




Financial channels and economic activity in the euro area: a large-scale Bayesian VAR approach

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Abstract

This paper explores the nexus between financial and macroeconomic developments in the euro area. It draws on key lessons from the literature and provides stylised facts on the main transmission channels through which financial developments have affected real economic activity in the recent years. Specifically, a large-scale Bayesian VAR (Bańbura et al. in *Int J Forecast* 31(3):739–756, 2015) is applied to set of macroeconomic and financial variables focusing at four key channels: (1) the interest rate channel; (2) the borrower balance sheet channel; (3) the bank balance sheet channel; and (4) the uncertainty channel. Overall, conditional forecasts from this model suggests that financial variables have significant impact on macroeconomic developments but also that the relative importance of individual channels varies across time. Notably, the interest rate channel (reflecting also the monetary policy stance) has helped the recovery in 2013/2014 by supporting both private and public consumption. The positive boost has been somewhat compensating the adverse effects of the borrower balance sheet channel. The bank balance sheet channel and the uncertainty channel play in turn a particularly important role in capturing the weakness in the rebound in investment.

Keywords Macro-financial linkages · Large-scale Bayesian VAR

JEL Classification C11 · C32 · E32 · E44

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1 Introduction

Since the global economic and financial crisis, the linkages between macroeconomic and financial developments have been on the frontline of both research and policy making. The massive dislocations observed during the crisis have forged a broad consensus that shocks originating in the financial sector can have profound effects on real economic activity and vice versa. While the effect of macroeconomic developments on financial conditions is rather straightforward (Jacobson et al. 2005), the effect of financial developments on the macroeconomy is more complex and was (until recently) largely omitted in mainstream macroeconomic thinking (see e.g. Brunnermeier and Sannikov 2014). The interest rate was the only financial variable included in standard macroeconomic models and only to the extent that it was assumed to influence the decisions of economic agents, while no genuine role was assigned to the financial sector itself. In reality, financial intermediation is subject to numerous *frictions* that can affect macroeconomic developments via diverse *transmission channels*. Given the decisive role of bank credit in financing the euro area economy, shocks originating in the banking sector are expected to play a crucial role.

This paper looks at macro-financial linkages in the euro area to shed light on how financial developments may have contributed to disappointing macroeconomic performance in the recent past. The methodology employed for this purpose is a large-scale Bayesian VAR that encompasses a wide set of macroeconomic and financial variables (Bańbura et al. 2015). Conditional forecasts from this model is used to evaluate relative importance of four key channels how financial developments can affect the macroeconomy of the euro area: (1) the interest rate channel; (2) the borrower balance sheet channel; (3) the bank balance sheet channel; and (4) the uncertainty channel.

Section 2 discusses the importance of the financial system for the real economy and reviews the relevant economic literature. Section 3 describes the main transmission channels from financial markets to the real economy and defines specific variables that could be used to capture these transmission channels in the euro area. Section 4 describes the empirical framework. Section 5 presents the results of the empirical analysis particularly some stylised facts on the co-movement between financial variables and economic activity since the crisis.

2 The financial system and the real economy

Market frictions are normally understood as a wide range of different bottlenecks that do not allow markets to efficiently clear demand and supply. *Financial frictions* are impediments to the smooth functioning of the financial market that do not allow funds to be channelled effectively from creditors to borrowers. Therefore, they play an important role in the way the financial system affects the real economy. Moreover, the presence of frictions during periods of financial turmoil

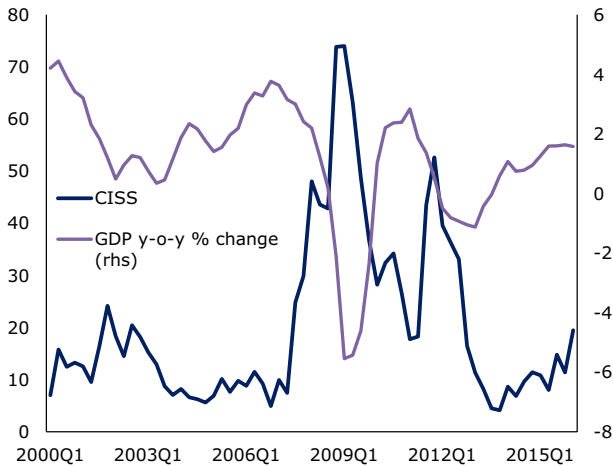


Fig. 1 Real GDP growth versus Composite Indicator of Systemic Stress (2000Q1–2016Q1). *Source:* ECB, Eurostat

undermines financial sector stability, which via *feedback effects* can have a detrimental impact on macroeconomic developments. For instance, hikes in bank funding costs when money markets stop functioning are likely to be transmitted to the lending rates applied to consumers, which in turn can have a significant drag on both investment and consumption. Also, financial frictions increase the likelihood of financial shocks occurring both from the demand and the supply side.

Financial shocks are usually deemed to have persistent and amplification effects, in the sense that even small shocks can produce large and long-lasting impact on the real economy (Brunnermeier et al. 2012). Figure 1 shows a clear negative correlation between GDP growth and financial distress in the euro area, as measured by the Composite Indicator of Systemic Stress (CISS).¹

Since the key role of the financial sector consists in funding economic activity, *new credit* is the main channel of transmission between the financial sector and the macroeconomy. Financial shocks occurring on the demand side are usually triggered by an impairment of borrowers' balance sheets, which in turn undermines their creditworthiness and their capacity to invest and consume. Financial shocks occurring on the supply side (i.e. those that originate from within the financial sector) normally manifest themselves through tightening of credit conditions and/or credit rationing which, again, impact real economic activity via the investment behaviour of households and non-financial corporations. Figure 2 shows the negative correlation between credit standards for firms and real investment.²

¹ The CISS (Holló et al. 2012) measures contemporaneous stress in the financial system. It is an aggregate of five market-specific sub-indices. More weight is put when stress prevails in several market segments at the same time, thus tracking financial stress of systemic nature.

² Credit standards are measured by the backward looking 3 months index from ECB Bank Lending Survey (BLS).

