taiwan Province of China, Thailand, Vietnam. Europe deficit and surplus economies are sorted based on the signs of their average current account balances between 2004 and 2006.

the persistence of stock imbalances reflected the deep contraction in some of these economies. Growth and the strength of the external flow adjustment will likely be the main forces determining the future direction of stock imbalances; valuation effects might help, but they cannot be relied on.

Looking Ahead: How Will Global Imbalances Evolve?

Where are global imbalances headed? The preceding discussion suggests that flow imbalances have narrowed, and the closing of output gaps should not in itself reverse much of the narrowing. But output gaps are only part of what drives current account dynamics: policy choices and other economic forces might lead to a renewed widening or further shrinking of flow imbalances. Projections underlying the WEO point to the latter: if these projections are realized, flow imbalances will decline from a total (deficit plus surplus) of 3.3 percent of world GDP in 2013 to less than 3.0 percent of world GDP by 2019 (Figure 4.15).[26] Although that is not a dramatic further narrowing of flow imbalances, they are at least not projected to grow.

The current account imbalance of the United States, the largest on the deficit side, is projected to remain roughly constant at about 0.60 percent of world GDP, as the effect of domestic demand growth offsets the improving energy trade balance. The negative balance of deficit economies in the European Union (EU) ("Europe deficit" in the figure) is projected to shrink marginally, from 0.20 percent of world GDP in 2013 to 0.14 percent of world GDP by 2019. On the surplus side, through 2019, oil exporters are projected to halve their imbalances from 0.70 percent of world GDP to 0.31 percent of world GDP, whereas China and other parts of Asia ("Other Asia" in the figure) are projected to widen their surpluses from 0.50 percent to 0.70 percent of world GDP. Germany and the other EU surplus economies ("Europe surplus" in the figure) together are projected to shrink their surpluses from 0.70 percent to 0.54 percent of world GDP.

In contrast, stock imbalances are projected to grow from about 40 percent of world GDP in 2013 to about 45 percent of world GDP by 2019 (Figure 4.16).[27] The net foreign asset position of China, the second-largest creditor, is projected to rise from 2.3 percent of world GDP in 2013 to 3.4 percent of world GDP by 2019, whereas the net foreign liabilities of the United States, the largest debtor, are projected to rise from 7.6 percent of world GDP to 8.5 percent of world GDP during that period. Several other economies that have large debtor positions as a share of their own GDP and that make the top 10 list globally in 2006 or 2013 (or both) are projected to stabilize or improve their international investment positions.

[26]These projections assume that output gaps are approximately closed by the end of the projection horizon (2019).

[27]These projections assume that the real effective exchange rate will be constant, and that there are no valuation effects.

Table 4.3. Decomposition of Changes in Net Foreign Assets between 2006 and 2013[1]
(Percent of GDP)

	Largest Debtor Economies, 2013					Largest Creditor Economies, 2013			
Country	Current Account, 2007–13	Valuation, 2007–13	Growth Adjustment, 2007–13	Change in Net Foreign Assets[2]	Country	Current Account, 2007–13	Valuation, 2007–13	Growth Adjustment, 2007–13	Change in Net Foreign Assets[2]
United States	–21.2	–2.4	2.5	–19.7	Japan	18.9	1.0	2.5	24.7
Spain	–34.3	–6.7	2.4	–33.7	China[3]	20.9	–7.4	–10.4	0.8
Brazil[3]	–11.3	–9.6	16.1	–4.8	Germany	42.5	–25.1	–4.0	19.2
Italy	–11.8	1.3	1.0	–11.6	Saudi Arabia[3]	102.8	3.3	–67.7	5.9
Australia	–25.4	9.2	18.8	2.9	Switzerland	63.4	–21.8	–18.6	21.3
France	–10.0	–11.3	0.2	–18.7	Taiwan Province of China[4]	62.8	18.6	–21.4	57.8
India[3]	–14.4	–4.6	11.4	–7.4	Hong Kong SAR	44.1	39.4	–81.0	3.3
Mexico[3]	–7.6	0.8	12.3	–0.4	Norway[5]	80.0	34.9	–16.4	88.3
Turkey[3]	–33.7	–5.6	19.8	–17.4	Kuwait	209.6	18.0	–87.7	147.0
Poland	–27.0	–14.0	16.2	–24.2	Singapore	118.8	–57.7	–90.1	–28.2
Weighted Average[6]	–19.1	–3.4	5.5	–16.0	Weighted Average[6]	34.1	–6.8	–11.7	14.6

Sources: External Wealth of Nations Mark II data set (Lane and Milesi-Ferretti 2007); IMF, World Economic Outlook database; Lane and Milesi-Ferretti 2012; and IMF staff calculations.

[1]The *World Economic Outlook* reports balance of payments data using the methodology of the sixth edition of the *Balance of Payments and International Investment Position Manual* (BPM6). For those national authorities still reporting data in BPM5, a generic conversion is employed. Hence, data for those countries are subject to change upon full adoption of the BPM6.

[2]A country's decomposition (cumulative current account, valuation, and growth adjustment) may not add up exactly to the change in net foreign assets, as cumulative capital account flows and errors and omissions are not shown. See Appendix 4.1.

[3]IMF staff estimates for these economies may differ from the international investment position, where reported.

[4]National sources.

[5]IMF staff estimates for 2013.

[6]Calculated using 2013 market shares.

To explore the expected dynamics of stock imbalances further, panel 1 of Figure 4.17 plots current account balances in 2013 against net foreign asset positions in 2013. For creditor economies, the relationship is upward sloping: economies with higher net foreign asset positions in 2013 ran larger current account surpluses. The relationship for debtor economies is instead negative, indicating that the more indebted the economy, the smaller its current account deficit or the larger its current account surplus. Moreover, for many debtor economies, the projected average current account balance for the next five years exceeds the balance that would be required to stabilize the ratio of net foreign assets to GDP, so these economies' net liability positions will decline (Figure 4.17, panel 2).[28]

Determining the point at which deficits or debtor positions become substantially more vulnerable is difficult, because many factors are typically at play in a crisis. Statistical analysis of past crises (banking, currency, sovereign debt, and sudden stops) suggests thresholds of 6 percent of GDP for the current account deficit and 60 percent of GDP for the net foreign liability position as points at which vulnerability to crisis is heightened in advanced economies.[29] Corresponding thresholds based on a sample of emerging market economies are 3 percent of GDP for the current account deficit and 40 percent of GDP for the net foreign liability position.[30] It bears emphasizing that these thresholds are purely indicative, with large type I (false negative) and type II (false positive) errors. For instance, among advanced economies, the likelihood of experiencing some form of crisis when the current account deficit exceeds 6 percent of GDP is 13 percent—almost double the 7 percent crisis probability when the deficit is below that threshold. But another way of stating the same

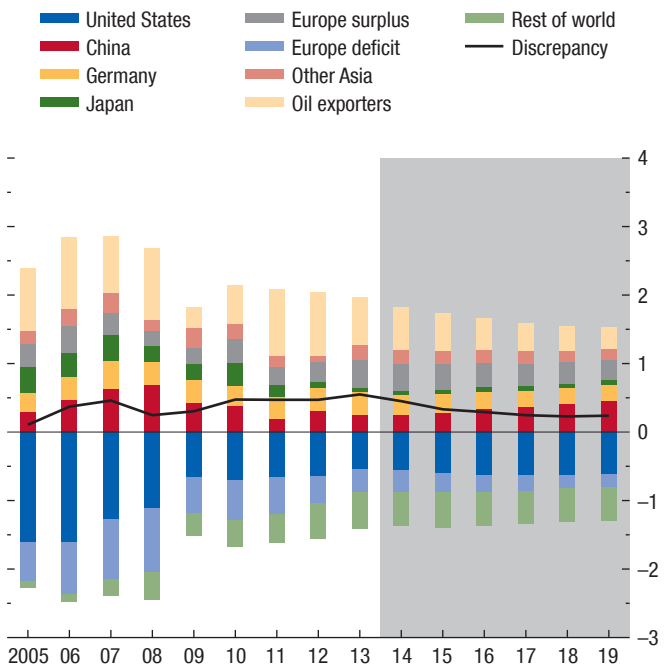
[28]The current account balance that stabilizes net foreign assets is calculated as $ca^* = g \times nfa$, where ca^* is the current account balance that stabilizes net foreign assets as a percentage of GDP, g is the (projected) growth rate of the U.S. dollar value of GDP, and nfa is the initial net foreign asset position as a percentage of GDP.

[29]The threshold is determined by calculating the value that minimizes the sum of the percentage of type I (false negative) and type II (false positive) errors for each type of crisis; the resulting threshold values are averaged, using as weights the goodness of fit (1 minus the sum of type I and type II errors); see Appendix 4.5.

[30]These estimated thresholds are similar to those obtained in the literature. Using 26 episodes of adjustment from a sample range of 1980–2003, Freund and Warnock (2005) calculate an average current account trough of 5.6 percent of GDP, after which a deficit economy has experienced reversals. Catão and Milesi-Ferretti (2013) study the extent to which net foreign liabilities help predict an external crisis. They find that net foreign liabilities are a significant predictor of a crisis (even if the current account balance is controlled for), particularly when they exceed 50 percent of GDP.

Figure 4.15. Global Current Account Imbalances
(Percent of world GDP)

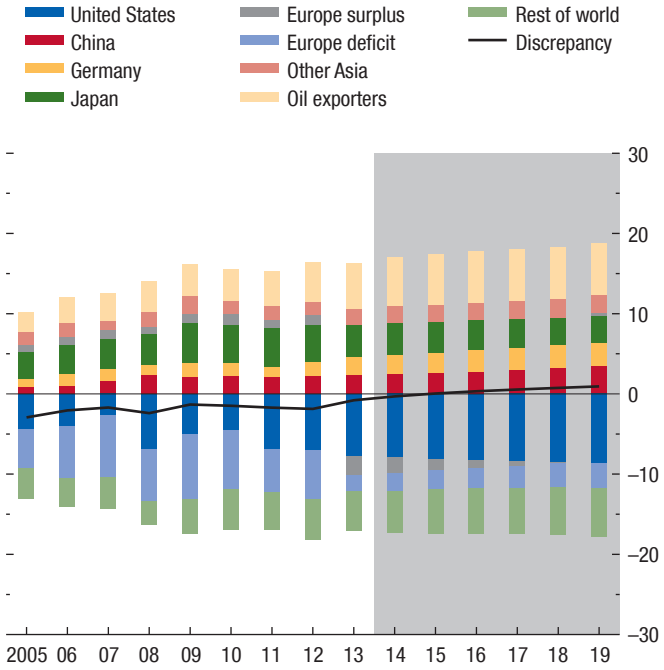
The WEO projects global current account balances to narrow slightly over the medium term. The WEO projections typically assume output gaps that close over the next five years and constant real effective exchange rates.



