IV. Investment dynamics in the euro area since the crisis[40] ✔️

This section analyses the investment dynamics in the euro area since the global financial and economic crisis. Investment across euro area remains below its pre-crisis level and its recovery has been sluggish. Investment is determined by a range of factors with complex and multiple interactions, which are not easy to capture in simple empirical models. Therefore, to better understand the dynamic relationships between investment and key macroeconomic variables, this section presents a sort of stress test for investment carried out with a relatively larger model for the period of the crisis in a system that takes into account joint dynamics of 26 macroeconomic variables. Overall, the analysis largely confirms previous findings: the weakness in investment dynamics is largely due to a strong accelerator effect and high real interest rates. However, to be able to explain the acute phases of the recession, the depth of the fall in investment during the first and second dip, and the delay in the rebound, long-lasting factors such as deleveraging in the private sector must be taken into account. Credit developments for both households and firms seem to have become important sources of fluctuations for the euro area business cycle in recent years. Therefore, given a protracted effect of private sector deleveraging, the European Investment Plan should play a central role in supporting capital formation.

Introduction

Investment in the euro area, in percent of GDP, remains below its pre-crisis level and even below its average level during the period 1995Q1-2007Q4 (see Chart IV.1). Moreover, its performance in terms of growth has been weaker during the crisis than in previous recessions. Several factors have been at the root of the investment weakness such as more sluggish economic growth than in previous downturns, high real long-term interest rates, bank and corporate deleveraging, weak public investment and increased uncertainty.[41] Given the

uncertainty about the interaction among these key drivers and investment, to better understand the role they have played during the crisis, this section presents a sort of stress test for investment in a large system that takes into account joint dynamics of 26 macroeconomic variables. [42] The model will also bring insights on the stability of the dynamic relationship between total investment and the rest of the economy as well as on the joint co-movement among other GDP components in the euro area since 2008.

Graph IV.1: **Real total investment and housing investment in the euro area (1)** *(% of GDP)*
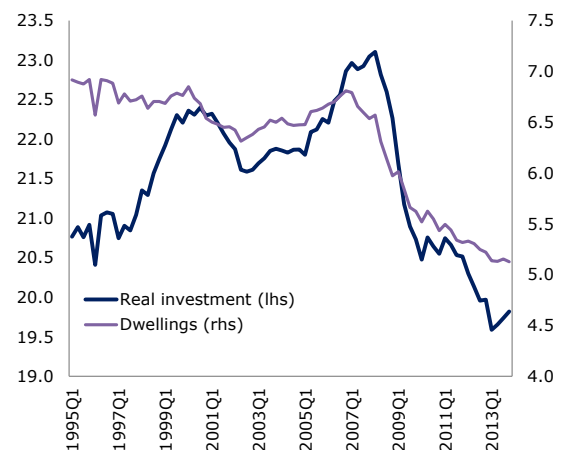
(1) Y0 marks the year of the cyclical trough as measured by ECFIN's output gap estimate. For the recovery after 2009, Y6 and Y7 are based on the Winter Forecast. EA 12 comprises of BE, DE, IE, EL, ES, FR, IT, LU, NL, AT, PT, FI.
Source: DG ECFIN.

The investment recovery in historical perspective

Recoveries from major recessions have always tended to be sluggish and hesitant in most euro area countries, especially when compared with the US. But, even against such a dismal record, the euro area recovery after the global financial crisis clearly stands out with domestic demand being the main cause of this weakness as identified in the Commission 2015 Winter Forecast.

---

(40) Section prepared by Narcissa Balta.
(41) Buti, M. and P. Mohl (2014), 'Lacklustre investment in the Eurozone: Is there a puzzle', *Vox Column*, June. European Commission (2014), *Autumn Forecast*, Box 1.1., 'Drivers and implications of the weakness of investment in EU'.

(42) Banbura M., D. Giannone and M. Lenza (2015), 'Conditional forecasts and scenario analysis with vector autoregressions for large cross-sections', *International Journal of Forecasting*, 01/2015.

Among the domestic demand components, national investment appears to have been much weaker in recent years than would normally be expected in a 'typical' recovery. Seven years after the onset of the global financial crisis, a 'typical' rebound in investment is foreseen to only begin in 2015. Chart IV.1 shows the investment recoveries of the three major recessions of the 1970s, 1980s and 1990s in the euro area. Such inter-temporal comparisons should of course be considered with caution, if only because of the radical institutional and structural changes brought by the single currency. However, they can illustrate the constraints bearing on the ongoing recovery in investment the euro area.