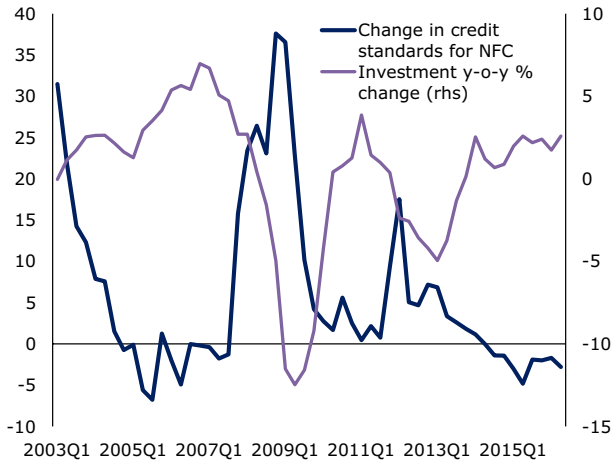


Fig. 2 Investment growth versus credit standards for NFC (2003Q1–2016Q1). *Source:* ECB BLS, Eurostat

2.1 Financial frictions in the macroeconomic models

The neglect of financial sector effects in traditional macroeconomic thinking has its foundation in the famous Modigliani-Miller theorem (Modigliani and Miller 1958) suggesting that the way a firm finances its investment (via debt or via equity) has no effect on its value. That implies that firms' investment decisions are driven primarily by macroeconomic conditions (namely, the real interest rate) rather than financial market developments. However, the validity of the theorem hinges on a set of very restrictive assumptions such as perfect information, equal tax treatment for debt and equity etc., which are generally not met in practice (Morley 2016). Financial intermediation typically involves asymmetry of information between borrowers and lenders and potentially costly verification of the borrower's financial situation (Carlstrom and Fuerst 1997).

The first attempts to include financial frictions in macroeconomic models were based on the insight that the cost of external financing very much depends on the borrowers' net worth (Bernanke and Gertler 1989) and/or the market value of their collateral (Kiyotaki and Moore 1997). In fact, changes in asset prices turn out to be a crucial determinant of both the cost of external financing and the value of collateral. Moreover, a relatively small shock can have a major effect on economic activity through the so-called "financial accelerator", whereby negative feedback loops between lower assets prices, restricted access to credit and lower consumption and investment, significantly amplify and prolong the impact on the real economy (Bernanke et al. 1999). Real estate, which is a typical asset used as collateral by both households and firms establishes a tight link between the housing market and the economy as a whole (Iacoviello and Neri 2010).

While the original theoretical contributions did not explicitly model financial intermediaries (assuming direct lending from investors to borrowers), the inclusion

of financial intermediaries (i.e. the banking sector) implies that financial frictions can appear also on the lenders' side (Gertler and Kiyotaki 2010). Specifically, financial intermediaries can become balance sheet constrained in times of economic and financial stress, which affects their funding costs. Such shocks to the lenders' side are usually mitigated by central bank intermediation during crisis times (Gertler and Karadi 2011).

Despite intensive efforts in recent years, the financial sector is still not fully established as a consolidated part of conventional macroeconomic models. Structural models augmented by a banking sector and financial markets (Christiano et al. 2010) typically find that financial factors, such as bank liquidity constraints, are indeed the main drivers of economic fluctuations in both the US and the euro area and that they were the main shock propagator during the global financial crisis.³

2.2 Empirical evidence on macro-financial linkages

Numerous empirical studies evaluate the effects of financial shocks on macroeconomic fluctuations.⁴ Importantly, financial factors can both reinforce the transmission of other shocks and be a source of disturbance in their own right. Credit appears to be one of the most studied financial variables in empirical studies due to its established regularities in terms of boom-and-bust behaviour and its link to financial crises and economic downturns (Balke 2000). Credit spreads play an important role for capital markets-based systems like the US economy. For example, corporate bond spreads usually increase disproportionately during periods of financial stress (so-called excess bond premiums), which in turn causes economic activity to contract (Gilchrist and Zakrajšek 2012). In the euro area, where external financing is mostly bank based, a crucial role is played by bank lending rates and bank lending volumes. Credit supply shocks have been identified as important determinants of the increase in lending rates and the decline in lending volumes during the recent crisis (Moccero et al. 2014). Therefore, bank lending represents the main transmission mechanism between financial and macroeconomic developments in the euro area countries (Cingano et al. 2016; Aldasoro and Unger 2017).

The evidence available indicates that the impact of financial shocks on the macroeconomy is 'state dependent,' i.e. the response of economic activity, inflation and credit to financial shocks is stronger during periods of stress. This is well documented for both the euro area and the US (Hubrich and Tetlow 2015; Prieto et al. 2016; Silvestrini and Zaghini 2015). Moreover, during periods of high systemic stress, financial shocks tend to have both a larger magnitude and a greater impact on

³ Gerke et al. (2013) and Wieland et al. (2016) provide detailed comparison exercise for different macro-financial models.

⁴ There is no exact definition of a financial shock. Mostly, they are identified in structural VAR literature. For example, Fornari and Stracca (2012) identify them as structural shocks having a positive impact on both the absolute share price of the financial sector and the share price relative to remaining sectors, a positive impact on credit to the private sector and on investment, while not driving a fall in the short-term interest rate (by contrast to differ from a monetary policy shock).

real activity (Hartmann et al. 2015). Notably, a single indicator of systemic stress, such as the CISS for the euro area, has been found to explain a significant part of macroeconomic developments, especially due to episodes of elevated systemic stress such as the global financial crisis and the euro area debt crisis (Kremer 2015).

Another strand of the empirical literature aims at cyclical component of financial variables showing that financial cycles are crucial for understanding business cycle fluctuations (e.g. Borio 2012). While studies on financial and business cycle have been popular for some time, there has been much less investigation into macro-financial linkages between countries. Existing evidence indicates that such linkages exist, but their intensity varies both across time and across countries. Specifically, it has been documented that the observed heterogeneity is mainly due to country-specific characteristics, which lead to international spillovers having a differentiated impact across countries (Ciccarelli et al. 2016). Such heterogeneity seems also to be present within the euro area.

3 Transmission channels from financial to macro developments

Despite the broad consensus about the existence of macro-financial linkages, the identification of *the transmission channels* is still a subject of debate. There are different ways to classify the channels through which the financial sector might affect macroeconomic developments. The important distinction applied in this section is whether the linkages are related to the balance sheets of borrowers or lenders. At the same time, the financial channels are also closely related to monetary transmission, which affects their functioning (see e.g. Basel Committee on Banking Supervision 2011). This section aims to better define the individual transmission channels in the euro area and at the same time it present the data to be used for the analysis.

