# Investment in the euro area

*The economic recovery in the euro area has also seen investment regain momentum. Aggregate fixed capital formation is still languishing well short of its level prior to the crisis, however, though that was admittedly a period marked by above-average investment growth in some countries. Construction investment, in particular, had reached a magnitude in those countries that was not sustainable.*

*Fixed capital formation has also been trailing behind its longer-term average when measured in terms of the aggregate investment ratio in recent years. Gross fixed capital formation accounted for a mean 22% of gross domestic product (GDP) between 1995 and 2007, shrinking to less than 20% by 2014. This decline was driven in part by a deterioration in financing conditions, a high degree of uncertainty and the need to deleverage. All in all, the macroeconomic environment was characterised by major adjustment processes, though some of these inhibitive factors have since lost significance. As a case in point, financing conditions are no longer as restrictive as they were in previous years, and macroeconomic uncertainty has eased. Positive impetus is also being provided by the Eurosystem's accommodative monetary policy and by the key macroeconomic adjustments that have already been made.*

*While these factors can all be expected to shore up investment, the combined impact of macroeconomic activity over the past few years falling well short of earlier expectations and a bleaker growth outlook than just a few years ago is continuing to place a strain on investment. Viewed from this perspective, it cannot be said that fixed capital formation has generally been too low in the period since the financial and economic crisis. Indeed, the aggregate capital-output ratio has eclipsed its pre-crisis level in recent years, despite the drop in the investment ratio, which would support this notion. The key to boosting fixed capital formation, then, is to focus not so much on investment itself, but more on ways of sustainably improving the euro area's long-term growth prospects. Rather than measures to stimulate the economy, what is mainly required here is a policy approach centred around strengthening long-term expansionary forces. A failure to do so would leave the investment growth rate – despite a cyclical improvement – mired at a subdued level over the medium term.*

## Underlying investment trends

*Investment on path of recovery for past three years, …*

Activity in the euro area has been rebounding since spring 2013, and the same can be said for gross fixed capital formation. However, the recovery is making slow progress at best, even if it did pick up pace somewhat in the first half of 2015. Real GDP had still not quite revisited its earlier high from the first quarter of 2008 by the end of the period under review and only exceeded its cyclical low from the beginning of 2013 by 3%. Although growth of gross fixed capital formation has since been slightly stronger at 4½%, it was almost 15% down on its level immediately prior to the crisis. Investment, above all in machinery and equipment, may have resumed an upward trajectory in the majority of euro-area countries, not least over the course of the last year, but it is still languishing far behind pre-crisis levels in most of them. The shortfall is biggest in Greece and Cyprus, at more than 70% and almost 60% respectively, compared with a figure of 30% in Italy, Spain and Portugal, and nearly 10% in France. Just three euro-area countries, including Germany, have returned to or marginally exceeded their pre-crisis levels.

**Real gross fixed capital formation and investment ratio in the euro area**

Quarterly data


Source: Eurostat. **1** Nominal gross fixed capital formation as a percentage of nominal GDP.

Deutsche Bundesbank

*… but investment ratio still below medium-term level*

A look at the aggregate investment ratio, ie expenditure on gross fixed capital formation as a percentage of nominal GDP, likewise reveals the current sluggishness of fixed capital formation. At slightly less than 20% at last count, it was more than 3½ percentage points down on 2007, and 2½ percentage points short of its average between 1995 and 2007. The global financial crisis depressed the investment ratio in a host of advanced economies, which is hardly surprising considering the weak growth dynamics,[1] but in the euro area, additional factors may have been at play, most notably the poorer financing conditions, the spells of intense macroeconomic uncertainty, and the lingering debt burden that followed the predominantly credit-fuelled investment boom in the pre-crisis period.[2] This was compounded by severe macroeconomic adjustment processes in some euro-area countries, which placed a considerable strain on domestic demand and particularly on investment expenditure. In Cyprus and Greece, gross fixed capital formation dwindled to just 12% of economic output in 2014, while in Portugal and Italy, the respective shares were 15% and 17%. This ratio was just over 10 percentage points lower than eight years ago in Spain and Ireland, standing at around 20% in both countries. Meanwhile, other euro-area countries, including Germany, saw almost no change, or they experienced only a slight decline, as was the case in France.

**1** See IMF, Private investment: what's the holdup?, World Economic Outlook, April 2015, pp 111-143.
**2** See European Investment Bank (2013), Investment and investment finance in Europe; B Barkbu, S Pelin Berkmen, P Lukyantsau, S Saksonovs and H Schoelermann (2015), Investment in the euro area: why has it been weak?, IMF Working Paper No 15/32; R Banerjee, J Kearns and M Lombardi, (Why) is investment weak?, BIS Quarterly Review, March 2015, pp 67-82; N Balta (2015), Investment dynamics in the euro area since the crisis, European Commission, Quarterly Report on the Euro Area, Vol 14, No 1, pp 35-43.

## From investment expenditure to capital stock

*Dual nature of investment*

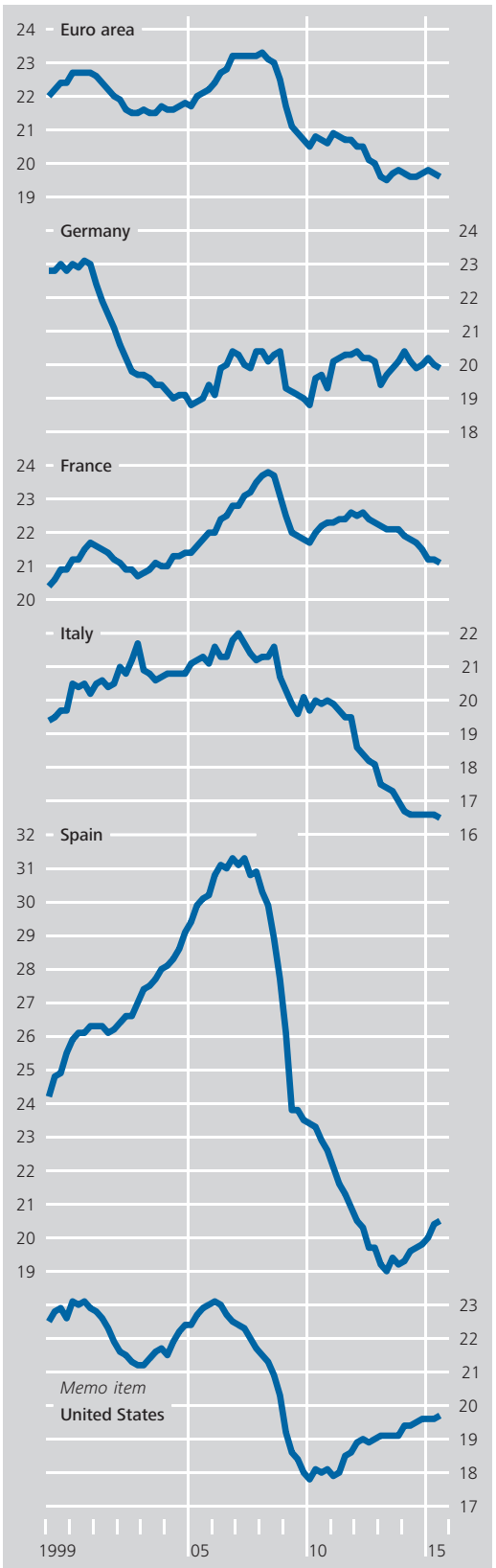
Investment performs two functions in the economic process. First, it is a major component of aggregate demand. Second, investment is critical for maintaining or building up the capital stock, which is a key determinant of aggregate potential output. In addition, without sufficient fixed capital formation, the capital stock cannot be renewed regularly, impeding technological advancements and hindering structural change in the economy as a whole.