Graph IV.2: **Comparing recoveries: gross fixed capital formation, EA12 , (1)**
(% of GDP, Index: Y0=0)
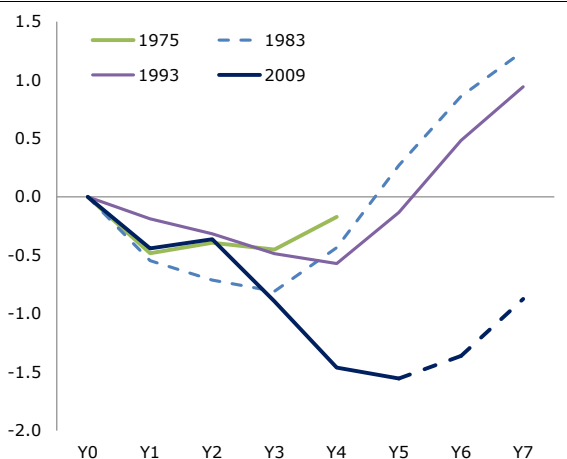
(1) Y0 marks the year of the cyclical trough as measured by ECFIN's output gap estimate. For the recovery after 2009, Y6 and Y7 are based on the Winter Forecast. EA 12 comprises of BE, DE, IE, EL, ES, FR, IT, LU, NL, AT, PT, FI.
Source: DG ECFIN.

**The investment dynamics since the crisis**

The observed decline in investment-to-GDP ratio since the beginning of the crisis, according to IMF methodology for classification of financial crises, seems to be more severe than in standard financial crises, however, in line with most severe financial crises [43] – with the ratio in 2014Q3 still standing 3 ½ percentage points below its 2008Q1 peak and 2 ¼ percentage points below its average level between 1995Q1 and 2007Q4 (see Graph IV.3).

Housing investment certainly has played a role in this decline. The housing investment-to-GDP ratio in 2014Q3 was 1 ¾ percentage points below its 2006Q4 peak and 1 ½ percentage points below its average during the period 1995Q1 to 2006Q3. This is not surprising, given the specificities of the current crisis, notably a severe house prices boom-bust episode in several euro area Member States.

However, there seems to be more than just developments in housing investment affecting the total investment-to-GDP ratio. Graph IV.3 shows developments in two domestic demand components: the investment ratio and the private consumption-to-GDP ratio since 1995Q1.

Graph IV.3: **Investment and private consumption, euro area**
(1995Q1-2014Q3, % of GDP, Index: 1995Q1=0)
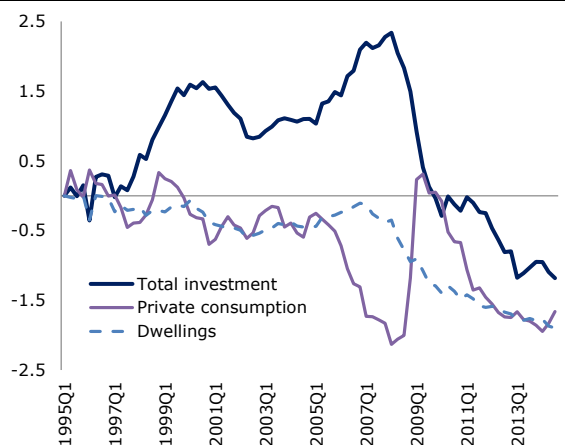
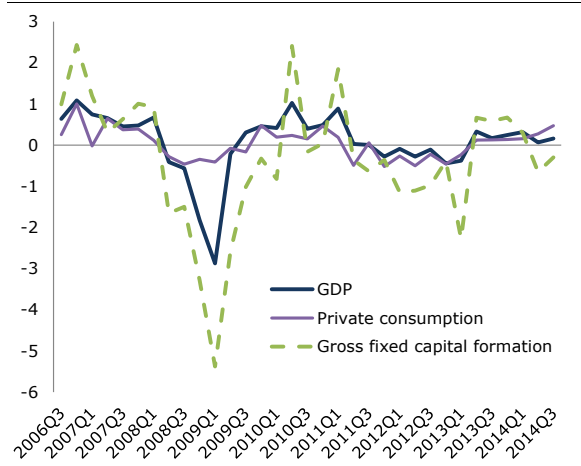(1) Euro area is defined as EA18.
Source: DG ECFIN.