The *interest rate channel* illustrates how money market rates affect the overall financing costs of the banking sector, the price of credit and, consequently, consumption and investment decisions. This channel is closely related to monetary policy decisions, as they directly affect the funding costs of banks. Moreover, at the zero lower bound, when the central bank uses other instruments besides short-term interest rates to conduct monetary policy, this channel is more complex and difficult to assess.

Thus, in the analysis below, the interest rate channel will be captured by variables that are affected by monetary policy decisions (Fig. 3). In the euro area, the most frequently used indicator, directly affected by the ECB's policy rates, is the *short-term interbank interest rate* (EONIA). While the effect of monetary policy actions on short-term rates is rather quick, there is also a delayed effect on long-term interest rates. The *long-term rates* are of specific relevance in the current time as short-term rates are at the zero lower bound and monetary policy aims to affect long rates directly. While long-term rates are commonly defined by the yield on respective sovereign bonds, in the euro area, this applies to a pool of euro area sovereigns. As the yields diverge across sovereigns since the global financial crisis, long-term rates in the euro area have become disconnected from short-term rates. Since the ECB has employed diverse unconventional measures that affect the financial system,

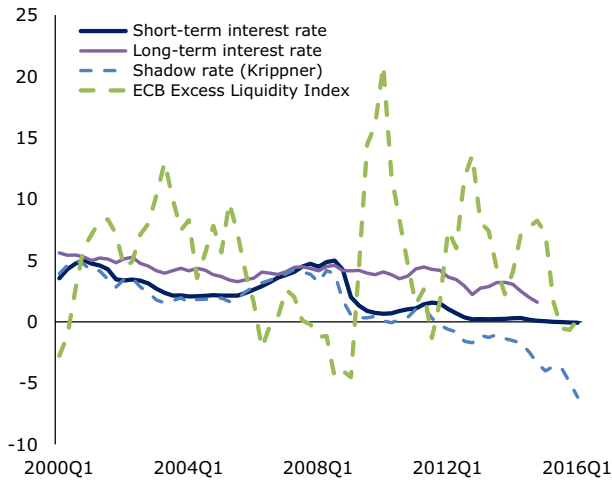


Fig. 3 Interest rate channel (2000Q1–2016Q1). *Source:* Eurostat, Bloomberg, Reserve Bank of New Zealand

additional measures need to be used to track their effect, namely *the shadow rate*, which is a factor model-based estimate of the short-term interest rate unconstrained by the ZLB.⁵ Likewise, the *excess liquidity* defined as the liquidity held by the euro area banking sector in excess of the aggregate needs arising from minimum reserve requirements and autonomous factors, is another quantitative-based indicator of the monetary policy stance, as it is driven by the ECB’s refinancing operations.

Figure 3 shows the dynamics of the variables described above in the period Q1-1996–Q1-2016, which suggest that monetary conditions have been very supportive in recent years. While short-term interest rates attained the ZLB, monetary easing through unconventional measures is reflected in a significant decline in the shadow rate as well as long-term rates.

The *borrower balance sheet channel* reflects the fact that it is the net worth of borrowers that determines the external finance premium, i.e. the opportunity cost of borrowing over using internal savings. In other words, it is the value of borrowers’ collateral that affects their credit conditions. As indicated above, fluctuations in asset prices can affect the ability of non-financial corporations and households to borrow, and thus their investment and spending decisions. While monetary policy commonly does not target asset prices (this is newly the role of macroprudential policy), its actions can affect the valuation of assets used as collateral, which affects the credit available for investment and consumption spending.⁶ Whereas the previous discussion focuses on the demand side of credit, the borrower balance sheet channel affects

⁵ There different shadow rates available; all being subject of significant model uncertainty. The shadow rate used is based on Krippner (2012) and available from the Reserve Bank of New Zealand website.

⁶ There is empirical evidence, especially for the US, stressing the importance of asset prices and different credit spreads as leading indicator of economic activity, e.g. Stock and Watson (2003).

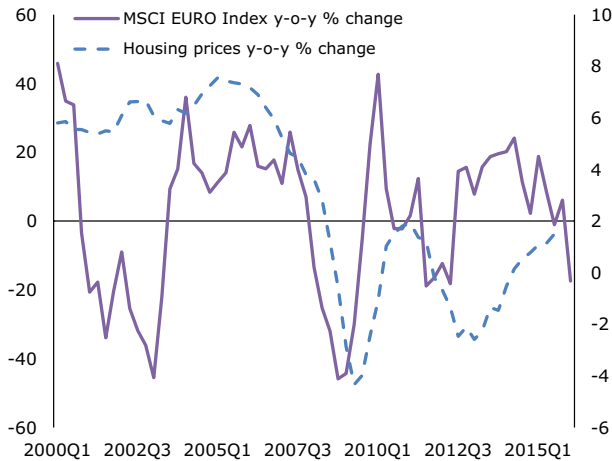


Fig. 4 Borrower balance sheet channel (2000Q1–2016Q1). *Source:* Bloomberg, BIS

also the supply of credit. Namely, weak borrower balance sheets might induce credit rationing by the lenders and affect overall credit conditions.⁷

The borrower balance sheet channel can be captured mainly by variables that reflect the risks related to the balance sheets of firms and households as borrowers from the banking sector or from capital markets. While there are no readily available direct measures of the quality of private balance sheets comparable across countries, asset prices can be considered as indicative of their quality, as they give the value of collateral for loans and of equity. Therefore, *house prices* and *stock prices* are generally used in the analysis to track this channel.⁸

Figure 4 suggests that developments in house prices and stock prices have been quite disconnected in recent years. Specifically, while house prices only started to recover in 2014, stock prices peaked in early 2015 and experienced a downward correction during that year.⁹

The *bank balance sheet channel* relates to the fact that how much a bank lends depends on its own balance sheet and the different risks involved in its business model (Bernanke and Blinder 1988). External developments (including monetary policy actions, but also longer-term factors such as financial regulation and innovations in the banking sector) may affect bank liabilities (the supply of loanable funds and also bank funding costs), and in turn, assets (supply of credit, and the

⁷ For micro evidence for the euro area countries see for example: Jiménez et al. (2010) and Holton et al. (2014).