*Investment ratio influenced by divergent price trends*

Actual changes in the real capital stock cannot be inferred directly from the nominal investment expenditure recorded. Two points are worth noting in this respect. First, the characteristics of capital goods change over time, often in response to technological progress. Second, price trends specific to capital goods can differ from those for intermediate and consumer goods. Hence, a price adjustment is necessary which also includes a quality adjustment. This is especially important in light of the rapid advancement seen in the information and communication technologies (ICT) sector. Official figures reveal that the quality-adjusted price of ICT goods dropped by an average of 2.6% *per annum* between 1999 and 2014, while the GDP deflator saw growth of 1.7%. So even if the ICT investment ratio remains static or eases slightly, it is nonetheless possible for investment to grow in real terms. For other machinery and equipment, too, prices have risen at a much gentler pace than the GDP deflator. Machinery and equipment goods prices overall grew by an average of only 0.3% each year. One major implication of these price trends is that the investment ratio follows a different path in nominal terms than it does in real terms.[3] ICT goods, however, have a higher depreciation rate than other capital goods on account of their shorter service lives. Owing to

**Investment ratios in the euro area***

As a percentage of nominal GDP



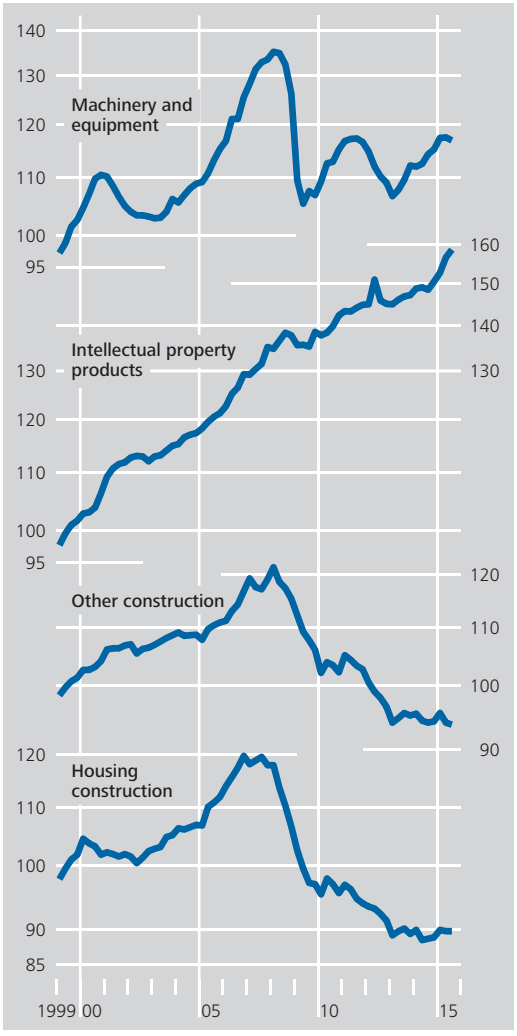

Sources: Eurostat, Global Insight, Bureau of Economic Analysis.
* Nominal gross fixed capital formation as a percentage of nominal GDP.

Deutsche Bundesbank

3 See, for example, Bank of England, Long-run equilibrium ratios of business investment to output in the United Kingdom, Quarterly Bulletin, Summer 2003, pp 177-187.

**Real gross fixed capital formation in the euro area by component**

1999 = 100, quarterly data, log scale




Source: Eurostat.
Deutsche Bundesbank

the increased significance of ICT investment, the aggregate depreciation rate has been on an upward trend in recent years.

*Capital stock data used to approximate actual real capital*

Capital stock figures are not normally obtained through data collection, but rather calculated indirectly using the perpetual inventory method. This involves adding together price-adjusted investment expenditure over time and calculating separate capital consumption rates for each investment category. The capital stock increases when gross capital formation outstrips capital consumption. What this means, however, is that the capital stock actually available at the enterprise level is only recorded as an approximation.[4]

## Tendencies by type of investment

*Construction dominating aggregate investment*

The 2014 revision of the European System of Accounts (ESA 2010) differentiates between three key types of investment: construction (this is subdivided into dwellings and other buildings and structures); machinery and equipment (including the components transport equipment, ICT equipment, and other machinery and equipment) and investment in intellectual property products.[5] In 2014, construction investment accounted for just over 50% of aggregate gross fixed capital formation in the euro area, followed by machinery and equipment at around 30%, and investment in intellectual property products at roughly 20%. Immediately prior to the crisis, construction investment's share was approximately 4 percentage points higher, and that of intellectual property products correspondingly lower. Broken down by sector, 59% of aggregate investment was attributable to enterprises (mainly investment in machinery and equipment as well as intellectual property products), 27% to households (primarily housing construction investment) and 14% to the public sector.

**4** Details on the European Commission's methodology for calculating the capital stock are outlined in K Havik, K McMorrow, F Orlandi, C Planas, R Raciborski, W Röger, A Rossi, A Thum-Tysen and V Vandermeulen, The production function methodology for calculating potential growth rates and output gaps, European Commission, Economics Papers No 535, November 2014.

**5** The transition to ESA 2010 partly redefined investment in intellectual property products. It is now chiefly composed of research and development expenditures, which were previously treated as intermediate consumption that was completely used in the production process, as well as computer software, databases, literary or artistic originals and mineral exploration. A further component is "cultivated biological resources", which makes up 0.3% of gross fixed capital formation and is disregarded in the remainder of this article.

## Construction investment

*Construction investment particularly frail*

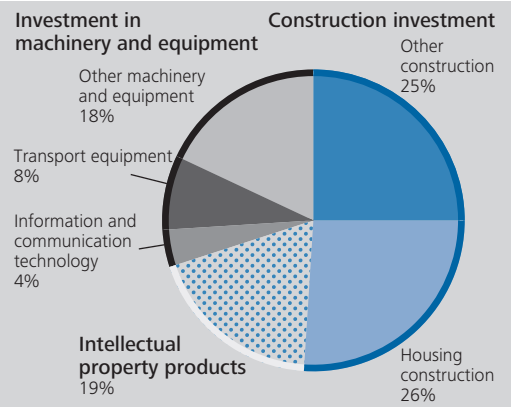
The investment slump is most evident in the construction category, where investment has been following a downward trajectory since 2008. The decline particularly hit housing construction, but it also took its toll on other areas of construction – that is, commercial and industrial construction and the development of public and private infrastructure. Although construction activity has stabilised at a low level over the past few quarters (almost one-quarter down on the 2007 level), there is still no sign of a rebound. This huge reduction in construction investment sent its share of GDP from almost 13% in 2007 to 10% in 2014. Between 2002 and 2007, it followed a steady growth path.

*Housing construction curtailed in many countries other than Germany*

The adjustments to housing construction activity should be seen against the backdrop of the pre-crisis boom experienced by some countries. There is a distinct negative correlation between the upturn in housing construction investment between 1999 and 2007 and its showing during the 2007-14 crisis period. In Spain, Greece and Ireland, housing construction investment accounted for more than 10% of GDP in 2007, compared with a euro-area mean of 6% in the last 20 years. While the steep rise in housing prices in these countries will have undoubtedly contributed to this, a more significant factor was the sharp increase in housing construction. Real estate prices, which had previously risen sharply and seemed to justify the high housing construction prices, later buckled as an oversupply of housing crippled the markets. On top of this came a deterioration in financing conditions. The combined impact of these factors sent housing construction investment plummeting by 90% in Greece, 70% in Ireland and 50% in Spain. Housing construction investment as a percentage of GDP contracted to 4% in Spain, 2% in Ireland and 1% in Greece, seriously impeding local value creation and sending shockwaves through these countries' labour markets. Both Italy and the Netherlands saw housing construction investment shrink by around one-third, while France suffered a decline of nearly a fifth. Only Germany has seen housing construction pick up in recent years, its growth of 14% since 2007 largely being driven by the country's brighter income prospects and the ongoing influx of immigrants.

**Breakdown of nominal gross fixed capital formation in the euro area**

2014

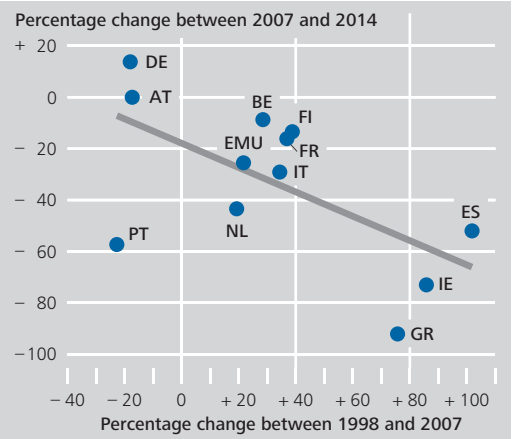



Source: Eurostat.
Deutsche Bundesbank

*Other construction investment also down*

Other construction investment (notably in commercial and industrial construction as well as in infrastructure) also plunged across the vast majority of euro-area countries. The steepest declines (of roughly two-fifths) were experienced by countries that underwent major adjustment processes, including Italy, Portugal,

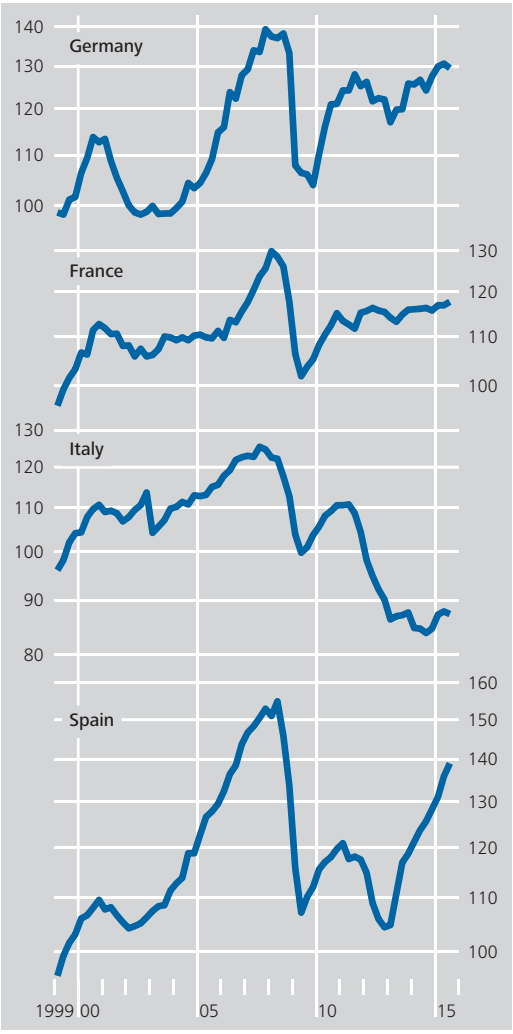
**Real housing construction investment**




Source: Eurostat.
Deutsche Bundesbank

**Real investment in machinery and equipment**

1999 = 100, quarterly data, log scale




Source: Eurostat.
Deutsche Bundesbank

Spain, Greece and Ireland. However, at -15% and -7% respectively, France and Germany, too, are still languishing far behind their respective pre-crisis levels. It has mainly been in the crisis countries that fiscal consolidation measures have hindered investment in infrastructure. A reluctance by businesses to invest in renewing and expanding their capacities is also likely to have been a factor.