Several stylised facts on the ratios to GDP are notable. First, the pre-crisis peak in the investment-to-GDP ratio occurred in 2008Q1, while the peak in housing investment-to-GDP ratio took place earlier in 2006Q4. Second, with the introduction of the euro in 1999, a positive upward shift in the investment-to-GDP ratio occurred in anticipation of the euro adoption during 1997-1999, which does not seem to be related to developments in housing investment. Third, a second upward shift occurred in 2004, this time in relation to the boom in housing-to-GDP ratio. Fourth, the correction brought by the 2008-09 recession pushed the investment-to-GDP ratio well below its 1995Q1 level. Last, while the investment-to-GDP ratios seemed to be still adjusting downwards in 2014Q3, private consumption-to-GDP ratio was very slowly rebounding, but still stood 1 ¼ percentage points

---

[43] Financial crisis as classified by IMF methodology: Barkbu B.B., P.S. Berkmen, and H. Schölermann (2015), 'Investment in the euro area: why it has been so weak ?', IMF *Working Paper*, 15/32.

below its pre-crisis average during the pre-housing investment peak period, 1995Q1 to 2006Q3.

Overall, the decline in the investment-to-GDP ratio seems to be long-lasting and the recovery in households' consumption ratio still at a distance.

Looking at growth rates, Graph IV.4 also shows that investment growth has not really recovered since the beginning of the crisis in 2008Q3 with no positive consecutive quarters of growth during the first GDP rebound between 2009Q4 and 2011Q1 and an episode of renewed contraction in 2014Q2-Q3 after the second GDP recovery in 2013Q2.

Graph IV.4: **Real GDP, private consumption and gross fixed capital formation, euro area (1)**
*(1995Q1-2014Q3, q-o-q % growth)*

(1) Euro area is defined as EA 18.
Source: Eurostat, QNA data (chain linked volumes (2010), million euro).

Private consumption has exhibited a clearer double dip pattern that tracks very closely GDP growth with a prolonged period of adjustment in household spending during the second contraction between 2011q4 and 2013Q1. However, its performance seems to have been slightly weaker than GDP growth with signs of a more robust pick-up only starting in 2014Q2 (see Chart IV.4).

At first sight, a protracted weakness in investment and household spending should not come as a surprise given the well-known legacy of excessive private and public-sector debt brought by the crisis. A large literature has highlighted the specificities of recoveries after financial and banking crises, pointing in particular at their persistent

sluggishness. [44] The euro area began the current recovery with a much higher level of private sector debt than in previous similar cyclical episodes and credit growth has since been flat or even decreasing when previous recoveries were typically associated with rapid credit expansion (see Chart IV.5).

Graph IV.5: **Comparing recoveries: credit to non-financial private sector, EA11**
(Index: Y0=100)
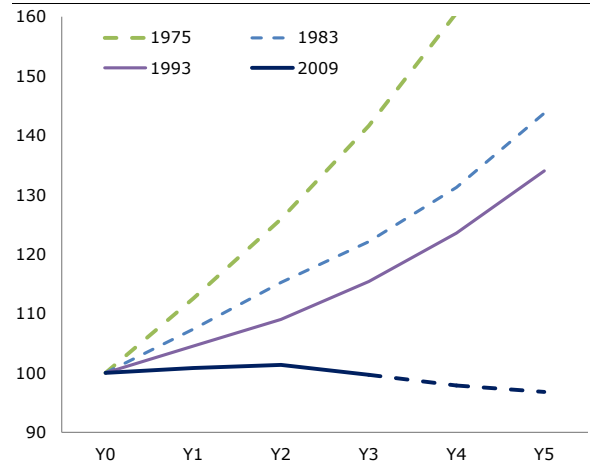
(1) Y0 marks the year of the cyclical trough as measured by ECFIN's output gap estimate. EA 11 comprises of BE, DE, IE, EL, ES, FR, IT, NL, AT, PT, FI.
Source: DG ECFIN.

