

*Private fixed investment in advanced economies contracted sharply during the global financial crisis, and there has been little recovery since. Investment has generally slowed more gradually in the rest of the world. Although housing investment fell especially sharply during the crisis, business investment accounts for the bulk of the slump, and the overriding factor holding it back has been the overall weakness of economic activity. In some countries, other contributing factors include financial constraints and policy uncertainty. These findings suggest that addressing the general weakness in economic activity is crucial for restoring growth in private investment.*

The disappointing performance of private fixed investment has featured prominently in the public policy debate in recent years.<sup>1</sup> As Chapter 3 suggests, the low level of private investment since the crisis has already contributed to the drop in potential output growth in numerous economies. In some countries, weak business investment has contrasted with the ebullience of stock markets, suggesting a possible disconnect between financial and economic risk taking, as discussed in the October 2014 *Global Financial Stability Report*. A number of proposals aimed at encouraging firms to increase capital spending have been made.<sup>2</sup>

However, there is little consensus as to what lies behind the weakness. Some view it as a symptom of the generally weak economic environment. For

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<sup>1</sup>“Fixed investment” refers to investment in physical assets, for example, equipment and structures (in contrast, for example, to investments in labor, ongoing operating expenses, materials, or financial assets), as well as intellectual property products (for example, expenditures for research and development and other rights providing long-lasting service to businesses). Throughout the chapter, “investment” refers specifically to fixed investment.

<sup>2</sup>These include, for example, the European Commission’s proposal to establish the European Fund for Strategic Investments, which is based on risk sharing between the public and private sectors.

example, Chinn (2011) and Krugman (2011) suggest that U.S. private investment has, if anything, been stronger since the crisis began than might have been expected based on the weakness in economic activity. Others suggest that private investment has been weaker than can be explained by output, highlighting the role of special impediments. The European Investment Bank (2013) concludes that the most important immediate cause of low investment in Europe has been uncertainty. Buti and Mohl (2014) highlight the roles of reduced public investment, financial fragmentation, and heightened uncertainty in constraining private investment in the euro area. A study by the Organisation for Economic Co-operation and Development (Lewis and others 2014) finds that, although it has been a major factor, low output growth since the crisis cannot fully account for the investment weakness in some of the major advanced economies, including France, Germany, Japan, and the United States. How should policymakers interpret the weakness of private investment?

To contribute to the policy debate, and to put some of the findings of recent studies into global perspective, this chapter focuses on the following five questions:

- Is there a global slump in private investment? Which economies have seen the weakest private investment performance since the crisis?
- Is the sharp slump in advanced economy private investment due just to weakness in housing, or is it broader? How has the performance of residential investment compared with that of other categories of investment, and how do the findings vary across economies?
- How much of the slump in business investment reflects weakness in economic activity? In particular, how much of the slump in business investment compared with precrisis forecasts is explained by the weakness in output?
- Which businesses have cut back more on investment? What does this imply about which channels—beyond output—have been relevant in explaining weak investment?

- Is there a disconnect between financial markets and firms' investment decisions? Have firms responded unusually weakly to stock market incentives?

To address these questions, the chapter reviews the recent evolution of private investment in both advanced and emerging market and developing economies. Focusing on advanced economies, where the weakness in private investment has been most striking, the chapter assesses how broad based the slump in investment has been by comparing residential and nonresidential investment. It then investigates how much of the weakness in private nonresidential investment can be explained by the weakness in output. To provide additional insights into what factors, beyond output, have held back investment, the chapter investigates which types of firms have cut back most on investment using a “difference-in-difference” empirical approach. Finally, the chapter assesses, using standard “Tobin’s Q” models of investment, whether financial market valuations and profitability have become disconnected from firms’ investment decisions.

The chapter’s main findings are as follows:

- The sharp contraction in private investment during the crisis, and the subsequent weak recovery, have primarily been a phenomenon of the advanced economies. For these economies, private investment has declined by an average of 25 percent since the crisis compared with precrisis forecasts, and there has been little recovery. In contrast, private investment in emerging market and developing economies has gradually slowed in recent years, following a boom in the early to mid-2000s.
- The investment slump in the advanced economies has been broad based. Though the contraction has been sharpest in the private residential (housing) sector, nonresidential (business) investment—which is a much larger share of total investment—accounts for the bulk (more than two-thirds) of the slump.<sup>3</sup> There is little sign of recovery toward precrisis investment trends in either sector.
- The overall weakness in economic activity since the crisis appears to be the primary restraint on business investment in the advanced economies. In surveys, businesses often cite low demand as the dominant factor. Historical precedent indicates that business investment has deviated little, if at all, from what could be expected given the weakness in economic activity in recent years. Deviations from this pattern have typically been small in relation to the overall loss in investment—at most one-fifth of the total loss since the crisis—and not statistically significant. The analysis here employs a novel empirical strategy that addresses concerns regarding reverse causality running from investment to output, as well as more conventional “accelerator” models of investment. Although the proximate cause of lower firm investment appears to be weak economic activity, this itself is due to many factors. And it is worth acknowledging that, as explained in Chapter 3, a large share of the output loss compared with precrisis trends can now be seen as permanent.
- Beyond weak economic activity, there is some evidence that financial constraints and policy uncertainty play an independent role in retarding investment in some economies, including euro area economies with high borrowing spreads during the 2010–11 sovereign debt crisis. Additional evidence comes from the chapter’s firm-level analysis. In particular, firms in sectors that rely more on external funds, such as pharmaceuticals, have seen a larger fall in investment than other firms since the crisis. This finding is consistent with the view that a weak financial system and weak firm balance sheets have constrained investment. Regarding the effect of uncertainty, firms whose stock prices typically respond more to measures of aggregate uncertainty have cut back more on investment in recent years, even after the role of weak sales is accounted for. This finding is consistent with the view that, given the irreversible and lumpy nature of investment projects, uncertainty has played a role in discouraging investment.
- Finally, regarding the apparent disconnect between buoyant stock market performance and relatively restrained investment growth in some economies, the chapter finds that this too is not unusual. In line with much existing research, it finds that the relationship between market valuations and business investment is positive but weak. Nevertheless, there is some evidence that stock market performance is a leading indicator of future investment, implying that if stock markets remain buoyant, business investment could pick up.

<sup>3</sup>Public investment constitutes less than 20 percent of total (private and public) investment in the advanced economies. Although public investment has also declined in a number of these economies in recent years (see Chapter 3 in the October 2014 *World Economic Outlook*), after initially rising on the back of fiscal stimulus, the contraction in total investment has been largely driven by private investment.

## Is There a Global Slump in Private Investment?

The sharp contraction in private investment during and since the global financial crisis combined with the subsequent weak recovery is largely an advanced economy phenomenon (Figure 4.1). For advanced economies as a whole, private investment during 2008–14 declined by 25 percent compared with forecasts made in early 2007, before the onset of the crisis.<sup>4</sup> The weakness in investment is evident across almost all advanced economies, although some economies saw a limited contraction in private investment and a more rapid recovery, due, for example, to mining and energy booms, as in Australia, Canada, and Norway (Figure 4.2).

To check whether the results are driven by the impact of any immediate precrisis boom or faltering, the analysis is repeated based on deviations relative to forecasts made in 2004, three years before the start of the crisis. For advanced economies, the estimated slump is similar in almost all cases.<sup>5</sup> This slump also shows up when outturns are compared to long-term historical trends in private investment calculated over the period 1990–2004. It also emerges when ratios of private investment to GDP, which have declined relative to long-term historical averages in advanced economies, are considered.

Investment has slowed more gradually in the emerging market and developing economies as a whole than in the advanced economies, and from unusually high levels. The recent slowdown follows a period of rapid growth during the boom years of the mid-2000s. Private investment remains broadly in line with forecasts made in the early 2000s. However, relative to forecasts made at the height of the boom, as in 2007, there has been a slowdown. Contributing factors vary by region but include lower commodity prices, spillovers from weak demand abroad, and tighter domestic and external financial conditions (Box 4.1).

The striking underperformance of private investment in advanced economies provides a rationale for

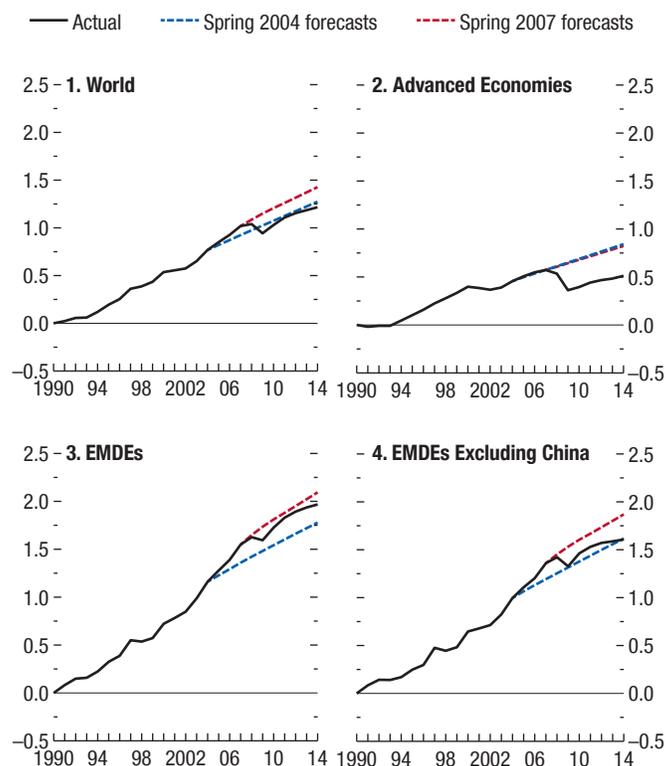
<sup>4</sup>The forecasts for private investment used here come from Consensus Economics' *Consensus Forecasts*. When this source is not available, forecasts from the IMF's *World Economic Outlook* are used instead.

<sup>5</sup>For Iceland, the measured slump is substantially deeper based on a comparison with the 2007 forecast rather than the 2004 forecast, which reflects the rapid growth and upward revisions in growth forecasts in the boom years preceding the crisis.

**Figure 4.1. Real Private Investment**

(Log index, 1990 = 0)

Private fixed investment in advanced economies contracted sharply during the crisis, and there has been little recovery since. The investment slowdown in the rest of the world has generally been more gradual and from unusually high levels.



Sources: Consensus Economics; IMF, Fiscal Monitor database; and IMF staff estimates.

Note: The figure presents data, where available, for the country groups as defined in the WEO Statistical Appendix. EMDEs = emerging market and developing economies.

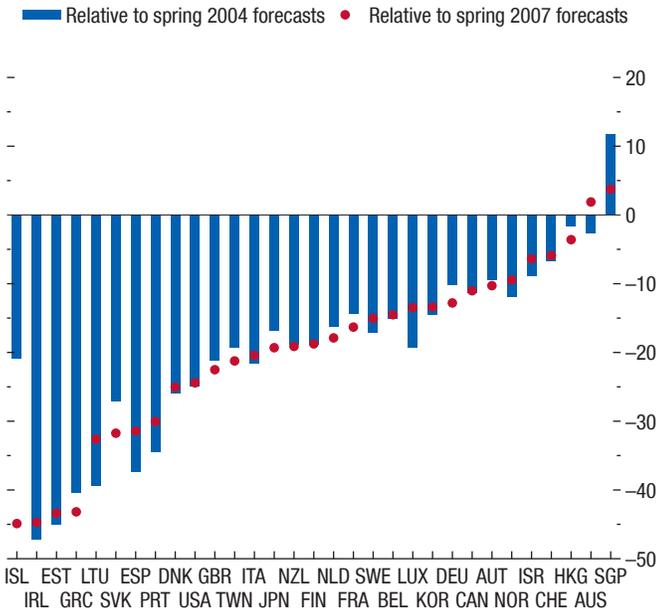
focusing on these economies for the remainder of the chapter.

## Is the Slump in Private Investment Due to Housing or Is It Broader?

The weakening of fixed investment in the advanced economies has been broad based, with both residential (housing) and nonresidential (business) investment showing little sign of recovery (Figure 4.3). Residential private investment has contracted most sharply, but it is business investment, given its much larger share in total investment, that accounts for the bulk (more than two-thirds) of the investment slump (Figures 4.4

**Figure 4.2. Real Private Investment, 2008–14**  
(Average percent deviation from precrisis forecasts)

The weakness in investment is evident across most advanced economies, with few exceptions.



Sources: Consensus Economics; IMF, Fiscal Monitor database; and IMF staff estimates.  
Note: Data labels in the figure use International Organization for Standardization (ISO) country codes.

and 4.5).<sup>6</sup> Within business investment, both structures and equipment and software categories have contracted relative to precrisis trends.<sup>7</sup> This development is worrying, because business investment is considered to be a particularly productive contribution to the capital stock (Kopcke 1993) and thus essential for supporting the economy’s future productive capacity and competitiveness. At the same time, despite the slump, the share of equipment investment in total private investment has been rising (Figure 4.5), in part reflecting its declining relative price and the rising rate of capital depreciation (Summers 2014).

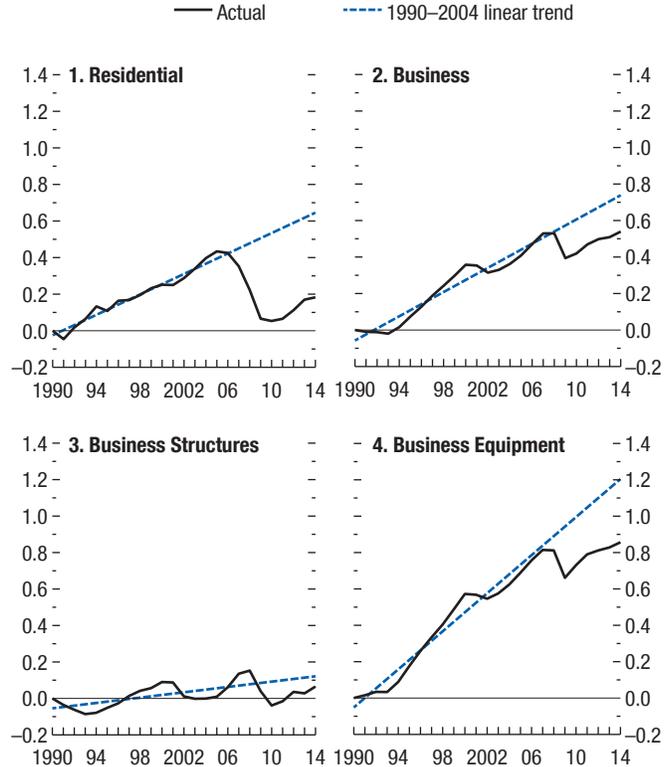
Public investment has made a relatively small direct contribution, relative to private investment, to the recent slump in total investment (Figure 4.5). A 2009–10 uptick in public investment in the United

<sup>6</sup>Given the lack of separate forecasts for residential investment and different categories of nonresidential investment, the analysis compares the evolution of these categories of investment relative to precrisis linear trends estimated for 1990–2004.

<sup>7</sup>See Annex 4.1 for the methodology used to calculate these contributions.

**Figure 4.3. Categories of Real Fixed Investment**  
(Log index, 1990 = 0)

The investment slump has been broad based, with both residential (housing) and nonresidential (business) investment showing little sign of recovery.



Sources: Haver Analytics; national authorities; and IMF staff calculations.  
Note: The figure presents data for 28 advanced economies: Australia, Austria, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Israel, Italy, Japan, Korea, Latvia, Luxembourg, Malta, Netherlands, New Zealand, Norway, Portugal, Singapore, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom, United States.

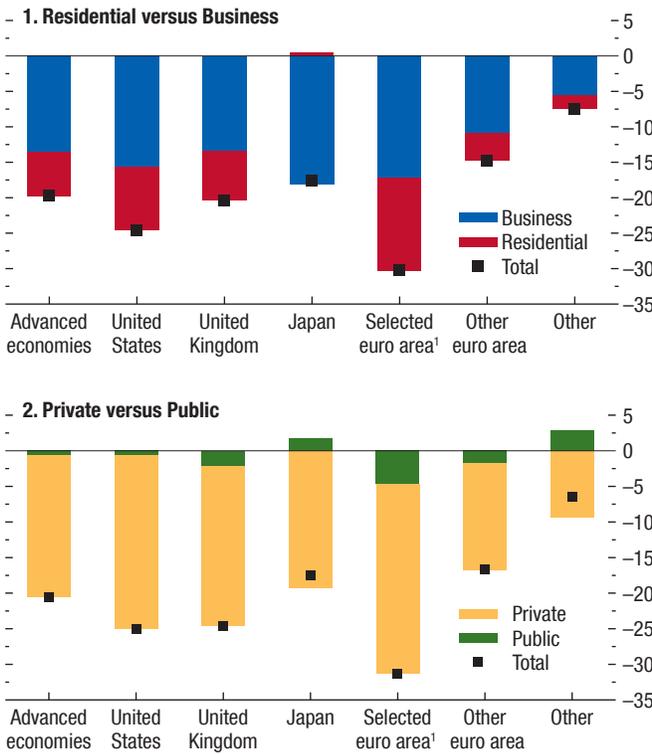
States and elsewhere resulting from fiscal stimulus was only a brief interlude in a long and gradual decline that started decades before the crisis (Figure 4.5). As discussed in Chapter 3 in the October 2014 *World Economic Outlook*, declining public investment can also reduce economic activity and private investment. This constitutes an additional indirect effect of public investment on total investment that is not captured by the accounting decomposition in Figure 4.5.