## Investment in machinery and equipment and intellectual property products

*Investment in machinery and equipment back on growth path since 2013*

Investment in machinery and equipment, which mainly arises in the corporate sector and is crucially important for potential output, follows a clear procyclical pattern. A period of steep growth between 2004 and 2007 – outstripping even the rise in construction investment – gave way to a slump when the global financial and economic crisis reared its head. A brief period of recovery was interrupted by the sovereign debt crisis of 2011-12, which once again drove down spending on machinery and equipment, though this contraction was admittedly milder than the one seen in the Great Recession. Investment in machinery and equipment has been back on the increase since early 2013, and spending was just over 10% up on the last trough as this report went to press. ICT investment saw the strongest growth in the machinery and equipment category, having already surpassed its pre-crisis level in 2014. At that time, investment in machinery and equipment as a percentage of GDP, at just under 6%, was 1¼ percentage points down on 2007, while its longer-term average stood at 6¾% of GDP.

*Investment in machinery and equipment sees fewer adjustments*

Investment in machinery and equipment, then, has fared better than construction investment, both as a mean for the euro area and in the vast majority of euro-area countries. While many countries are still short of their pre-crisis levels, including Germany (by 7%), France and Spain (both by 10%), the trend towards increased investment in ICT, in particular, has remained intact. Only Italy, Portugal and Greece saw a fresh bout of very substantial declines in machinery and equipment investment during the euro-area debt crisis. Consequently, the gap between these countries' current positions and their pre-crisis levels is particularly wide. Italy and Portugal are lagging by around 30%, while the shortfall in Greece is as high as 70%. But most countries will have seen their investment in machinery and equipment resume an upward path over the last year, if not before.

Indeed, growth rates were exceptionally high in some countries, Spain and Portugal being among them. In these countries, the reform measures have markedly improved local conditions.[6] In Greece, on the other hand, the first green shoots of recovery in machinery and equipment investment were interrupted by the turbulence in the first half of 2015.

*Significance of investment in intellectual property products markedly greater*

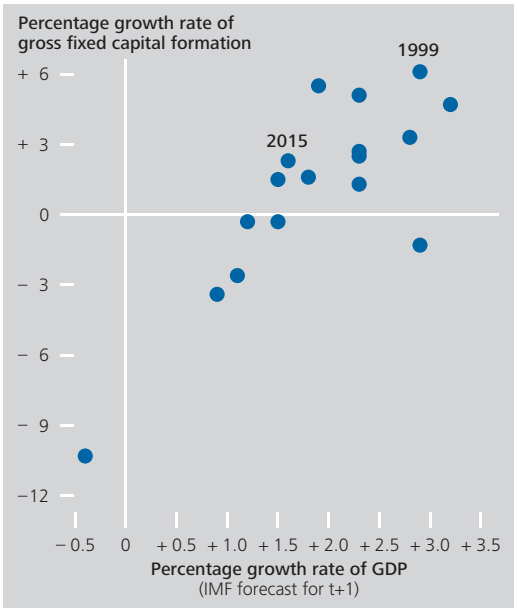
Despite the weakness of investment activity overall, the structural change raising the profile of research and development and the attendant accumulation of intangible assets continued. The pace of growth of investment in intellectual property products, which is largely confined to the (non-financial) corporate sector but also concerns the public sector, has merely slowed since 2008. In real terms, investment in this area exceeded its pre-crisis level by 14% at last count, sending its share of GDP up by ¼ percentage point to 3¾%. Most countries follow a similar pattern.[7] Only in a few isolated cases, such as in Italy, is this expenditure still down on its pre-crisis level. As a percentage of GDP, this investment has risen in most cases, with current figures ranging from 1½% in Lithuania to around 5% in France, Finland and Ireland. At 3½%, Germany is not far off the euro-area average.

## Determinants of investment activity

*Investment mainly driven by expected income prospects*

From the perspective of an individual enterprise, an important determinant of investment is most likely to be the demand it expects its products to attract. This will also depend on changes in macroeconomic activity levels. As for housing construction investment, households' income expectations will have a bearing, and they, too, are closely linked to aggregate growth prospects. The same can be said for the public sector's projected revenue, which determines the scope of infrastructure investment. To illustrate the rather close positive correlation that exists between aggregate investment and growth expectations, one need only plot the annual growth of gross fixed capital formation against the economic growth forecasts for the following year.[8] Other key factors are financing conditions and the availability of funds, pre-existing obligations and the ability to gauge future developments.

**Gross fixed capital formation and growth expectations in the euro area from 1999 to 2015**




Sources: Eurostat and IMF. Projections according to the April World Economic Outlook of each year for the coming year, gross fixed capital formation in the respective year. Gross fixed capital formation data for 2015: average of annual growth rates from 2015 Q1 to Q3.
Deutsche Bundesbank

*Macroeconomic environment worse since 2007*

Macroeconomic investment conditions have changed fundamentally since 2007. The global financial and economic crisis took quite a toll on the macroeconomic and financial environment, shaking the credit and property-fuelled

6 See World Economic Forum, The global competitiveness report, various editions. In the case of Spain, growing capacity utilisation improvements in the manufacturing sector as well as easing credit conditions, especially for smaller enterprises, are likely to have improved conditions. See Banco de España, Economic Bulletin, September 2015, pp 9-15.
7 In Ireland, these expenditures have doubled over the past year thanks to growth in the purchase of patents. Economic and Social Research Institute, Quarterly Economic Commentary, Winter 2015.
8 This has been done here using the IMF's spring forecasts for the euro area; other forecasts would present a very similar picture.

growth model that held sway in some euro-area countries to its very core. Problems that had piled up in the run-up to the crisis, particularly exaggerations in the real estate markets, yawning external deficits and the loss of price competitiveness, prevented the economy from rebounding and moving to a new growth path. They also contributed to the outbreak of the euro-area debt crisis. A fresh recession was the direct consequence, even though extensive consolidation measures and reforms had been introduced.[9] Overall, the protracted adjustment phase came at quite a heavy price in the form of unemployment and income losses. The economic recovery that began to emerge in spring 2013 remained tentative and lagged behind expectations, not least because of the at times cumbersome adjustment and reform processes. It was not until last year that the macroeconomic outlook began to brighten up a little. However, the need for economic policy reforms is still considered a priority issue.[10]

## Tightening of financing conditions

*Lending rates probably only partial and temporary inhibitive factor*

The financial and economic crisis was accompanied by a tightening of the hitherto favourable financing conditions. This was reflected not so much in the lending rates as in the credit standards. Indeed, average euro-area household and corporate lending rates quickly toppled from the elevated level that had been reached during the economic boom. But the member states did not all benefit from this reduction in equal measure. Quite the opposite, in fact: interest rates diverged strongly, particularly during the sovereign debt crisis. As a case in point, the spread between interest rates on new loans to enterprises in Italy and Spain and the corresponding German interest rates began to widen sharply in 2011 and only started converging in 2014. A higher degree of interconnectedness between bank and sovereign risks is likely to have been a key factor in the interest rate premium.[11] Thanks to the monetary policy measures which have since been taken, interest rate conditions have, however, been very favourable for some time now.

*Tightened credit standards, particularly in crisis countries*

A development that might have influenced investment more substantially than lending rates was the changes which banks made to their lending practices and their much more restrictive credit conditions. In the financial and economic crisis, this hit all euro-area countries to a similar degree; later, in the sovereign debt crisis, its impact was largely confined to the member states directly affected by the crisis. The ECB's Bank Lending Survey found that this was initially caused, above all, by a deterioration in financing conditions in the money and bond markets, liquidity shortfalls and higher capital costs. These factors later gave way to cyclical and demand-side factors, the survey revealed.[12] What is more, in countries such as Italy and Spain, heightened risks associated with loans to enterprises and large stocks of non-performing loans are also likely to have played a role.[13] Credit standards in some member states only began to ease off somewhat over the course of last year. In comparison with the pre-crisis period, they remain, however, much more restrictive, particularly in some southern member states.[14] Yet, the – in some cases – very favourable financing environment was probably a major reason for the excesses seen in the run-up to the crisis.