⁸ Recently, Gilchrist and Mojon (2017) proposed credit risk indicators for banks and non-financial corporations of four largest euro area countries and the whole euro area. These indices aggregate the information obtained from thousands of corporate bonds and hundreds of thousands of monthly observations on the yield to maturity since 1999.

⁹ From 2016 till early 2018, the stock prices were on the increasing path, but this is period is not included in the estimation sample anymore.

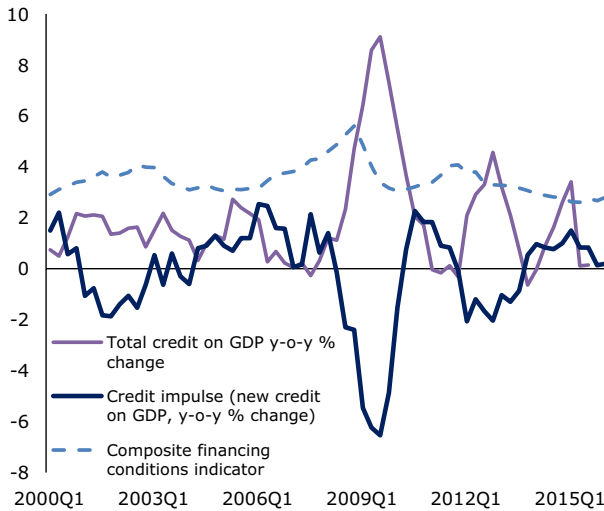


Fig. 5 Bank balance sheet channel (2000Q1–2016Q1). *Source:* Capital Economics, BIS, DG ECFIN

lending cost). Bank lending is determined by banks' business models; it usually increases with the increase in leverage in the economy, while deleveraging episodes may significantly hamper lending activities. This makes leverage highly pro-cyclical (Adrian and Shin 2010). Importantly, the impact of bank balance sheets on the real economy can be more pronounced in the euro area than in capital-market based systems as alternative forms of financing are relatively undeveloped.

The bank balance sheet channel can thus be illustrated by variables such as banking leverage, the stock of non-performing loans, banks' funding costs, or the price of Credit Default Swaps (CDS). However, reliable data for the euro area are relatively short, available only for the period since the beginning of the crisis. Indeed, the lack of knowledge about the quality of bank balance sheets was an important aspect of the euro area financial crisis and a reason for the implementation of the Asset Quality Review (AQR) by the ECB in 2014. Therefore, for the analysis in this section, measures which directly track the supply of credit have been used instead.¹⁰ Namely, the flow of credit as measured by the *credit impulse* (i.e. the change in new credit granted by the banking sector as a percentage of GDP), the stock of credit on banks' balance sheet as measured by *total economy credit as a percentage of GDP*, and the price of credit, as measured by *the Composite Financing Conditions Indicator (CFCI)* for non-financial corporations, which (assuming a constant mark-up) proxies bank funding costs.

Figure 5 shows that there is a negative correlation between the credit impulse and credit as a percentage of GDP. Thus, during downturns the flow of new credit declines, while the ratio of credit to GDP increases due to the collapse of GDP. The credit impulse indicator shows that the supply of new credit has been fairly limited

¹⁰ In practice, the lending volumes and rates can be affected both by supply and demand side.

since the onset of the global financial crisis. The *CFCI* tracks the ECB policy rates rather closely with the exception of the euro area sovereign debt crisis episode (2011–2012), when financing costs increased due to idiosyncratic increases in some Member States, reflecting financial market fragmentation.

While the previous channels are related to the quality of balance sheets either on the borrower or the lender side, some shocks can originate in the overall financial system. Examples are liquidity shocks or confidence shocks. These shocks work both via the balance sheets but also by directly altering agents' decisions through precautionary motives affecting both investment and consumption behaviour. These mechanisms are defined as the *uncertainty channel*.¹¹

The uncertainty channel is captured by variables reflecting the different types of uncertainty that can affect the economy. One type is commonly related to increased volatility in financial markets. Given a high degree of global interconnectedness, the euro area economy can be affected by uncertainty related to global financial developments, which is usually measured by *the implied volatility of S&P 500 index options (VIX)*.¹² The euro area specific stress in the financial system is measured through the ECB's *Composite Indicator of Systemic Stress (CISS)*.

Another type of uncertainty is linked to swings in business and consumer confidence. Variations in the confidence of euro area households and non-financial firms are illustrated through the European Commission' confidence indicator, the *Economic Sentiment Indicator (ESI)*, which is based on data collected through business and consumer surveys. However, the indicator exhibits a very high contemporaneous correlation with actual GDP growth, indicating that its dynamics are likely to reflect very accurately economic conditions rather than information related to exogenous changes in confidence.

Finally, unexpected outcomes of economic policy decisions can lead to policy uncertainty, which in turn can have adverse effects on the savings and investment behaviour of firms and households. *Policy uncertainty* is illustrated through an indicator based on newspaper coverage of uncertainty-generating events (Baker et al. 2015).¹³

Figure 6 indicates that there is an apparent co-movement among these indicators, even if they measure different types of uncertainty. While economic sentiment has been gradually improving and uncertainty related to financial markets has ceased, the policy uncertainty affecting the euro area was still relatively high at the end of the estimation sample.

¹¹ Bloom (2009) point to uncertainty shocks (that might be related but also unrelated to the financial system) as a crucial driver of economic dynamics. Recently, Caldara et al. (2016) argue for the needs to distinguish uncertainty shocks from financial shocks, while both of them are important source of macroeconomic fluctuations separately; the Great Recession was likely outcome of the toxic interaction between the two.

¹² The VIX is calculated by the Chicago Board Options Exchange (CBOE).

¹³ Data source: www.policyuncertainty.com.