### How Much of the Slump in Business Investment Reflects Weak Economic Activity?

Devising policies to encourage a recovery in business investment requires a clear diagnosis of its weakness.

**Figure 4.4. Decomposition of the Investment Slump, 2008–14**  
(Average percent deviation from spring 2007 forecasts)

Residential investment fell especially sharply, but business investment accounts for the bulk of the slump, given its much larger share in total investment. The direct contribution of public investment to the recent slump was relatively small.

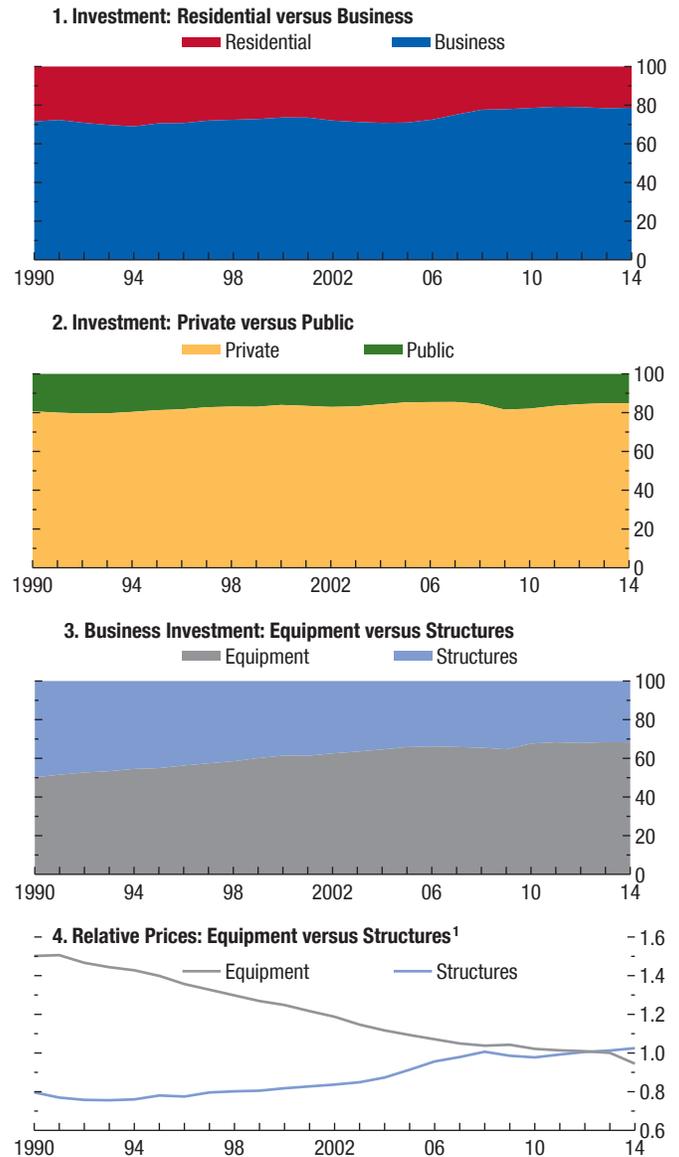


Sources: Consensus Economics; Haver Analytics; IMF, Fiscal Monitor database; national authorities; and IMF staff estimates.  
 Note: The figure presents data for 28 advanced economies: Australia, Austria, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Israel, Italy, Japan, Korea, Latvia, Luxembourg, Malta, Netherlands, New Zealand, Norway, Portugal, Singapore, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom, United States.  
<sup>1</sup>Euro area economies (Greece, Ireland, Italy, Portugal, Spain) with high borrowing spreads during the 2010–11 sovereign debt crisis.

Has investment been undermined primarily by the prevailing weak economic environment, or are special impediments at work? If weak investment is mainly a symptom of weak sales, calls for supporting aggregate demand, including through macroeconomic policies, could be justified. But if the weakness in investment is not well explained by the slow growth in economic activity and, instead, other obstacles are holding it back, those obstacles must be removed before investment can make a sustained recovery. The discussion of these questions here focuses on business investment—the largest component of private investment and that which accounts for most of the investment slump.

**Figure 4.5. Shares and Relative Prices of Investment Categories**  
(Percent of total fixed investment, unless noted otherwise)

The share of equipment investment in total private investment has been rising, in part reflecting its declining relative price. An uptick in public investment in 2009–10 on the back of fiscal stimulus was only a brief interlude in a decline that started well before the crisis.



Sources: Haver Analytics; IMF, Fiscal Monitor database; national authorities; and IMF staff calculations.  
 Note: The figure presents data for 28 advanced economies: Australia, Austria, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Israel, Italy, Japan, Korea, Latvia, Luxembourg, Malta, Netherlands, New Zealand, Norway, Portugal, Singapore, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom, United States.  
<sup>1</sup>Relative price is calculated as the ratio of the investment category deflator to the overall GDP deflator.

How might weak economic activity cause business investment to decline? A standard implication of theoretical models is that firms reduce investment when opportunities for selling their products are limited. A weak current and prospective economic climate and, hence, low current and expected sales are thus likely to deter firms from investing in new capital. Weak product demand can also hamper investment through the “financial accelerator” channel, in which credit markets amplify and propagate both real and monetary shocks across the economy.<sup>8</sup> For instance, a drop in sales may damage a firm’s financial position, constraining its ability to repay loans and borrow to finance further investment.

This section starts by assessing whether the recent comovement of investment and output has been unusual by historical standards. The next step is to quantify the influence of weak economic activity on the poor performance of investment. In both of these subsections, the analysis focuses on a panel of advanced economies. Finally, the section complements the broad cross-country assessment with country-specific estimates of the amount of business investment “explained” and “unexplained” by output.

### Has the Comovement of Business Investment and Output Been Unusual since the Crisis?

Previous recessions have generated various patterns for the relative paths of investment and output. These patterns are natural antecedents for benchmarking the joint evolution of investment and output following the global financial crisis. There is a consensus that the fall in investment during and since the crisis has, in general, been much worse than in previous recessions. However, it is important to place this fall in the context of how output behaved.

To conduct an assessment of this, the chapter compares investment and output after historical recessions relative to their respective forecasts published in the spring issues of Consensus Economics’ *Consensus Forecasts* and the IMF’s *World Economic Outlook* in the year of each recession. This method of computing the contraction in investment is similar to that used

<sup>8</sup>The inverse relationship between the external finance premium—the difference between the cost to a borrower of raising funds externally and the opportunity cost of internal funds—and the financial position of the borrowing firm creates a channel through which otherwise short-lived economic shocks may have long-lasting effects. See Bernanke, Gertler, and Gilchrist 1996.

in the previous section for quantifying the deviation in investment from its precrisis forecasts.<sup>9</sup> Based on the availability of data, including for the forecasts, the sample covers 27 advanced economies.

According to this analysis, investment contracted more severely following the global financial crisis than in historical recessions (Figure 4.6). For advanced economies as a whole, weighted by GDP, business investment declined by 20 percent relative to precrisis forecasts, on average, during the six years after the start of the global financial crisis. For those advanced economies that experienced banking crises, the decline was even larger, about 22 percent, whereas the drop for advanced economies that avoided banking crises was about 16 percent.<sup>10</sup> In contrast, the decline in investment during the six years following historical recessions averaged 10 percent.

However, the contraction in output was also much more severe than in historical recessions, implying a broadly normal comovement of investment and output. The relative response of investment was, overall, two to three times greater than that of output in previous recessions, and this relative response was similar in the current context (Figure 4.6).<sup>11</sup> If anything,

<sup>9</sup>The starting dates of recessions are identified according to the Harding and Pagan 2002 algorithm of output peaks and troughs, as computed by Claessens, Kose, and Terrones 2012. The latter work identifies the start of recessions with quarterly data. The present analysis, which uses annual data, takes the start of a recession to be the beginning of the year that includes the starting quarter of the recession. For example, a recession starting in the fourth quarter of 1990 is assumed here to start in 1990. Annex 4.1 provides the sources used to compile the chapter’s data on investment.

<sup>10</sup>These two groups are based on the data set of banking crises of Laeven and Valencia 2012, according to which 19 advanced economies had a banking crisis between 2007 and the publication of that study: 13 of these are classified as having experienced a “systemic banking crisis” (Austria, Belgium, Denmark, Germany, Greece, Iceland, Ireland, Latvia, Luxembourg, Netherlands, Spain, United Kingdom, United States) and 6 as “borderline cases” (France, Italy, Portugal, Slovenia, Sweden, Switzerland). The study found that 13 advanced economies did not experience banking crises during that period: Australia, Canada, the Czech Republic, Estonia, Finland, Israel, Japan, Korea, Lithuania, New Zealand, Norway, Singapore, and the Slovak Republic.

<sup>11</sup>These results are robust to the method of measuring the contraction of investment and output after the crisis and after historical recessions. In particular, while the baseline result that investment contracts by two to three times as much as output is based on deviations from precrisis and prerecession forecasts, the result is similar when the deviations are computed relative to univariate (local projection method) forecasts. More generally, the finding that investment contracts by two to three times as much as output is consistent with research showing that investment varies relatively strongly in response to overall economic conditions. Relatedly, since investment is more volatile than output, a decline in the investment-to-GDP

investment dipped slightly less relative to the output contraction than in previous recessions.

At the same time, the endogenous nature of investment and output—that is, the simultaneous feedback from output to investment and then back to output—complicates the interpretation of these results. The findings on the relative movement of investment and output suggest that nothing unusual occurred. But to shed light on whether the weakness in investment was mainly a *symptom* of weak economic activity, an estimate that addresses the issue of reverse causality is needed.<sup>12</sup>

### How Much Is Explained by Output? Insights Based on Instrumental Variables

This subsection investigates the extent to which weak economic activity has contributed to the decline in business investment using a simple but novel approach based on instrumental variables. The approach estimates the historical relationship between investment and output based on macroeconomic fluctuations not triggered by a contraction in business investment. The chapter focuses on changes in fiscal policy motivated primarily by the desire to reduce the budget deficit and not by a response to the current or prospective state of the economy.<sup>13</sup>

The results from this exercise are then used to predict the contraction in investment that would have been expected to occur after 2007 based on the observed contraction in output.<sup>14</sup> This predicted decline in investment after 2007 is then compared with the actual decline in investment to assess whether investment has been unusually weak given its historical relation with output—in other words, whether the actual decline exceeds the predicted decline. If the

ratio following the crisis does not necessarily suggest that investment has fallen by more than can be explained by output weakness.

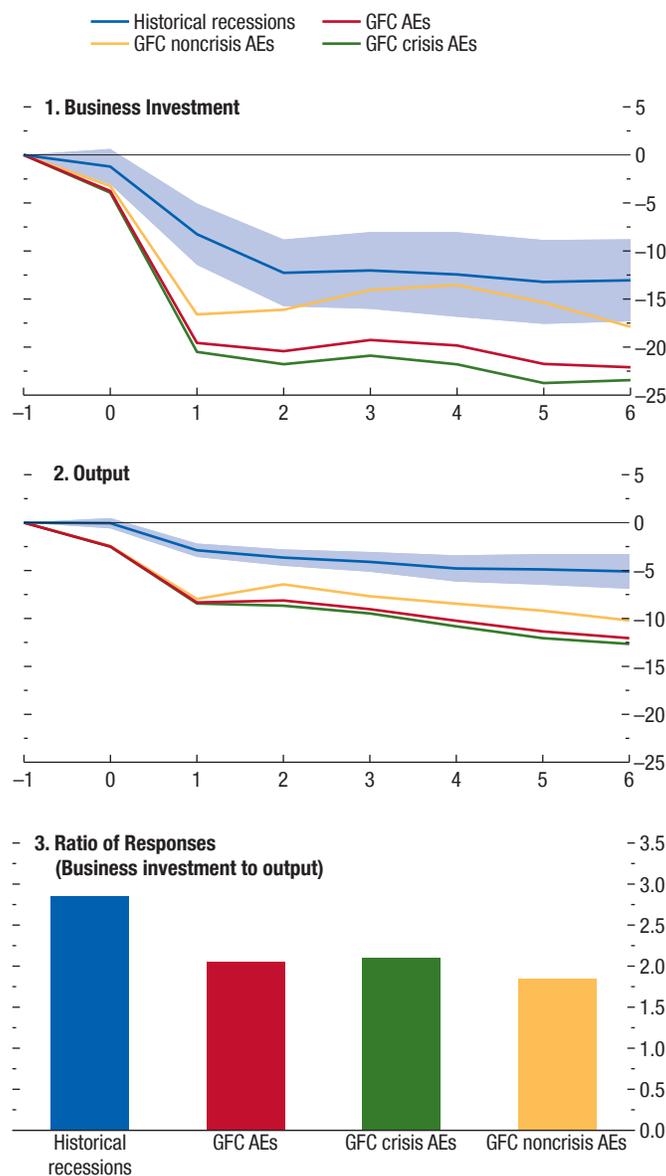
<sup>12</sup>It is worth clarifying that the finding that the recent comovement of investment and output in advanced economies has been broadly normal is not inconsistent with the observation, highlighted in Box 1.2 in the October 2014 *World Economic Outlook*, that negative errors in the forecast for investment account for more than half of the recent negative forecast errors for output growth. Owing to the generally high volatility of investment relative to output, investment also accounted for more than half of the negative errors in the growth forecast during the precrisis period.

<sup>13</sup>To assess the robustness of the results, the chapter also considers an alternative source of fluctuations not triggered by business investment: recessions associated with housing slumps (Annex 4.3).

<sup>14</sup>As before, the contraction in output is measured as the deviation of actual real GDP from the precrisis forecasts published in the spring 2007 issues of Consensus Economics' *Consensus Forecasts* and the IMF's *World Economic Outlook*.

**Figure 4.6. Real Business Investment and Output Relative to Forecasts: Historical Recessions versus Global Financial Crisis**  
(Percent deviation from forecasts in the year of recession, unless noted otherwise; years on x-axis, unless noted otherwise)

Real business investment has contracted more severely following the global financial crisis than in historical recessions. But the contraction in output has also been more severe than after prior recessions. Overall, investment has dipped slightly less relative to the output contraction than in previous recessions.



Sources: Consensus Economics; Haver Analytics; national authorities; and IMF staff estimates.

Note: For historical recessions,  $t = 0$  is the year of recession. Deviations from historical recessions (1990–2002) are relative to spring forecasts in the year of the recession. Recessions are as identified in Claessens, Kose, and Terrones 2012. For the global financial crisis (GFC),  $t = 0$  is 2008. Deviations are relative to precrisis (spring 2007) forecasts. Shaded areas denote 90 percent confidence intervals. Panels 1 and 2 present data for the advanced economies (AEs) listed in Annex Table 4.1.1. GFC crisis and noncrisis advanced economies are as identified in Laeven and Valencia 2012.

contraction in output during that period was driven by a contraction in business investment, then the decline in investment should have been greater than predicted by the historical investment-output relationship based on output fluctuations *not* triggered by business investment.

The chapter estimates the historical investment-output relationship using fiscal policy changes aimed at reducing budget deficits for a sample period ending in 2006. The series of fiscal policy changes—policy-induced government spending reductions or tax increases—is “narrative” in nature. They come from Devries and others 2011, which examines contemporaneous policy documents for 17 Organisation for Economic Co-operation and Development economies to identify changes in fiscal policy motivated by a desire to reduce budget deficits rather than to counteract current and prospective economic conditions. As reported in Guajardo, Leigh, and Pescatori 2014, these narrative fiscal policy changes are found to be uncorrelated with the state of the economy. In the context of this chapter, it is reassuring that they are also uncorrelated with lagged business investment.<sup>15</sup> Such policy changes provide a source of output fluctuations not primarily triggered by a contraction in business investment and are thus appropriate for isolating the effect of output on investment.

The resulting estimated investment-output relationship implies that a 1 percent decline in output is associated with a 2.4 percent decline in investment.<sup>16</sup> This estimated relationship is then considered in conjunction with the actual deviation of output from its precrisis forecast since 2007 to provide an idea of how investment would have been expected to evolve after the crisis, given the change in output.

<sup>15</sup>A regression of the fiscal shocks on lagged business investment yields a slope coefficient near zero with a *p*-value of 32 percent.