Source: IMF staff estimates.
Note: Oil exporters = Algeria, Angola, Azerbaijan, Bahrain, Bolivia, Brunei Darussalam, Chad, Republic of Congo, Ecuador, Equatorial Guinea, Gabon, Iran, Iraq, Kazakhstan, Kuwait, Libya, Nigeria, Norway, Oman, Qatar, Russia, Saudi Arabia, South Sudan, Timor-Leste, Trinidad and Tobago, Turkmenistan, United Arab Emirates, Venezuela, Yemen; Other Asia = Hong Kong SAR, India, Indonesia, Korea, Malaysia, Philippines, Singapore, Taiwan Province of China, Thailand. European economies (excluding Germany and Norway) are sorted into surplus or deficit each year by the signs (positive or negative, respectively) of their current account balances.

Figure 4.16. Global Net Foreign Asset Imbalances
(Percent of world GDP)

Global stock imbalances are projected to widen further over the medium term, reflecting the continued (albeit narrowing) flow imbalances.



Source: IMF staff estimates.
Note: Oil exporters = Algeria, Angola, Azerbaijan, Bahrain, Bolivia, Brunei Darussalam, Chad, Republic of Congo, Ecuador, Equatorial Guinea, Gabon, Iran, Iraq, Kazakhstan, Kuwait, Libya, Nigeria, Norway, Oman, Qatar, Russia, Saudi Arabia, South Sudan, Timor-Leste, Trinidad and Tobago, Turkmenistan, United Arab Emirates, Venezuela, Yemen; Other Asia = Hong Kong SAR, India, Indonesia, Korea, Malaysia, Philippines, Singapore, Taiwan Province of China, Thailand. European economies (excluding Germany and Norway) are sorted into surplus or deficit each year by the signs (positive or negative, respectively) of their current account balances.

result is that there is an 87 percent probability of *not* experiencing a crisis, even when the current account deficit exceeds the threshold.

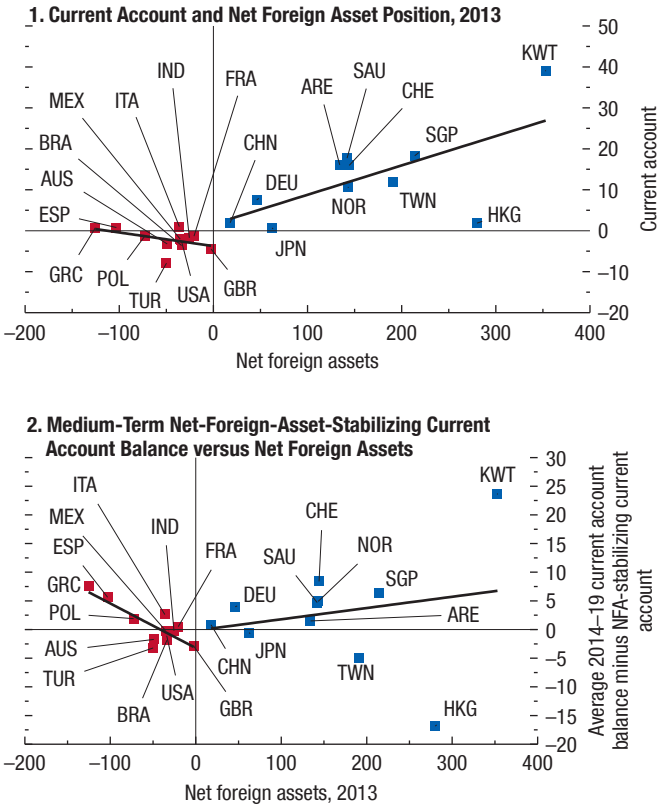
With these caveats in mind, Figure 4.18 plots the evolution of the current account and net foreign asset positions of the economies on the 2006, 2013, or (projected) 2019 top flow or stock imbalances lists, together with the indicative thresholds. Whereas several economies are below or close to either or both of these thresholds in 2006, a handful are in 2013 or are expected to be in 2019. In general, the most vulnerable economies move by 2019 toward the upper right quadrant in panel 3 of the figure, which indicates diminishing vulnerability to a sudden stop or external crisis.

Some of these economies, including a few major emerging market economies, nevertheless remain vulnerable to shifts in market sentiment or to sudden increases in world interest rates (which would, over time, worsen the dynamics of their net liability positions), for instance, as monetary policy in advanced economies is normalized.[31] Loss of financing would of course narrow the imbalances, but the adjustment would be too abrupt, entailing high economic and social costs. Beyond the systemically large debtors, moreover, several smaller European economies, as well

[31]See Chapter 1 of the October 2014 *Global Financial Stability Report*.

Figure 4.17. Determining Net Foreign Asset Sustainability
(Percent of GDP)

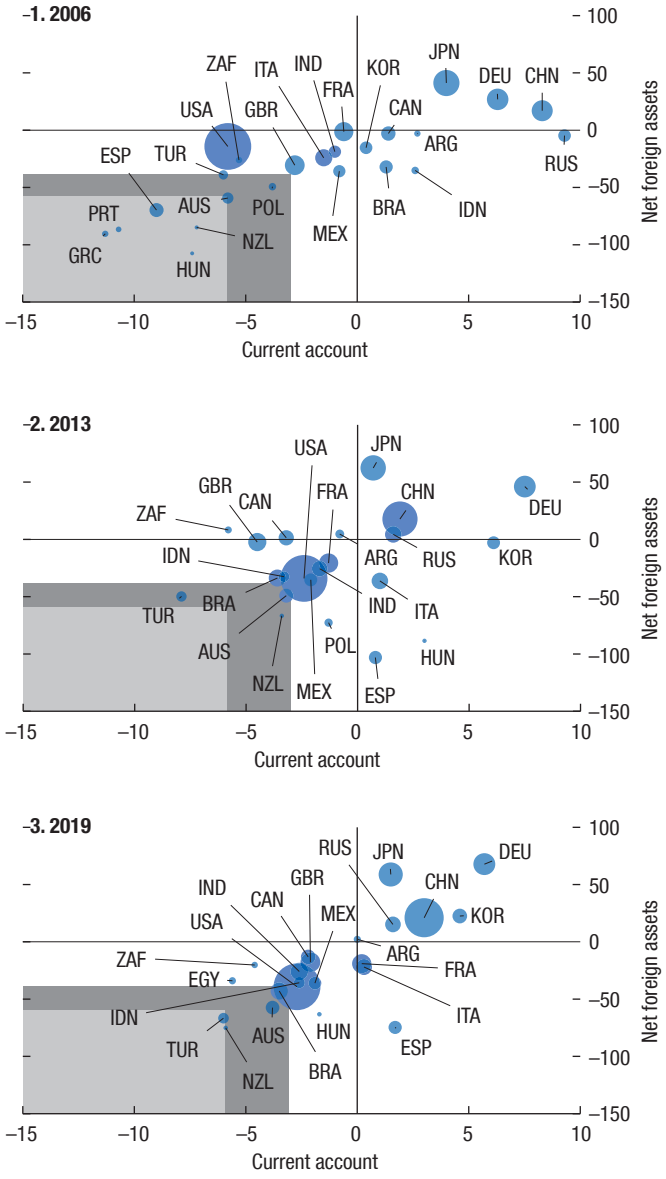
For creditor economies there is a positive association between current account balances and net foreign asset (NFA) positions both in the short and medium term. In contrast, for debtor economies the association between current account balances and NFAs is negative, indicating that the more indebted the economy, the smaller its current account deficit (or the larger its surplus).



Source: IMF staff calculations.
Note: Red data points are largest debtor economies, 2006 and 2013; blue data points are largest creditor economies, 2006 and 2013. Data labels in the figure use International Organization for Standardization country codes.

Figure 4.18. Largest Deficit/Debtor Economies: Current Account versus Net Foreign Assets, 2006, 2013, and 2019
(Percent of GDP)

In 2006, the current account balance and net foreign asset positions of several economies were close or exceeded the thresholds associated with past crises (banking, currency, sovereign debt, and sudden stops). In 2013 and 2019 only a handful of these economies exceeded or are projected to exceed the crisis thresholds. This indicates that the vulnerability of these economies to crisis has diminished.



Source: IMF staff calculations.
Note: Size of bubble is proportional to the share of world GDP. Data labels in the figure use International Organization for Standardization country codes. Shaded areas represent vulnerability thresholds for advanced economies (light gray) and emerging market and developing economies (dark gray and light gray together); see Appendix 4.5.

as some frontier markets among developing economies, remain vulnerable in the medium term, requiring substantial improvements in their net-exports-to-GDP ratios. While the deficits and debtor positions of these economies do not account for a significant proportion of global imbalances, experience during the global financial crisis has underscored that crises even in small economies may have wider repercussions due to upstream and downstream financial linkages.

Among the major debtors, the key exception to the trend of diminishing vulnerability is the unique case of the United States, whose net foreign liability position is projected to deteriorate from 4 percent of world GDP

in 2006 to 8.5 percent of world GDP in 2019. Indeed, one of the concerns with growing global imbalances in the mid-2000s was the (admittedly remote) possibility of the U.S. liability position suddenly reaching a tipping point, after which private and public holders of U.S. assets would lose confidence, and the U.S. dollar would lose its reserve currency status.

The U.S. net liability position in fact worsened to almost 8 percent of world GDP in 2013, but for a number of reasons, the likelihood that the dollar will lose its reserve currency status seems substantially lower than it did eight years ago. First, projected flow deficits of the United States are now considerably smaller than they were in 2006. Second, the U.S. dollar continues to be the leading transaction currency in foreign exchange markets and a key invoicing currency in international trade. It accounts for a dominant share of all outstanding debt securities issued anywhere in the world and especially of those securities sold outside the issuing country in a currency other than that of the issuer (Goldberg 2010). Third, dollar assets held in central bank reserves are not excessive in relation to central banks' "optimal" currency portfolios.[32] Fourth, at present, the dollar has relatively few competitors, since being a reserve currency requires that a substantial stock of assets be denominated in that currency. Fifth, and perhaps most telling, during the global financial crisis—whose epicenter was the United States—investors rushed for the safety of the U.S. dollar.[33]

Conclusion

Global current account imbalances have narrowed substantially since their precrisis peaks in 2006, and their configuration changed markedly along the way. As a proportion of world GDP, the United States' large current account deficit has been more than halved, and the euro area deficit economies have moved into surplus. The surpluses in China and Japan, the two main counterparts to the 2006 U.S. deficit, have decreased markedly as well. Moreover, a few advanced economy commodity exporters and some major emerging market economies that previously had surpluses have now switched to deficits, contributing to smaller imbalances, but also, in some cases, contributing to new vulnerabilities.