It is difficult to estimate just how far the tightened credit standards have actually influenced

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**9** See Deutsche Bundesbank, Adjustment processes in the member states of economic and monetary union, Monthly Report, January 2014, pp 13-78.
**10** See European Central Bank, Progress with structural reforms across the euro area and their possible impacts, Economic Bulletin, Issue 2, March 2015, pp 59-71.
**11** See Deutsche Bundesbank, The interest rate pass-through in the crisis, Monthly Report, September 2015, pp 33-35.
**12** See Deutsche Bundesbank, Recent developments in loans to euro-area non-financial corporations, Monthly Report, September 2015, pp 15-39.
**13** See Deutsche Bundesbank (2015), op cit, pages 31 and 32.
**14** See Deutsche Bundesbank, The level of credit standards in the Bank Lending Survey, Monthly Report, August 2014, pp 44-47. The results of the question on the current level of credit standards in historical terms broadly apply to 2015 as well.

*Some impairment of investment due to weak credit dynamics*

investment. Although the credit volume initially expanded more slowly after 2008 and even contracted thereafter, this could also be down to weaker credit demand.[15] In some member states, access to finance, particularly for SMEs, temporarily deteriorated.[16] Particularly those enterprises which had previously been highly dependent on bank financing are likely to have found it difficult to tap alternative sources of funding. Investment projects are likely to have failed as a result.[17] The reduced availability of loans for house purchase probably also dampened households' propensity to invest.

*Larger corporations with more leeway*

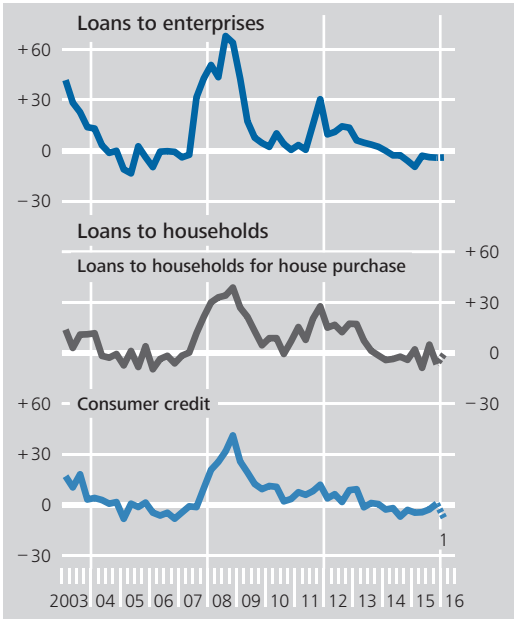
Larger non-financial corporations, however, can counter a deterioration in the availability of bank loans by seeking to make greater use of internal financing or alternative sources of external financing. During the global financial crisis, non-financial corporations across the euro area as a whole saw their net borrowing position of -2.3% of GDP in 2008 switch to a net lending position of +1.2% of GDP in 2009 on the back of a sharp reduction in investment expenditure and lower payouts. Since then, the non-financial corporate sector overall has stopped funding its fixed capital formation externally, and the recent expansion of investment spending has also been covered by internal financing hitherto.[18] It is reasonable to assume, then, that the comparatively low propensity to invest owes something to other factors.

## Need to deleverage

*Credit-fuelled investment boom sends debt levels rocketing*

Another factor inhibiting investment activity in a host of member states is likely to have been the high debt levels which non-financial corporations and households accumulated during the largely credit-fuelled investment boom in the run-up to the crisis. As a case in point, household debt as a share of GDP climbed by 39 percentage points to 81% in Spain, by 34 percentage points to 87% in Portugal, and by 50 percentage points to 100% in Ireland between 1999 and 2007. Debt levels rose in other member states as well, but they generally remained comparatively moderate, such as in France and also in Greece at around 50% of GDP, and in Italy at roughly 40% of GDP. In Germany, household debt even contracted to 60% of GDP. Non-financial corporations likewise experienced mounting debt levels relative to GDP in most member states, with Spain and Portugal again running up the highest increases, at about 60 and 30 percentage points respectively.

**Change in credit standards* in the euro area**

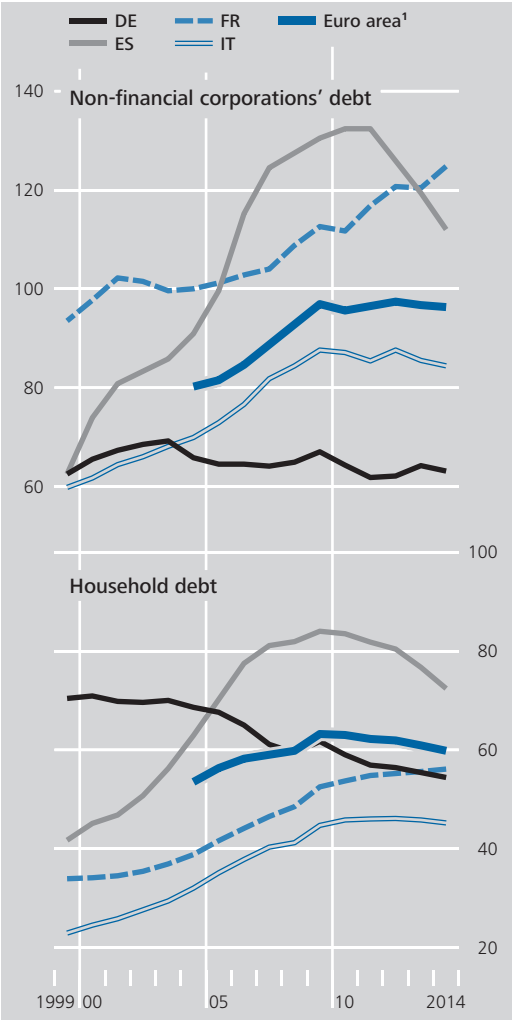



Source: ECB, Bank Lending Survey. * Difference between the total number of respondents reporting "tightened considerably" and "tightened somewhat" and the total number of respondents reporting "eased somewhat" and "eased considerably" as a percentage of the responses given. **1** Expectations for 2016 Q1.
Deutsche Bundesbank

**15** See, for example, S Holton, M Lawless and F McCann, SME financing conditions in Europe: credit crunch or fundamentals?, National Institute Economic Review No 225, August 2013; A Ferrando and N Griesshaber, Financing obstacles among euro area firms: who suffers the most?, ECB Working Paper No 1293, February 2011.
**16** See ECB, Survey on the access to finance of small and medium-sized enterprises in the euro area, various editions.
**17** This is indicated by the results presented by A Buca and P Vermeulen in Corporate investment and bank-dependent borrowers during the recent financial crisis, ECB Working Paper No 1859, October 2015.
**18** France is something of an exception here in that non-financial corporations there continued to raise additional external funding in recent years to finance fixed asset investment, a large proportion of which consisted, however, of equity instruments and debt securities, with bank loans again playing a secondary role.

**Debt ratios***

As a percentage of GDP




Source: Eurostat, ESA 2010. * Unconsolidated sum of debt securities, loans and pension provisions as a percentage of GDP. 1 Data only available from 2004.
Deutsche Bundesbank

*Burdens due to high debt levels*

The reappraisal of income prospects and the asset price correction that followed in the wake of the global financial crisis caused debt levels to bear down more heavily on enterprises and households, and led to a reassessment of debt sustainability going forward. The banking system, saddled with huge stocks of non-performing loans, found it difficult to obtain funding, while enterprises or households highly indebted to banks proved to be particularly vulnerable to a tightening of credit standards. If these enterprises or households cannot fall back on suitable alternative sources of funding, they will have no option but to deleverage should they intend to use bank loans to fund future investment. However, the need to deleverage depresses economic activity as a whole and investment in particular. Funds generated are no longer available for investment but need to be used to reduce debt.[19]

*Debt levels still high despite partial adjustments*

The adjustment processes did succeed in reducing debt levels, particularly in some of the countries affected by the crisis. Households in Spain and Ireland, say, scaled back their debt levels noticeably (by 10 and 15 percentage points of GDP respectively). Spain also saw the debt burden on non-financial corporations contract sharply, and in Italy and Portugal, too, the consolidation efforts did reap some rewards. Yet corporate indebtedness continued to mount in other countries. In France, corporate debt as a percentage of GDP climbed by a fifth to more than 125%. In Ireland, it even doubled to 200% (in Germany, it stagnated just shy of 60%). So while some improvements have been made, debt levels in the euro area as a whole are still fairly high. This would suggest that the debt burden will continue to dampen economic activity and the propensity to invest, at least in some member states, over the coming years, particularly so if interest rates begin to edge upwards.