<sup>16</sup>The estimation results are obtained via two-stage least-squares regression. The equation estimated is

$$\Delta \ln I_{i,t} = \alpha_i + \lambda_t + \beta \{\text{Instrumented } \Delta \ln Y_{i,t}\} + \rho \Delta \ln I_{i,t-1} + \varepsilon_{i,t}$$

in which *i* denotes the *i*th country, and *t* denotes the *t*th year;  $\Delta \ln I_{i,t}$  is the change in (log) real business investment; and  $\Delta \ln Y_{i,t}$  is the change in (log) real GDP. The equation controls for the lagged value of the investment term, given that investment projects can be spread over time, and includes a full set of country ( $\alpha_i$ ) and time ( $\lambda_t$ ) fixed effects. As reported in Annex Table 4.3.1, the first-stage regression results indicate that the narrative fiscal shocks have explanatory power for real GDP growth (the *F*-statistic on the excluded instrument has a *p*-value below 0.01 percent [one one-hundredth of 1 percent] and is above 15). The second stage yields an estimate for  $\beta$  of 2.4 that is statistically significant at the 1 percent level. The predicted path of investment relative to forecast based on the path of output relative to forecast is defined as  $\ln I_{i,t} - F_{i,2007} \ln I_{i,t} = \beta (\ln Y_{i,t} - F_{i,2007} \ln Y_{i,t})$ , in which  $F_{i,2007}$  denotes the spring 2007 forecast.

The analysis suggests that the bulk of the slump in business investment since the crisis reflects the weakness in economic activity (Figure 4.7). For advanced economies as a whole, the predicted fall in business investment since the crisis, which averages 21 percent, in GDP-weighted terms is close to the actual path of investment. The actual decline of investment, which averages 20 percent, falls well inside the 90 percent confidence interval of the prediction. Thus, little of the observed decline in investment remains unexplained after the expected effects of the output decline are taken into consideration. The finding of little unexplained weakness in investment also holds when advanced economies are divided into broad subgroups comprising those that experienced a banking crisis after 2007 and those that did not.

To check whether the results are driven by the impact of any immediate precrisis boom or faltering, the analysis is repeated based on deviations relative to forecasts made in 2004, three years before the start of the crisis. As reported in Annex 4.3, the results are similar, and they also hold up to additional robustness tests. In each case, there is little evidence, if any, of investment being weaker than would be expected.

Overall, these results are consistent with the view that the weakness in business investment in advanced economies is, on the whole, primarily a symptom of weak economic activity. However, although the proximate cause of lower firm investment since the crisis appears to be weak economic activity, this weakness itself is due to many factors, including financial factors.

## Country-Specific Insights

The results reported thus far for groups of advanced economies could hide specific cases of unexplained weakness in business investment beyond what could be expected based on economic activity. This subsection therefore presents estimates of how much investment weakness can be explained by output dynamics based on investment models estimated at the individual-country level.

The analysis is based on the conventional accelerator model of investment, which is applied to a sample of 19 advanced economies. A key assumption is that firms adjust their capital stock gradually toward a level that is proportional to output. In addition, firms are assumed to invest to replace capital that depreciates over time. Based on these assumptions, the theory predicts that investment should respond positively to current and lagged changes in output and to the

lagged capital stock.<sup>17</sup> The empirical literature has found strong support for this model, as in Oliner, Rudebusch, and Sichel 1995 and Lee and Rabanal 2010 for the United States, and, more recently, in IMF 2014a and Barkbu and others 2015 for European economies.<sup>18</sup> Depending on data availability and the economy in question, the sample starts between the first quarter of 1990 and the second quarter of 2000 and ends in the third quarter of 2014.<sup>19</sup>

Overall, the country-specific results confirm the earlier finding of little unexplained weakness in investment in recent years. Figure 4.8 reports the actual and predicted values for business investment for France, Germany, Japan, and the United States.<sup>20</sup> The actual and predicted values for investment are close to one another, and departures from the predicted level are typically inside the model's 90 percent confidence interval.<sup>21</sup> The model thus appears to account well

<sup>17</sup>Jorgenson and Siebert (1968) provide a derivation of the accelerator model. Based on the theory underlying the model, the empirical specification typically estimated is as in Oliner, Rudebusch, and Sichel 1995:

$$I_t = \alpha + \sum_{i=0}^N \beta_i \Delta K_{t-i}^* + \delta K_{t-1},$$

in which  $I_t$  denotes real business investment and  $\Delta K_t^*$  denotes the change in the desired capital stock, which, in turn, is assumed to be proportional to the change in output:  $\Delta K_t^* = \zeta \Delta Y_t$ . To alleviate reverse-causality concerns, a typical approach involves dropping the contemporaneous value of the change in output. The analysis here includes 12 lags of the changes in output ( $N = 12$ ), also a conventional choice. It also follows the literature in normalizing the equation by the lagged capital stock,  $K_{t-1}$ , to address concerns of nonstationarity, and computing standard errors using the Newey-West procedure with a lag truncation parameter of 3, a conventional choice for samples of this size. The estimation results can be found in Annex Table 4.5.1.

<sup>18</sup>See IMF 2014b and IMF 2014c for further country-specific analysis of private investment in European economies.

<sup>19</sup>For a number of economies, available data for the business capital stock are limited, constraining the size of the sample. Given that constraint, the analysis is conducted on an "in-sample" basis, using the full sample ending in 2014. However, for the eight economies in the sample with data starting in 1990, thus covering at least two business cycles, the analysis is also repeated, for the purposes of robustness, on an "out-of-sample" basis, based on data ending in 2006 (Annex Figure 4.5.1 and Annex Table 4.5.2).

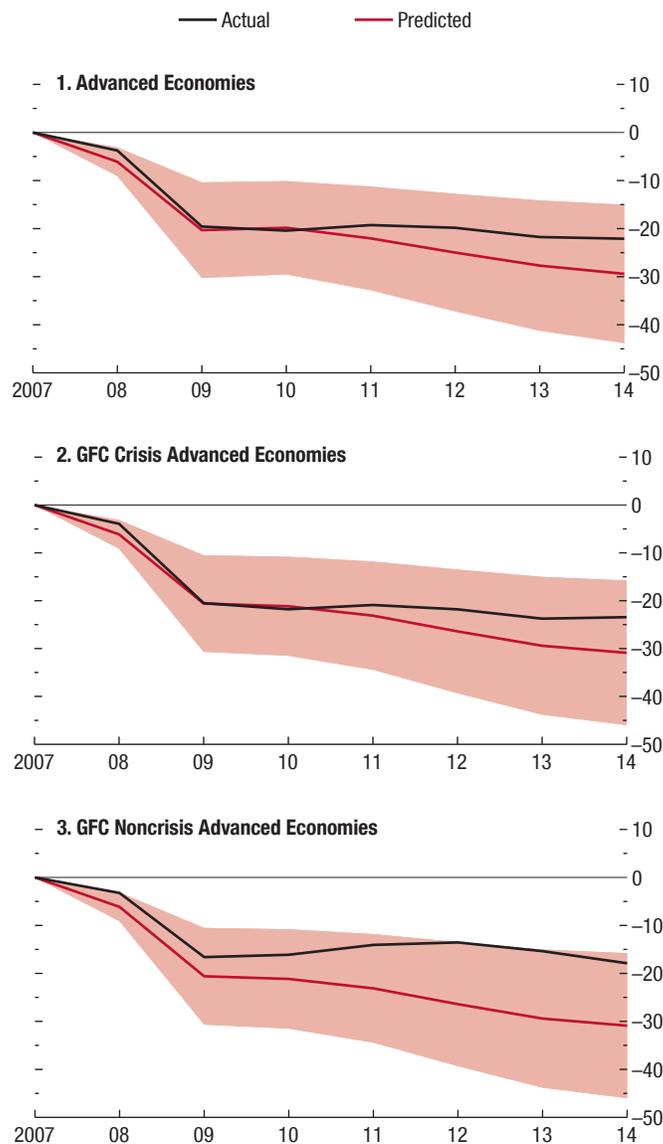
<sup>20</sup>The model yields predicted values for the investment rate (investment as a share of the previous period's capital stock). Figure 4.8 rescales the fitted values by the lagged capital stock to obtain predicted values for the level of investment. To put the residuals into perspective, the figure also reports the actual level of investment and the precrisis forecast, which comes from Consensus Economics' April 2007 *Consensus Forecasts* or, when this is unavailable, the April 2007 *World Economic Outlook*.

<sup>21</sup>As reported in Annex Figure 4.5.2, the result of a close fit between the actual and predicted values of business investment also holds when the baseline specification is augmented to include the user cost of capital.

**Figure 4.7. Real Business Investment: Actual and Predicted Based on Economic Activity**

(Percent deviation of investment from spring 2007 forecasts)

The bulk of the slump in business investment since the crisis reflects the weakness in economic activity. For broad groups of advanced economies, there is little unexplained investment.

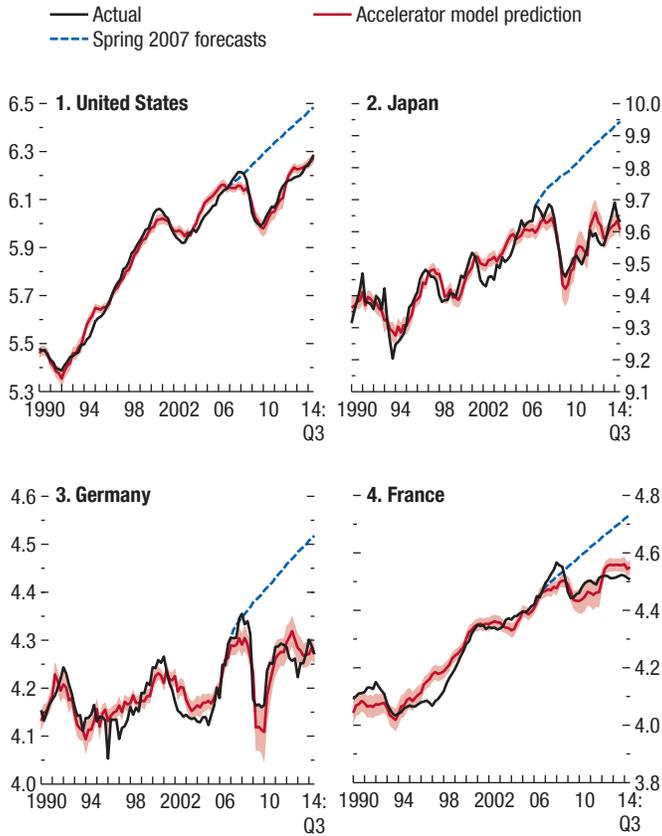


Sources: Consensus Economics; Haver Analytics; national authorities; and IMF staff estimates.

Note: Prediction based on investment-output relationship estimates reported in Annex Table 4.3.1 and postcrisis decline in output relative to precrisis (spring 2007) forecasts. Shaded areas denote 90 percent confidence intervals. Global financial crisis (GFC) and noncrisis advanced economies are as identified in Laeven and Valencia 2012.

**Figure 4.8. Accelerator Model: Real Business Investment (Log index)**

Actual business investment has been close to the level predicted by the accelerator model since the crisis.

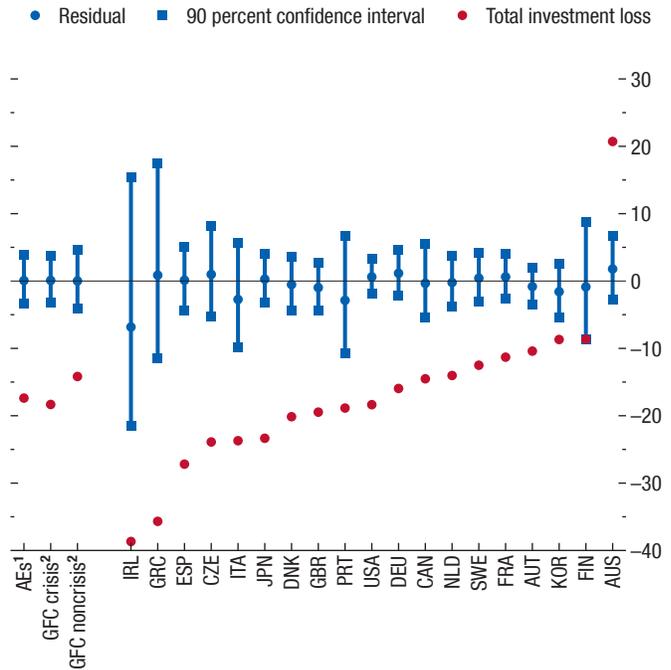


Sources: Consensus Economics; Haver Analytics; national authorities; and IMF staff estimates.  
 Note: Accelerator model predictions for investment are obtained by multiplying the predicted value for the investment rate by the lagged capital stock. Shaded areas denote 90 percent confidence intervals, based on the Newey-West estimator.

for the weakness of investment relative to precrisis forecasts, which are also indicated in Figure 4.8. The model also generally provides a close fit for the other economies in the sample, with residuals typically not statistically distinguishable from zero and accounting for, at most, one-fifth of the total loss in investment relative to precrisis forecasts for the 2008–14 period (Figure 4.9). Furthermore, these results are consistent with those presented in the previous subsection. Figure 4.9 provides GDP-weighted averages of these country-specific results for the advanced economies in the sample, and these results show little evidence of unexplained investment weakness.

**Figure 4.9. Real Business Investment: Accelerator Model Residuals and Investment Losses Relative to Precrisis Forecasts, 2008–14 (Percent)**

The model generally provides a close fit, with residuals typically not statistically distinguishable from zero and accounting for, at most, one-fifth of the total loss relative to forecasts for 2008–14 made prior to the global financial crisis.



Sources: Consensus Economics; Haver Analytics; national authorities; and IMF staff estimates.  
 Note: Total investment loss denotes average deviations of actual investment from precrisis (spring 2007) forecasts. Residuals denote average deviations of actual investment from accelerator model predictions. Data labels in the figure use International Organization for Standardization (ISO) country codes.  
 119 advanced economies as reported in the figure.  
 2Global financial crisis (GFC) and noncrisis advanced economies are as identified in Laeven and Valencia 2012.

At the same time, the analysis reveals a few cases of investment weakness during 2011–14 that are not explained by the model. In particular, for euro area economies with high borrowing spreads during the 2010–11 sovereign debt crisis, actual real investment falls 7 percent short of the level implied by the accelerator model, on average, during 2011–14, although the gap is not always statistically significant (Figure 4.10). To put these residuals into context, recall that the slump in investment relative to precrisis forecasts has averaged about 40 percent a year since the crisis. And during 2008–10, investment was above the predicted level

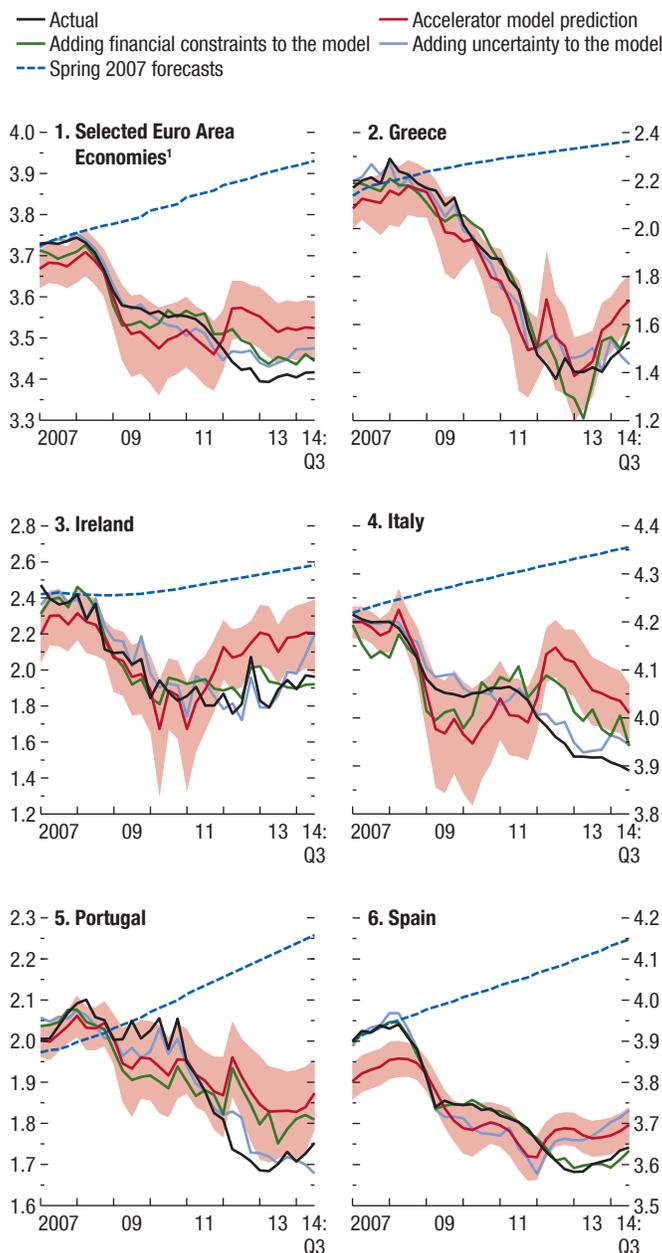
for these economies by about 4 percent, on average, although the deviation was not statistically significant.<sup>22</sup>

To investigate what may lie behind these cases of unexplained investment weakness, the analysis considers two factors that have been emphasized in the policy debate: financial constraints and policy uncertainty. Firms with financial constraints face difficulties expanding business investment because they lack funding resources to do so, regardless of their business perspectives. Here, financial constraints are measured as the percentage of respondents in the European Commission's Business and Consumer Surveys that identify such constraints as a factor limiting their business production.<sup>23</sup> Uncertainty about the economic outlook can discourage investment because of the lumpy and irreversible nature of investment projects. It is measured here by Baker, Bloom, and Davis's (2013) index of policy uncertainty, which is based on newspaper coverage of policy-related economic uncertainty.<sup>24</sup> When these variables are added directly to the estimated model, the analysis can reveal their independent influence—beyond their role via output—on investment.<sup>25</sup>

The results are consistent with the view that, for some economies, financial constraints and policy uncertainty have played a role beyond output in impeding investment in recent years. For euro area economies with high borrowing spreads during the 2010–11 sovereign debt crisis, adding these variables to the accelerator model reduces the degree of unexplained investment. Figure 4.10 shows the results of

**Figure 4.10. Selected Euro Area Economies: Accelerator Model—Role of Financial Constraints and Policy Uncertainty (Log index)**

For some euro area economies, there are cases of unexplained investment weakness during 2011–14, with evidence of financial constraints and policy uncertainty playing a role beyond output in impeding investment. Earlier in the crisis, investment was above the level predicted for these economies.