With the shrinkage in large deficits, the systemic risks from flow imbalances surely decreased. The IMF's most recent *Pilot External Sector Report* (IMF 2014) still finds that many larger economies' flow imbalances are excessive relative to levels consistent with fundamentals and appropriate policy settings, but the current account imbalances have nevertheless narrowed, in some cases considerably, from their 2006 levels. Likewise, the current account gaps related to new deficits remain relatively small. Although many large current account deficits remain in economies other than the largest ones, the related reversal risks are likely to be country specific, not systemic.

Much of the adjustment in flow imbalances has been driven by lowered demand in deficit economies after the global financial crisis and by growth differentials related to the faster recovery of emerging market economies and commodity exporters after the Great Recession. Expenditure switching (from imports to domestic goods and services or vice versa) has, in general, played less of a role throughout the recent adjustment period, especially in economies that have faced significant slack and operate under fixed-exchange-rate regimes. But such expenditure switching has risen among the largest deficit and surplus economies, as it did in earlier episodes of narrowing global imbalances.

The significant role of weaker demand and growth differentials in the narrowing of global flow imbalances has been associated in many economies with high costs in the form of increased internal imbalances. However, the weaker demand has also allowed substantial current account adjustment without the disruptive exchange rate corrections—most notably of the U.S. dollar—that some feared were in the offing before the global financial crisis. In the process, some of the asset price bubbles and credit booms that underlay the large imbalances in many advanced economies up to about 2006 have also been corrected, although others may have since emerged, including as a result of the response to the crisis.

[32]Optimal currency composition of reserve portfolios is calculated under the assumption that the objective is to preserve the "real" value of reserves. A natural choice of deflator in this context is the import deflator, because the ultimate purpose of holding reserves is to enable net imports. Such an exercise yields a global optimal currency portfolio for reserves in which the dollar accounts for roughly 60 percent of the value (regardless of whether individual economies' optimal portfolios are weighted by imports or by reserve holdings); that level approximately matches the reported share in the IMF's Currency Composition of Official Foreign Exchange Reserves database for 2013; see Ghosh, Ostry, and Tsangarides 2011 for details of this calculation.

[33]See, for instance, Ghosh, Ostry, and Tsangarides 2011, Prasad 2014, and Schenk 2013 on historical precedents of global switches in reserve currencies.

The widening of internal imbalances while external imbalances narrowed has led, however, to concerns that, without further expenditure switching, external imbalances could widen again once output gaps close. Indeed, as output gaps in several advanced economies widened in 2013, global imbalances narrowed further. In advanced economies, much will depend on whether the lowering of their output since the global financial crisis has been mostly structural or mostly cyclical. If structural—the case incorporated in WEO baseline forecasts—much of the narrowing in global flow imbalances will be lasting.

But in some advanced economies with current account deficits, notably those in the euro area, output gaps are most likely large, and more expenditure switching would help these economies boost growth while maintaining narrower external imbalances. Against this backdrop, the uneven contribution of surplus economies to the narrowing of global imbalances remains a concern. The imbalances remain large among European surplus economies and oil exporters.

The nature and intensity of the policy measures needed to address remaining external imbalances and to contain emerging imbalances vary across economies and country groups. For instance, deficit economies need to take actions to advance fiscal consolidation and introduce structural reforms to facilitate external adjustment (including those to raise saving, make labor markets more flexible, and remove supply bottlenecks). In some emerging market economies with increasing deficits, measures to rein in private demand may be needed, including macroprudential measures to restrain credit booms and asset price bubbles. Surplus economies, in contrast, need to take steps to rebalance growth—including, in some cases, by raising public sector investment (see Chapter 3). In some other cases, adoption of more market-based exchange rates, reduction of capital account restrictions, strengthening of social safety nets, and implementation of financial sector reforms might also be required. As historical precedents and theory suggest, greater coordination of economic policies between, and among, surplus and deficit economies will make it easier to achieve these goals individually and collectively (see Ostry and Ghosh 2013).

Although concerns about global flow imbalances may have lessened since 2006, problems remain with respect to net external positions or stock imbalances. As a percentage of GDP, these metrics have generally widened further since most economies continue to be either net lenders or net borrowers, with current account imbalances typically only narrowing rather than reversing. Output declines or low output growth, together with low inflation, are another reason why net external liabilities have remained high as a share of GDP. Some large debtor economies thus remain vulnerable to changes in market sentiment and hence represent continued possible systemic risks. However, the liability position of the United States, the largest debtor globally, in relation to its own GDP remains relatively low, and the behavior of investors during the global financial crisis is a testament to their continued confidence in dollar assets.

Containing stock imbalances in debtor economies ultimately requires improvements in current account balances and stronger growth; increased resilience will also depend on the structure of assets and liabilities. Policy measures to achieve both stronger and more balanced growth in the major economies would help in this respect, including in large surplus economies with available policy space. Such measures would also help further reduce global imbalances.

Appendix 4.1. Data Definitions, Sources, and Descriptions

The primary sources for this chapter are the IMF's *Balance of Payments Statistics* (BOPS), *Direction of Trade Statistics* (DOTS), *International Financial Statistics* (IFS), World Economic Outlook (WEO) database, and Global Data Source (GDS); the World Bank's *World Development Indicators*; and the updated and extended version of the External Wealth of Nations (EWN) data set, constructed by Lane and Milesi-Ferretti (2007). Data for all variables (shown in Table 4.4 along with their data sources) are collected on an annual basis from 1970 to 2013, where available.

The main variables, including current account balance, net foreign asset position, trade balance, exports, imports, savings, and investment, are reported as percentages of nominal GDP. Weights used to construct country group aggregates are based on nominal GDP (market-value-based) weights. In addition, real variables, including domestic demand, exports, imports, and GDP, are constructed as percentage changes (log differences).

Precrisis trends are obtained from data in previous WEO reports, such as the September 2006 WEO database, and are constructed using a linear trend for a

Table 4.4. Data Sources

Variable	Sources[1]
Capital Account	IMF, Balance of Payments and International Investment Position Statistics Database.
Consumer Price Index (CPI) Inflation	IMF, World Economic Outlook Database.
Current Account	IMF, Balance of Payments and International Investment Position Statistics Database.
Financial Account	IMF, Balance of Payments and International Investment Position Statistics Database.
Financial Derivative Assets	External Wealth of Nations Database Mark II data set (Lane and Milesi-Ferretti 2007); Lane and Milesi-Ferretti 2012.
Financial Derivative Liabilities	External Wealth of Nations Database Mark II data set (Lane and Milesi-Ferretti 2007); Lane and Milesi-Ferretti 2012.
Foreign Direct Investment Assets	External Wealth of Nations Database Mark II data set (Lane and Milesi-Ferretti 2007); Lane and Milesi-Ferretti 2012.
Foreign Direct Investment Liabilities	External Wealth of Nations Database Mark II data set (Lane and Milesi-Ferretti 2007); Lane and Milesi-Ferretti 2012.
Net Foreign Assets	External Wealth of Nations Database Mark II data set (Lane and Milesi-Ferretti 2007); Lane and Milesi-Ferretti 2012.
Nominal Exchange Rate versus U.S. Dollar, End-of-Period	International Financial Statistics Database.
Nominal Exchange Rate versus U.S. Dollar, Period Average	International Financial Statistics Database.
Nominal Exports in U.S. Dollars	IMF, Balance of Payments and International Investment Position Statistics Database; and IMF, World Economic Outlook Database.
Nominal GDP (Local Currency and U.S. Dollars)	IMF, World Economic Outlook Database.
Nominal Imports in U.S. Dollars	IMF, World Economic Outlook Database.
Other Debt Assets	External Wealth of Nations Database Mark II data set (Lane and Milesi-Ferretti 2007); Lane and Milesi-Ferretti 2012.
Other Debt Liabilities	External Wealth of Nations Database Mark II data set (Lane and Milesi-Ferretti 2007); Lane and Milesi-Ferretti 2012.
Portfolio Equity Assets	External Wealth of Nations Database Mark II data set (Lane and Milesi-Ferretti 2007); Lane and Milesi-Ferretti 2012.
Portfolio Equity Liabilities	External Wealth of Nations Database Mark II data set (Lane and Milesi-Ferretti 2007); Lane and Milesi-Ferretti 2012.
Real Domestic Demand Growth	IMF, World Economic Outlook Database and IMF Staff Calculations.
Real Domestic Demand Growth, Trading Partners	IMF, World Economic Outlook Database; IMF, Information Notice System Weights; and IMF Staff Calculations.
Real Effective Exchange Rate (CPI based)	IMF, International Financial Statistics; and IMF Staff Calculations.
Real Exports	IMF, World Economic Outlook Database.
Real GDP	IMF, World Economic Outlook Database.
Real GDP Growth	IMF, World Economic Outlook Database and IMF Staff Calculations.
Real Imports	IMF, World Economic Outlook Database.
Reserve Assets Excluding Gold	External Wealth of Nations Database Mark II data set (Lane and Milesi-Ferretti 2007); Lane and Milesi-Ferretti 2012.
Terms of Trade	IMF, World Economic Outlook Database.

Source: IMF staff compilation.

[1]Not all countries have converted to the sixth edition of the *Balance of Payments and International Investment Position Manual* (BPM6). Data are subject to change once fully converted. Please refer to Table G of the Statistical Appendix for the list of countries that still use the BPM5.

seven-year period that ends three years earlier, such as, for example, the 1996–2003 period for 2006.

The economies included in Tables 4.1 and 4.2 are identified using current account balances and net foreign asset data from the BOPS database and EWN data set. Given the focus of the chapter, the rankings in these tables allow the identification of economies with imbalances with potentially systemic implications.

- *Largest current account deficits and surpluses.* These economies are identified by ranking the WEO database's full list of economies by the dollar size of their current account balances. The top 10 surplus and deficit economies are then selected.
- *Largest net foreign asset (creditors) and liabilities (debtors) positions.* Economies are selected from available data by the dollar size of their positive (creditors) or negative (debtors) net foreign asset positions.

Saving and Investment

The current account balance (*CA*) is equal to national savings (*S*) minus investment (*I*). As the data for savings are the least reliable, values for that variable are derived from the other two using the following identity:

$$S = CA + I, \tag{4.1}$$

in which each variable is expressed as a percentage of GDP. The current account data are obtained from BOPS, and investment is obtained from WEO national accounts data.

Decomposing the Change in Net Foreign Assets

The change in a country's net foreign asset position is defined as follows:

$$NFA_t - NFA_{t-1} \equiv CA_t + KA_t + EO_t + X_t, \tag{4.2}$$

in which *CA* is the current account—which is the sum of net exports of goods and services, current transfers, and investment income; *KA* is capital transfers; *EO* is errors and omissions; and *X* is net capital valuation gains (losses if negative) from shifts in exchange rates and asset prices.