## Uncertainty as a braking factor

*Financial and economic crisis probably increased uncertainty markedly*

Many believe the weak investment observed in recent years owes something to heightened uncertainty.[20] The macroeconomic and political turmoil unleashed by the financial and sovereign debt crisis sparked one negative surprise

19 See S Chen, M Kim, M Otte, K Wiseman and A Zdzienicka (2015), Private sector deleveraging and growth following busts, IMF Working Paper No 15/35; G Tang and C Upper, Debt reduction after crises, BIS Quarterly Review, September 2010, pp 25-38; Deutsche Bundesbank, Private debt – status quo, need for adjustment and policy implications, Monthly Report, January 2014, pp 53-65.
20 See European Investment Bank (2013), op cit; N Balta, I Valdés Fernández and E Ruscher (2013), Assessing the impact of uncertainty on consumption and investment, European Commission, Quarterly Report on the Euro Area, Vol 12, No 2, pp 7-16.

after the next. Prior to 2008, observers who could have imagined that a financial and economic crisis of this magnitude was possible, or at least an immediate prospect, were probably very much in the minority. Its onset probably shook widely-held beliefs to the core.[21] In the ensuing period, it was not always clear how other market players and politicians intended to respond to the new challenges they faced, and this probably caused macroeconomic uncertainty to grow markedly. So bearing this in mind, it is only natural to adopt a wait-and-see attitude when decisions have a bearing on the future. Investment decisions by businesses are probably a notable example of this phenomenon.[22]

*Global financial crisis hit all countries, the sovereign debt crisis Italy and Spain in particular*

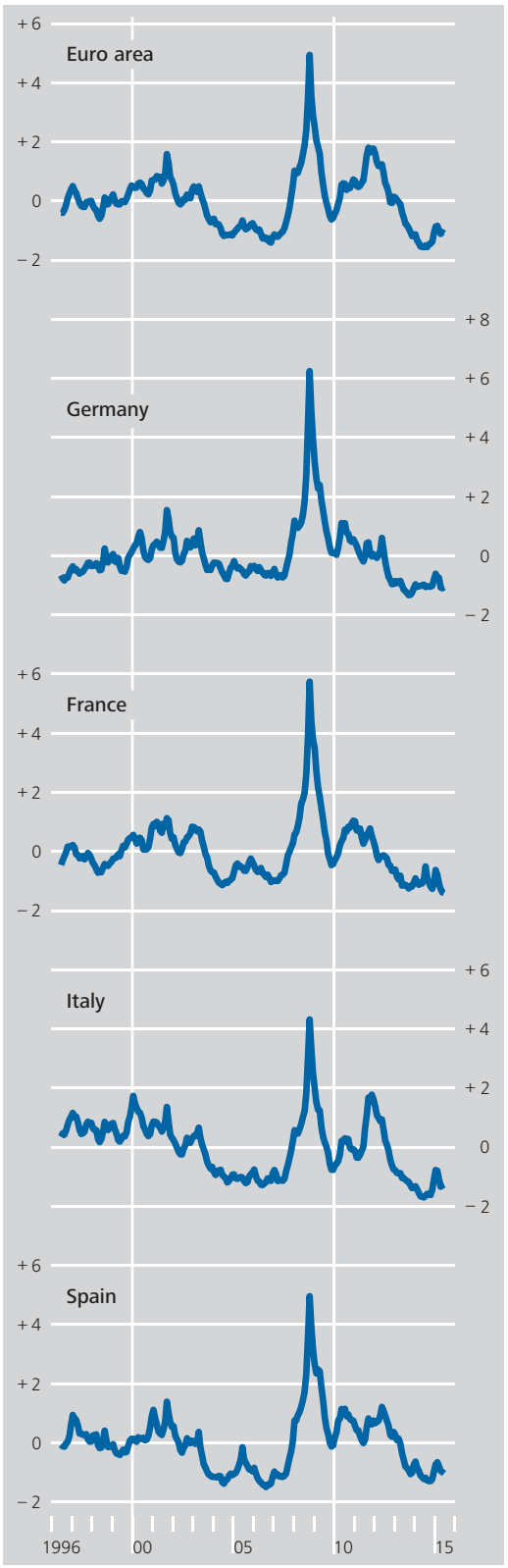
The uncertainty that has a bearing on economic activity and particularly on investment cannot be observed directly, but must instead be suitably approximated. The indicator selected here measures the extent to which economic developments can be predicted (see the box on pages 42 to 44). That indicator signals that uncertainty was distinctly elevated in both the euro area as a whole and its four largest member states, and the reading was particularly clear during the course of the global financial and economic crisis. Conversely, in the ensuring euro-area sovereign debt crisis, the indicator rose markedly only in the countries that were particularly affected by it – Italy and Spain – while in France, it increased only slightly and Germany's reading remained virtually unchanged.

*Uncertainty markedly diminished in recent years*

Econometric estimations suggest that the heightened uncertainty acted as a brake on corporate investment at the height of both the

**Macroeconomic uncertainty***

Monthly data




Source: Bundesbank calculations based on data provided by Eurostat, Haver Analytics and Global Insight. * The measures of uncertainty are calculated based on the non-forecastable component of macroeconomic indicators. An increase (decrease) in the standardised indicator implies a rise (fall) in uncertainty.

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21 This is the key topic addressed in J Kozlowski, L Veldkamp and V Venkateswaran (2015), The tail that wags the economy: belief-driven business cycles and persistent stagnation, NBER Working Paper No 21719. This paper posits that the shock of 2007-08 even has a persistent impact on the level of macroeconomic activity.

22 See B Bernanke (1983), Irreversibility, uncertainty and cyclical investment, The Quarterly Journal of Economics, Vol 98, No 1, pp 85-106; R Pindyck (1991), Irreversibility, uncertainty and investment, Journal of Economic Literature, Vol 29, pp 1110-1148.

## Measuring macroeconomic uncertainty and its impact on investment in the euro area

A common hypothesis in economic theory holds that uncertainty depresses investment.[1] An empirical assessment of this relationship requires a quantification of uncertainty. However, there are no objective, theoretically-founded measures of uncertainty, only approximations.

Some of the commonly used empirical measures of uncertainty are built upon conceptually very different methodologies. For instance, many of them capture the volatility of certain key variables (eg stock prices[2]) or the dispersion thereof (eg production expectations[3]).

Such dispersion and volatility measures are, however, also prone to capture developments that are not necessarily uncertain. As a case in point, the dispersion of production expectations might reflect heterogeneous, albeit certain (sector or firm-specific) expectations. Equally, stock market volatility might increase without this being attributable to uncertainty in the sense of an unanticipated change in macroeconomic fundamentals.[4]

More recent approaches to empirically approximating uncertainty focus directly on the predictability of economic variables in that they analyse a large number of data series in an effort to gauge the forecastability of macroeconomic developments and, thus, the level of macroeconomic uncertainty. Specifically, this initially involves determining the relevant forecastable component of the underlying macroeconomic time series with the aid of a factor model approach. The factor-based forecast is carried out in two steps. First, statistical methods are used to bundle the information contained in a multitude of individual indicators (the calculation includes both activity-related time series and financial market data) into a small number of factors. In a second step, the estimated factors are fed into the actual forecast model. Finally, based on the resulting forecast errors, a stochastic volatility model is applied to capture the individual uncertainty attributable to the corresponding macroeconomic time series. The measure for macroeconomic uncertainty is determined by aggregating time-series-specific uncertainty.[5]

An empirical analysis of the euro area's four largest countries (Germany, France, Italy and Spain) shows that there are similarities but also important differences between the various measures of uncertainty. Specifically, these measures are stock market volatility (SVOL),[6] the dispersion of production expectations in the manufacturing sector (EDISP)[7] and a measure of macroeconomic uncertainty (MU) based on the non-

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**1** See A Carruth, A Dickerson and A Henley (2000), What do we know about investment under uncertainty?, Journal of Economic Surveys 14 (2), pp 119-154.

**2** Actual stock index volatility and the implied volatility of stock indices derived from stock options are commonly used as a proxy for uncertainty. See N Bloom (2009), The impact of uncertainty shocks, Econometrica 77 (3), pp 623-685.

**3** For more information, see R Bachmann, S Elstner and E R Sims (2013), Uncertainty and economic activity: evidence from business survey data, American Economic Journal: Macroeconomics 5 (2), pp 217-249.

**4** For example, changes in market participants' risk aversion and swings in general market sentiment can trigger an increase in stock market volatility even if the assessment of macroeconomic fundamentals remains unchanged.

**5** A detailed description of this methodology can be found in K Jurado, S C Ludvigson and S Ng (2015), Measuring uncertainty, American Economic Review 105 (3), pp 1177-1216.

**6** Where available, stock market volatility (SVOL) is calculated based on the implied volatility of country-specific stock market indices, as derived from stock options. In all other cases, the actual volatility of the underlying price indices is used.

**7** The dispersion of production expectations in the manufacturing sector (EDISP) is calculated on the basis of monthly country-specific economic surveys by the European Commission.