Sources: Consensus Economics; Haver Analytics; national authorities; and IMF staff estimates.

Note: Fitted values for investment are obtained by multiplying fitted values for the investment rate by the lagged capital stock. Shaded areas denote 90 percent confidence intervals, based on the Newey-West estimator.

<sup>1</sup>Euro area economies (Greece, Ireland, Italy, Portugal, Spain) with high borrowing spreads during the 2010–11 sovereign debt crisis.

<sup>22</sup>Investment across Greece, Ireland, Italy, Portugal, and Spain averaged some 1.1 percent of GDP less than the model's prediction during 2011–14 and some 0.6 percent of GDP more than the model's prediction during 2008–10.

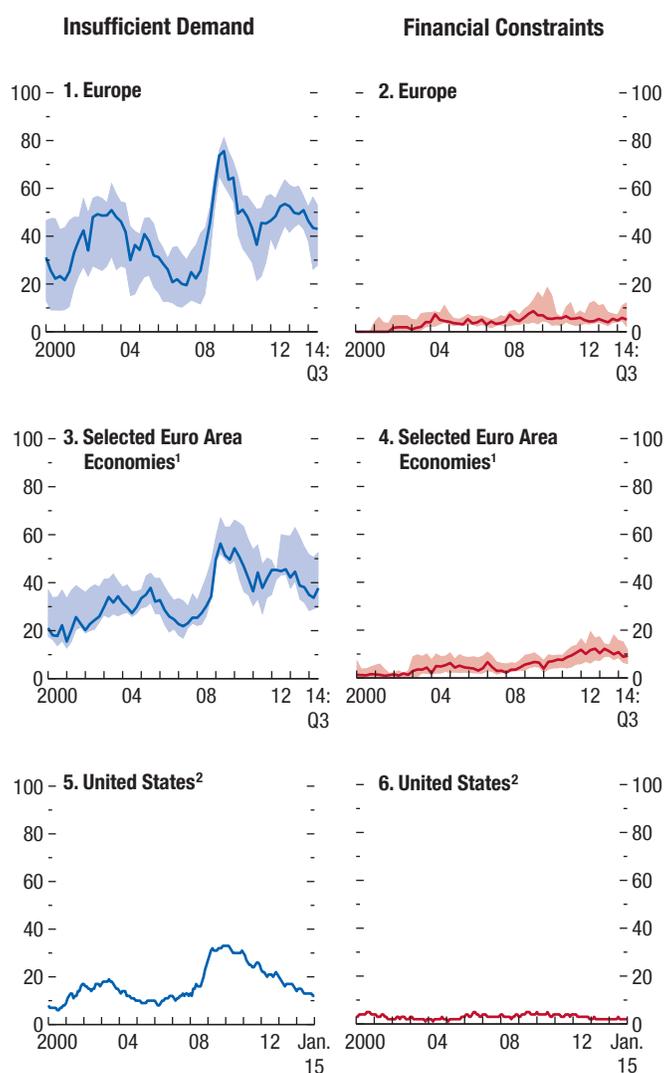
<sup>23</sup>These surveys ask respondents to identify what factors, if any, are limiting their production. Although survey-based variables have their limitations, the variable in principle reflects the role of both borrowing costs and quantitative restrictions on borrowing (credit rationing). To make it easier to interpret the regression results, the variable is normalized by subtracting the mean, for each economy, and dividing by the standard deviation. The index thus has a mean of 0 and a standard deviation of 1.

<sup>24</sup>As explained by Baker, Bloom, and Davis (2013), the index quantifies newspaper coverage of terms related to economic policy uncertainty (Annex 4.1). The index also incorporates information on the extent of disagreement among professional forecasters about the future path of policy-relevant macroeconomic variables such as inflation and government budget balances. It may thus reflect uncertainty about the overall economic outlook.

<sup>25</sup>The normal influence of both variables on investment through output would already be captured in the baseline model estimated previously.

**Figure 4.11. Firm Survey Responses: Factors Limiting Production**  
(Percent)

In surveys, businesses cite insufficient customer demand as the dominant factor.



Sources: European Commission, Business and Economic Surveys; National Federation of Independent Business, *Small Business Economic Trends*; and IMF staff calculations.

Note: Solid lines in the figure report the median percentage of survey respondents across countries in the group, indicating that demand and financial constraints, respectively, have been a factor limiting production; shaded areas show the dispersion across countries (25th and 75th percentiles of the sample).

<sup>1</sup>Euro area economies (Greece, Ireland, Italy, Portugal, Spain) with high borrowing spreads during the 2010–11 sovereign debt crisis.

<sup>2</sup>Percentage of small businesses surveyed by the National Federation of Independent Business reporting “poor sales” (blue line) or “financial and interest rate” (red line) as the single most important problem they are facing; three-month moving average.

adding these variables, one at a time, to the baseline model. The underlying regression coefficient estimates also typically have the expected negative sign and are statistically significant, although they are not always economically significant.<sup>26</sup> These mixed results reflect the inherent difficulty of disentangling the independent roles of these economy-wide variables, as well as the small number of observations for each country since the crisis for which the financial constraints and uncertainty data are available.

Overall, the results in this section indicate that the bulk of the slump in business investment since the crisis reflects the weakness in output and are consistent with the view that the weakness in investment is primarily a symptom of the weak economic environment. The results are also in line with surveys of firms, which often indicate that a lack of customer demand is the dominant factor constraining their production (Figure 4.11). There is also some suggestive evidence that financial constraints and policy uncertainty play a role in certain economies. However, identifying the effect of these factors is challenging based on macroeconomic data, particularly given the limited number of observations for each country since the crisis. Therefore, the next section turns to firm-level data for a clearer assessment of whether financial constraints and policy uncertainty have held back investment since the crisis.

### Which Firms Have Cut Back More on Investment? The Roles of Financial Constraints and Policy Uncertainty

To provide additional insights into what factors, beyond aggregate economic activity, have held back investment since the crisis, this section investigates which types of firms have cut back most on investment in recent years. The focus is on the roles of financial constraints and policy uncertainty, for which the analysis in the previous section provides suggestive evidence. In particular, this section investigates whether reduced credit availability has caused lower firm investment, after the effect of sales and

<sup>26</sup>As reported in Annex Table 4.5.3, the coefficient estimates imply that a one standard deviation rise in the financial constraints variable is associated with a decline in the investment rate (investment as a share of the previous year’s capital stock) by 0 to 1.1 percentage points of the capital stock. A one standard deviation rise in the policy uncertainty variable is associated with a decline in the investment rate by 0 to 0.4 percentage point of the capital stock. To put these estimates into context, note that the investment rate for Greece, Ireland, Italy, Portugal, and Spain averages 2.3 percent of the capital stock.

other factors on investment is allowed for. It also investigates whether periods of elevated uncertainty have played an independent role in reducing firm investment.

Using firm-level data has notable advantages. The large number of observations allows the analysis to control for a profusion of factors affecting investment, including through the use of fixed effects at the firm, industry-year, and country-year levels. This analysis uses annual data for 27,661 firms across 32 advanced economies for 2000–13 based on annual data from Thomson Reuters Worldscope.<sup>27</sup>

At the same time, the use of firm-level data comes with a number of caveats. Since the data in Thomson Reuters Worldscope cover publicly listed firms only, the results of the analysis do not necessarily apply to whole economies, including to unlisted small and medium-sized enterprises. In addition, the data on firm-level investment are based on total capital expenditure, both in the domestic economy and abroad. In this context, however, it is reassuring that the sum of investment by all firms in the data set is correlated with domestic business investment from the national accounts.<sup>28</sup> This suggests that the results obtained in this section for the listed firms in the sample are relevant for firms more generally.

### The Role of Financial Constraints

To shed light on the role of constrained credit availability in holding back investment, this subsection investigates whether, in recent banking crises, firms in more financially dependent sectors have seen a larger drop in investment than those in other sectors.

The methodology is similar to the “difference-in-difference” approach of Dell’Ariccia, Detragiache, and Rajan (2008), who investigate the impact of previous banking crises (during 1980–2000) on firm production in both advanced and emerging market economies. The

premise of this difference-in-difference approach is that if a reduction in credit availability plays a role in depressing investment when a banking crisis occurs, then industries that rely more on external funds would be expected to cut investment more than other sectors. It is worth acknowledging that, while this difference-in-difference approach is well suited to analyzing factors that explain differential performance across different firms following banking crises, it does not directly quantify economy-wide effects.

The analysis in this subsection covers the 2000–13 period, focusing on advanced economies, which means that the bulk of the banking crises in the sample are those that have occurred since 2007. Unlike in the research of Dell’Ariccia, Detragiache, and Rajan (2008), the focus here is on firm investment rather than firm production. Following the literature, a firm’s dependence on external finance is measured by the fraction of its investment not financed through internal funds.<sup>29</sup> An example of a sector among those most dependent on external finance would be drugs and pharmaceuticals; one of the least dependent on external finance would be beverages.

The estimation results are consistent with the view that a contraction in credit availability in recent banking crises played a role in reducing business investment. In particular, as reported in Table 4.1, more

<sup>29</sup>The estimated equation has the firm’s investment rate (capital expenditure as a share of the previous year’s capital stock) as the dependent variable on the left side. On the right side, the explanatory variable of interest is the level of financial dependence interacted with a variable indicating whether the economy is experiencing a banking crisis. The equation estimated is

$$\frac{I_{ijk,t}}{K_{ijk,t-1}} = \beta \text{Financial Dependence}_{j,t} \times \text{Banking Crisis}_{k,t} + \sum_i \gamma_i x_{ijk,t} + \alpha_i + \sum_{k,t} \lambda_{k,t} d_{k,t} + \sum_{j,t} \phi_{j,t} d_{j,t} + \varepsilon_{ijk,t},$$

in which  $i$  denotes the  $i$ th firm,  $j$  denotes the  $j$ th sector, and  $k$  denotes the  $k$ th country. The equation also controls for two key firm-level factors included in the  $x$  terms: the level of sales and Tobin’s  $Q$  in the previous period. Following the literature, Tobin’s  $Q$  is calculated using Thomson Reuters Worldscope data as the sum of the market value of equity and the book value of debt divided by the book value of assets. Finally, as already mentioned, the equation controls for firm fixed effects ( $\alpha_i$ ) and industry-year ( $d_{j,t}$ ), and country-year ( $d_{k,t}$ ) fixed effects. As in the pioneering work of Rajan and Zingales (1998), the analysis assumes that a firm’s dependence on external finance is an intrinsic feature of its industrial sector. Annex 4.2 provides details on how the sector-level approximation of a firm’s intrinsic dependence on external finance is computed. Standard errors are clustered at the three-digit-sector-country-year level. The results of the analysis are similar if the Banking Crisis dummy is lagged by one year and if the sample is limited to years from 2006 onward.

<sup>27</sup>Data are obtained from Thomson Reuters Worldscope on the balance sheets, cash flows, and income statements for all listed nonfinancial companies.

<sup>28</sup>On average, according to the firm-level data, investment by the firms in the data set amounts to 37 percent of total (economy-wide) business investment for the 2000–13 period. Reassuringly, however, as reported in Annex Table 4.2.1, total business investment and the sum of firm-level investment are correlated. In particular, a 1 percent rise in total business investment is associated with, on average, a 0.8 percent rise in the sum of firm-level investment. The finding of an almost one-for-one relationship between economy-wide business investment and firm-level investment holds for various sample splits, and after controlling for country and time fixed effects.

**Table 4.1. Firm-Level Evidence: Financial Constraints Channel**

	(1)	(2)	(3)
Dependent variable: Ratio of firm investment to lagged capital			
Bank Crisis × Financial Dependence	-0.024*** (0.007)	-0.023*** (0.007)	-0.026*** (0.008)
Recession × Financial Dependence			0.008 (0.006)
Sales-to-Lagged-Capital Ratio		0.008*** (0.000)	0.008*** (0.000)
Lagged Tobin's Q		0.042*** (0.002)	0.042*** (0.002)
Fixed Effects			
Firm	Y	Y	Y
Sector × Year	Y	Y	Y
Country × Year	Y	Y	Y
Number of Observations	161,073	160,239	160,239
R <sup>2</sup>	0.03	0.13	0.13

Sources: Haver Analytics; national authorities; Thomson Reuters Worldscope; and IMF staff calculations.

Note: The table presents results from a panel regression with fixed effects at the firm, sector-year, and country-year levels. Bank crisis dates are as identified in Laeven and Valencia 2012. Recession dates are taken from Claessens, Kose, and Terrones 2012. Standard errors are in parentheses.

\*\*\* $p < .01$ .

financially dependent sectors invest significantly less than less-dependent sectors during banking crises. In banking crises, more financially dependent sectors (those in the top 25 percent of the external dependence distribution) see a fall in the investment rate—capital expenditure as a share of the previous year's capital stock—about 1.6 percentage points larger than that of less financially dependent sectors (those in the lowest 25 percent of the external dependence distribution).<sup>30</sup> This differential amounts to about 10 percent of the sample median investment rate of 16 percent.<sup>31</sup>

Figure 4.12 provides a simple illustration of this finding by reporting the evolution of investment for firms in the highest 25 percent and the lowest 25 percent of the external dependence distribution for all

advanced economies since 2007. Given the lack of precrisis forecasts for investment in individual sectors, the results are reported as deviations from a univariate forecast of investment.<sup>32</sup> The figure suggests that by 2009, investment had dropped by 50 percent, relative to the forecast, among firms in more financially dependent sectors—about twice as much as for those in less financially dependent sectors. During 2009–10, the difference between the two groups of firms is statistically significant. In more recent years, however, the difference between the two groups declines, until by 2013 it is no longer apparent.

The effect of banking crises on firm investment discussed thus far could, in principle, reflect the normal response of firms' balance sheets to a recession rather than special impediments due to a weak financial sector. Many banking crises coincide with recessions, during which low sales result in weak firm balance sheets, which could induce firms that are more dependent on external finance to invest disproportionately less.

To distinguish the effect of such balance sheet effects owing to recession from the specific effect of banking crises, the analysis allows for separate differential effects during recessions and during banking crises.

<sup>30</sup>As Table 4.1 reports, the coefficient on the interaction of financial dependence and banking crisis is estimated to be  $-0.02$ , which implies that increasing the level of financial dependence from the lowest 25 percent to the top 25 percent of the distribution—an increase of 0.8 unit in the index—reduces the investment rate by 1.6 percentage points ( $-0.02 \times 0.8 \times 100$ ). The estimate is strongly statistically significant (at the 1 percent level) and robust to the inclusion of firm-level controls in the specification, in addition to the set of fixed effects already mentioned.

<sup>31</sup>These results may be influenced by "survivorship bias," which would bias the analysis against finding evidence of a role for financial constraints. In particular, firms that experienced the most severe financial constraints during the crisis and ceased operating are, by definition, excluded from the sample. Despite their exclusion, the analysis still finds significant effects of financial constraints, suggesting that the true effects of such constraints may be larger than reported here.

<sup>32</sup>In particular, the figure reports impulse responses based on Jordà's (2005) local projection method, as described in Annex 4.4. For the purposes of this illustration, the analysis does not control for county-year, sector-year, or firm fixed effects, or for any other sectoral features of firms, which might contribute to the impact of other channels through financial dependence.