Thus, the relationship between external flows and stocks can be rewritten as follows (Lane and Milesi-Ferretti 2014):

$$NFA_t \equiv NFA_{t-1} - FA_t + X_t, \tag{4.3}$$

in which FA_t is the financial account balance, that is, $FA_t = -(CA_t + KA_t + EO_t)$; and X_t is the valuation effect.

Hence, to calculate the cumulative valuation effects during 2006–13 as presented in Table 4.3, one can use the following equation:

$$\sum_{t=2007}^{2013} X_t = NFA_{2013} - NFA_{2006} + \sum_{t=2007}^{2013} FA_t. \tag{4.4}$$

These variables are in levels and calculated in local currency using period-average exchange rates for flows and end-of-period exchange rates for stocks. Recursive iteration and substitution in equation (4.2) shows two of the main components of the net foreign asset position—the cumulative current account and the cumulative valuation effect:

$$NFA_t = \sum_{s=0}^{q-1} CA_{t-s} + \sum_{s=0}^{q-1} (KA_{t-s} + EO_{t-s}) + \sum_{s=0}^{q-1} X_{t-s} + NFA_{t-q}. \tag{4.5}$$

However, a better proxy for a country's stock imbalance is the ratio of its net foreign asset position to GDP, which controls for the size of the economy. In this case, equation (4.5) can be written as follows:

$$nfa_t - nfa_{t-q} = \frac{(\sum_{s=0}^{q-1} CA_{t-s})}{Y_t} + \frac{(\sum_{s=0}^{q-1} (KA_{t-s} + EO_{t-s}))}{Y_t} + \frac{(\sum_{s=0}^{q-1} X_{t-s})}{Y_t} - \frac{g_{y_{t,t-q}}}{1 + g_{y_{t,t-q}}} nfa_{t-q}, \tag{4.6}$$

in which lowercase letters denote variables as a ratio to GDP. The final term on the equation's right-hand side captures the adjustment due to nominal GDP growth, in which $g_{y_{i,t=q}}$ is the nominal GDP growth between $t - q$ and t, and $q \geq 1$.

Appendix 4.2. Panel Estimations

A country's current account balance is determined by a number of factors, both domestic and foreign, summarized in the following relationship:

$$CA = f(DD, DD^*, \varepsilon, \tau). \tag{4.7}$$

The current account (as a share of GDP), *CA*, is a function of real domestic demand, *DD*; real domestic demand in trading partner economies, *DD**; the real effective exchange rate, ε; and the terms of trade, τ. Taking the total derivative yields the relationship to be estimated:

$$dCA = \frac{\partial CA}{\partial DD} dDD + \frac{\partial CA}{\partial DD^*} dDD^* + \frac{\partial CA}{\partial \varepsilon} d\varepsilon + \frac{\partial CA}{\partial \tau} d\tau. \tag{4.8}$$

Economic theory gives us an idea of the sign of these effects in advance:[34]

$$\frac{\partial CA}{\partial DD} < 0; \frac{\partial CA}{\partial DD^*} > 0; \frac{\partial CA}{\partial \varepsilon} < 0; \frac{\partial CA}{\partial \tau} > 0. \tag{4.9}$$

Given the chapter's global focus, panel data techniques are applied to test equation (4.8) and establish the relative importance of expenditure changing and expenditure switching during current account adjustment periods. Because current account balances are the outcome of intertemporal decisions taken jointly

[34]The negative relationship between the change in the real effective exchange rate and the change in the current account as a percentage of GDP assumes that the Marshall-Lerner condition is satisfied, that is, that the sum of the elasticities of exports and imports with respect to the real exchange rate exceeds unity.

Table 4.5. Sample Economies

Europe		Asia	
Austria	Netherlands	Australia	Malaysia
Belgium	Norway*	China	Morocco
Bulgaria	Poland	Hong Kong SAR	New Zealand
Croatia	Portugal	India	Pakistan
Czech Republic	Romania	Indonesia	Philippines
Denmark	Russia*	Ireland	Singapore
Estonia	Serbia	Israel	Sri Lanka
Finland	Slovak Republic	Japan	Taiwan Province of China
France	Slovenia	Korea	Thailand
Germany	Spain	**Americas**	
Greece	Sweden	Argentina	El Salvador
Hungary	Switzerland	Brazil	Guatemala
Iceland	Turkey	Canada	Mexico
Italy	Ukraine	Chile	Peru
Latvia	United Kingdom	Colombia	United States
Lithuania		Costa Rica	Uruguay
Africa		Dominican Republic	
South Africa	Tunisia		

Source: IMF staff compilation.
* Oil exporters.

by multiple agents globally, pooling information in a panel regression allows a richer set of dynamics to be captured over time and across economies.

This relationship is specified econometrically as follows:

$$\Delta CA_{i,t} = \beta_0 + \beta_1 \Delta DD_{i,t} + \beta_2 \Delta DD^*_{i,t} + \beta_3 \Delta REER_{i,t} + \beta_4 \Delta ToT_{i,t} + u_i + \varepsilon_{i,t}, \quad (4.10)$$

in which for country i, $\Delta CA_{i,t}$ is the year-over-year change in the current account (as a share of GDP); $\Delta DD_{i,t}$ is the annual growth rate of real domestic demand; $\Delta DD^*_{i,t}$ is the weighted average annual real domestic demand growth across country i's trading partners; $\Delta REER_{i,t}$ is the annual percentage change in the real effective exchange rate; $\Delta ToT_{i,t}$ is the annual growth rate in the terms of trade; u_i captures country-specific fixed effects; and $\varepsilon_{i,t}$ are the idiosyncratic errors.

Fixed-effects panel estimation with robust standard errors is used for the regression for a sample of 64 economies (Table 4.5) using annual data for the period 1970–2013. The panel is unbalanced owing to gaps in the data.

The results for 10 regression estimations are reported in Table 4.6. The first column of the table reports the coefficients from the full regression of the change in current account balances as a share of GDP on the four explanatory variables (regressors) and their one-period lags as listed in equation (4.10). The results indicate that over the full sample period, a 1 percentage point increase in the growth rate of domestic demand for one year is associated with a deterioration in the current account balance of slightly more than 0.3 percentage point of GDP over two years. A 1 percentage point increase in trading partner demand growth for one year leads instead to an improvement in the current account by a little more than 0.06 percentage point of GDP over two years. Finally, a 5 percent depreciation in the real effective exchange rate is associated with an improvement in the current account balance of 0.3 percentage point over two years.

The next five columns of the table explore how the explanatory power of the regression (the overall R^2) alters once certain key explanatory variables are excluded. As noted in the chapter text, the omission of the change in the real effective exchange rate (column 4) has little impact on overall explanatory power, but removing growth in aggregate demand (both domestic demand and that of trading partners) leads to a sharp reduction in the model's goodness of fit (from slightly more than 0.4 to 0.1).

Columns (7) through (10) present results from partitioning the data set into two subsets. The first subset looks at the effect of a change in the explanatory variables in the years of adjustment in global imbalances (using binary indicators for the years 1975–

Table 4.6. Panel Regression Results, 1970–2013

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
							Partitioned Samples			
	Full Sample						Adjustment Years[1]	Nonadjustment Years	Peg[2]	Float[2]
Real Domestic Demand (YoY change, percent)	–0.37***		–0.38***		–0.36***		–0.42***	–0.33***	–0.46***	–0.34***
	(–12.6)		(–13.6)		(–12.8)		(–11.0)	(–10.7)	(–5.80)	(–11.4)
Real Domestic Demand, Trading Partners (YoY change, percent)	0.13**		0.15***	–0.32***	0.12**		0.12*	0.16***	0.16	0.15**
	(2.49)		(2.83)	(–4.18)	(2.29)		(1.83)	(2.70)	(1.48)	(2.38)
Real Effective Exchange Rate (CPI based, YoY change, percent)	–0.03***	–0.08***		–0.07***	–0.03**		0.01	–0.05***	–0.04*	–0.04***
	(–2.96)	(–7.66)		(–7.01)	(–2.38)		(0.28)	(–4.16)	(–2.04)	(–3.11)
Terms of Trade (YoY change, percent)	0.16***	0.11***	0.15***	0.12***	0.15***		0.16***	0.17***	0.20***	0.15***
	(7.62)	(5.14)	(7.40)	(5.57)	(7.45)		(6.24)	(6.93)	(6.52)	(6.12)
Real Domestic Demand {*t*–1} (YoY change, percent)	0.05***		0.04**			–0.05**	0.08***	0.04*	0.06*	0.05**
	(2.93)		(2.42)			(–2.64)	(2.89)	(1.80)	(1.74)	(2.67)
Real Domestic Demand, Trading Partners {*t*–1} (YoY change, percent)	–0.07		–0.06	–0.09**		–0.10*	–0.17***	0.02	–0.07	–0.07
	(–1.55)		(–1.44)	(–2.11)		(–1.96)	(–2.96)	(0.28)	(–1.49)	(–1.31)
Real Effective Exchange Rate {*t*–1}, (CPI based, YoY change, percent)	–0.03***	–0.02**		–0.03***		–0.02*	–0.03**	–0.02***	–0.02	–0.03***
	(–3.17)	(–2.53)		(–2.95)		(–1.79)	(–2.35)	(–3.01)	(–1.01)	(–3.15)
Terms of Trade {*t*–1}, (YoY change, percent)	0.00	–0.03***	–0.01	–0.03**		–0.03***	0.00	0.01	0.03	–0.01
	(0.28)	(–3.66)	(–1.02)	(–2.52)		(–3.42)	(–0.44)	(0.82)	(1.42)	(–0.92)
R^2 (within)	0.44	0.10	0.42	0.15	0.42	0.03	0.45	0.44	0.54	0.41
R^2 (overall)	0.41	0.10	0.39	0.14	0.38	0.03	0.43	0.42	0.51	0.38
Standard deviation of residuals within groups	0.57	0.28	0.59	0.37	0.62	0.28	0.80	0.66	0.59	0.62
Standard deviation of residuals	2.14	2.70	2.17	2.63	2.18	2.80	2.37	2.03	1.84	2.32
Intraclass correlation	0.07	0.01	0.07	0.02	0.07	0.01	0.10	0.10	0.09	0.07
Number of observations	1,929	1,971	1,936	1,959	1,992	1,929	763	1,229	666	1,326
Number of countries	64	64	64	64	64	64	64	64	22	42

Source: IMF staff estimates.

Note: *t*-statistics in parentheses. CPI = consumer price index; YoY = year over year.

[1]Periods of adjustment in global current account imbalances: 1975–79, 1987–91, and 2007–13.