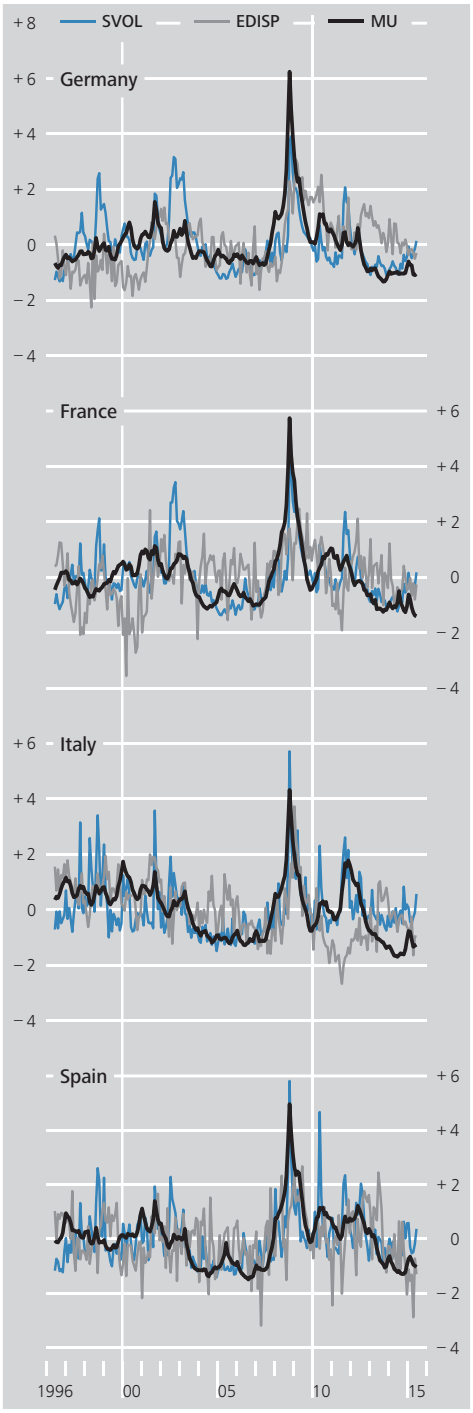
forecastable component of key macroeconomic series.[8]

First, a comparison of the uncertainty indicators reveals that all the measures in the four surveyed countries peaked during the global financial crisis of 2008-09. Second, simple correlations suggest that all three measures of uncertainty exhibit countercyclical behaviour with respect to investment activity. However, the measures of uncertainty also show considerable differences. The MU measure, which addresses the predictability of key variables, particularly stands out for showing the highest degree of persistence by far, while the other uncertainty indicators are distinctly more volatile and sometimes display a significantly higher number of uncertainty episodes.[9]

Structural vector autoregression (SVAR) models allow the relationship that exists between the various measures of uncertainty and investment to be explored in greater depth. The model specification chosen here contains six variables, each with four lags.[10] These are the annual growth rate of the stock price index,[11] a measure of uncertainty, a shadow short rate,[12] the inflation rate, the unemployment rate and the an-

**Development of various measures of macroeconomic uncertainty in selected euro-area countries***

Monthly data




Source: Bundesbank calculations based on data from Eurostat, Haver Analytics and Global Insight. * The uncertainty indicators presented in this chart are stock market volatility (SVOL), the dispersion of production expectations in the manufacturing sector (EDISP) and a measure of macroeconomic uncertainty (MU) based on the non-forecastable component of key macroeconomic variables. An increase (decrease) in the standardised indicators implies a rise (decline) in uncertainty.

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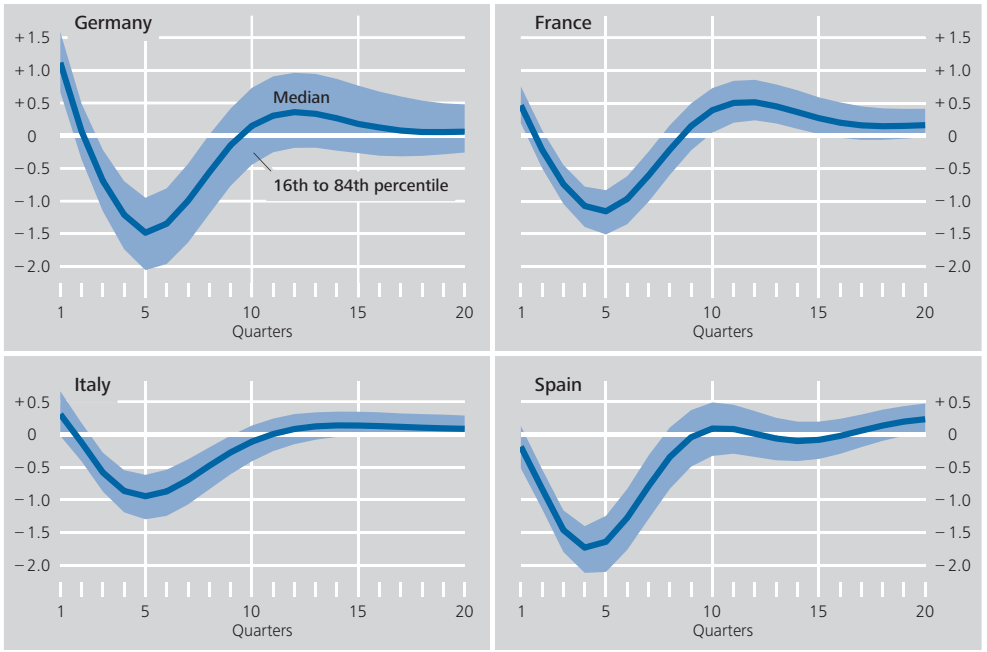
8 Depending on the country in question, the calculation comprises between 108 and 122 time series, including cyclical indicators, survey data, financial market series as well as prices and exchange rates.
9 The observed persistence of MU is consistent with empirical evidence for the United States. See Jurado et al (2015), op cit.
10 The specification and the ordering of variables in the SVAR model are based on Bloom (2009). The same applies to the identification of structural shocks which, as in Bloom (2009), is based on a Cholesky decomposition. See Bloom (2009), op cit.
11 The stock price indices used are the CDAX (Germany), the SBF250 (France), the MSCI Index (Italy) and the IGBM Index (Spain).
12 The shadow short rate (SSR) is intended to measure the degree of monetary policy accommodation when the policy rate is at the zero lower bound. In "normal" times, the SSR corresponds to the policy rate. See L Krippner (2013), Measuring the stance of monetary policy in zero lower bound environments, Economics Letters, 118 (1), 135, as well as Deutsche Bundesbank, The influence of credit supply shocks on the development of real GDP and lending to euro-area non-financial corporations, Monthly Report, September 2015, pp 36-38.

**Impact of a contractionary uncertainty shock on the annual growth rate of investment in machinery and equipment***




* Impulse-response functions of investment growth rates for a one-standard-deviation increase in uncertainty derived from an estimated SVAR model using Bayesian techniques. Estimation period: 1996 Q3 to 2015 Q2.

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nual growth rate of machinery and equipment investment. The estimations are based on Bayesian techniques and refer to the period from the third quarter of 1996 to the second quarter of 2015.[13]

The robustness of the empirical results is tested using a multitude of sensitivity analyses, which reveal that the measure of uncertainty designed to capture unforecastable components (MU), in particular, produces robust results regarding the impact of uncertainty shocks on investment.[14] While the results produced by the other two measures of uncertainty (SVOL and EDISP) in the robustness analysis for the individual countries vary between distinctly negative and barely significant effects, the impulse-response functions for MU show that investment in machinery and equipment consistently responds negatively to uncertainty shocks.

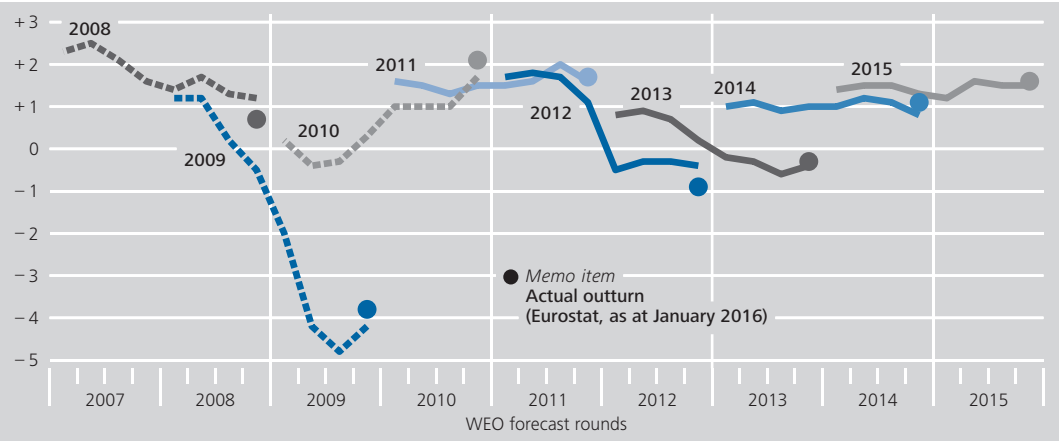
Measured in terms of MU, uncertainty was found to be high in all four countries under review during the global financial crisis of 2008-09. Moreover, the MU measure points to mounting uncertainty in the course of the European sovereign debt crisis of 2011-12, first and foremost in Italy and to a lesser extent in Spain. This could imply that uncertainty during these periods had a significant bearing on the weak investment developments in these countries. That being said, uncertainty has eased significantly in all four countries over the past two years.