When both effects are allowed for, the estimated effect of banking crises remains unchanged relative to the baseline estimate, suggesting that the results reflect disruptions in credit supply due to banking crises (Table 4.1).<sup>33</sup> Although this chapter does not further investigate the separate roles of weak firm balance sheets and impaired credit supply, a growing number of studies do so and suggest that both channels have been relevant.<sup>34</sup>

### The Role of Policy Uncertainty

To shed light on the role of uncertainty in holding back investment, this subsection investigates whether investment in sectors that are more sensitive to uncertainty is lower during times of elevated economy-wide uncertainty.

The approach is analogous to the difference-in-difference approach adopted in the last subsection. The premise is that if the uncertainty channel is important in suppressing investment, this should be reflected in a relatively worse performance, during times of high economy-wide uncertainty, of those sectors more sensitive to uncertainty compared with those sectors that are less sensitive to uncertainty. A firm's sensitivity to economy-wide uncertainty is measured by the usual correlation of its stock return with economy-wide uncertainty, after the overall market return is controlled for.<sup>35</sup> Economy-wide uncertainty is, in turn,

<sup>33</sup>Following Dell'Ariccia, Detragiache, and Rajan (2008), the chapter distinguishes between these two effects by adding an interaction term to the baseline equation estimated: Financial Dependence<sub>*j*</sub> × Recession<sub>*k,t*</sub>. As reported in Table 4.1, the coefficient on this term is found to be statistically indistinguishable from zero, while the coefficient on the key variable of interest, Financial Dependence<sub>*j*</sub> × Banking Crisis<sub>*k,t*</sub>, is unchanged and remains statistically significant.

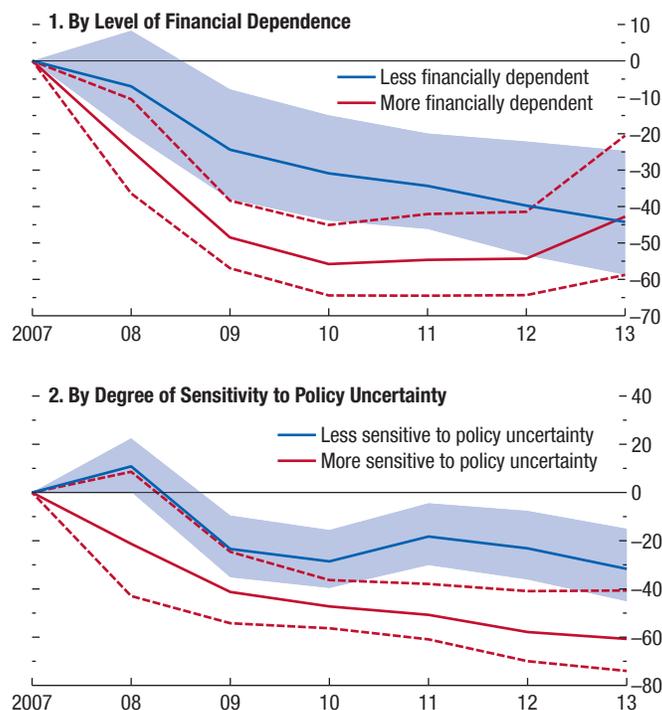
<sup>34</sup>For example, Kalemli-Ozcan, Laeven, and Moreno (forthcoming) investigate the separate roles of weak corporate balance sheets, corporate debt overhang, and weak bank balance sheets in hindering investment in Europe in recent years using a firm-level data set on small and medium-sized enterprises in which each firm is matched to its bank. They find that all three of these factors have inhibited investment in small firms but that corporate debt overhang (defined by the long-term debt-to-earnings ratio) has been the most important.

<sup>35</sup>As before, the estimated equation has the firm's investment rate as the dependent variable on the left side. On the right side, the explanatory variable of interest is the level of uncertainty sensitivity interacted with the level of stock market volatility. The equation estimated is

$$\frac{I_{ijk,t}}{K_{ijk,t-1}} = \beta \text{Uncertainty Sensitivity}_{j,t} \times \text{Volatility}_{k,t} + \sum_l \gamma_l x_{ijk,t} + \alpha_i + \sum_{k,t} \lambda_{k,t} d'_{k,t} + \sum_{j,t} \phi_{j,t} d'_{j,t} + \epsilon_{ijk,t}$$

**Figure 4.12. Firm Investment since the Crisis, by Firm Type**  
(Percent; impulse responses based on local projection method)

Firms in sectors that are more financially dependent cut investment more sharply than other firms, particularly early in the crisis. Firms in sectors that are more sensitive to policy uncertainty also reduced investment by more than other firms.



Sources: Thomson Reuters Worldscope; and IMF staff calculations.  
Note: Less (more) financially dependent and less (more) sensitive firms are those in the lowest (highest) 25 percent of the external dependence and news-based sensitivity distributions, respectively, as described in the chapter. Shaded areas (less dependent/sensitive) and dashed lines (more dependent/sensitive) denote 90 percent confidence intervals. Sample includes all advanced economies except Cyprus, Latvia, Malta, and San Marino.

based on Baker, Bloom, and Davis's (2013) news-based measures of economic policy uncertainty, used in the analysis earlier in the chapter. Intuitively, sectors that emerge as the most sensitive to uncertainty include those that could plausibly be expected to have particularly lumpy and irreversible investment decisions, such

in which the same set of additional controls is included as before. The level of aggregate stock market volatility in country *k* in year *t* (Volatility<sub>*k,t*</sub>) is here measured as the standard deviation of weekly returns of the country-level stock market index. Stock market volatility moves closely with the economy-wide policy uncertainty index constructed by Baker, Bloom, and Davis (2013). The uncertainty sensitivity measure is at the sector level and is time invariant. It is estimated based on a precrisis sample spanning 2000–06.

**Table 4.2. Firm-Level Evidence: Policy Uncertainty Channel**

	(1)	(2)	(3)
Dependent variable: Ratio of firm investment to lagged capital			
Market Volatility × Policy Uncertainty Sensitivity	-0.010* (0.006)	-0.028*** (0.008)	-0.017** (0.008)
Bank Crisis × Financial Dependence		-0.024*** (0.007)	-0.023** (0.007)
Sales-to-Lagged-Capital Ratio			0.008*** (0.000)
Lagged Tobin's Q			0.042*** (0.002)
Fixed Effects			
Firm	Y	Y	Y
Sector × Year	Y	Y	Y
Country × Year	Y	Y	Y
Number of Observations	202,211	160,476	159,645
R <sup>2</sup>	0.03	0.03	0.13

Sources: Haver Analytics; national authorities; Thomson Reuters Worldscope; and IMF staff calculations.

Note: The table presents results from a panel regression with fixed effects at the firm, sector-year, and country-year levels. Market volatility is measured as the standard deviation of weekly returns of the country-level stock market index. Policy uncertainty sensitivity is based on Baker, Bloom, and Davis's (2013) news-based measures of economic policy uncertainty. Bank crisis dates are as identified in Laeven and Valencia 2012. Standard errors are in parentheses.

\* $p < .10$ ; \*\* $p < .05$ ; \*\*\* $p < .01$ .

as, for example, concrete work; those least sensitive include, for example, veterinary services.<sup>36</sup>

The estimation results are broadly consistent with the view that a rise in economy-wide uncertainty causes firms to invest less. In particular, as reported in Table 4.2, sectors that are more sensitive to uncertainty experience a larger fall in investment relative to less sensitive sectors during times of high economy-wide uncertainty. The results are economically and statistically significant. They imply that, during spikes in economy-wide stock market volatility (in the top 10 percent of episodes, which generally corresponds to 2008–09 in the sample), investment in those sectors more sensitive to uncertainty (those in the top 25 percent of the distribution) falls by 1.3 percentage points more than investment in the less sensitive sectors (those in the lowest 25 percent). This differential amounts to about 8 percent of the median investment rate of 16 percentage points (1.3/16).<sup>37</sup>

<sup>36</sup>As is the case for the sector-specific financial dependence index used earlier, the estimation of sector-specific uncertainty sensitivity is computed for the United States and applied to other economies. In particular, the median firm-level coefficient for each sector obtained for the United States is applied to all other economies.

<sup>37</sup>As Table 4.2 reports, the coefficient on the interaction of news-based uncertainty sensitivity and realized stock market volatility is estimated to be  $-0.02$ . The estimate is strongly statistically significant (at the 1 percent level) and robust to the inclusion of additional firm-level controls in the specification, as well as the set of fixed effects already mentioned. The estimate implies that during spikes in economy-wide uncertainty to the top 10 percent of the distribution

Panel 2 of Figure 4.12 provides a simple illustration of this finding by reporting the evolution of investment for firms in the highest 25 percent and the lowest 25 percent of the uncertainty sensitivity distribution for all advanced economies since 2007.<sup>38</sup> It suggests that by 2011, investment had dropped by about 50 percent, relative to the forecast, in sectors more sensitive to uncertainty—more than twice as much as in less sensitive sectors. During 2011–12, the difference between the two groups of firms is statistically significant. After that, however, the difference between the two groups wanes.

Overall, the results based on firm-level data confirm that, beyond weak aggregate economic activity, there is some evidence that financial constraints and policy uncertainty have played independent roles in retarding investment.

(a volatility above 4.46), firms that are in the more sensitive sectors (top 25 percent of the distribution) should have substantially less investment than those in the less sensitive sectors (in the lowest 25 percent of the distribution). In particular, moving from the lowest 25 percent of firms to the top 25 percent of firms, in terms of sensitivity, a difference of 0.14 units in the index, implies a reduction in the investment rate of 1.3 percentage points ( $-0.02 \times 0.14 \times 4.46 \times 100$ ).

<sup>38</sup>As before, the figure reports impulse responses based on the local projection method.

## Have Firms' Investment Decisions Become Disconnected from Profitability and Financial Market Valuations?

Despite the steady recovery in stock markets since the crisis, investment has remained subdued. This apparent divergence between economic and financial risk taking has already been highlighted in the October 2014 *Global Financial Stability Report*. The question is whether business investment has somehow become detached from growing expectations of future profitability, as captured by the stronger performance of equity markets.

To address this question, this section uses the Tobin's Q model of investment. According to the theory underpinning this model, developed by Tobin (1969) and formalized by Mussa (1977) and Abel (1983), firms should invest in capital to the point at which the marginal product of capital equals its user cost. In other words, if the return from an extra unit of capital is greater than its cost, additional investment is warranted. This return-to-cost ratio has come to be known as "Tobin's Q" (or "marginal Q") and is typically approximated by the ratio of a firm's stock market valuation to the replacement cost of its capital (also known as "average Q").<sup>39</sup> Therefore, theory would predict a close relationship between stock markets and investment, assuming perfect substitutability between internal and external finance. To estimate this relationship, data from national authorities on capital expenditure and Tobin's Q at the economy-wide level are used.<sup>40</sup>

The weak relationship between investment rates and contemporaneous Tobin's Q is noticeable but not historically unusual. For four major advanced economies, Tobin's Q is found to have increased much more sharply in recent years than business investment

(Figure 4.13). This is also borne out in the estimated relationship between the growth of investment and contemporaneous changes in Tobin's Q, which delivers a near-zero coefficient (Table 4.3). The relationship is weak whether the estimation sample is limited to the precrisis period (ending in 2006) or includes the years since the crisis. These findings are consistent with the broader literature, in which a weak connection between firm investment and stock market incentives is not unusual.<sup>41</sup>

At the same time, there is also some evidence that, historically, stock market performance is a leading indicator of future investment. In particular, the predicted growth rate of investment is closer to the actual once lagged values of Tobin's Q are included (Figure 4.14 and Table 4.3). The fit improves further when either current profits or cash flow are also included in the model. Overall, these results suggest that, despite the apparent disconnect between stock markets and investment, if stocks remain buoyant, investment could eventually pick up.

## Policy Implications

The analysis in this chapter suggests that the main factor holding back business investment since the global financial crisis has been the overall weakness of economic activity. Firms have reacted to weak sales—both current and prospective—by reducing capital spending. Evidence from business surveys provides complementary support: firms often mention lack of customer demand as the dominant factor limiting their production. Beyond weak economic activity, other factors, including financial constraints and policy uncertainty, have also held back investment in some economies, particularly euro area economies with high borrowing spreads during the 2010–11 sovereign debt crisis. Confirmation of these additional factors at play comes from the chapter's analysis based on firm-level data.

What policies, then, could encourage a recovery in investment? The chapter's findings suggest that addressing the broader weakness in economic activity is crucial for supporting private investment. As explained in Chapter 3, a large share of the output loss since the crisis can now be seen as permanent, and policies are thus unlikely to return investment fully to its precrisis

<sup>39</sup>As shown by Hayashi (1982), marginal Q and average Q can be equal under certain conditions, including perfect competition, perfect capital markets, and a certain form of adjustment costs. Following the literature, the chapter constructs Tobin's Q as the ratio of nonfinancial corporations' equity liabilities to their total financial assets, using flow of funds data from national sources.

<sup>40</sup>Following the related literature (Blanchard, Rhee, and Summers 1993, for example), the equation, estimated on aggregate annual data for 2000–13, is as follows:

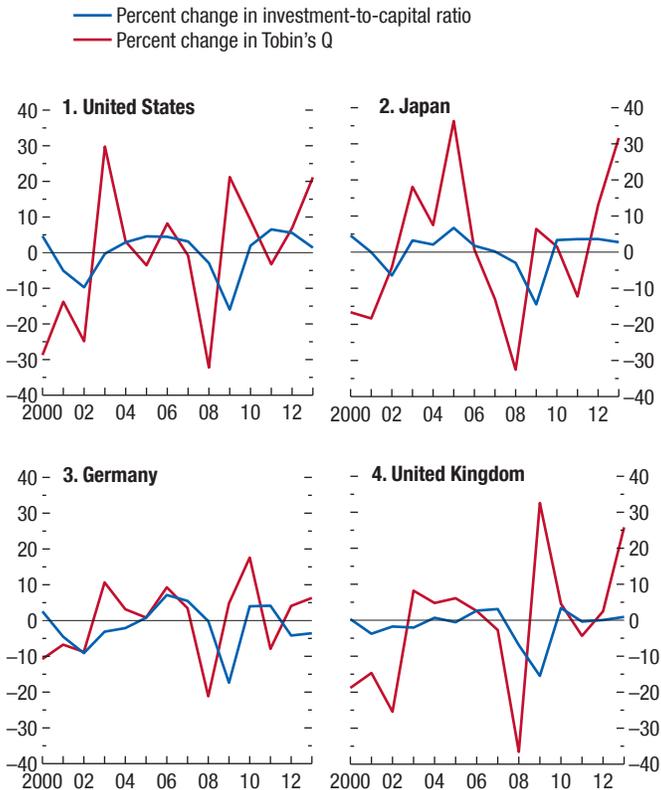
$$\Delta \ln \frac{I_{i,t}}{K_{i,t-1}} = \alpha_i + \lambda_t + \beta_0 \Delta \ln Q_{i,t} + \beta_1 \Delta \ln Q_{i,t-1} + \beta_2 \Delta \ln Q_{i,t-2} + \varepsilon_{i,t}$$

in which  $Q_{i,t}$  denotes the aggregate Tobin's Q for country  $i$  in year  $t$  and  $\alpha_i$  and  $\lambda_t$  denote country and year fixed effects, respectively. As reported in Table 4.3, the analysis is also repeated with additional controls (cash flow and profits).

<sup>41</sup>Given this weak relationship with Tobin's Q, a number of studies instead focus on the effect of current profits and cash flow on investment (see Fazzari, Hubbard, and Petersen 1988, for example).

**Figure 4.13. Tobin's Q and Real Business-Investment-to-Capital Ratios**

Investment has not moved in lockstep with Tobin's Q in recent years. But this is not historically unusual.



Sources: Haver Analytics; national authorities; and IMF staff calculations.