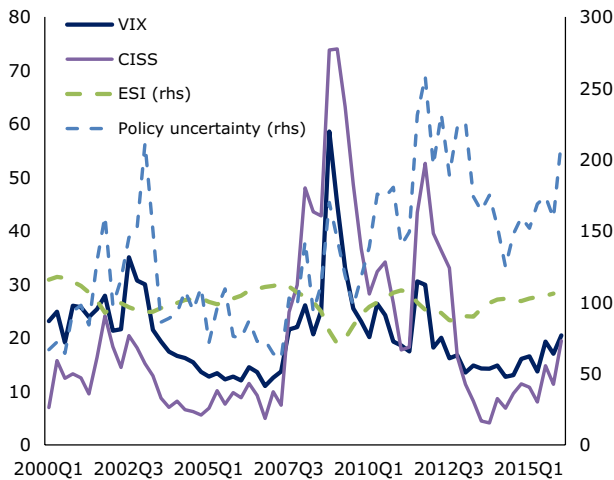


Fig. 6 Uncertainty channel (2000Q1–2016Q1). *Source:* Chicago Board of Exchange, ECB, www.policyuncertainty.org

4 Empirical methodology

The analysis aims at the potential interaction between macroeconomic and financial variables to better understand recent developments in economic activity. Several empirical studies have already shown that financial variables can improve macroeconomic forecasts.¹⁴ The empirical analysis presented here uses the conditional forecast (i.e. a projection of macro variables on the observed paths of financial variables) to test whether and how financial developments have affected the real side of the euro area economy since the crisis. By contrast unconditional forecasts do not assume any knowledge of the future path of any variables. This approach aims to provide stylised facts on the transmission channels defined above. Each channel can be captured by several alternative variables, it proves useful to apply a broader approach that allows a wider set of information to be taken into account, such as estimating a large-scale VAR.

The analysis is based on developments in the literature of vector autoregressions (VARs) tools for large data sets (Bańbura et al. 2015; Giannone et al. 2015). VARs are considered to be a reliable tool for building empirical benchmarks as a complement to alternative representations such as dynamic stochastic general equilibrium

¹⁴ While financial variables are available in real time, macroeconomic variables are normally released with lags. Therefore, conditioning macroeconomic forecasts on observed financial developments can improve forecasts, as more informative data are taken into account. Stock and Watson (2003) provide a seminal contribution on the role of financial variables, namely asset prices, for GDP and inflation forecast concluding that different financial variables allow macroeconomic forecasting in different times. Espinosa et al. (2012) document using standard VAR approach that financial variables improve GDP forecast for the euro area, especially in the real time when numerous financial variables are available ahead of the macroeconomic releases.

(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, 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.

Our large-scale Bayesian VAR includes 37 macroeconomic and financial variables: macroeconomic conditions (GDP and expenditure components, consumer and producer prices, labour market data, survey indicators, effective exchange rate, world economic activity, commodity prices), monetary aggregates (M1 and M3) and the financial variables described above capturing the financial channels (short and long term interest rates, stock prices, credit variables, bank balance sheet variables and uncertainty measures).¹⁵ 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 2015 update of the Euro 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. The model is estimated for the sub-period Q1-2000–Q4-2011 which covers both normal and crisis times but does not include some of the most important unconventional monetary policy measures.

Given the estimated past correlations, a counterfactual path for the macroeconomic variables (i.e. a distribution of conditional forecasts) can be obtained for the entire period Q1-2000–Q4-2015. The first eight quarters in the sample are used as initial conditions. Thus, the conditional forecasts for 2000–2011 can be considered as “in-sample”, while those over 2012–2015 as “out-of-sample”. The conditioning set in the baseline includes only observed real GDP and inflation. The “in-sample” part of the conditional forecasts is compared with the observed developments to see whether knowing only the time series included in the conditioning set is sufficient to capture the dynamics of the variables in our model. The “out-of-sample” part (i.e. from 2012 onward) of the conditional forecasts is compared to the observed developments to assess whether the financial and the sovereign debt crises have caused a change in the estimated structural economic relationships. Subsequently, the conditioning set in the baseline is extended by financial variables corresponding to each transmission channel described above in order to capture information on potential financial shocks (notably, those not fully captured by real GDP and inflation), which could explain the changes in the structural economic relationships identified in the baseline. The idea is to see if including financial variables (that tracks subsequently

¹⁵ Alternative strand of literature using rich set of data in order to nowcast or forecast employs dynamic factors models where data dimension is reduced in a first step by factor estimation, with common factors being consequently used in the forecasting exercise, see e.g. Giannone et al. (2008). Bellégo and Ferrara (2012) find using factor-augmented probit model that financial variables allow tracking better recession periods in the euro area (in the pre-crisis period) with optimal lead of financial variables over recession of around 1 year.

Misalignments of financial and real variables with real GDP and inflation since the crisis

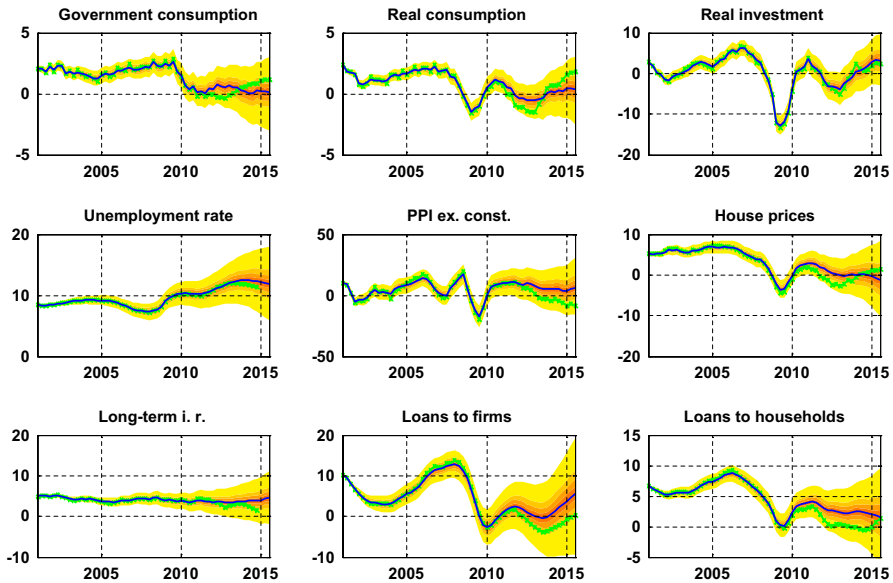


Fig. 7 Conditional forecasts based on real GDP and inflation (2000Q1–2015Q4, *y-o-y* % growth). *Note:* Shades of orange: distribution of the conditional forecasts in the BVAR in levels, excluding the lower and higher 5% quantiles. Green line with crosses: actual values. Dark blue line: the median of the distribution of the conditional forecasts. 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 and HICP (colour figure online)

each financial channel) improves the “out-of-sample” conditional forecast of macroeconomic variables (i.e. the counterfactual path gets closer to the observed values).¹⁶

5 Evidence on financial developments and economic activity

Figure 7 shows the baseline conditional forecasts (when only real GDP and inflation are included in the conditioning set) of the main GDP components, producer prices, the unemployment rate and the long-term interest rate. It also shows the balance sheet variables of households and firms.