[2]Economies partitioned into those with pegged and floating exchange rate regimes as specified in Ghosh, Ostry, and Tsangarides (2011).

*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$.

Table 4.7. Panel Regression Results, 2007–13

	(1)	(2)	(3)	(4)	(5)
	Full Sample	Sample from 2007 to 2013			
Real Domestic Demand (YoY change, percent)	–0.37***	–0.45***		–0.45***	
	(–12.6)	(–6.93)		(–6.91)	
Real Domestic Demand, Trading Partners (YoY change, percent)	0.13**	0.04		0.05	–0.77***
	(2.49)	(0.34)		(0.40)	(–5.19)
Real Effective Exchange Rate (CPI based) (YoY change, percent)	–0.03***	0.02	–0.05		0.00
	(–2.96)	(0.83)	(–1.38)		(0.10)
Terms of trade (YoY change, percent)	0.16***	0.10**	0.02	0.11**	0.04
	(7.62)	(2.30)	(0.35)	(2.51)	(0.85)
Real Domestic Demand {*t*–1} (YoY change, percent)	0.05***	0.06		0.06	
	(2.93)	(1.25)		(1.27)	
Real Domestic Demand, Trading Partners {*t*–1} (YoY change, percent)	–0.07	–0.17**		–0.17**	–0.22***
	(–1.55)	(–2.25)		(–2.28)	(–3.43)
Real Effective Exchange Rate {*t*–1} (CPI based, YoY change, percent)	–0.03***	0.00	0.04		0.02
	(–3.17)	(0.15)	(0.91)		(0.64)
Terms of Trade {*t*–1} (YoY change, percent)	0.00	0.00	–0.06*	0.00	–0.02
	(0.28)	(–0.26)	(–1.84)	(–0.24)	(–0.98)
R^2 (within)	0.44	0.54	0.03	0.54	0.30
R^2 (overall)	0.41	0.51	0.02	0.51	0.27
Standard deviation of residuals within groups	0.57	1.21	1.58	1.23	1.44
Standard deviation of residuals	2.14	2.32	3.34	2.32	2.85
Intraclass correlation	0.07	0.21	0.18	0.22	0.20
Number of observations	1,929	320	320	320	320
Number of countries	64	64	64	64	64

Source: IMF staff estimates.
Note: *t*-statistics in parentheses. CPI = consumer price index; YoY = year over year.
*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$.

79, 1987–91, and 2007–13; column 7) compared with remaining years in the sample (column 8). In this case, the negative coefficient on the growth in real domestic demand is larger in the years of adjustment relative to more "normal" periods. In addition, expenditure switching does not appear to have been strongly associated with changes in the current account during the periods of adjustment, unlike in other years. However, it is possible that the strength of expenditure switching is weakened by the more extreme fallout from the global financial crisis and subsequent Great Recession. Columns (9) and (10) show very similar regression results for economies with either pegged or floating exchange rates. In particular, the impact of changes in the real effective exchange rate on the current account is virtually identical, but more precisely estimated in the case of economies with floating exchange rates.

When the relationship is tested for the 1986–91 adjustment period (see Box 4.1), the change in the real effective exchange rate has a statistically significant negative effect on the current account balance; that is, a real depreciation improves a country's external balance. A simple robustness test, performed by substituting lagged terms for each explanatory variable, shows that the significance and sign of the effects of the different factors on the change in the current account do not alter substantially for the real effective exchange rate and domestic demand (column 6).

The panel regression is also performed for the recent adjustment period in global imbalances, 2007–13 (Table 4.7). As noted in the chapter text, the impact of domestic demand growth is even stronger between 2007 and 2013 (column 2) than in the full sample (column 1), whereas neither growth in domestic demand in trading partners nor changes in the real effective exchange rate has a statistically significant impact. One factor that may explain the lack of significance of the impact of real effective exchange rate changes is the fact that increases in indirect taxes—which happened in a number of deficit economies—imply an appreciation in the consumer-price-index-based real effective exchange rate used in the regression but no change in underlying competitiveness.

The coefficients from the full regression (column 1 of Table 4.6) are used to calculate a counterfactual

path for the current account balance for the case in which the expenditure-switching channel is turned off. As noted in the chapter text, this exercise suggests that under those circumstances, imbalances would have widened by an additional 0.4 percent of world GDP in 2013.

Appendix 4.3. Distortions, Policies, and Imbalances

The text compares "current account gaps" in 2006 and 2013 as a measure of the degree to which lower distortions and improved policies have contributed to the narrowing of flow imbalances. This appendix provides details of that analysis.

A country's current account (as a percentage of GDP) may be modeled as depending upon a vector of policies, **P**; a vector of distortions, **D**; a vector of observed fundamentals, **F**; and a vector of unobserved fundamentals, **U**:

$$CA = \alpha + \mathbf{P}'\beta + \mathbf{D}'\gamma + \mathbf{F}'\delta + \mathbf{U}'\theta. \quad (4.11)$$

The appropriate current account balance (that is, taking account of multilateral consistency, as well as sustainable and appropriate policies, $\mathbf{P}^*$)—the current account "norm"—is given by

$$CA^* = \alpha + \mathbf{P}^{*\prime}\beta + \mathbf{F}'\delta + \mathbf{U}'\theta. \quad (4.12)$$

Ideally, the actual current account (equation 4.11) would be compared with its norm (equation 4.12),

$$CA - CA^* = \rho = \alpha + (\mathbf{P} - \mathbf{P}^*)'\beta + \mathbf{D}'\gamma, \quad (4.13)$$

with the difference between them providing a measure of the policy or other distortions that underlie observed current account positions. Moreover, a comparison of ρ over time (for example, ρ_{2013} versus ρ_{2006}) would provide an indication of the extent to which these distortions had diminished or grown.

The norm is not directly observable, however, and instead a regression model of the current account must be employed as a proxy:[35]

$$\widehat{CA} = \alpha + \mathbf{P}'\beta + \mathbf{F}'\delta. \quad (4.14)$$

The regression residual is

$$CA - \widehat{CA} = \varepsilon = \mathbf{D}'\gamma + \mathbf{U}'\theta. \quad (4.15)$$

As a proxy for δ (the true deviation of the current account from its norm), the regression residual ε suffers from two shortcomings: first, in addition to genuine distortions, it includes unobserved fundamentals (that is, variables that are omitted from the regression); and second, since the regression controls for actual policies, the residual does not capture the effect on the current account of any divergence of actual policies, **P**, from their appropriate or desirable values, $\mathbf{P}^*$.

To the extent that the unobserved fundamentals are relatively constant, the first of these problems is mitigated by comparing the residual over time. Therefore, smaller residuals in 2013 than in 2006 ($|\varepsilon_{2013}| < |\varepsilon_{2006}|$) can be taken as an indication of fewer distortions. To address the second problem, if an estimate of the desirable policy settings is available, a residual inclusive of the policy distortion may be defined:

$$\vartheta = \varepsilon + (\mathbf{P} - \mathbf{P}^*)'\beta = \mathbf{D}'\gamma + \mathbf{U}'\theta + (\mathbf{P} - \mathbf{P}^*)'\beta, \quad (4.16)$$

where again, comparing ϑ over time likely reduces the impact of the omitted variables. The difficulty in implementing this strategy is that, although estimates of $\mathbf{P}^*$ are available for 2013 as part of the EBA and *External Sector Report* (ESR) exercises, corresponding estimates for 2006 are not available. Since the desirable policies are likely to be fairly invariant over time (for instance, the fiscal balance is defined in cyclically adjusted terms), however, it is possible to approximate the 2006 value using its 2013 value and calculate $\vartheta_{2006} = \varepsilon_{2006} + (\mathbf{P}_{2006} - \mathbf{P}^*_{2013})'\beta$.

Figure 4.11 (panel 1) compares $|\varepsilon_{2013}|$ with $|\varepsilon_{2006}|$ as an indication of how nonpolicy distortions underlying observed current account balances have changed over time, while Figure 4.11 (panel 2) compares $|\mathbf{P}_{2013} - \mathbf{P}^*_{2013}|$ to $|\mathbf{P}_{2006} - \mathbf{P}^*_{2006}|$ as an indication of how all distortions—policy and other—have evolved. It bears emphasizing that neither the regression residuals, ε, nor the policy-gap-inclusive residuals, ϑ, correspond precisely to the ESR gaps. The latter incorporate IMF staff judgment concerning appropriate external balances, taking account of additional information that cannot be readily captured in standard regression analysis. Although in many cases the ESR gaps (which are available only for 2013) are similar to the policy-gap-inclusive residuals, ϑ, for 2013, there are some instances in which there are marked differences due to country-specific factors.[36]

[35]The regression that underlies the IMF's External Balance Assessment is used for this purpose (see http://www.imf.org/external/np/res/eba/pdf/080913.pdf).

[36]Notably Japan (among the economies with large imbalances considered here); for this reason, the residual for Japan is not shown in Figure 4.11.

Table 4.8. Estimated Threshold Values and Associated Classification Errors

Variable	Crisis	Sample	Threshold (percent)	Crises Missed (type I error; percent)	Noncrises Misclassified (type II error; percent)
NFA	Sudden Stops	AE	–20.0	45.7	37.1
NFA	Debt	AE	–81.2	0.0	3.2
NFA	Currency	AE	–39.6	42.9	18.7
NFA	Bank	AE	–1.4	20.0	65.6
NFA	Any	AE	–21.0	52.4	34.8
NFA	Weighted Average	AE	–55.7		
CA	Sudden Stops	AE	–4.5	74.3	15.8
CA	Debt	AE	–9.9	0.0	3.0
CA	Currency	AE	–2.4	0.0	30.2
CA	Bank	AE	–2.4	48.0	31.0
CA	Any	AE	–3.3	60.3	23.1
CA	Weighted Average	AE	–6.0		
NFA	Sudden Stops	EMDE	–36.2	43.8	48.2
NFA	Debt	EMDE	–44.0	50.0	36.9
NFA	Currency	EMDE	–16.9	14.5	78.3
NFA	Bank	EMDE	–77.4	84.3	11.4
NFA	Any	EMDE	–16.7	18.2	78.6
NFA	Weighted Average	EMDE	–38.4		
CA	Sudden Stops	EMDE	–6.6	58.3	20.7
CA	Debt	EMDE	–2.0	13.0	58.3
CA	Currency	EMDE	–2.0	22.8	58.3
CA	Bank	EMDE	0.2	7.8	78.2
CA	Any	EMDE	–2.0	26.6	58.2
CA	Weighted Average	EMDE	–2.7		

Source: IMF staff estimates.
Note: AE = advanced economies; CA = current account; EMDE = emerging and developing economies; NFA = net foreign assets.