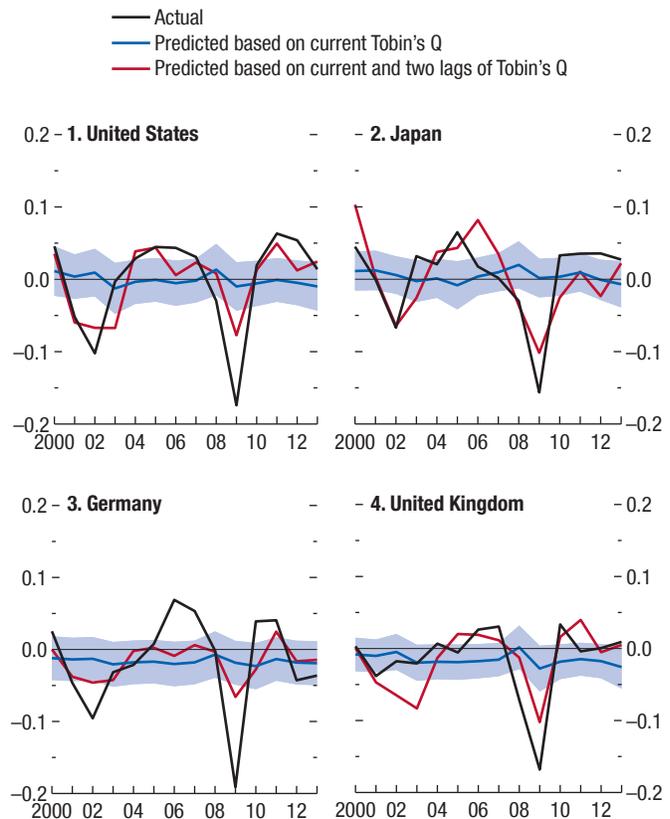
trend. This does not imply, however, that there is no scope for using fiscal and monetary policies to help sustain the recovery and thus to encourage firms to invest. As discussed in Chapter 1, in many advanced economies, accommodative monetary policy also remains essential to prevent real interest rates from rising prematurely, given persistent and sizable economic slack as well as strong disinflation dynamics.

Moreover, there is a strong case for increased public infrastructure investment in advanced economies with clearly identified infrastructure needs and efficient public investment processes and for structural economic reforms more generally. In this context, additional public infrastructure investment may be warranted to spur demand in the short term, raise potential output in the medium term, and thus “crowd in” private investment (Chapter 3 in the October 2014 *World Economic Out-*

**Figure 4.14. Investment: Actual and Predicted Based on Tobin's Q**

(Percentage points)

Historically, Tobin's Q is only weakly related to investment in the current year. Tobin's Q has more explanatory power for predicting future investment.



Sources: Haver Analytics; national authorities; and IMF staff calculations.

Note: The figure reports the predicted and actual values for the change in the log of the investment-to-capital ratio. Shaded areas denote 90 percent confidence intervals.

look). There is also a broad need for structural reforms in many economies, including, for example, reforms to strengthen labor force participation and potential employment, given aging populations (Chapter 3). By increasing the outlook for potential output, such measures could encourage private investment. Finally, the evidence presented in this chapter of financial constraints holding back investment suggests a role for policies aimed at relieving crisis-related financial constraints, including through tackling debt overhang and cleaning up bank balance sheets to improve credit availability. Overall, a comprehensive policy effort to expand output would contribute to a sustained rise in private investment.

**Table 4.3. Investment, Tobin's Q, Profits, and Cash**

	Precrisis		Full Sample			
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable: Growth rate of investment-to-capital ratio						
Growth Rate of Tobin's $Q_t$	0.026 (0.021)	0.024 (0.037)	-0.030 (0.018)	-0.004 (0.022)	-0.002 (0.018)	0.012 (0.019)
Growth Rate of Tobin's $Q_{t-1}$		0.103*** (0.022)		0.211*** (0.038)	0.175** (0.047)	0.194*** (0.041)
Growth Rate of Tobin's $Q_{t-2}$		0.082** (0.026)		0.110*** (0.022)	0.096** (0.024)	0.103*** (0.025)
Operating Profit Growth $_t$					0.030** (0.010)	
Operating Profit Growth $_{t-1}$					0.028** (0.009)	
Operating Profit Growth $_{t-2}$					0.005 (0.009)	
Cash Flow Growth $_t$						0.072*** (0.014)
Cash Flow Growth $_{t-1}$						0.046* (0.017)
Cash Flow Growth $_{t-2}$						0.004 (0.018)
Number of Observations	181	151	293	261	245	249
Adjusted $R^2$	-0.001	0.117	0.001	0.266	0.354	0.354

Sources: Haver Analytics; national authorities; and IMF staff calculations.

Note: The table presents results from a panel regression with country fixed effects; heteroscedasticity-robust standard errors are in parentheses. The sample comprises 17 advanced economies, 1990–2013. Precrisis sample ends in 2006.

\* $p < .10$ ; \*\* $p < .05$ ; \*\*\* $p < .01$ .

## Annex 4.1. Aggregate Data

### Data Sources

The primary data sources for this chapter are the IMF's World Economic Outlook (WEO) database, the April 2014 *Fiscal Monitor*, Haver Analytics, and the Thomson Reuters Worldscope database.<sup>42</sup>

### Investment and GDP

Data on nominal and real investment are collected primarily from national sources on an annual and quarterly basis. Residential investment, for the most part, is composed of investment in dwellings (housing). Nonresidential or "business" investment is defined as the sum of fixed investment in equipment, machinery, intellectual property products, and other buildings and structures. Public sector contributions to residential and nonresidential investment are excluded from these categories when data for these contributions

are available. Where data for public sector contributions are unavailable, the evolution of private nonresidential investment and total nonresidential investment may diverge. GDP data come from the same national sources as investment data.

### Capital Stock and User Cost of Capital

Capital stock series are collected for 19 advanced economies from national sources and, when these are not available, from the Penn World Table (Annex Table 4.1.1). Capital stock series for fixed assets corresponding to business investment are used when available. Linear interpolation is used to convert annual capital stock series to a quarterly frequency. The quarterly data are then linearly extrapolated using country-specific implied depreciation rates, which in turn are calculated based on the standard capital accumulation equation combined with existing capital stock and investment flow data. The user cost of capital is constructed as the sum of the country-specific real interest rate and depreciation rate multiplied by the relative price of investment goods to output. Real interest rates are defined as monetary financial institutions' lending rates for new business at all maturities

<sup>42</sup>The WEO list of 37 advanced economies is used as the basis for the analysis in this chapter. The maximum data range available spans 1960–2014, with data for 2014 being preliminary. Data limitations constrain the sample size in a number of cases, as noted in the chapter text.

**Annex Table 4.1.1. Data Sources**

Country	Business Investment	Capital Stock
Australia	Australian Bureau of Statistics/Haver Analytics	Penn World Table 8.0
Austria	Statistical Office of the European Communities/Haver Analytics	Eurostat
Belgium	Banque Nationale de Belgique/Haver Analytics	...
Canada	Statistics Canada/Haver Analytics	Statistics Canada/Haver Analytics
Czech Republic	Statistical Office of the European Communities/Haver Analytics	Eurostat
Denmark	Statistical Office of the European Communities/Haver Analytics	Eurostat
Estonia	Statistical Office of the European Communities/Haver Analytics	...
Finland	Statistical Office of the European Communities/Haver Analytics	Eurostat
France	Statistical Office of the European Communities/Haver Analytics	Eurostat
Germany	Statistisches Bundesamt/Haver Analytics	Statistisches Bundesamt/Haver Analytics
Greece	Hellenic Statistical Authority (ELSTAT)/Haver Analytics	Penn World Table 8.0
Iceland	Statistics Iceland/Haver Analytics	...
Israel	Central Bureau of Statistics/Haver Analytics	...
Italy	Istituto Nazionale di Statistica/Haver Analytics	Eurostat
Japan	Cabinet Office/Haver Analytics	RIETI, Japan Industrial Productivity Database
Korea	Bank of Korea/Haver Analytics	Bank of Korea
Latvia	Statistical Office of the European Communities/Haver Analytics	...
Luxembourg	Statistical Office of the European Communities/Haver Analytics	...
Malta	Statistical Office of the European Communities/Haver Analytics	...
Netherlands	Statistical Office of the European Communities/Haver Analytics	Eurostat
New Zealand	Statistics New Zealand/Haver Analytics	...
Norway	Statistics Norway/Haver Analytics	...
Portugal	Statistical Office of the European Communities/Haver Analytics	Penn World Table 8.0
Singapore	Department of Statistics/Haver Analytics	...
Slovak Republic	Statistical Office of the Slovak Republic	...
Slovenia	Statistical Office of the European Communities/Haver Analytics	...
Spain	Statistical Office of the European Communities/Haver Analytics	Valencian Institute of Economic Research
Sweden	Statistical Office of the European Communities/Haver Analytics	Eurostat
United Kingdom	Office of National Statistics/Haver Analytics	Office of National Statistics/Haver Analytics
United States	Bureau of Economic Analysis/Haver Analytics	Bureau of Economic Analysis/Haver Analytics

Source: IMF staff calculations.

Note: Business investment data are unavailable for Cyprus, Hong Kong SAR, Ireland, Lithuania, San Marino, Switzerland, and Taiwan Province of China. RIETI = Research Institute of Economy, Trade, and Industry.

(for euro area countries) and corporate bond yields (for Japan and the United States) minus the year-over-year change in the investment deflator. The relative price of investment goods is defined as the ratio of the investment deflator to the overall GDP deflator.

#### ***Firm Survey Responses: Factors Limiting Production***

For European economies, survey responses are taken from the European Commission's Business and Consumer Surveys for the manufacturing sector, which shows the percentage of respondents citing each listed factor as a factor limiting production. The chapter's analysis uses the responses provided for two of the factors: "financial constraints" and "demand." The data are available for European economies at a quarterly frequency. For the United States, survey responses are taken from the National Federation of Independent Business survey of small businesses for the single most important problem they are facing. The chapter's

analysis uses the responses provided for two factors: "poor sales" and "financial and interest rates."

#### ***Policy Uncertainty***

The chapter uses Baker, Bloom, and Davis's (2013) news-based policy uncertainty index, which is available for major advanced economies at <http://www.policyuncertainty.com>. Among euro area economies, the index is available for France, Germany, Italy, and Spain. For other euro area economies, the euro area average is used as a proxy.

#### ***Precrisis Forecasts and Trends***

Precrisis forecasts of private investment and its components shown in Figures 4.1 and 4.2 are based on the spring issues of Consensus Economics' *Consensus Forecasts* for the years of interest (2004 and 2007) or, where those data are unavailable, on the IMF's WEO

database. The linear precrisis trends in Figure 4.3 are constructed using data for 1990–2004.

### Decomposing the Investment Slump

For the decomposition shown in Figure 4.4, data from Consensus Economics' *Consensus Forecasts* for spring 2007 are used for both total private investment and nonresidential (business) investment. The forecast for residential investment is computed as the difference between the forecast for total private investment and the forecast for nonresidential investment (panel 1). For the decomposition of total investment (including both public and private investment), the forecast for total investment comes from the spring 2007 WEO. The forecast for public investment is then computed as the difference between the WEO forecast for total investment and the Consensus Economics forecast for private investment already mentioned. The decomposition calculation involves multiplying the deviation of each component from its precrisis forecast by its share in total investment. For panel 1, the share in total private investment is used. For panel 2, the share in total investment (including both private and public investment) is used.

### Annex 4.2. Firm-Level Data

Annual data from Thomson Reuters Worldscope on the balance sheets, cash flows, and income statements for all listed nonfinancial companies are used. The data cover 28 advanced economies. The sample period

is 2000–13. The data are winsorized at the 1 percent level to reduce the influence of outliers.

### Comparison of Firm-Level and Aggregate Data

To assess how the firm-level investment data compare with the economy-wide investment data, panel regressions of the annual growth rate of aggregate firm-level investment on the growth rate of economy-wide business investment from the national accounts are performed. The results suggest that a 1 percent change in economy-wide investment is associated with a change in aggregate firm-level investment of about 0.8 percent (Annex Table 4.2.1). The firm-level data thus appear to capture the key dynamics of the economy-wide business investment data.

### Construction of Sector-Level Financial Dependence Index

The sector-level approximation of a firm's intrinsic dependence on external finance for fixed investment is constructed following the methodology first developed by Rajan and Zingales (1998). Specifically,

$$\text{Financial Dependence} = \frac{\text{Capital Expenditures} - \text{Cash Flow}}{\text{Capital Expenditure}}$$

For the purposes of this chapter, the index is constructed following the approach of Tong and Wei (2011) and Claessens, Tong, and Wei (2012). For each U.S. firm, the index is computed for the pre-

#### Annex Table 4.2.1. Aggregate Firm-Level Investment versus National Investment

Equation estimated:

Aggregate firm-level investment growth $_{i,t} = \alpha_i + \lambda_t + \beta(\text{National accounts business investment growth}_{i,t}) + \varepsilon_{i,t}$

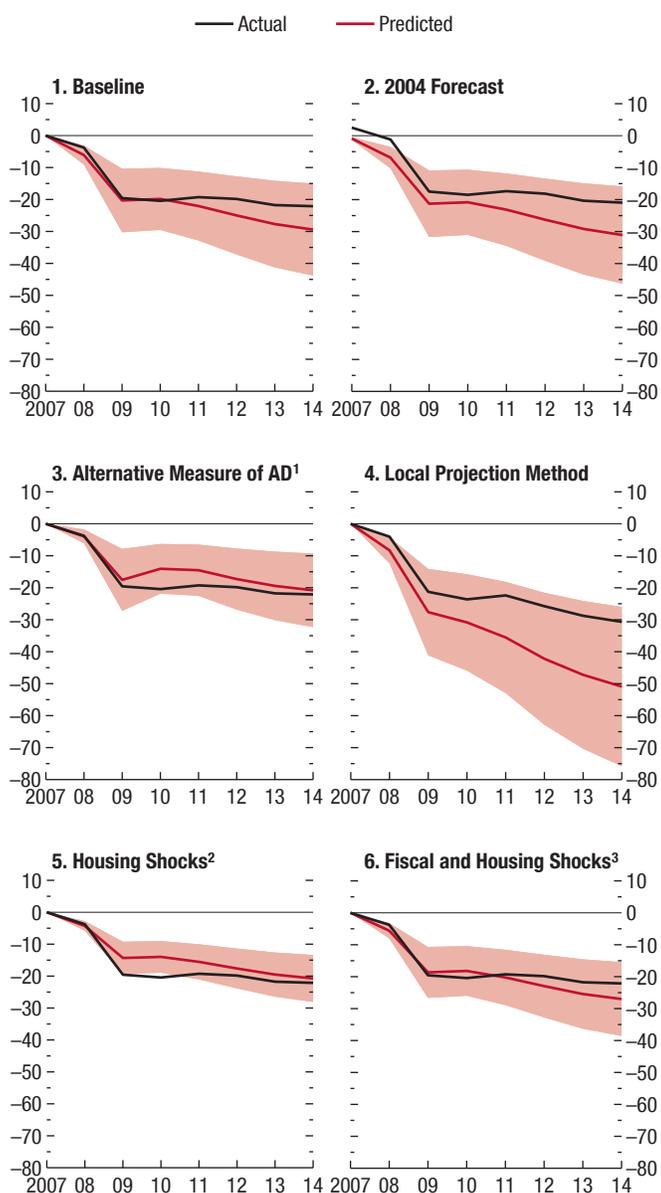
	Full Sample	Pre-2007	Post-2007
$\beta$	0.834*** (0.161)	0.904*** (0.237)	0.719** (0.238)
Number of Observations	482	315	167
Adjusted $R^2$	0.378	0.375	0.372

Sources: Haver Analytics; national authorities; Thomson Reuters Worldscope; and IMF staff calculations.

Note: The table presents results from a panel regression with country and time fixed effects; heteroscedasticity-robust standard errors are in parentheses. Extreme values are omitted.

\*\* $p < .05$ ; \*\*\* $p < .01$ .

**Annex Figure 4.3.1. Actual versus Predicted Real Business Investment—Robustness**



Sources: Haver Analytics; national authorities; and IMF staff estimates.

Note: Shaded areas denote 90 percent confidence intervals. Sample includes advanced economies listed in Annex Table 4.1.1.

<sup>1</sup>Based on the relationship between investment and an alternative measure of aggregate demand (AD), defined as the sum of domestic consumption and exports.

<sup>2</sup>Based on recessions associated with house price busts.

<sup>3</sup>Uses both fiscal policy shocks and recessions associated with house price busts.

crisis period (1990–2006) based on annual data from *Compustat USA Industrial Annual*. The sector-level value of the index for the United States is then obtained by calculating the median across all firms in the sector (at the Standard Industrial Classification [SIC] three-digit level). Whereas Rajan and Zingales (1998) cover only 40 (mainly two-digit SIC) sectors, the analysis here is expanded to cover 111 (three-digit SIC) sectors. Following Rajan and Zingales (1998), the analysis then assumes that the same intrinsic external financing dependence applies to the corresponding sector in all other economies, based on the argument that U.S. firms are the least likely to suffer from financing constraints during normal times and thus the U.S. value of the index for a particular sector likely represents a minimum value for same-sector firms in other economies.