Moreover, public debt has been increasing since 2009 at a much faster pace than in than in previous similar cyclical episodes, reflecting both the direct impact of the crisis on public finances and the need to rescue the financial sector. Macroeconomic policies have been substantially constrained compared with the past, with monetary policy at the zero lower bound (ZLB) and front-loaded fiscal consolidation.

Nevertheless, given their deep impact on the euro area economy, the question arises to what extent the financial and sovereign crises has brought changes in the historical behaviour of domestic demand components that might render the investment rebound uncertain.

[44] Reinhart, C. M. and K. S. Rogoff (2014), 'Recovery from financial crises: Evidence from 100 episodes', *American Economic Review*, Vol. 104(5), pp. 50-55; May. Jorda, O., M. Schularick and A. M. Taylor (2013), 'Sovereigns versus banks: credit, crises, and consequences', Working Paper Series 2013-37, Federal Reserve Bank of San Francisco; Jorda, O., M. Schularick and A. M. Taylor (2013), 'When credit bites back', *Journal of Money, Credit and Banking* 45(s2): 3–28; Claessens, S., A. Kose, L. Laeven, and F. Valencia (2013), 'Understanding financial crises: Causes, consequences, and policy responses', *CEPR Discussion Papers*, No. 9310.

Comparing investment developments with a counterfactual path for investment

Sluggish aggregate demand

To understand to which extent the weakness in investment dynamics during the crisis can be attributed to economic activity such as sluggish weakness in aggregate demand and high real interest rates and to which extent it can be attributed to other factors such as uncertainty and deleveraging pressures present in both private and public sectors, a large system that models the joint dynamics of 26 macroeconomic variables has been estimated for the period 1995Q1-2007Q4. Given the estimated past correlations, a counterfactual path for investment (i.e. a conditional forecast) can be obtained for the entire period, 1995Q1-2014Q3, conditional on observed GDP growth, inflation and short-term interest rates. The deviations of current investment developments from this counterfactual path can be interpreted as a lower bound on possible estimates of the existing gaps in the relationship between investment and the rest of the economy in the euro area since the crisis. The correlations in the data have been obtained using three models, a large Bayesian VAR, both in levels and in differences as well as a factor model (see Box IV.1 for details on the methodology). All three models point qualitatively towards the same conclusions.

Graph IV.6 presents the conditional forecasts of 9 macroeconomic variables implied by the observed path of real GDP, inflation and short-term interest rates between 1995Q1 and 2014Q3. The graphs show the actual data as compared to the results obtained using the three models: (i) the distribution of the conditional forecasts in the BVAR in levels; (ii) the point estimate of the median of the distribution of the conditional forecasts in the BVAR in differences; and (iii) the point estimate of the conditional forecasts in the factor model.

Several stylised facts on business cycle co-movement during the crisis emerge from the counterfactual analysis.

First, the large fall in economic activity during the first dip of the recession and the more moderate drop during the second dip should have implied a less sharp fall in investment than the observed one, both for total and housing investment. This is also true when one takes into account the fact that, due to the zero lower bound, real interest rates have been higher than what the pre-crisis relationship between interest rates and activity would have suggested. The actual fall in investment lies in the tails of the distribution of conditional forecasts during both the first and the second dip of the recession (see Graph IV.6).

Second, the observed fall in private consumption during the second dip of the recession has been faster than what economic activity would have implied, but not during the first dip. The actual data lie almost outside of the distribution of conditional forecasts during the second dip of the recession (see Graph IV.6).

Third, large deviations occur between the observed decrease in outstanding loans to households and firms and their counterfactual paths, illustrating that deleveraging pressures in the private sector during the recession have been much stronger than what the downturn in economic activity and the level of real interest rates would have predicted (see Graph IV.6, loans to households, loans to firms).

Fourth, large deleveraging pressures in the public sector have led to a significant decline in the euro area aggregate government consumption over the period 2011-2012. However, this decline had almost been reversed by the end of 2014, closing the gap between actual government consumption and its counterfactual path obtained through conditioning on economic activity (see Graph IV.6, Government consumption). By 2014Q3, the government consumption-to-GDP ratio had actually slightly increased - by ½ percentage point - as compared to 2008Q4.

Last, external as well as labour market performances seem to be fully in line with their counterfactual paths given by the distribution of conditional forecasts (see Graph IV.6, Real exports, Real imports and the Unemployment rate).