Appendix 4.4. Counterfactual Output Gap Analysis

One of the key questions tackled in the chapter is whether the unwinding of global current account imbalances will prove durable. This question is examined by looking at cyclically adjusted current account balances. To the extent that the relatively narrow imbalances now can be attributed to the difference in cyclical positions or to global excess capacity, a bounce back can be expected in the medium term as output gaps close.

However, there is no universally accepted methodology for assessing how cyclical conditions affect current account balances. To get an idea of magnitudes, a simple, parsimonious approach based on the IMF's EBA methodology is employed.[37] The cyclical component of the ratio of the current account to GDP for a given country is computed as the difference between its output gap and the world output gap multiplied by a factor (–0.4) recovered from the EBA current account regression.[38]

[37]See, for instance, http://www.imf.org/external/np/res/eba/pdf/080913.pdf.

[38]The EBA regression is estimated on a sample of 49 mostly advanced and emerging market economies (covering 90 percent of global GDP) for the period 1986–2000.

The world output gap is computed using the purchasing-power-parity-weighted average of output gaps for all economies recorded in the IMF's WEO database.

Cyclically adjusted current account balances are calculated for the Group of Twenty economies using three country-specific output gap measures: (1) the output gap reported in the WEO, (2) the difference between the 2013 level of GDP implied by the 2006 precrisis trend (calculated using the average growth rate for 1998–2005), and (3) a hybrid of (1) for the United States and China and (2) for all other economies.

The cyclical components are then aggregated separately for surplus and deficit Group of Twenty economies and subtracted from the sum of their raw balances to arrive at cyclically adjusted current account balances for the two country groups.[39] These are compared with the "unadjusted" current account surpluses and deficits (actual current account balances), calculated for the full sample of economies in the WEO.

Measures calculated using (1) deliver a narrowing of 2.6 percent of world GDP (dashed lines in panel 1 of Figure 4.9), 1.5 percent using (2) (solid lines in panel

[39]Economies are classified as surplus or deficit based on their positions in 2006.

2 of Figure 4.9), and 2 percent using (3) (dashed lines in panel 2 of Figure 4.9).

Appendix 4.5. Vulnerability Thresholds

To establish the level at which a current account deficit (or net liability position) exposes a country to significantly greater risk, a threshold value is chosen so as to minimize the percentage of crises missed and the percentage of noncrises misclassified (type I and type II errors, respectively). By defining the loss function in terms of the percentages of crises and noncrises, the estimation penalizes missing a crisis much more heavily than issuing a false alarm (for example, if crises are 5 percent of the sample, missing one crisis is as costly as issuing 19 false alarms).

Four types of crisis are considered: banking, currency, and debt crises (from Laeven and Valencia 2012), and an indicator for sudden stops (from Chapter 4 of the April 2012 WEO); a comprehensive crisis indicator, which takes the value of one if there is at least one crisis in a given year, is also defined. The model is estimated using lagged values for the current account and net foreign asset position, since these variables may adjust sharply following a crisis (and vulnerabilities are better captured by the lagged value, that is, before the postcrisis adjustment). For that reason, observations in the year following a crisis are excluded from the estimation.

The exercise is performed for two samples of economies. The first sample consists of 34 advanced economies and corresponds to the sample used in the IMF's Vulnerability Exercise for Advanced Economies. The second sample consists of 53 emerging market and developing economies. It includes the sample used in the IMF's Vulnerability Exercise for Emerging Market and Developing Economies, as well as recently designated advanced economies that were emerging market and developing economies in the historical sample (for example, Korea). The data cover the period 1980–2010. Table 4.8 reports the results for the different crises. To obtain the average threshold (used in the chapter text), a weighted average of the thresholds for the different crises is calculated, in which the weights are proportional to the explanatory power of the threshold for the type of crisis with which it is associated (1 minus the sum of type I and type II errors).

Box 4.1. Switching Gears: The 1986 External Adjustment

Another exceptional episode of adjustment in global imbalances began in 1986 following an agreement between the largest deficit and surplus economies. This box highlights how expenditure switching featured more heavily in this episode against a backdrop of relatively strong global economic conditions.

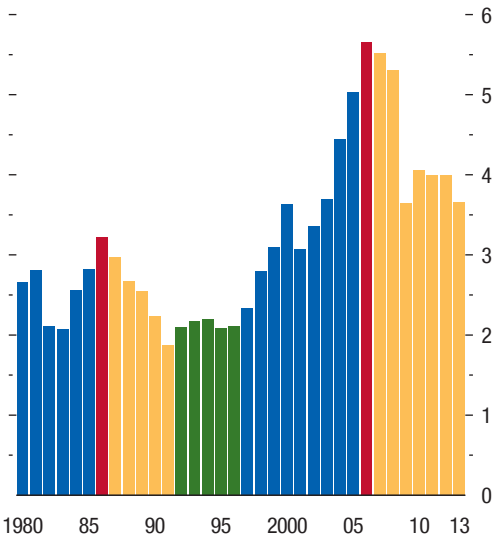
The Plaza Accord of September 1985 initiated a period of adjustment in global imbalances. The accord among the world's five largest economies (the Group of Five) sought to limit the widening imbalances between the world's largest deficit economy (the United States) and largest surplus economies (Japan and West Germany). The agreement would work through coordinated foreign exchange rate interventions that would help depreciate the U.S. dollar against other currencies, mainly the Japanese yen and the German deutschmark (or "appreciate nondollar currencies").[1] As a result, absolute global current account imbalances declined during the five years beginning in 1986 at an average annual rate of ¼ percent of world GDP, resulting in a total adjustment of 1¼ percent by 1991 (Figure 4.1.1).

The configuration of imbalances at the start of the adjustment in 1986 was similar to that of 2006, with deficits and surpluses largely concentrated in a handful of systemically important economies (Table 4.1.1). As of 1986, the U.S. current account deficit accounted for three-fourths of the sum of the world's top 10 deficits, and the combined surpluses of Japan and West Germany were almost as large in dollar terms. By 1991, the U.S. external imbalance had moved into surplus and accounted for the lion's share of the reduction in the world's largest deficits. The primary counterparts to this adjustment on the surplus side (switching from surplus to large deficits) were Germany, which was undergoing reunification, and Spain. Therefore, the share of Japan and the United States in absolute global imbalances declined from more than 50 percent in 1986 to 17 percent in 1991.

Unlike the adjustment in the recent period, the adjustment that began in 1986 took place against a relatively more benign global economic landscape, with GDP across major deficit and surplus economies remaining close to or above trend during this period. GDP in the United States remained close to preadjustment trends, and those in major surplus economies climbed above trend. Overall, global GDP growth remained steady between 1987 and 1989, dipping only in 1990 as the United States fell into recession.

A key difference between the two periods of adjustment is the relatively larger role for expenditure switching in the earlier episode. Expenditure switching between foreign-produced and domestically produced goods was inevitable given that the adjustment was engineered through exchange rate intervention, and the result was an 11 percent real appreciation of the yen during the period 1986–88 and a 15 percent real depreciation of the dollar.[2] However, outside these two major

Figure 4.1.1. Global Current Account Imbalances in Absolute Terms
(Percent of world GDP)



Source: IMF staff calculations.
Note: Yellow bars highlight main periods of adjustment in absolute global imbalances, with red bars marking the beginning year of the adjustment period. Green bars highlight extended period of compressed absolute imbalances following the 1986–91 adjustment. Blue bars are used for all other years.

The authors of this box are Aqib Aslam and Juan Yépez.

[1]See Funabashi 1988. In fact, the dollar had already started depreciating from its peak in March 1985, but the pace of depreciation picked up following the Plaza Accord.

[2]Indeed, the Plaza Accord succeeded too well: concerned that the sharp depreciation of the dollar was disrupting currency markets, ministers from the parties to the agreement as well as from Canada (the Group of Six) met at the Louvre in February 1987 (the "Louvre Accord") seeking to "put the brakes" on the dollar decline. The dollar continued to depreciate, however, with the depreciation ultimately resulting in the October 1987 stock

Box 4.1 *(continued)*

Table 4.1.1. Largest Deficit and Surplus Economies, 1986 and 1991

1986				1991			
	Billions of U.S. Dollars	Percent of GDP	Percent of World GDP		Billions of U.S. Dollars	Percent of GDP	Percent of World GDP
1. Largest Deficit Economies							
United States	–147.2	–3.2	–1.05	Italy	–29.9	–2.5	–0.10
Saudi Arabia	–11.8	–13.6	–0.08	Saudi Arabia	–27.5	–20.9	–0.09
Canada	–11.2	–3.0	–0.08	Kuwait	–26.2	–242.2	–0.09
Australia	–9.2	–5.0	–0.07	Germany	–24.3	–1.3	–0.08
Iran	–5.7	–6.8	–0.04	Canada	–22.4	–3.7	–0.07
Brazil	–5.7	–2.1	–0.04	Spain	–20.0	–3.6	–0.07
United Kingdom	–5.3	–0.9	–0.04	United Kingdom	–14.9	–1.4	–0.05
India	–4.6	–1.8	–0.03	Mexico	–14.6	–4.1	–0.05
Norway	–4.5	–5.9	–0.03	Iran	–11.2	–11.5	–0.04
Denmark	–4.5	–5.2	–0.03	Australia	–10.6	–3.3	–0.04
Total	**–209.5**	**–47.5**	**–1.5**	**Total**	**–201.8**	**–294.4**	**–0.7**
2. Largest Surplus Economies							
Japan	84.5	4.1	0.60	Japan	68.1	1.9	0.23
West Germany	38.5	4.2	0.27	Taiwan Province of China	12.5	6.7	0.04
Taiwan Province of China	16.3	21.0	0.12	Switzerland	10.2	4.1	0.03
Switzerland	6.7	4.6	0.05	Netherlands	7.5	2.5	0.02
Kuwait	5.7	32.6	0.04	Norway	5.0	4.2	0.02
Netherlands	4.4	2.4	0.03	Singapore	4.9	10.7	0.02
Spain	3.7	1.5	0.03	Belgium	4.8	2.3	0.02
Belgium	3.1	2.7	0.02	Hong Kong SAR	3.8	4.3	0.01
South Africa	2.8	4.2	0.02	United States	2.9	0.0	0.01
Korea	2.8	2.3	0.02	Brunei Darussalam	2.6	69.3	0.01
Total	**168.4**	**79.6**	**1.2**	**Total**	**122.2**	**106.1**	**0.4**

Source: IMF, World Economic Outlook database.