### Annex 4.3. Instrumental Variables Estimation

The subsection “How Much Is Explained by Output? Insights Based on Instrumental Variables” estimates the effects of economic activity on investment using a two-stage least-squares approach. The estimated equation is

$$\Delta \ln I_{i,t} = \alpha_i + \lambda_t + \beta \{\text{Instrumented } \Delta \ln Y_{i,t}\} + \rho \Delta \ln I_{i,t-1} + \varepsilon_{i,t} \quad (\text{A4.3.1})$$

in which  $i$  denotes the  $i$ th country and  $t$  denotes the  $t$ th year;  $\Delta \ln I_{i,t}$  is the change in (log) real business investment; and  $\Delta \ln Y_{i,t}$  is the change in (log) real GDP. The approach includes a full set of country fixed effects ( $\alpha_i$ ) to take account of differences among countries’ normal growth rates. It also includes a full set of time fixed effects ( $\lambda_t$ ) to take account of global shocks. As already mentioned, in the first stage, output growth,  $\Delta \ln Y_{i,t}$ , is regressed on the narrative series of fiscal policy changes of Devries and others (2011). In the second stage, these instrumented output growth rates are regressed on the growth in business investment.

The baseline estimate of  $\beta$  is 2.4, which implies that a 1 percent decline in output is associated with a 2.4 percent decline in investment (Annex Table 4.3.1). To obtain a predicted path of investment relative to forecast, this estimate is used together with the equation

$$\ln I_{i,t} - F_{i,2007} \ln I_{i,t} = \beta (\ln Y_{i,t} - F_{i,2007} \ln Y_{i,t}), \quad (\text{A4.3.2})$$

in which  $F_{i,2007}$  denotes the spring 2007 forecast and  $\ln I_{i,t}$  and  $\ln Y_{i,t}$  denote the log levels of business and

**Annex Table 4.3.1. Investment-Output Relationship: Instrumental Variables Estimation**Growth<sub>*t*</sub> Equation estimated:

Business Investment Growth<sub>*t*</sub> ( $\Delta \ln I_{i,t}$ ) =  $\alpha_i + \lambda_t + \beta \{\text{Instrumented } \Delta \ln Y_{i,t}\} + \rho \Delta \ln I_{i,t-1} + \varepsilon_{i,t}$

	(1)	(2)	(3)	(4)
$\beta$	2.445*** (0.726)	2.633*** (0.883)	1.719*** (0.371)	2.243*** (0.583)
$\rho$	0.128* (0.066)	0.179*** (0.062)	0.108* (0.064)	0.138** (0.064)
$R^2$	0.652	0.465	0.511	0.659
Number of Observations	356	356	604	356
First-Stage <i>F</i> -Statistic	15.916	18.461	6.843	11.899
<i>p</i> -Value	<0.0001	<0.0001	0.0090	<0.0001
Overidentification Restrictions <i>p</i> -Value	...	...	...	0.516
Definition of $Y_{i,t}$	GDP	C + X	GDP	GDP
Instruments for $\Delta \ln Y_{i,t}$	Fiscal shocks	Fiscal shocks	Housing shocks	Fiscal and housing shocks

Sources: Haver Analytics; national authorities; and IMF staff calculations.

Note: The table reports point estimates; heteroscedasticity-robust standard errors are in parentheses. Fiscal shocks denote changes in fiscal policy motivated primarily by the desire to reduce the budget deficit (Devries and others 2011). Housing shocks denote recessions associated with house price busts (Claessens, Kose, and Terrones 2012). C = consumption; X = exports.

\* $p < .10$ ; \*\* $p < .05$ ; \*\*\* $p < .01$ .

real GDP, respectively, in year  $t$ . The 90 percent confidence interval for the prediction is computed using the standard error for  $\beta$  ( $\pm 1.645$  times the standard error).

The main result based on this approach is that the actual slump in business investment since the crisis is no weaker than expected given output, and the actual path of investment is inside the prediction's 90 percent confidence interval (Figure 4.7). This result holds up to repeating the analysis based on deviations of investment and output relative to forecasts made in the spring of 2004 rather than the spring of 2007. Replacing the deviations of investment and output from WEO and Consensus Economics forecasts with deviations from univariate trends estimated using the local projection method (Annex 4.4) also provides no evidence of a larger-than-explained decline in investment (Annex Figure 4.3.1).

A similar result also emerges when the analysis is repeated with output replaced in the estimated equation by a measure of aggregate demand that excludes investment. In particular, equation (A4.3.1) is reestimated with the term  $\Delta \ln Y_{i,t}$  redefined as the change in the (log) sum of total consumption (private and government) and exports. As in the baseline, the first stage is strong (Annex Table 4.3.1). The *F*-statistic on the excluded instrument has a *p*-value below 0.01 percent (one one-hundredth of 1 percent) and is above 15, indicating that the narrative fiscal policy changes have explanatory power for domestic and foreign sales

growth. The second stage yields an estimate for  $\beta$  of 2.6. When combined with the path of consumption and exports since 2007, relative to forecast, this estimate again yields a predicted fall in business investment that is close to the actual path of investment (Annex Figure 4.3.1).

### Using Housing Price Busts As an Alternative Instrumental Variable

The analysis is also repeated with an alternative instrument based on recessions associated with housing price busts. These busts imply a sharp reduction in household wealth and, therefore, a contraction in household consumption and residential investment. Such developments could thus provide another source of output fluctuations not triggered by a contraction in business investment. The data on recessions and house price busts are taken from Claessens, Kose, and Terrones 2012. The overall results obtained using this approach, in terms of the estimate of  $\beta$  and the predicted path of investment, are similar to the baseline (Annex Table 4.3.1 and Annex Figure 4.3.1). However, the first stage is not as strong, with a *p*-value just less than 1 percent and an *F*-statistic less than 10. Using the housing bust recessions together with the fiscal policy changes—a set of two instruments—yields stronger first-stage results, and the implied predicted path of investment is similar to the baseline.

## Annex 4.4. Local Projection Methods

Local projection methods are used to estimate the responses of output and investment following specific events. As in Chapter 3, the methodology used is the one first set out in Jordà 2005 and developed further in Teulings and Zubanov 2014. It is used in the chapter as a robustness check for the deviations of investment and output from precrisis WEO and Consensus Economics forecasts.

The method consists of estimating separate regressions for the variable of interest (investment or output) at different horizons using the following specification:

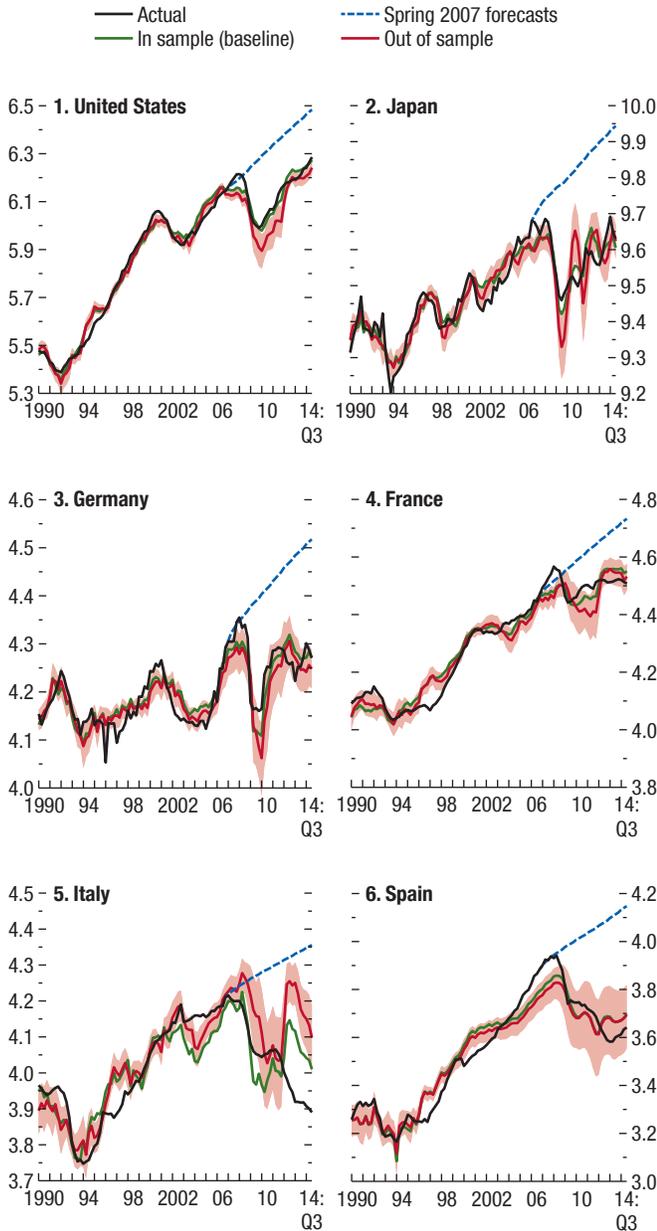
$$\begin{aligned}
 y_{i,t+h} = & \alpha_i^h + \lambda_t^h + \beta_{i,1}^h S_{i,t} + \sum_{j=1}^p \beta_{i,2}^h S_{i,t-j} \\
 & + \sum_{j=0}^{h-1} \beta_{i,3}^h S_{i,t+h-j} + \sum_{j=1}^p \beta_{i,4}^h y_{i,t-j} \\
 & + \varepsilon_{i,t}^h,
 \end{aligned} \tag{A4.4.1}$$

in which  $y$  denotes the growth rate of the variable of interest;  $i$  denotes countries;  $t$  denotes years;  $h$  denotes the horizon of the projection after time  $t$ ;  $p$  denotes the number of lags included; and  $S$  is the event indicator dummy, which in this chapter indicates the start of the global financial crisis (Figure 4.12 and Annex Figure 4.3.1).

## Annex 4.5. Accelerator Model Estimation Results

This annex reports the estimation results for the baseline and augmented versions of the accelerator model discussed in the chapter text (see Annex Figures 4.5.1 and 4.5.2 and Annex Tables 4.5.1, 4.5.2, and 4.5.3).

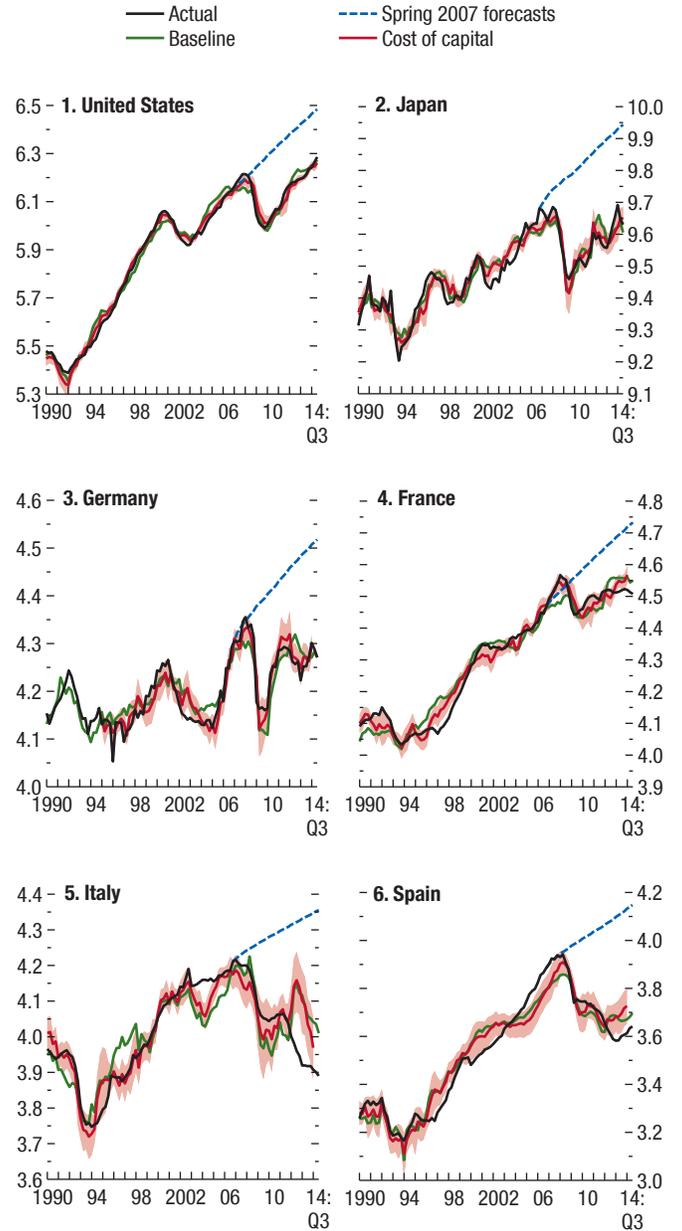
**Annex Figure 4.5.1. Accelerator Model: In Sample versus Out of Sample**  
(Log index)



Sources: Consensus Economics; Haver Analytics; national authorities; and IMF staff estimates.

Note: Fitted values for investment are obtained by multiplying fitted values for the investment rate by the lagged capital stock. Shaded areas denote 90 percent confidence intervals, based on the Newey-West estimator.

**Annex Figure 4.5.2. Accelerator Model: Controlling for the User Cost of Capital**  
(Log index)



Sources: Consensus Economics; Haver Analytics; national authorities; and IMF staff estimates.

Note: Fitted values for investment are obtained by multiplying fitted values for the investment rate by the lagged capital stock. Shaded areas denote 90 percent confidence intervals, based on the Newey-West estimator.

**Annex Table 4.5.1. Baseline Accelerator Model**

$$\text{Equation estimated: } \frac{I_t}{K_{t-1}} = \frac{\alpha}{K_{t-1}} + \sum_{i=1}^{12} \beta_i \frac{\Delta Y_{t-i}}{K_{t-1}} + \delta + \varepsilon_t$$

	$\alpha$	$\delta$	$\Sigma\beta$	Number of Observations	$R^2$
Australia	27.15***	0.03***	0.620	99	0.88
Austria	5.43***	0.01***	1.725***	62	0.82
Canada	-41.11***	0.03***	1.265***	99	0.83
Czech Republic	9.59	0.01***	3.431***	62	0.70
Denmark	-53.79***	0.02***	3.254***	82	0.60
Finland	-7.20***	0.03***	3.291***	86	0.73
France	-26.04***	0.03***	2.902***	99	0.51
Germany	40.55***	0.00***	1.679***	99	0.95
Greece	-0.01	0.02***	2.950***	66	0.82
Ireland	0.81	0.01*	4.932***	58	0.55
Italy	-1.35	0.01***	4.616***	99	0.64
Japan	1,494.51*	0.02***	2.084***	99	0.85
Korea	13,296.28***	0.01***	6.063***	99	0.92
Netherlands	-25.01***	0.03***	3.260***	99	0.82
Portugal	2.31	0.01***	4.765***	66	0.89
Spain	4.60***	0.02***	3.414***	99	0.78
Sweden	-77.94***	0.05***	3.212***	74	0.69
United Kingdom	11.47***	0.01***	1.969***	99	0.73
United States	-230.26***	0.03***	3.150***	99	0.91

Sources: Haver Analytics; national authorities; and IMF staff calculations.

\* $p < .10$ ; \*\*\* $p < .01$ ; Newey-West estimator.

**Annex Table 4.5.2. Accelerator Model: In-Sample versus Out-of-Sample Estimates**

$$\text{Equation estimated: } \frac{I_t}{K_{t-1}} = \frac{\alpha}{K_{t-1}} + \sum_{i=1}^{12} \beta_i \frac{\Delta Y_{t-i}}{K_{t-1}} + \delta + \varepsilon_t$$

	Baseline			Precrisis Sample		
	$\Sigma\beta$	$R^2$	Number of Observations	$\Sigma\beta$	$R^2$	Number of Observations
France	2.902***	0.51	99	3.082***	0.576	68
Germany	1.679***	0.95	99	1.702***	0.952	68
Italy	4.616***	0.64	99	3.882***	0.464	68
Japan	2.084***	0.85	99	2.151***	0.873	68
Spain	3.414***	0.78	99	3.005***	0.497	68
United States	3.150***	0.91	99	3.833***	0.934	68

Sources: Haver Analytics; national authorities; and IMF staff calculations.

Note: The baseline model is estimated on a 1990:Q1–2014:Q2 sample. Out-of-sample estimation is based on a 1990:Q1–2006:Q4 sample.

\*\*\* $p < .01$ ; Newey-West estimator.

**Annex Table 4.5.3. Selected Euro Area Economies: Baseline and Augmented Accelerator Model—Equalized Sample**

$$\text{Equation estimated: } \frac{I_t}{K_{t-1}} = \frac{\alpha}{K_{t-1}} + \sum_{i=1}^{12} \beta_i \frac{\Delta Y_{t-i}}{K_{t-1}} + \sum_{i=1}^{12} \gamma_i X_{t-i} + \delta + \varepsilon_t$$

	Baseline			Financial Constraints Added			
	$\Sigma\beta$	$R^2$	Number of Observations	$\Sigma\beta$	$\Sigma\gamma$	$R^2$	Number of Observations
Greece	2.957***	0.80	59	1.455***	-0.136*	0.90	59
Ireland	4.932***	0.55	58	6.093***	-1.109***	0.81	58
Italy	2.776***	0.72	59	4.101***	-0.167**	0.72	59
Portugal	4.301***	0.87	59	5.489***	0.098	0.85	59
Spain	6.170***	0.91	59	2.898***	-0.373***	0.99	59

	Baseline			Uncertainty Added			
	$\Sigma\beta$	$R^2$	Number of Observations	$\Sigma\beta$	$\Sigma\gamma$	$R^2$	Number of Observations
Greece	2.957***	0.80	59	1.402**	-0.391***	0.92	59
Ireland	4.932***	0.55	58	2.784***	-0.249***	0.80	58
Italy	2.776***	0.72	59	1.853**	-0.096	0.83	59
Portugal	4.301***	0.87	59	-0.585	-0.226***	0.95	59
Spain	6.170***	0.91	59	6.438***	0.0384	0.89	59

Sources: Haver Analytics; national authorities; and IMF staff calculations.