The results suggest that private consumption was unusually low during the period of the euro area debt crisis and deleveraging (2012–2013), while it overshot during the consecutive recovery (from 2014 onward). Investment behaved in line with

¹⁶ The correlations between macroeconomic and financial developments can arguably change across time. However, the dimensionality of the model does not allow to model the time variation explicitly. Therefore, we use for the estimation data up to the euro area debt crisis 2011 assuming stability of the correlations.

Business and consumer confidence and short-term interest rates

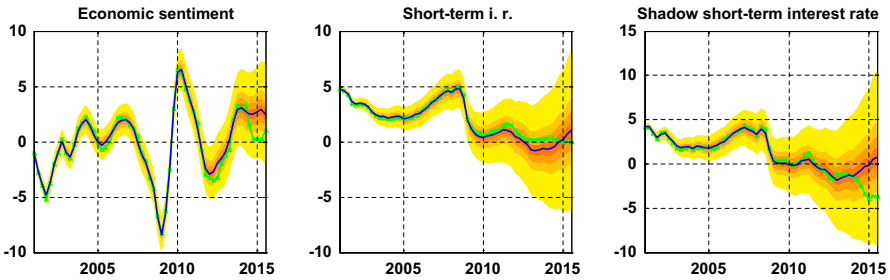


Fig. 8 Conditional forecasts based on real GDP and inflation (2000Q1–2015Q4, *y-o-y* % growth). *Note:* Shades of orange: distribution of the conditional forecasts in the BVAR in levels, excluding the lower and higher 5% quantiles. Green line with crosses: actual values. Dark blue line: the median of the distribution of the conditional forecasts. 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 and HICP (colour figure online)

historical correlations during both downturn episodes (2008–2009 and 2012–2013) and was weak during the deleveraging phase because overall output growth was weak. However, its recent recovery (since 2014) has been more subdued than what the pace of economic activity would have predicted; the observed investment path is positioned on the lower tail of the distribution of conditional forecasts).¹⁷

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, with public consumption starting to overshoot from 2015 onwards (relative to its counterfactual path obtained through conditioning on output growth), reflecting the aggregate euro area fiscal stance, which started to turn mildly expansionary.

Moreover, the results show that several variables capturing price and balance sheet developments are still at odds with historical patterns. In particular, producer prices, long-term interest rates and loans to firms and households undershoot the distribution of the conditional forecasts. On one side, this underlines that the recent recovery is characterized by a historically low inflation environment and loose monetary conditions pushing the long-term rates down. On the other side, the ongoing balance sheet adjustment is translating into very weak credit dynamics due to unprecedented deleveraging pressures. Similarly, house prices have also been unusually low during the sovereign debt crisis positioned in the lower tail of the distribution of the conditional forecasts.

¹⁷ There is some relative instability in the estimated correlations over the sample period, notably pre-crisis versus crisis years. However, it does not significantly affect the result on the unusual weakness in investment recovery since 2014. Balta (2015) found that estimating the past correlations only with the sample for the pre-crisis period, the amplitude of the investment fall during the first downturn (2008–2009) would also be slightly underestimated by the conditional forecasts.