Table 4.1.2. Panel Regression Results: Post–Plaza Accord versus Post–2006 Current Account Adjustments

	(1)	(2)	(3)	(4)	(5)
	1986–91 Adjustment Period			2007–13 Adjustment Period	
Real Domestic Demand (YoY change, percent)	–0.31*** (–4.86)	–0.33*** (–5.20)		–0.48*** (–9.26)	–0.47*** (–8.96)
Real Domestic Demand, Trading Partners (YoY change, percent)	0.15 (1.18)	0.16 (1.27)		0.07 (0.64)	0.08 (0.77)
Real Effective Exchange Rate (CPI based) (YoY change, percent)	–0.04* (–1.71)		–0.06*** (–3.93)	0.04 (1.35)	
Terms of Trade (YoY change, percent)	0.10*** (2.69)	0.10** (2.63)	0.05 (1.42)	0.11*** (2.81)	0.12*** (2.98)
R^2 (within)	0.31	0.29	0.06	0.48	0.47
R^2 (overall)	0.30	0.27	0.05	0.48	0.47
Standard deviation of residuals within groups	0.84	0.94	0.96	0.96	0.99
Standard deviation of residuals	1.96	1.98	2.28	2.54	2.55
Intraclass correlation	0.16	0.18	0.15	0.12	0.13
Number of observations	242	242	242	384	384
Number of countries	50	50	50	64	64

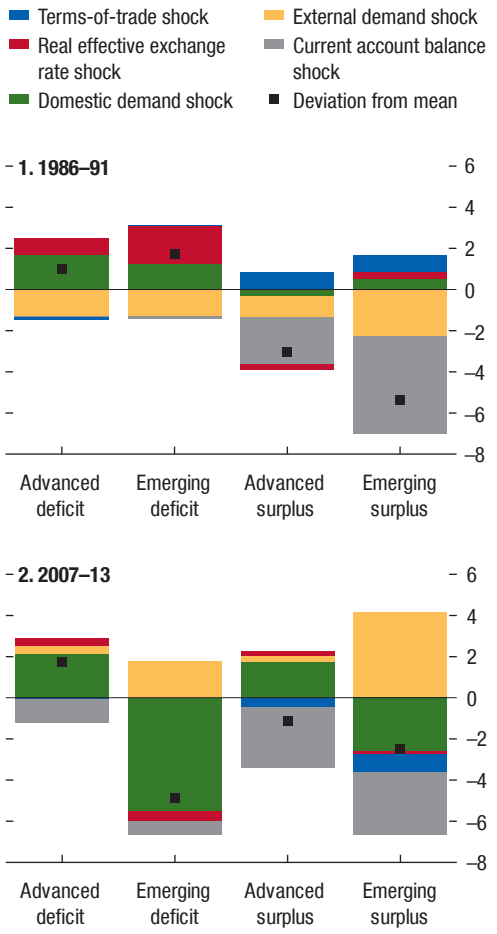
Source: IMF staff estimates.

Note: *t*-statistics in parentheses. CPI = consumer price index; YoY = year over year.

*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$.

Box 4.1 *(continued)*

Figure 4.1.2. Historical Decomposition of Current Account Adjustment



Source: IMF staff calculations.
Note: Advanced deficit = Australia, Czech Republic, Estonia, France, Greece, Iceland, Ireland, Italy, Latvia, New Zealand, Portugal, Slovak Republic, Slovenia, Spain, United Kingdom, United States; advanced surplus = Austria, Belgium, Canada, Denmark, Finland, Germany, Hong Kong SAR, Israel, Japan, Korea, Netherlands, Norway, Singapore, Sweden, Switzerland, Taiwan Province of China; emerging deficit = Bulgaria, Colombia, Costa Rica, Croatia, Dominican Republic, El Salvador, Guatemala, Hungary, India, Lithuania, Mexico, Pakistan, Poland, Romania, Serbia, South Africa, Sri Lanka, Thailand, Tunisia, Turkey, Uruguay; emerging surplus = Argentina, Brazil, Chile, China, Indonesia, Malaysia, Morocco, Peru, Philippines, Russia, Ukraine.

surplus and deficit economies, there was no strong change in the direction of real effective exchange rates, and the rest of the world's absolute level of imbalances remained the same as a portion of world GDP.

The relatively greater role for expenditure switching in the 1986 episode can be seen in a panel regression that examines the contribution of domestic demand and the real effective exchange rate in the 1986–91 and 2006–13 current account adjustment periods (Table 4.1.2). For example, in the years following the Plaza Accord, a 10 percentage point reduction in the real appreciation rate increases the rate of adjustment of the current account by 3 percentage points, an effect that is statistically significant. In contrast, although the estimate is larger in the most recent adjustment period, its effect is not statistically significant.

At the same time, if the demand variables of the panel regression are dropped, the R^2 of the 1986–91 period is larger than that of the 2007–13 adjustment period, and the coefficient of the real effective exchange rate becomes larger and more statistically significant. The contemporaneous relationship between the real effective exchange rate, the terms of trade, and the current account is complex because these variables are jointly determined; therefore, the estimates from these regressions could be biased.

The stronger role of expenditure switching in the second half of the 1980s is also recovered using a complementary framework—a parsimonious panel vector autoregression—in which the issue of potential endogeneity can be better addressed. Historical decompositions (Figure 4.1.2) of the current account adjustment into demand and price factors show that shocks to the real effective exchange rate can explain one-third of the improvement in the current account from its historical average for advanced and emerging market deficit economies (red segments) in the years immediately following the Plaza Accord (compared with one-eighth in the 2007–13 adjustment period).[3]

market crash, when coordinated interest rate cuts by Group of Seven (adding Italy to the group) central banks allowed them to inject liquidity without exerting further stress on exchange rates; see Ghosh and Masson 1994, chapter 4.

[3]The historical decomposition is obtained from a panel vector autoregression for 64 economies calculated for the 1973–2013 period using annual data. The identification strategy is based on contemporaneous restrictions based on the following recursive ordering: the terms of trade; the real effective exchange rate; and the changes in real external demand, real domestic demand, and the current account balance as a share of GDP; therefore, there

Box 4.1 *(continued)*

Overall, the key lesson from the 1986 episode is that, in a favorable global economic environment, a policy-engineered current account adjustment can prove to be both effective and durable. Imbalances remained compressed in the aftermath of the 1991 global recession until as late as 1996, making this the longest period of current account narrowing since the Bretton Woods era (see green bars in Figure 4.1.1). Therefore, the Plaza Accord, although not without its detractors, provides some insight into how policy-induced expenditure switching could reduce external imbalances and in some cases boost growth.[4]

is a series of shocks for each variable in the model. Results are qualitatively robust to different orderings.

[4]Some commentators blame the Plaza and Louvre Accords for igniting the expansionary policies that led to Japan's asset boom and bust, which triggered that country's "lost decade" in the 1990s. See Box 4.1 of the April 2010 *World Economic Outlook*.

Box 4.2. A Tale of Two Adjustments: East Asia and the Euro Area

The experiences of the stressed euro area economies during the recent euro area sovereign debt crises stand in contrast to those of the Asian market economies during the Asian financial crisis of the late 1990s. The difference between these two groups in their patterns of adjustment is stark: East Asian economies were able to rely on demand-switching effects to a much greater degree than have the stressed euro area economies and thereby avoided the prolonged contraction in output that has afflicted the latter.

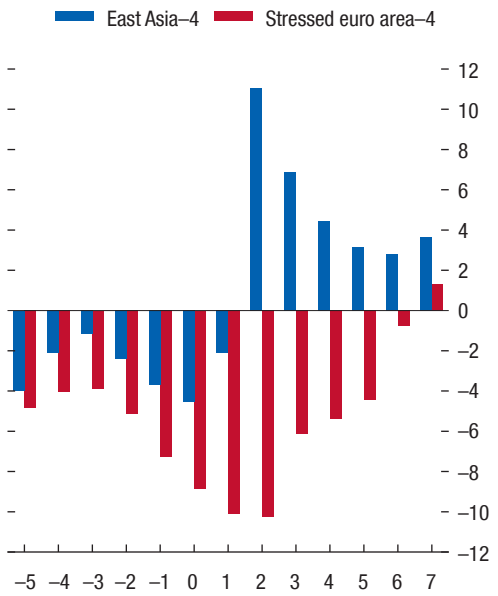
Financial crises erupted in Asia starting in Thailand in July 1997 before spreading to other economies in the region. Four of the affected economies—Indonesia, Korea, Malaysia, and Thailand (the "East Asia–4")—all experienced severe recessions. More than a decade later, three euro area economies—Greece, Ireland, and Portugal—became embroiled in sovereign debt crises in the wake of the global financial crisis, and one other in the euro area—Spain—faced strong funding pressures arising from banking sector problems. As a result, these four economies also experienced sharp economic downturns (the "stressed euro area–4"). Both the East Asian and the stressed euro area economies endured sizable external adjustments, though the current account swing in the former was much more abrupt than that in the latter (Figure 4.2.1).

The experiences of the two groups of economies share some important similarities and differences. Both groups experienced what appear to be permanent losses in output in the aftermath of their respective crises (Figure 4.2.2). By the end of 1998, average real output growth in the East Asia–4 had fallen to –10 percent, and during the Great Recession, average annual growth in the stressed euro area economies turned negative, falling to –4 percent in 2009.[1]

Yet the subsequent paths for output and current accounts in the two sets of economies have differed markedly. In the East Asia–4, output growth recovered relatively quickly, returning within a few years to rates closer to those observed before the crisis. In contrast, pressures from the region's sovereign debt crisis meant that activity in the stressed euro area economies contracted again in early 2011 and started to rebound only in the second half of 2013. As a result, output in the stressed euro area–4 remains firmly below 2006 projections and has yet to recover. Therefore, relative patterns in aggregate demand changes and expenditure switching could shed light on the differences in external adjustment.

In the East Asia–4, average real domestic demand growth plummeted to –18 percent in 1998 before recovering the following year (Figure 4.2.3). The corresponding drop in the stressed euro area economies was not as great, at about –6 percent in 2009.

Figure 4.2.1. Current Account Balances
(Percent of regional GDP)



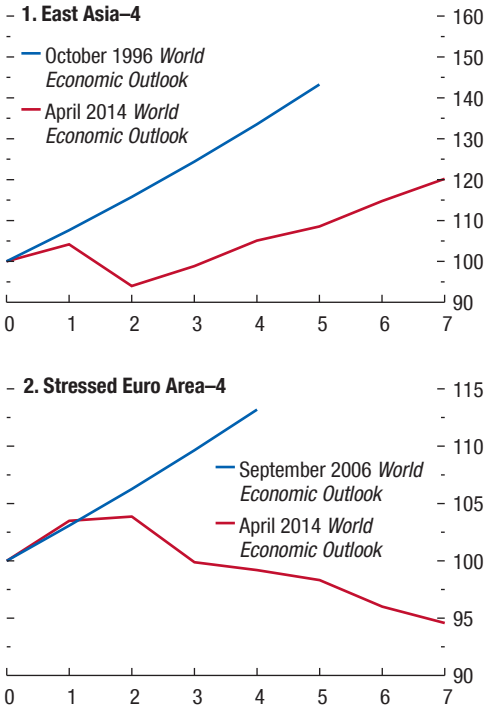
Source: IMF staff calculations.
Note: The horizontal axis depicts years, with year 0 being 1996 for the East Asia economies and 2006 for the stressed euro area economies. East Asia–4 = Indonesia, Korea, Malaysia, Thailand; stressed euro area–4 = Greece, Ireland, Portugal, Spain.