Uncertainty

Adding a measure of macroeconomic uncertainty to the conditioning set of variables describing economic activity seems to deliver better conditional forecasts for the unemployment rate and the long-term interest rates. However, it does not seem to significantly affect the distribution of conditional forecasts of investment. This is suggesting that uncertainty might have not been one of the main factors driving the misalignments between investment and economic activity

Graph IV.6: **Conditional forecasts based on real GDP, inflation and short-term interest rates (1)**
(1997Q1-2014Q3, y-o-y % growth)
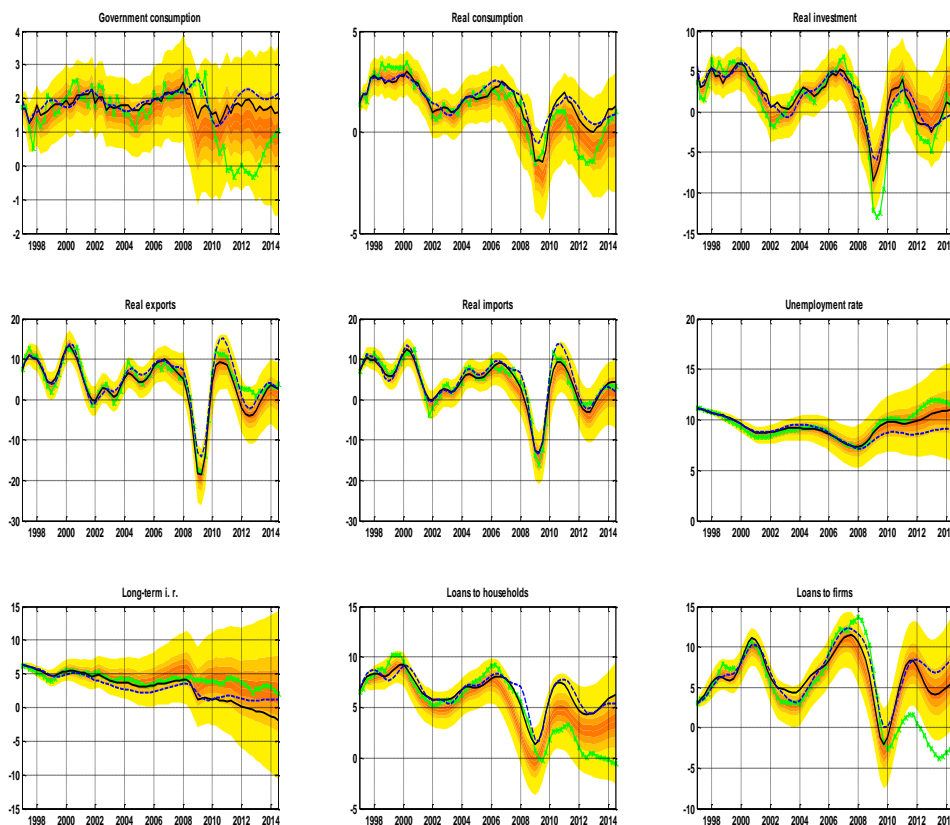
(1) Shades of orange: distribution of the conditional forecasts in the BVAR in levels, excluding the lower and higher 5% quantiles. Dashed blue line: point estimate of the conditional forecasts in the DFM model. Solid black line: point estimate of the conditional forecasts in the BVAR in differences, which is computed as the median of the distribution of the conditional forecasts in this model. Green line with crosses: actual values. The variables are all reported in terms of annual percentage changes, except for the unemployment rate and the long-term interest rate, which are in levels. Conditioning assumptions: real GDP, HICP, and the short-term interest rate.
Source: DG ECFIN, MATLAB codes replication files of the methodological paper (see Box IV.1).
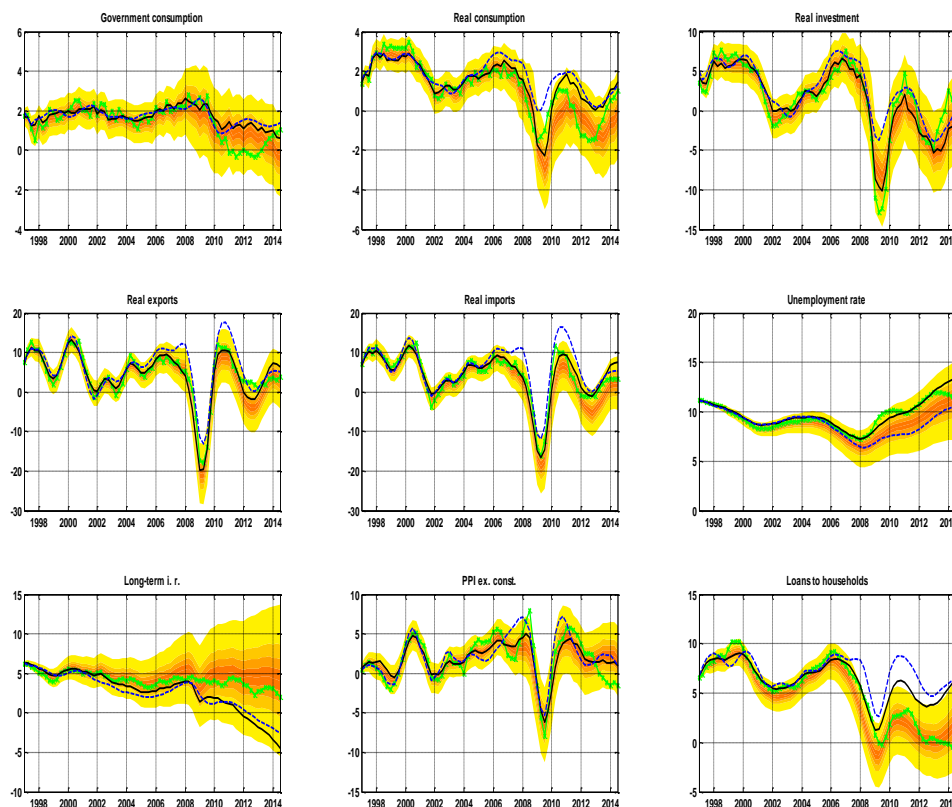
evidenced above, and that, by contrast, uncertainty developments have been fully in line with real GDP. Uncertainty has been measured as the dispersion in answers provided by households to the Commission Consumer Confidence Survey on questions related to their expected financial situation over the next 12 months.[45] Alternative measures of macroeconomic uncertainty have also been considered without a qualitative change in results.