13 An Independent Normal-inverse Wishart prior is used, with the hyperparameters being specified in line with the literature; see, for example, F Canova (2007), Methods for applied macroeconomic research, Princeton University Press. A prior distribution is specified for the coefficients and diagonal elements of the covariance matrix on the basis of estimated AR(1) models for each variable over a four-year sampling period (training sample).

14 Various model specifications are considered (bivariate models, changes to the ordering of variables), alternative investment measures used (investment in machinery and equipment, industrial production of capital goods), and models based on different data frequencies estimated (monthly and quarterly data). In addition, conducting the analysis across all four economies ensures that the results are not country-specific.

**Evolution of IMF projections of euro-area GDP growth in the year indicated**

Year-on-year percentage change




Sources: Various issues of the IMF World Economic Outlook (WEO) and updates between April 2007 and October 2015.
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financial and economic crisis and the sovereign debt crisis (see the box on pages 46 to 48). Uncertainty has since receded significantly, however. Predicting the economic environment now seems to have become easier again, probably because of the efforts to enhance the resilience of the banking sector and the stabilising effects of monetary and fiscal policy. Heightened uncertainty has not been a particular obstacle to investment of late.

## Growth expectations dashed

*Macroeconomic activity short of expectations*

The protracted spell of feeble economic growth has placed a strain on investment since 2008 (see the findings derived from an estimated structural vector autoregressive model in the box on pages 46 to 48). Not only that, the outlook for growth – a key factor for investment – has been revised downwards in recent years, not least because earlier expectations were dashed by the arduous adjustment processes. Evidence of this can be found by comparing IMF projections for euro-area economic growth with the actual outturns. European Commission and ECB projections would paint a similar picture, as would the results of the ECB Survey of Professional Forecasters or Consensus Forecasts. If medium-term projections from previous years are also factored into the equation, it can be concluded that, in 2015, the level of macroeconomic activity in the euro area was around 15% down on what had been expected directly before the crisis. The discrepancy in the case of Italy and Spain was particularly wide, at just over 20%.[23] In hindsight, longer-term investments effected in anticipation of stronger activity probably turned out to be a bad move, or the investments in question were not utilised appropriately.[24]

*Higher aggregate capital-output ratio in the euro area …*

From a macroeconomic perspective, this would manifest itself in a persistently elevated aggregate capital-output ratio (ie the ratio of capital stock to aggregate output).[25] The jump in the capital-output ratio during the course of the deep recession in 2009 was attributable to the irreversibility of fixed capital formation. The

**23** S Bond et al (2015) use data for Italy to demonstrate that expectations were revised to such a drastic extent at the firm level as well. See S Bond, G Rodano and N Serrano-Velarde, Investment dynamics in Italy: financing constraints, demand, and uncertainty, Banca d'Italia, Occasional Papers No 283, July 2015.

**24** These are the findings of a working paper by M Bussière et al (2015). Estimations for a panel of 22 advanced economies indicate that if growth prospects had not been systematically overestimated since 2007, cumulative investment would have been 12 percentage points lower until 2014. See M Bussière, L Ferrara and J Milovich, Explaining the recent slump in investment: the role of expected demand and uncertainty, Banque de France, Document de travail No 571, September 2015.

**25** See also D Gros, Investment as the key to recovery in the euro area?, CEPS Policy Brief No 326, November 2014.

## Determinants of investment activity in the euro area from the perspective of an SVAR model

The development of aggregate investment activity is determined by a number of different variables. These include factors affecting the real economy, as well as the financial market situation or the degree of macroeconomic uncertainty (see the box on pages 42 to 44). Structural vector autoregressive (SVAR) models are a standard tool in empirical business cycle analysis for identifying these drivers in the form of structural shocks. In particular, by means of a historical decomposition, SVAR models make it possible to identify the relative importance of structural shocks for the development of key macroeconomic indicators.

In the following, a historical shock decomposition of the growth in quarterly investment in machinery and equipment is carried out for the four largest euro-area countries (Germany, France, Italy and Spain). The SVAR model is estimated using Bayesian techniques[1] and has a lag order of four. It encompasses seven variables: the annual growth rate of real gross domestic product (GDP), of the GDP deflator, of real investment in machinery and equipment, of real MFI loans to non-financial corporations and of a stock index,[2] as well as a measure of macroeconomic uncertainty[3] and a shadow short rate.[4] The estimations are based on the period from the fourth quarter of 1998 to the second quarter of 2015.

Structural shocks are identified through the application of contemporaneous sign restrictions. This involves imposing qualitative restrictions on the impulse-response functions so that the initial effects of the shocks to be identified are consistent with economic theory.[5] A supply shock, a demand shock, a monetary policy shock and an uncertainty shock are identified. The shocks must satisfy the following restrictions. A supply shock leads to an increase in the GDP growth rate and a fall in the rate of inflation. By contrast, for a demand shock and an uncertainty shock it is assumed that the GDP growth rate, the inflation rate and the monetary policy interest rate all respond in the same direction. An uncertainty shock is set apart from a demand shock on the basis of the relative change in the growth rate of investment compared with the growth rate of GDP. In particular, it is assumed that – in contrast to an expansionary demand shock – the reaction in the rate of investment growth is stronger than the reaction in the rate of GDP growth.[6] It is also assumed that an expansionary uncertainty

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**1** Specifically, an "Independent Normal-inverse Wishart prior" is used, with the specification of hyperparameters in line with the literature; see, for example, F Canova (2007), Methods for Applied Macroeconomic Research, Princeton University Press. A prior distribution of the coefficients and diagonal elements of the covariance matrix is specified on the basis of estimated AR(1) models for each variable over a period of four years (training sample).
**2** The stock indices used are the CDAX (Germany), the SBF 250 (France), the MSCI Index (Italy) and the IGBM Index (Spain).
**3** The measure of uncertainty is based on the non-predictable component of key macroeconomic indicator series (see the box on pages 42 to 44).
**4** The shadow short rate is intended to measure the degree of monetary policy accommodation when the key interest rate is at the zero lower bound. In "normal" times, the shadow short rate corresponds to the policy rate. See L Krippner (2013), Measuring the stance of monetary policy in zero lower bound environments, Economics Letters, Vol 118 (1), pp 135-138, as well as Deutsche Bundesbank, The influence of credit supply shocks on the development of real GDP and lending to euro-area non-financial corporations, Monthly Report, September 2015, pp 36-38.
**5** See J Faust (1998), The robustness of identified VAR conclusions about money, Carnegie-Rochester Conference Series on Public Policy, Vol 49, pp 207-244; F Canova and G De Nicoló (2002), Monetary disturbances matter for business fluctuations in the G-7, Journal of Monetary Economics, Vol 49 (6), pp 1131-1159; H Uhlig (2005), What are the effects of monetary policy on output? Results from an agnostic identification procedure, Journal of Monetary Economics, Vol 52 (2), pp 381-419. The implementation follows the approach of J F Rubio-Ramírez, D F Waggoner and T Zha (2010), Structural vector autoregressions: theory of identification and algorithms for inference, The Review of Economic Studies, Vol 77 (2), pp 665-696.
**6** This identification strategy follows the approach of F Furlanetto, F Ravazzolo, S Sarferaz (2014), Identification of financial factors in economic fluctuations, Norges Bank Working Paper, No 9/2014.

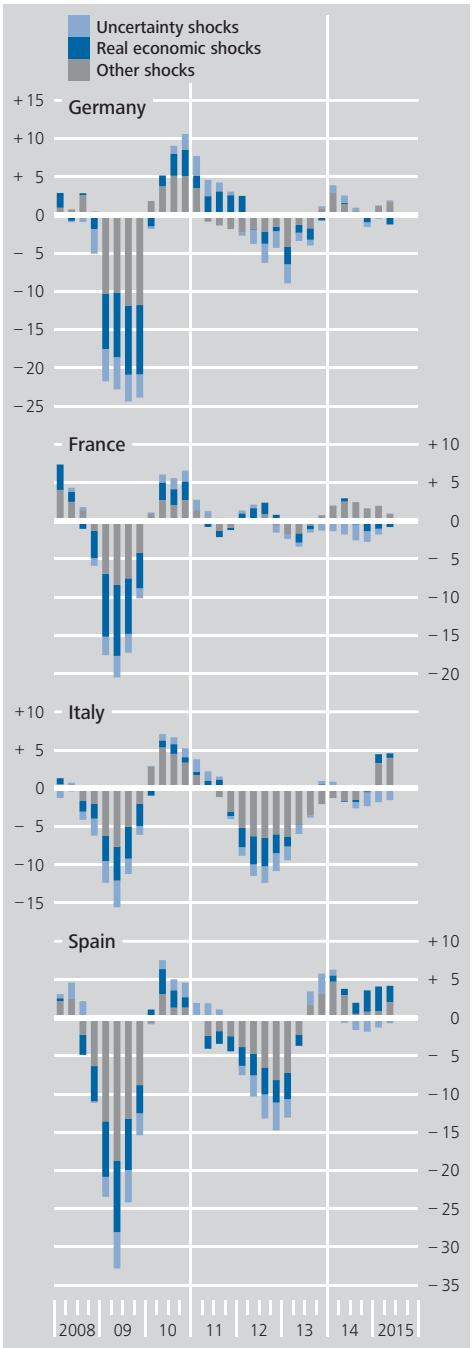
shock leads to a reduction in uncertainty and an upturn in the rate of investment growth.[7] A monetary policy shock is defined by a countervailing movement of the interest rate and the growth rates of both GDP and the GDP deflator. Below, supply shocks and demand shocks are subsumed under the term real economic shocks.[8]