The author of this box is Aqib Aslam.

[1]The two groups shared two other important similarities when their respective crises struck, notably fixed or semifixed exchange rates and large current account deficits. Indonesia, Korea, and Thailand operated such exchange rate regimes before the crisis, and the stressed euro area group was subject to fixed exchange rates in respect to one another and their major regional trading partners. In the East Asia case, current account deficits were mainly associated with private sector overinvestment, creating downward pressure on the currencies in the region and encouraging speculative attacks. Current account imbalances in most of the stressed euro area economies were instead partly linked to fiscal imbalances.

Box 4.2 *(continued)*

Figure 4.2.2. Real GDP
(Index, year 0 = 100)



Source: IMF staff calculations.
Note: The horizontal axis depicts years, with year 0 being 1996 for the East Asia economies and 2006 for the stressed euro area economies. East Asia–4 = Indonesia, Korea, Malaysia, Thailand; stressed euro area–4 = Greece, Ireland, Portugal, Spain.

Figure 4.2.3. Real Domestic Demand Growth
(Percent)

Source: IMF staff calculations.
Note: The horizontal axis depicts years, with year 0 being 1996 for the East Asia economies and 2006 for the stressed euro area economies. East Asia–4 = Indonesia, Korea, Malaysia, Thailand; stressed euro area–4 = Greece, Ireland, Portugal, Spain.

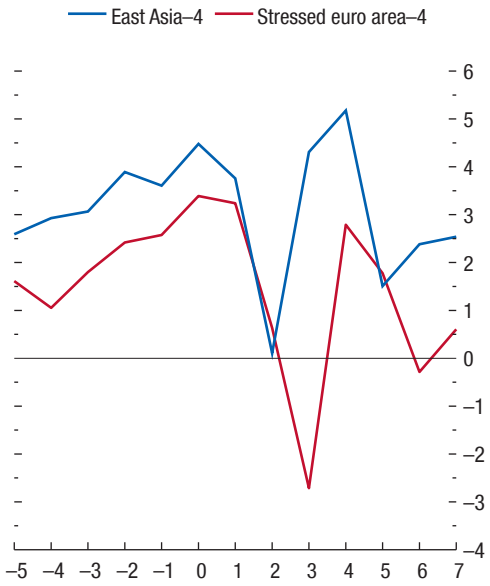
However, the protracted nature of the euro area crisis has meant that domestic demand in these economies has continued to shrink, on average, by slightly more than 3 percent per year since 2008. Furthermore, the average growth of external demand for the East Asia–4 was stronger than that for the stressed euro area–4. That strength boosted exports, which in turn improved the current account balance and economic growth. Indeed, real domestic demand among the major trading partners of the East Asia–4 grew during the postcrisis period (Figure 4.2.4). In contrast, the weak external demand for the four stressed euro area economies reflected the severity of the Great Recession and the anemic global recovery, an environment that made the external adjustment and growth recovery for that group much more challenging than for the East Asian economies.

Another key divergence in experiences is the extent of expenditure switching. Most of the economies in the East Asia–4 abandoned their de facto currency pegs soon after the crisis hit, experiencing sharp real depreciations that ranged from 15 percent to 50 percent (Figure 4.2.5).[2] By contrast, real effective exchange rate movements for the stressed euro area economies have been much smaller; the average real depreciation peaked at 2.5 percent in 2010 and then

[2]In most cases, these economies also resisted subsequent nominal and real currency appreciations by accumulating reserves to replenish their depleted stocks of foreign exchange reserves.

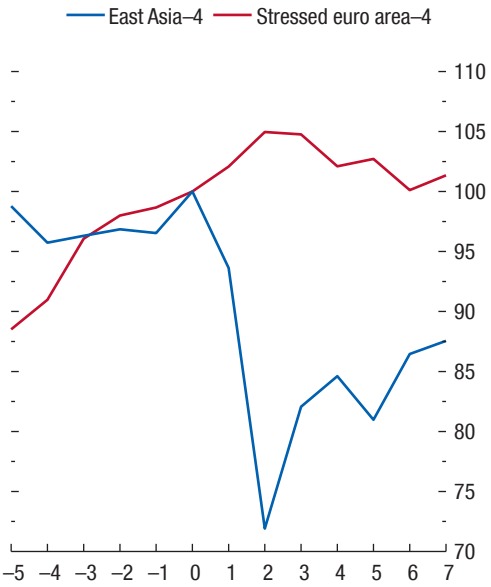
Box 4.2 *(continued)*

Figure 4.2.4. Real External Demand Growth
(Percent)



Source: IMF staff calculations.
Note: The horizontal axis depicts years, with year 0 being 1996 for the East Asia economies and 2006 for the stressed euro area economies. The figure depicts the weighted average of real domestic demand for trading partners of each country. East Asia–4 = Indonesia, Korea, Malaysia, Thailand; stressed euro area–4 = Greece, Ireland, Portugal,Spain.

Figure 4.2.5. Real Effective Exchange Rates (CPI Based)
(Index, year 0 = 100)



Source: IMF staff calculations.
Note: CPI = consumer price index. The horizontal axis depicts years, with year 0 being 1996 for the East Asia economies and 2006 for the stressed euro area economies. East Asia–4 = Indonesia, Korea, Malaysia, Thailand; stressed euro area–4 = Greece, Ireland, Portugal, Spain.

again in 2012. Instead, these economies have had to rely on slow and painful internal wage and price declines to improve their competitiveness.

These relative differences in the effects of demand compression and switching on external balances can be traced through the changes in saving, investment, and the trade balance. In both episodes, the reduction in domestic demand manifested itself as a sharp contraction in investment. For instance, in East Asia, the abrupt collapse in investment in response to the capital flow reversal led to a marked improvement in current account balances. Broadly similar patterns were observed for the stressed euro area economies, although the decline in investment was more moderate and protracted.

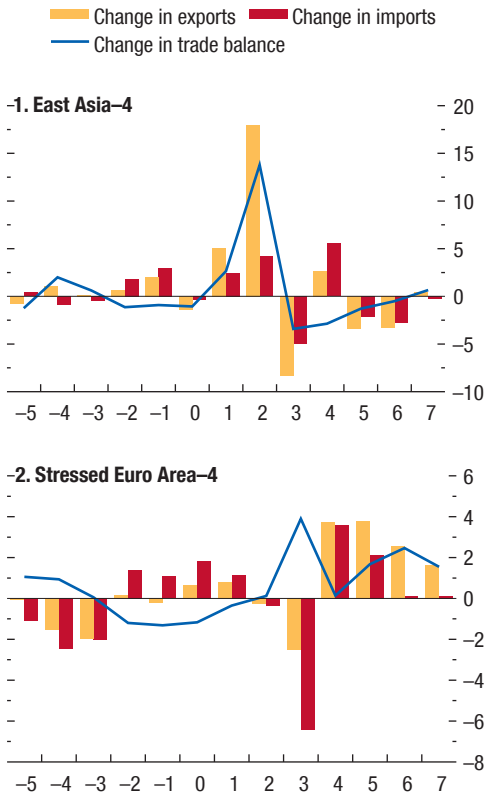
The marked improvement in East Asian trade balances reflects both the effects of demand compression on imports (a decrease) and the effects of demand switching on exports (an increase) and imports (a further decrease) (Figures 4.2.6 and 4.2.7). The improved trade balance was complemented by stronger exports resulting from buoyant external demand. In contrast, the improvement in the stressed euro area–4's trade balance has been largely due to the effects of demand compression on imports and the drag on exports from a weak external environment. With insufficient expenditure switching, exports have only recently returned to precrisis levels for the region on average (see Figure 4.2.7).

When both expenditure reduction and expenditure switching are at work, external adjustment can clearly

Box 4.2 *(continued)*

Figure 4.2.6. Exports and Imports as a Share of GDP

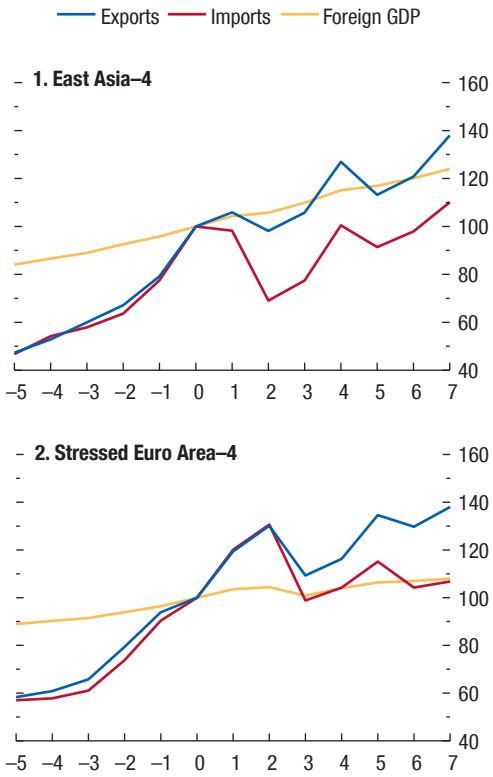
(Percent of regional GDP)



Sources: IMF, Balance of Payments Statistics database; and IMF staff calculations.
Note: The horizontal axis depicts years, with year 0 being 1996 for the East Asia economies and 2006 for the stressed euro area economies. East Asia–4 = Indonesia, Korea, Malaysia, Thailand; stressed euro area–4 = Greece, Ireland, Portugal, Spain.

Figure 4.2.7. Real Exports, Imports, and Foreign GDP

(Index, year 0 = 100)



Sources: IMF, Balance of Payments Statistics database; and IMF staff calculations.
Note: The horizontal axis depicts years, with year 0 being 1996 for the East Asia economies and 2006 for the stressed euro area economies. East Asia–4 = Indonesia, Korea, Malaysia, Thailand; stressed euro area–4 = Greece, Ireland, Portugal, Spain.

be substantially quicker and potentially less painful. For the East Asian economies, in which both those mechanisms were in play, current account imbalances corrected sharply within two years of the genesis of the crisis. In contrast, it has taken the stressed euro area economies seven years to move to surpluses. However, sudden stops wreaked far greater havoc on the financial systems and output of the East Asia–4 than did the financial and sovereign debt crises on the economies of the stressed euro area, a difference partly reflecting the automatic stabilizers that operated within the Economic and Monetary Union.

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