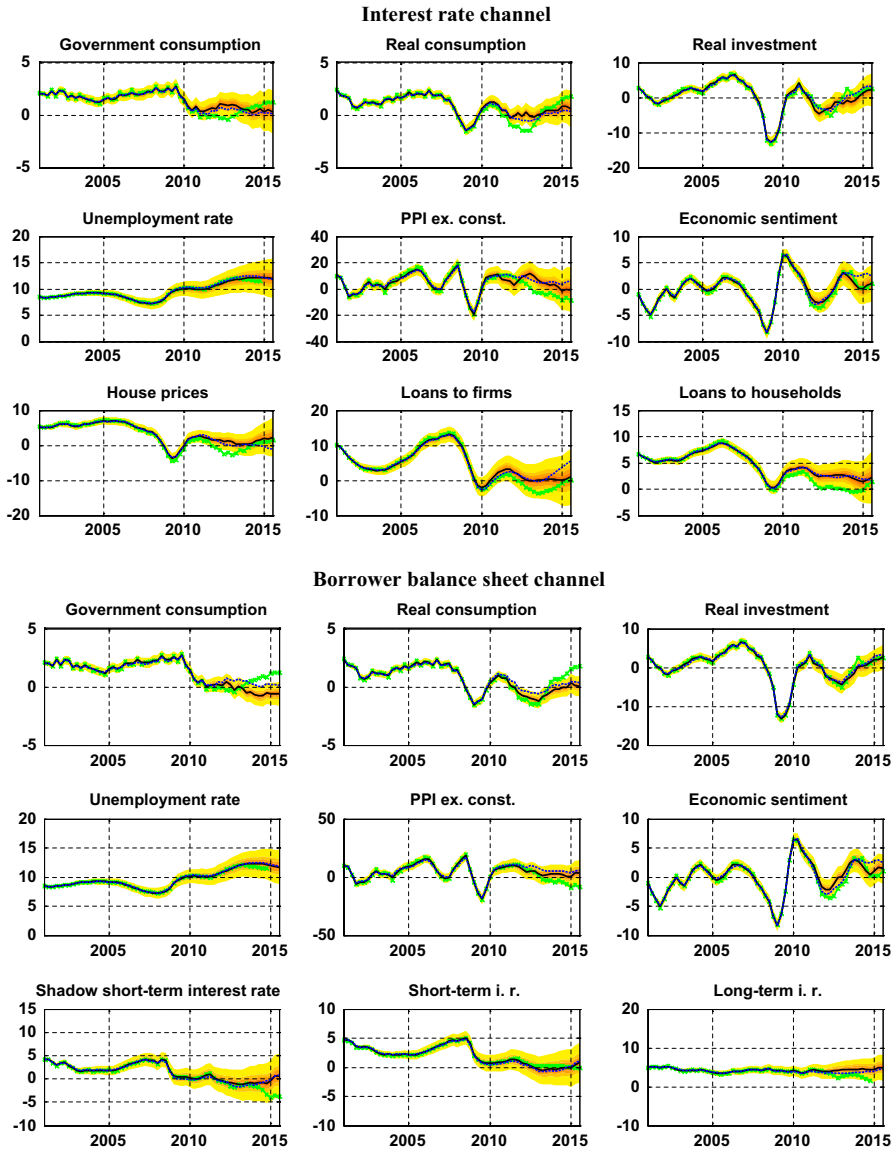


Fig. 9 Conditional forecasts based on variables capturing the interest rate channel and borrower balance sheet channel (2000Q1–2015Q4, *y-o-y* % growth). *Note:* Shades of orange: distribution of the conditional forecasts in the BVAR in levels, excluding the lower and higher 5% quantiles. Green line with crosses: actual values. Black line: the median of the distribution of the conditional forecasts in this model. Dashed blue line: the median of the distribution of the conditional forecasts in the baseline. 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 interest rate channel: GDP, HICP, the short-term interest rate, the long-term interest rate, the shadow interest rate, and the ECB excess liquidity measure. Conditioning assumptions borrower balance sheet channel: GDP, HICP, house prices, stock prices, and outstanding loans to households and firms (colour figure online)

Figure 8 illustrates the zero lower bound constraint on monetary policy rates and the subsequent break in the correlation of economic activity with the two measures of monetary policy rates since 2012. Among all variables, the Economic sentiment indicator (ESI) comes out as having the strongest contemporaneous correlation with economic activity during the crisis, however, over the last years of the sample it is also positioned in the lower tail of the distribution.

In the consecutive analysis, the conditioning dataset in the baseline (including only real GDP and inflation) is augmented by financial variables corresponding to each transmission channel.

The interest rate channel (Fig. 9, upper panel) seems to better account for the pattern of consumption during the recent recovery (compared to the baseline). This channel, which reflects mainly monetary conditions, suggests that monetary easing implemented since 2014 by means of additional unconventional measures (namely the targeted long-term refinancing operations (TLTRO), the asset-backed securities purchasing program (ABSPP) and the public securities purchase program (PSPP)), have translated into a further decline in the long-term interest rate and the shadow policy rate. It also reflects an increase in excess liquidity, which has had a very benign effect on the recent recovery. However, producer prices developments (PPI) still appear unusually subdued. Likewise, including information capturing the interest rate channel does not help explain the dismal performance of consumption during the deleveraging phase (2012/2013) or the persistent weakness of credit dynamics. Therefore, these developments seem to be determined also by drivers other than monetary conditions.

The borrowers balance sheet channel (Fig. 9, lower panel) captures in turn the exceptional deleveraging developments of 2012/2013 but clearly underestimates the pace of the consecutive recovery. This finding suggests that strained balance sheets of households and firms represented the main weight on the recovery at the time of euro area sovereign debt crisis. However, whereas a mild recovery started in the euro area in 2011, private balance sheets still did not improve much. In fact, when the borrower balance sheet channel is taken into account, observed consumption overshoots the conditional forecast even by a higher margin than in the baseline scenario and real investment seems to be on the upper side as well. This suggests that the borrower balance sheet channel should have led to more subdued dynamics of both consumption and investment than what has been observed in 2014 and 2015, indicating that other channels have been somewhat compensating the adverse effects of this channel.

The bank balance sheet channel (Fig. 10, upper panel) improves the forecast of investment since 2014 and reduces the uncertainty around the median for some variables such as consumption, unemployment and long-term interest rate. The good fit of investment dynamics indicates a strong correlation of investment with total economy credit developments both in terms of flows and stocks. Interestingly, the bank balance sheet information, namely the total economy credit as percentage of GDP (including credit to public sector), the private sector credit impulse and the price of credit for the private sector, cannot capture the weak observed dynamics of outstanding loans to firms and households. This shows that the private deleveraging process has been much stronger than the public sector deleveraging, making