Deleveraging in the private and public sectors

The most significant change in the counterfactual path of investment during the crisis can be obtained when adding measures of private deleveraging pressures to the conditioning set of variables describing economic activity (see Graph IV.7). Including the change in the stock of loans to firms in the conditioning set describing economic activity, makes the observed fall in investment during the second dip of the recession fully in line with its counterfactual path as described by the distribution of conditional forecasts. This also holds true for private consumption, when including the change in the stock of loans to households. By contrast, the

---

[45] For more details on uncertainty indicators, see 'Focus: Assessing the impact of uncertainty on consumption and investment', *Quarterly Report on the Euro Area*, Volume 12, N° 2.

(1) Shades of orange: distribution of the conditional forecasts in the BVAR in levels, excluding the lower and higher 5% quantiles. Dashed blue line: point estimate of the conditional forecasts in the DFM model. Solid black line: point estimate of the conditional forecasts in the BVAR in differences, which is computed as the median of the distribution of the conditional forecasts in this model. Green line with crosses: actual values. The variables are all reported in terms of annual percentage changes, except for the unemployment rate and the long-term interest rate, which are in levels. Conditioning assumptions: real GDP, HICP, the short-term interest rate, the uncertainty indicator and the change in the stock of loans to firms.
Source: DG ECFIN, MATLAB codes replication files of the methodological paper (see Box IV.1).

observed initial fall in total investment during the first dip of the recession remains faster than what economic activity would have implied (see Graph IV.7, Real investment). However, when looking only at non-housing investment, the fall during the first dip of the recession moves into the distribution of conditional forecasts, indicating that the exceptional depth of the first trough in total investment (compared with normal recessions) was much related to a housing cycle and severe corrections in housing investment.

Last, adding a measure of public deleveraging pressures, as measured by the changes in public consumption, together with the measure of private deleveraging does not seem to change the

counterfactual paths for total investment and private consumption during the crisis, indicating that deleveraging pressures in the private sector were the key factor explaining deviations from 'typical' downturns during the second dip of the recession. Public sector deleveraging, despite its large size and its misalignment with economic activity, does not seem to have been one of the main factors driving the gap between investment developments and economic activity during the crisis.