Note: The table presents results for euro area economies (Greece, Ireland, Italy, Portugal, Spain) with high borrowing spreads during the 2010–11 sovereign debt crisis. The same number of observations is used to estimate baseline and augmented model specifications.  $x$  denotes the additional variable added to the equation (either financial constraints or policy uncertainty). The baseline model is reestimated for an equalized sample, for which the additional variables are available. The policy uncertainty variable is available only for Italy and Spain; the average level of euro area policy uncertainty is used for Greece, Ireland, and Portugal.

\* $p < .10$ ; \*\* $p < .05$ ; \*\*\* $p < .01$ ; Newey-West estimator.

### Box 4.1. After the Boom: Private Investment in Emerging Market and Developing Economies

Following brisk private investment growth in emerging market and developing economies during the boom years of the 2000s, most regions have experienced a slowdown in recent years. In many emerging market and developing economies, investment is back in line with forecasts made in the early 2000s but has disappointed relative to forecasts made at the height of the boom, such as in the spring of 2007 (Figure 4.1.1).<sup>1</sup>

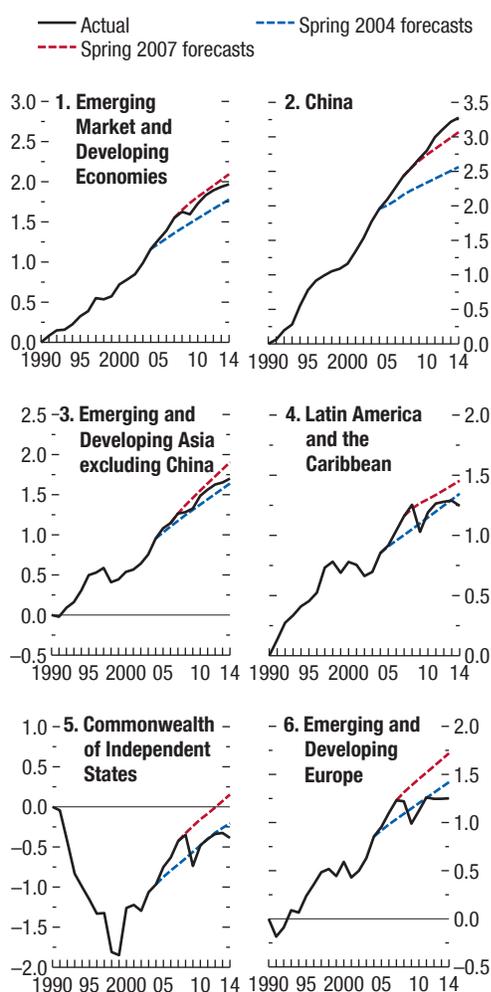
A number of developments initially cushioned investment in emerging market and developing economies after the onset of the global financial crisis, and investment recovered rapidly. These developments included macroeconomic policy stimulus, which played a supportive role (as in China and a number of other Asian economies), and a strong improvement in the terms of trade and robust capital inflows, which also helped (particularly in Latin America and the Caribbean). But the rebound was short-lived, and a slowdown set in from 2011 onward, with significant investment growth disappointments across most emerging market regions during 2011–13 (Box 1.2 in the October 2014 *World Economic Outlook*).

Part of the investment slowdown since 2011 likely reflects the general weakness in economic activity. The investment slowdown has coincided with a reduction in overall output growth—both current and expected (Chapter 3)—and it is plausible that firms have responded to the associated weakening in sales by reducing investment. Nevertheless, unlike in advanced economies, the relative slowdown of investment compared with output has been unusually large by historical standards, which suggests that factors beyond output have been at work (Figure 4.1.2). In particular, during past episodes of unexpected weakness in output growth, private investment has generally fallen by less than twice as much as output. In contrast, the slowdown in private investment since 2011 has been some two to four times as large as that of output, depending on the region (Figure 4.1.2). This greater dip in investment relative to output suggests that the investment slowdown reflects more than weak output.

The authors of this box are Samya Beidas-Strom, Nicolas Magud, and Sebastian Sosa.

<sup>1</sup>Private investment as a share of the capital stock in emerging market and developing economies has also declined in recent years, although it remains above the levels of the early 2000s that preceded the boom (Figure 3.10).

**Figure 4.1.1. Real Private Fixed Investment**  
(Log index, 1990 = 0)



Sources: Consensus Economics; IMF, Fiscal Monitor database; and IMF staff estimates.

Note: The figure presents data, where available, for the country groups as defined in the WEO Statistical Appendix.

What factors beyond output lie behind the slowdown in investment since 2011, and how do they vary by region? The analysis in this box addresses this question by examining firm-level Thomson Reuters Worldscope data for 16,000 firms across 38 emerging markets for the period 1990–2013. It draws on the results reported in Magud and Sosa, forthcoming, and the April 2015 *Regional Economic Outlook: Western*

**Box 4.1 (continued)**

*Hemisphere.* The empirical model is a variation of the traditional Tobin's Q investment model, augmented to include other variables identified in the literature as possible determinants of corporate investment.<sup>2</sup>

The analysis yields an illustrative decomposition of the 2011–13 change in the investment rate for major emerging market regions (Figure 4.1.3).<sup>3</sup> It is worth acknowledging that the panel regression approach used here does not fully disentangle causal channels through which these factors transmit to private investment. The main results are as follows:

- Lower commodity export prices (green bars in Figure 4.1.3)—measured as a country-specific

<sup>2</sup>The baseline equation estimated for each major emerging market region, while allowing for different coefficients by region, has the following basic specification:

$$\begin{aligned} \frac{I_{i,c,t}}{K_{i,c,t-1}} = & \beta_0 + \beta_1 Q_{i,c,t} + \beta_2 \frac{CF_{i,c,t}}{K_{i,c,t-1}} + \beta_3 Lev_{i,c,t-1} \\ & + \beta_4 \frac{\Delta Debt_{i,c,t}}{K_{i,c,t-1}} + \beta_5 Int_{i,c,t} + \beta_6 \Delta P^x_{c,t-1} + \beta_7 KI_{c,t} \\ & + \delta RECENT + \eta_b RECENT \times b_t + d_i + t + \varepsilon_{i,c,t} \end{aligned}$$

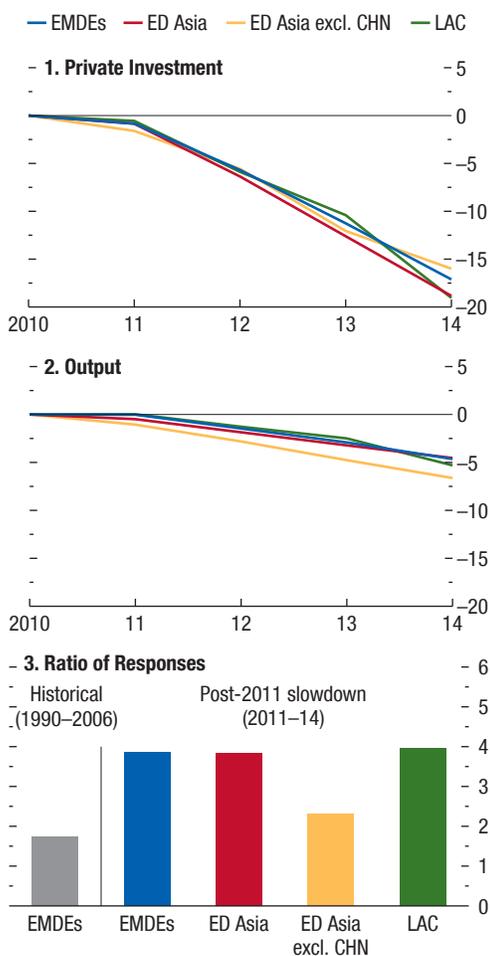
$$\text{for } b_t = \left\{ \frac{CF_{i,c,t}}{K_{i,c,t-1}}, Lev_{i,c,t-1}, \frac{\Delta Debt_{i,c,t}}{K_{i,c,t-1}}, \Delta P^x_{c,t-1}, KI_{c,t} \right\}$$

The subscripts *i*, *c*, and *t* denote firms, countries, and years, respectively. The specification controls for firm fixed effects and includes a trend (*d<sub>i</sub>* and *t*, respectively). The results hold when replacing the trend with time fixed effects and adding country fixed effects. *I* denotes investment and *K* the stock of capital; *Q* represents Tobin's Q; *CF* denotes the firm's cash flow; *Lev* denotes leverage, measured as the ratio of total debt to total assets;  $\Delta Debt$  stands for the change in total debt from the previous period; *Int* is a measure of the firm's cost of capital;  $\Delta P^x$  denotes the change in the log of the economy-specific commodity export price index; *KI* denotes (net) economy-level capital inflows (measured by the financial account balance in percent of GDP); *RECENT* stands for a dummy variable that takes a value of 1 for observations during 2011–13; and  $\varepsilon$  represents the error term. Estimation is conducted based on ordinary least squares, with standard errors clustered by country. The estimation results for the firm-specific variables (such as Tobin's Q and cash flow) are similar when country-year fixed effects are added to the equation in place of the economy-level variables. In addition, similar results hold if the regression is estimated using the Arellano-Bond generalized method of moments approach.

<sup>3</sup>The investment rate is defined as firm capital expenditure as a share of the previous year's capital stock. As reported in Magud and Sosa, forthcoming, the estimated interaction coefficients are of the expected sign, although not all are statistically significant. Only the coefficient estimates that are found to be statistically significant are used to decompose the change in the investment rate reported in Figure 4.1.3.

**Figure 4.1.2. Private Investment and Output Forecast Errors: Historical versus Post-2011 Slowdown**

(Percent deviation from spring 2011 forecasts, unless noted otherwise)

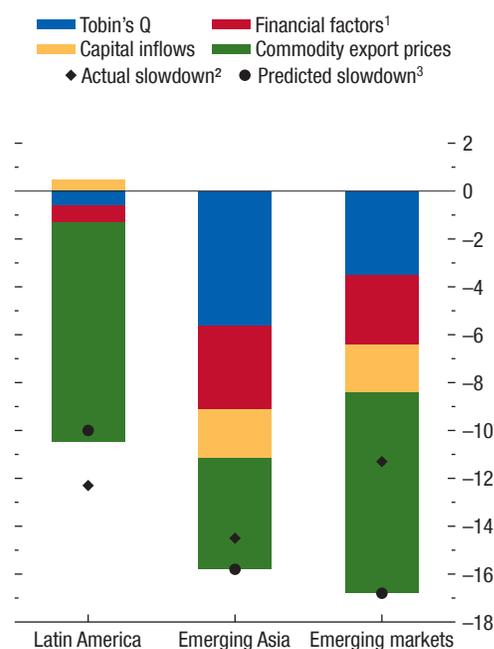


Sources: Consensus Economics; IMF, Fiscal Monitor database; and IMF staff estimates.

Note: The average forecast error of private investment is compared to that of real GDP in years in which actual output growth is below the forecast made early in the year (implying a negative forecast error). The forecast errors are defined as actual growth in year *t* minus the forecast made in the spring of year *t*. The forecasts come from Consensus Economics' *Consensus Forecasts* or, when these are unavailable, the *World Economic Outlook* (WEO). The sample consists of 128 emerging market and developing economies from 1990 to 2014. The figure presents data, where available, for the country groups as defined in the WEO Statistical Appendix. CHN = China; ED = emerging and developing; EMDEs = emerging market and developing economies; LAC = Latin America and the Caribbean.

## Box 4.1 (continued)

**Figure 4.1.3. Contributors to the Private Investment Slowdown since 2011**  
(Percent of 2011 level; for average firm in the sample)



Source: IMF staff calculations.

Note: The figure shows the relative contribution of each determinant of business investment to the 2011–13 change in the private-investment-to-capital ratio in percent of the 2011 level. The contributions are computed as the recent period's change in each factor multiplied by the sum of its corresponding estimated coefficient and the coefficient on its interaction with the recent dummy. Contributions are based on the specific regression corresponding to each emerging market subregion. The figure presents data for 38 emerging markets: emerging Asia = China, India, Indonesia, Korea, Malaysia, Philippines, Singapore, Taiwan Province of China, Thailand, Vietnam; Latin America = Argentina, Brazil, Chile, Colombia, Mexico, Peru, Venezuela; emerging markets include, in addition, Bulgaria, Croatia, Czech Republic, Egypt, Hungary, Israel, Jordan, Kazakhstan, Lithuania, Morocco, Pakistan, Poland, Romania, Russia, Serbia, Slovak Republic, Slovenia, South Africa, Sri Lanka, Turkey, Ukraine.

<sup>1</sup>Financial factors comprise cash flow, leverage, and "change in debt."

<sup>2</sup>Actual percentage change in private-investment-to-capital ratio between 2011 and 2013.

<sup>3</sup>Predicted percentage change in private-investment-to-capital ratio between 2011 and 2013.

export price index—emerge as the largest contributor to the slowdown, particularly for Latin America and the Caribbean. The substantial contribution of weaker commodity prices to the decline in private investment growth observed since 2011 is not surprising given the large share of commodities in this region's economies. Outside Latin America and the Caribbean, investment in other emerging markets has also been adversely affected by lower commodity prices, including, for example, in Indonesia, Russia, and South Africa. Since the regressions control for a period dummy covering 2011–13 (*RECENT*), this result does not simply reflect shifts in global growth.

- Weaker expectations of firms' future profitability have also played a key role, as reflected in the large contribution of Tobin's Q (blue bars), particularly for emerging market and developing Asia. This result is consistent with the view that a dimming outlook for potential output growth has sapped firm investment. As Chapter 3 explains, potential GDP growth has slowed considerably in emerging markets since 2011.
- Tighter financial conditions—both external and domestic—have also been associated with the investment slowdown. A number of economies have seen a decline in capital inflows (yellow bars) since 2012, and the firm-level analysis suggests that this explains a nonnegligible share of the investment slowdown.<sup>4</sup> The contribution of higher corporate leverage and lower internal cash flow (red bars) in explaining the slowdown is consistent with the view that, in an environment of tightening external financial conditions, domestic corporate financial weaknesses constrain investment more.<sup>5</sup> Here, additional analysis suggests that larger firms (measured by the size of assets or revenues) and those with a larger share of foreign ownership have faced, on average, less severe financial constraints. And the extent of the relaxation of borrowing constraints associated with capital

<sup>4</sup>For a further discussion of the role of capital flows, see Chapter 4 in the October 2013 *World Economic Outlook* and the IMF's 2014 *Spillover Report* (IMF 2014d).

<sup>5</sup>The domestic "financial factors" component groups the contributions of firm cash flow and leverage and the change in debt. For a further discussion of the role of leverage, see Chapter 2 in the April 2014 *Regional Economic Outlook: Asia and Pacific* and IMF 2015. The latter finds that about one-third of the decline in India's corporate-investment-to-GDP ratio since 2011–12 can be attributed to the buildup of corporate leverage.

**Box 4.1 (continued)**

inflows is stronger for firms in the nontradables sector (Magud and Sosa, forthcoming).<sup>6</sup>

The foregoing firm-level analysis, however, does not capture all the developments that have inhibited private investment in emerging market and developing economies. Indeed, a number of recent studies have highlighted more country-specific constraints to investment in some large emerging markets, including Brazil, India, Russia, and South Africa. IMF 2014e argues that weak competitiveness and low business confidence are factors that have held back private investment in Brazil. Anand and Tulin 2014 and IMF 2014f estimate that business and regulatory uncertainty has contributed about three-quarters of the most recent slump in India, delaying project approvals

<sup>6</sup>The latter result is also consistent with the indirect evidence in Tornell and Westermann 2005.

and implementation of infrastructure and other large-scale projects. IMF 2014g suggests that in Russia, a difficult business environment and, more recently, sanctions have increased the uncertainty of doing business, with a chilling effect on investment. Finally, IMF 2014h reports that in South Africa, in addition to the factors analyzed in this box, deep-seated structural and infrastructure bottlenecks, weak business confidence, and perceptions of political uncertainty have played an important role in inhibiting private investment.

What does this imply for private investment in emerging market and developing economies? Given the sustained weakness in commodity prices and tighter domestic and external financial conditions with lower capital inflows (see Chapter 1 and the Commodity Special Feature), a strong rebound in private investment seems unlikely in the near term.

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