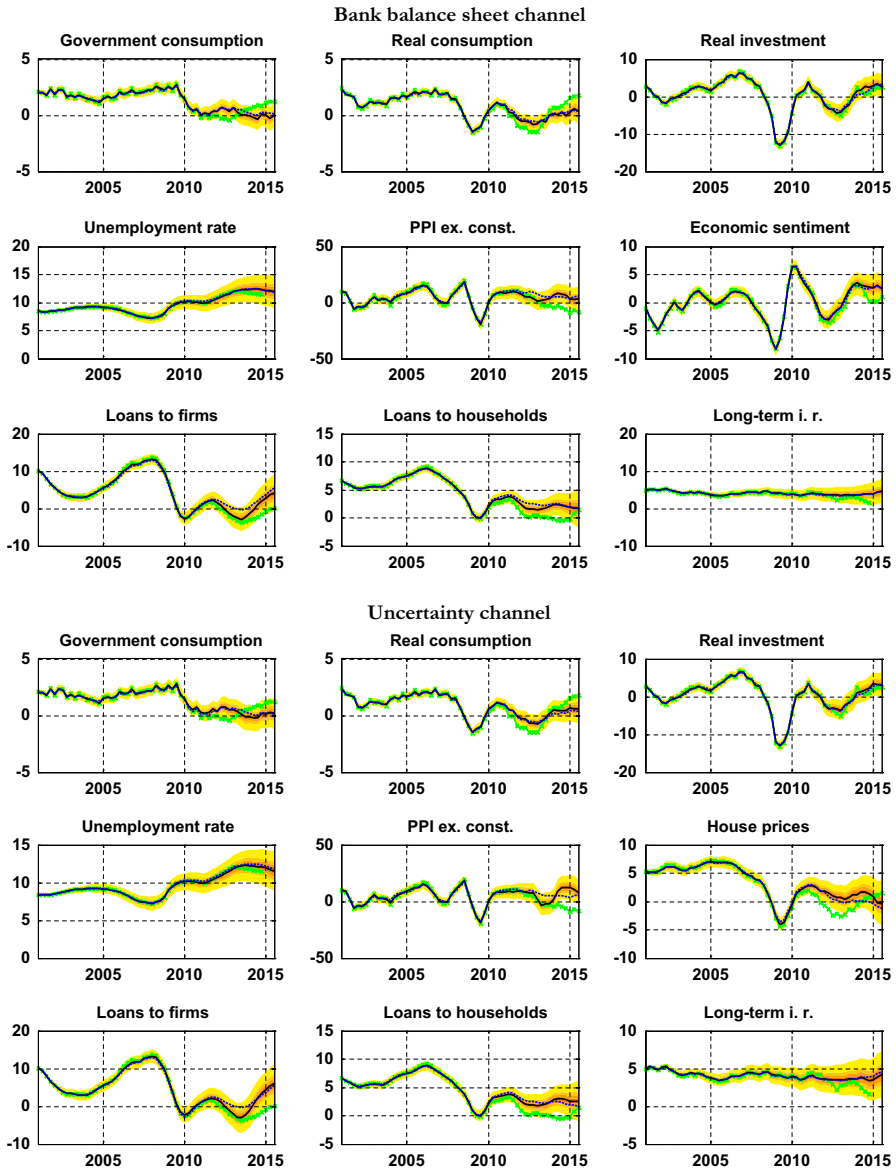


Fig. 10 Conditional forecasts based on variables capturing the bank balance sheet channel and uncertainty channel (2000Q1–2015Q4, *y-o-y % growth*). *Note:* Shades of orange: distribution of the conditional forecasts in the BVAR in levels, excluding the lower and higher 5% quantiles. Green line with crosses: actual values. Black line: the median of the distribution of the conditional forecasts in this model. Dashed blue line: the median of the distribution of the conditional forecasts in the baseline. 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 for the bank balance sheet channel: GDP, HICP, the credit impulse, the private credit volumes (debt-to-GDP ratio), and bank lending rates for households and firms (CFCI). Conditioning assumptions uncertainty channel: GDP, HICP, ESI, the policy uncertainty indicator, the CISS and the VIX (colour figure online)

private credit developments disconnected from GDP growth.¹⁸ Therefore, while the recovery in real activity has been originally rather weak, the private credit dynamics have been even weaker. Furthermore, the recovery during the first years was too modest to facilitate passive deleveraging (a decrease in the relative debt burden due to a growing economy, i.e. denominator effect) and fed the active deleveraging (a decrease of absolute level of debt, i.e. nominator effect). The long-term interest rate seems very low even when the financing costs for non-financial corporations (which also attained historical minima) are taken into account. This underlines the importance of the ECB's measures that implied very easy financing conditions over an extended period.

Finally, the *uncertainty channel* (Fig. 10) seems to improve the conditional forecast over the baseline in the same spirit as the bank balance sheet channel. Namely, there is a good fit of investment, indicating a strong correlation of investment with confidence and financial stress measures. On the contrary, the rebound in private and public consumption is on the upper side of the conditional forecast, indicating that consumption (driven by the easy financing conditions, see previous results for the interest rate channel) rebounded more than what the gradual decrease in uncertainty would induce. In general, results for the uncertainty channel are very similar to those for the bank balance sheet channel, suggesting that in bank-based systems like the euro area both channels are closely linked. For example, in periods of high uncertainty, bank funding costs increase (bank balance sheet channel) and firms with weaker balance sheets cannot obtain credit for new loans (borrower balance sheet channel).

Overall, the findings above suggest that while there is clear evidence of the transmission of monetary policy measures on financial variables and from financial variables to consumer lending rates, the evidence on the effects on real activity is more complex, with different channels playing an important role at different stages of the crisis. The interest rate channel (Fig. 9, upper panel) has helped the modest recovery in 2014 by supporting both public and private consumption growth and by partially compensating the balance sheet channel for both borrowers and banks. The results in Fig. 9 (lower panel) can be interpreted as showing that in the absence of massive monetary easing, given the high level of debt in the economy and the wealth effects associated with house and asset prices decreases, both private and public consumption growth could have been much more subdued than what it is currently observed.

Figure 10 (both panels) illustrate the importance of the bank balance sheet and the uncertainty channel for capturing investment dynamics. Weak investment growth is well captured both by credit developments as captured through the bank balance sheet channel and confidence effects through the uncertainty channel. On the contrary, the pick-up in consumption was stronger to what could be attributed to the bank balance sheet repair and improved confidence and seems to be mainly driven by the easy monetary conditions.

¹⁸ GDP is a denominator of the credit indicators in bank balance sheet channel.

6 Conclusions

The paper explores the nexus between financial and macroeconomic developments in the euro area, drawing some lessons from the literature and providing some stylised facts on the main transmission channels through which financial developments may have affected real economic activity in the recent years. The analysis focuses on four key channels: (1) the interest rate channel; (2) the borrower balance sheet channel; (3) the bank balance sheet channel; and (4) the uncertainty channel. The importance of these channels is analyzed by means of a conditional forecast from a large-scale Bayesian VAR (Bańbura et al. 2015).

The results suggest that financial variables have significant impact on macroeconomic developments in the euro area with the relative importance of individual channels varying across time. The conditional forecasts are closer to the actual outcomes when including financial variables in the conditioning sets both for the “in-sample” and the “out-of-sample” period, indicating that these variables contain additional information on important sources of fluctuations which cannot be captured just by real GDP and inflation. For the “out-of-sample” period, the state of private balance sheets seems to have significantly contributed to the unusual poor performance of consumption during the euro area debt crisis, as high debt levels weighed on aggregate demand. The analysis suggests that easy monetary conditions represented an important change that led to the mild recovery of 2013/2014. The balance sheets of banks seem to have been another source of fluctuations, which together with the uncertainty channel, can fully match the subdued investment dynamics during the mild recovery of 2013/14, despite the gradual improvement in banks’ balance sheets that allowed better transmission of easy monetary conditions to the lending rates.

Given persistently high levels of debt in the economy and the wealth and confidence effects associated with house and asset prices corrections, both private and public consumption growth could have been much more subdued than what was observed, were it not for the exceptional easing of monetary conditions. Unfortunately, the recovery started to facilitate the deleveraging process only very recently. The stock of debt and the ongoing deleveraging combined with adverse confidence effects represented major impediments for a stronger recovery in investment at the time.

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