Overall, it is necessary to add uncertainty, private deleveraging, inflation and interest rates to the conditioning variables to explain changes in the relationship between total investment and GDP

since the crisis. These variables are, therefore, crucial to understand the change in the euro area business cycle in recent years.

Some degree of stability in the economic relationships following the financial crisis seems to still exist as the conditional forecasts for this period based on the parameters estimated with data until end of 2007 are relatively accurate. However, conditional forecasts based on three variables (real GDP, inflation and short-term interest rate) cannot without credit variables track very closely the severe fall in total investment and private consumption during the last two dip recession.

There are three stylised facts that cannot be tracked by conditional forecasts based on only three variables: (i) the initial sharp decline in total investment during the first dip of the recession, leading to a protracted downward adjustment in the investment-to-GDP ratio, and the more moderate decline of the second dip; (ii) the fall in private consumption during the second dip of the recession; and (iii) the observed path of adjustment in outstanding loans to firms and households, which seem to lie in the tail of the distribution of conditional forecasts, indicating existing misalignments between credit to the real economy and economic activity that cannot be tracked down by aggregate demand, inflation and short-term interest rates.

In order to understand the relationships between GDP and key macro variables such as domestic demand and unemployment since the crisis, in addition to inflation and short-term interest rates, there is a need to include also private credit and uncertainty in the conditioning set of variables. These variables are therefore crucial to understand the sources driving the fluctuations in the euro area business cycle in recent years.

While the investment dynamics in the euro area seems to be very much determined by an accelerator model in which past changes in output explain well much of the investment path, there are episodes of the last recession, notably the depth of first and the second dip, which cannot be tracked down, both for total and housing investment, unless credit and housing cycle developments are taken into account. In particular, a continued long-lasting deleveraging period in the household and non-financial corporate sectors seems to have played an important role in shaping the investment path since the crisis.

Conclusions

Euro area investment has been much weaker in recent years than would normally be expected in a 'typical' recovery. Seven years into the current crisis, a 'typical' rebound in investment is only foreseen to begin in 2015.

The analysis presented in this section suggests that three or four variables are sufficient to capture most developments in the euro area economy, indicating that there are only few sources of fluctuations in the euro area. All in all, the model estimates point to a relatively stable economic relationships following the financial crisis: the conditional forecasts for this period based on the parameters estimated with data until end of 2007 are relatively accurate.

Nevertheless, for the period of the crisis, some exceptions are notable from what would have been expected based on the 1995Q1-2007Q4 estimated economic relationships: (i) differences appear in the developments in credit variables, whose actual developments were much more subdued than what would have been predicted based on information on economic activity; (ii) differences also appear in private consumption for some of the more severe periods of the double dip recession when credit variables are not included in the information on economic activity; and (iii) even when credit developments are taken into account, some misalignments are still present, notably the initial sharp decline in total investment during the first dip of the recession.

The analysis shows that the weakness in investment behaviour since the crisis can be attributed to a large extent to economic activity such as sluggish weakness in aggregate demand and high real interest rates, but also to credit factors such as deleveraging pressures in the private sector. The latter seem to have started to play a more important role since the second dip of the recession with long-lasting effects on investment dynamics. Credit developments have become a major source of fluctuations in the euro area economy during the current recession. Therefore, given the protracted effect of private sector deleveraging on investment dynamics, there is a need to put in place policies to support capital formation in the euro area. By boosting infrastructure spending, the European Investment Plan should play central role in ensuring a sustained rebound in investment in 2015/2016.

Box IV.1: **Conditional forecasts of investment during the crisis**

The analysis is based on recent developments in the literature of vector autoregressions (VARs) tools for large data sets (Banbura et. al, 2015, Giannone et. al, 2014). VARs are considered to be a reliable tool for building empirical benchmarks as a complement to alternative representations such as dynamic stochastic general equilibrium (DSGE) models, which provide structural benchmarks more grounded in theory, at the cost of imposing more restrictions on the dynamic cross-sectional correlations in the data. Empirically, there are currently two approaches to deal with the complexity of large datasets, without losing their salient features: Bayesian VARs (BVARs) and dynamic factor models (DFMs). The Bayesian VARs offer a solution to the curse of dimensionality in the VAR framework by adopting Bayesian shrinkage. The idea of this method is to combine the likelihood coming from a highly parameterised VAR model with a prior distribution for the parameters that is naïve but enforces parsimony. As a consequence, the estimates are "shrunk" toward the prior expectations. Factor models exploit the fact that macroeconomic and financial time series are characterised by strong cross-sectional correlation. Under the assumption that most of the fluctuations are driven by a relatively limited set of common sources, factor models offer a parsimonious representation by summarizing the information from a large number of data series in few common factors.