The historical shock decomposition of investment in machinery and equipment from the estimated SVAR model shows the respective explanatory contribution of the shocks to the deviation of the investment growth rate from its unconditional mean.[9] The results suggest that both real economic shocks and uncertainty shocks had a negative impact on investment in the four countries during the global financial crisis of 2008-09. In Germany, France and Spain, the negative contribution of real economic shocks to investment growth was comparatively stronger than that of uncertainty shocks. By contrast, in Italy the negative effects of increased macroeconomic uncertainty on investment in machinery and equipment were relatively stronger.

In the wake of the European sovereign debt crisis of 2011-12, real economic shocks played a notable role in explaining the negative development of investment activity, particularly in Spain and Italy. Macroeconomic uncertainty also hindered investment in both countries during this period. Moreover, a dampening effect of macroeco-

**Historical decomposition of the effects of economic shocks on the annual growth rates of real investment in machinery and equipment in Germany, France, Italy and Spain***

%




* Contributions of present and past realisations of economic shocks to the deviation of the respective variables from their unconditional mean, as derived from a structural VAR model with sign restrictions. The median of the posterior distribution of each shock's contribution is shown. The real economic shock contains the effects of the aggregate supply shock and the aggregate demand shock. The category "Other shocks" captures the contributions of the other four shocks.

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7 Under the identification strategy chosen, it cannot be excluded that the identified uncertainty shock also captures aspects specific to investment and the financial market. For details, see F Furlanetto et al (2014), op cit.

8 Due to its small explanatory contribution, the monetary policy shock is not explicitly listed in the historical decomposition.

9 The contribution of an economic shock, at point in time t, to the deviation of the respective variable from its unconditional mean includes both present and past realisations of said shock. The illustrated contributions of the individual shocks correspond to the median of the posterior distribution of the shocks from the Bayesian estimation of the SVAR model. It should be noted that the estimation uncertainty shown by the distribution is relatively high.

nomic uncertainty can be found in Germany, while uncertainty scarcely had any negative effect on investment in France in this period. In the past two years, the importance of negative uncertainty shocks for investment in machinery and equipment has diminished in all countries.

Although investment was discernibly affected by supply shocks, demand shocks and uncertainty shocks during both the financial crisis and the sovereign debt crisis, the historical decomposition reveals that, to some extent, the other shocks also played a considerable part in this. This can be explained not least due to the fact that, in relation to the identified shocks, the estimated SVAR model contains a large number of variables. These variables deliberately aim to cover additional factors that are potentially difficult to identify, including, for example, factors specific to the financial market such as credit supply shocks and stock market shocks,[10] as well as investment-specific factors.

Finally, it should be taken into consideration that the results are model-specific. Difficult to capture, yet potentially relevant factors such as inaccurate forecasts, credit constraints or debt burdens could affect the results if adequately taken into account. Furthermore, it should be noted that the historical decomposition does not reveal the specific transmission channels of the identified shocks. It is, for example, conceivable that the observed negative effects of uncertainty shocks are, among other things, attributable to existing financial market frictions.[11]

**10** See Deutsche Bundesbank, The influence of credit supply shocks on the development of real GDP and lending to euro-area non-financial corporations, Monthly Report, September 2015, pp 36-38.
**11** See L J Christiano, R Motto and M Rostagno (2014), Risk shocks, American Economic Review, Vol 104 (1), pp 27-65, as well as S Gilchrist, J W Sim, E Zakrajšek (2014), Uncertainty, financial frictions, and investment dynamics, NBER Working Paper No 20038.

capital-output ratio has more or less persisted at a higher level since then because fixed capital formation in the years thereafter was abundant, relative to actual economic growth rates. Viewed from this perspective, an even lower investment ratio would have sufficed, if only because of the weaker growth.[26] But this line of thinking might not give two points the attention they deserve. One is that some of the fixed capital formed in the pre-crisis years and thereafter would have had to be adjusted for impairment losses owing to a lack of potential uses; the second is that the simplified calculation methods make the currently useable capital stock appear excessively high.

*… and in a number of countries, too*

There is evidence that the aggregate capital-output ratio is persistently high in a number of member states as well, the differences in Italy, Spain and Portugal being particularly pronounced. The ratio has also surged in France since 2007. Germany, meanwhile, saw its capital stock as a proportion of aggregate production swiftly retreat from its peak during the financial crisis thanks to the quick recovery by the country's economy and the – at times – reduced investment ratio.

*Medium-term growth expectations decisive for investment outlook*

However, the longer-term growth expectations are probably more important for investment than a potential capital overhang. Various surveys suggest that such expectations have stabilised at a lower level. For one thing, the high level of structural unemployment is braking activity, also over the medium term. Another important point is that, in a host of member states, structural barriers are inhibiting the necessary adjustments to the labour and product markets and dulling the positive impact of technological progress and innovation.[27] Added to this, demographic prospects are becoming increasingly gloomy in some countries. Yet,

**26** See also D Gros (2014), op cit.
**27** See OECD (2015), Economic Policy Reforms 2015: Going for Growth.

given an unchanged capital-output ratio, slower trend growth requires only a smaller investment ratio.[28] The capital-output ratio itself, however, is related to the rate of return on capital. Hence, the current low real interest rates open up the possibility of lifting the capital intensity of aggregate economic activity to a certain degree.

## Outlook

*View investment slump in macroeconomic context*

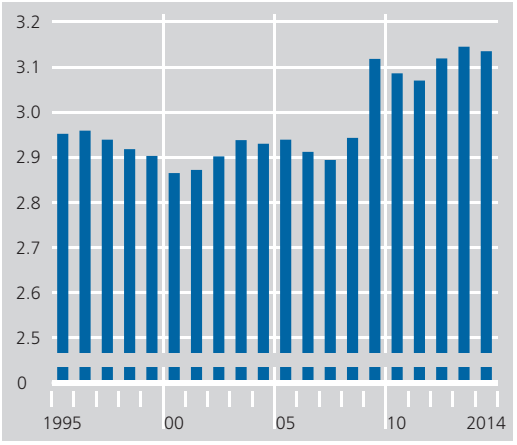
The spell of weak investment that has persisted for several years now in the euro area should be viewed against the backdrop of exaggerations and the build-up of massive macroeconomic imbalances prior to the outbreak of the financial and economic crisis. The correction of these imbalances put a huge damper on domestic demand and particularly on investment expenditure, especially so in some countries in southern Europe. This coincided with the pressure to deleverage, more restrictive access to finance and surges in uncertainty, not least in the economic policy sphere. The retarding effects of these forces were not necessarily confined to investment, however – employment and consumption decisions, and thus macroeconomic development as a whole, probably felt the pinch as well. This caused the euro area to fall short of its expected growth rates for a number of years. Viewed from this perspective, fixed capital formation which largely moved in line with expectations, has not generally been too low.

*Outlook*

Investment has picked up again on the back of the economic recovery which began in 2013 and has remained intact since then. Expenditure on investment in machinery and equipment, in particular, has even risen steeply in some member states of late. The recovery looks set to continue in the coming quarters, since burdening factors such as restrictive financing conditions are no longer as effective as they were in previous years. Macroeconomic uncertainty has eased considerably. Furthermore, important adjustments have already been made in an effort to reduce macroeconomic imbalances. Even so, given subdued trend growth and in light of the above-average capitalisation compared with current activity levels, the pace of investment growth is unlikely to increase significantly. It will only be possible to stimulate additional fixed capital formation if a lasting improvement is made to the euro area's growth prospects. But that would call for a coordinated package of measures to unleash the underlying forces of growth. Hoping for cyclical factors and the effects of the accommodative monetary policy alone to provide the necessary stimulus will not suffice to sustainably improve the investment climate.

**Capital-output ratio in the euro area**

Real capital stock in relation to real GDP




Source: European Commission.
Deutsche Bundesbank

28 On an equilibrium growth path, the aggregate capital-output ratio k is determined by the investment ratio iq, the growth rate g and the depreciation rate δ: $k^* = iq/(g+\delta)$. See R Solow (1956), A contribution to the theory of economic growth, The Quarterly Journal of Economics, Vol 70, pp 65-94.