The analysis will consider two versions of the BVAR – with data in log-levels and in log-differences – and a dynamic factor model. The dataset includes 26 quarterly variables for the euro area, as listed in the data appendix of the methodological reference paper, providing also the details of the data transformation applied prior to parameter estimation (Banbura et. al, 2015): macroeconomic conditions (GDP and expenditure components, consumer and producer prices, labour market data, surveys, effective exchange rate, world economic activity, commodity prices), financial variables (short and long-term interest rates, stock prices), credit (both to households and firms) and monetary aggregates (M1 and M3). As a measure of macroeconomic uncertainty, an indicator of consumer confidence is used, measuring the dispersion in the answers given by households to the Commission Consumer Confidence Survey on their expected financial situation over the next 12 months. The sample covers the period from 1995Q1 to 2014Q3 for EA18. Most of the data comes from the Eurostat, Quarterly National Accounts. Data on the world economic activity, as measured by global GDP, oil prices, and non-oil commodity prices, are taken from the last 2014 update of the Area Wide Model database. Remaining variables, notably prices, credit and monetary aggregates are taken from the ECB Statistical Data Warehouse. The US short-term interest rate is downloaded from the FRB database.

From each of the three models, forecasts are generated conditional on the observed realised paths of two sets of variables: (i) a small set: real GDP, HICP, and the short-term interest rate; and (ii) a broader set: real GDP, HICP, the short-term interest rate, the uncertainty indicator and changes in outstanding loans to households and firms. The conditional forecasts are generated over the period 1997-2014. The first two years in the sample are used as initial conditions. Thus the conditional forecasts for 1997-2007 can be considered as "in-sample" while those over 2008-2014 as "out-of-sample". The conditional forecasts computed for the three models provide similar insights: (i) the "in-sample" part (1997-2007) of the conditional forecasts can be compared with the observed developments in order to test whether knowing only the time series of real GDP, HICP and the short-term interest rate is sufficient in order to capture the dynamics of the variables in the model; (ii) by comparing the "out-of-sample" part (i.e. from 2008 onward) of the conditional forecasts with the observed developments, it can also be assessed whether the financial and the sovereign debt crises have produced a change in the structural economic relationships in the euro area. A change in the economic relationships would likely lead to relevant inaccuracies of the conditional forecasts based on parameters representing the pre-2007 economic relationships (Graph IV. 6 and Graph IV. 7 in the text).

The conditional forecasts are close to the actual outcomes, in particular in the "in-sample" period. This fact suggests that few "dimensions" are sufficient to capture the developments in most of the economy. Turning to the "out-of-sample" evidence, there is a general similarity of the conditional forecasts across approaches. However, some differences appear between forecasts and observed developments for a few variables, indicating instability in the relationships of these variables with the conditioning set. In particular, notable differences appear in the developments in credit variables, whose actual developments were much more subdued than what would have been predicted based on the conditioning information. Furthermore, some differences appear between forecasts and observed developments for investment and private consumption

Box (continued)

for some of the more severe periods of the double dip recession when credit variables are not included in the conditioning information.

References

Banbura, M., Giannone, D. and M. Lenza (2014), "Conditional forecasts and scenario analysis with vector autoregressions for large cross-sections", *International Journal of Forecasting*, forthcoming. Acknowledgements to the authors for sharing the MATLAB codes replication files of the paper.

Banbura, M., D. Giannone, and L. Reichlin (2010): "Large Bayesian vector auto regressions," *Journal of Applied Econometrics*, 25(1), 71–92.

European Commission (2013), "Focus: Assessing the impact of uncertainty on consumption and investment", *Quarterly Report on the Euro Area*, Volume 12, N° 2, DG ECFIN.

Giannone, D., M. Lenza, and G. E. Primiceri (2014): "Prior selection for vector autoregressions," *Review of Economics and Statistics*, forthcoming.