Trusting the Bankers:
A New Look at the Credit Channel of Monetary Policy*

Matteo Ciccarelli
European Central Bank

Angela Maddaloni
European Central Bank

José-Luis Peydró
European Central Bank

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Abstract

We test the credit channel of monetary transmission. Our contribution lies in disentangling the impact of loan supply and loan demand by using the answers from the confidential Bank Lending Survey for the Euro Area and the Senior Loan Officer Opinion Survey for the US. National central banks and regional Feds respectively request from a sample of 90 and 60 banks quarterly information on the lending standards they apply and on the loan demand they observe. Using this rich information, we find robust evidence that (i) a monetary contraction tightens bank loan supply both for business, mortgage and consumer loans; (ii) the tightening of bank loan supply reduces real GDP both directly and indirectly through reducing loan demand; (iii) the credit channel works both through the bank lending and the balance sheet channels; and (iv) to test the credit channel it is necessary to take into account all the different type of bank loans to avoid omitted variable problems which bias results when only business loans are considered. We find different effects in terms of size and timing across different type of loans, channels, and economic areas. All in all, our results suggest the existence of a strong credit channel of monetary policy transmission and have inmediate policy implications given the currently all-time low policy rates and the possible credit crunch.

Keywords: Monetary policy, Bank lending standards, Loan supply, Monetary transmission channels, Credit channel, Bank lending channel, Balance sheet channel, Credit crunch, Panel VAR

JEL Classification: C33, E32, E40, E5, G21

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1 Introduction

Does the stance of monetary policy affect the willingness and the ability of banks to lend? In other words, does monetary policy affect loan supply? And, if so, how? Is the strength of the balance sheet of banks and of firms equally important? Are business, mortgages and consumer loans equally affected? Finally, what are the real effects of the credit channel in terms of GDP? The dramatic events unfolding in the global financial markets over the last two years have again highlighted the financial frictions in credit markets and the key role of banks in providing credit to firms and households. Expansionary monetary policy on both sides of the Atlantic, with policy rates at an all-time low, was not only charted to stimulate consumption and investment but also to counter a deepening credit crunch by increasing bank willingness and/or ability to supply loans.

In this paper we test the credit channel of the monetary policy transmission, where the main identification problem is to disentangle the effect of monetary policy on loan supply versus demand (Bernanke and Gertler, 1995; and Bernanke, 2007).[1] For example, following a monetary contraction, both the classical interest rate channel (through loan demand) and the credit channel (through loan supply) predict a decline in (new) loan growth, in turn, reducing real output. In addition, loan growth is also affected by previously committed loans (i.e., no new lending) and bank loan demand may increase after a monetary tightening to finance working capital or due to a decrease of market finance access (Bernanke and Gertler, 1995). Moreover, average loans spreads may not increase after a monetary tightening due to the flight of quality from banks (Bernanke, Gertler and Gilchrist 1996). In consequence, using average credit aggregates to isolate the effects of monetary policy on bank loan supply presents an identification problem. Finally, assuming loan supply can be identified, another important identification problem is to disentangle whether the supply effect comes from the balance sheet or from the bank lending channel (Gertler and Gilchrist, 1994).

Our contribution lies in disentangling loan supply from demand by using the answers from the confidential Bank Lending Survey of the Euro Area and the Senior Loan Officer Opinion Survey for the US. National central banks and regional Feds respectively request from a panel of 150 banks multiple quarterly information on their lending standards applied and on their loan demand received. For example, the surveys include the change on loan standards and demand, and also multiple information on how exactly, to whom and why loan demand and standards change. Lown and Morgan (2006) analyse the information content of the Senior Loan Officer Survey from the Federal Reserve. However they use only

[1] See also Bernanke and Blinder, 1988 and 1992; Den Haan et al., 2007; Giannone, Lenza and Reichlin, 2008; Angeloni, Kashyap and Mojon, 2003.

the answers from one of the questions of the survey on lending standards – namely changes in credit standards applied to C&I loans – and proxy loan demand by macro variables commonly used in the literature. Their research question is to analyse the predictive power of lending standards, thus they use the whole history of the SLO survey and, hence, cannot use the answers to questions related to the loan demand, which only started in 1992. They find that the standards predict future output and credit growth. They do not find, however, any impact of monetary policy shocks on credit standards.

We, on the other hand, use several variables of bank lending standards: the changes in lending conditions and terms, the reasons why and how and to whom banks change their standards, and we proxy loan demand by directly using the loan demand variables from the BLS and SLO. Therefore, our first and main contribution to the literature is to try to solve the identification problem of loan demand versus supply by directly using the lending standards and the loan demand reported in the surveys by the bank senior loan officers. Our second contribution is to identify the balance sheet and bank lending channels by using the survey questions related to the reasons why and how and to whom banks change their standards: e.g., banks may change their standards due to their capital and liquidity positions (bank lending channel), or due to the borrower's industry/firm outlook and risk of collateral (balance sheet channel). Finally, following up on the recent work by De Haan et al. (2007), we address the impact of monetary policy on the composition of the loans' portfolio, in particular on business, mortgage and consumer loans.

Since lending standards and loan demand may react to the business cycle and, in turn, affect the evolution of the business cycle (Bernanke and Gertler, 1995), we use a VAR methodology. We follow standard VAR analysis a la Christiano, Eichenbaum and Evans (1999). For the Euro Area, given that there is some heterogeneity of the business and credit cycles of the different countries, and given the common monetary policy, we use a panel VAR including lending survey and macro data on each of the 12 countries which comprised the euro area in 2002 for the period between 2002:Q4 to 2008:Q4. For the US, we restrict the analysis to the period 1992:Q3 to 2008:Q4 since there is information on both supply and demand for loans in SLO.

We find robust evidence that (i) a monetary contraction tightens bank loan supply both for business, mortgage and consumer loans; (ii) the tightening of bank loan supply reduces real GDP both directly and, indirectly through reducing loan demand; (iii) the credit channel works both through the bank lending and the balance sheet channels; and (iv) to test the credit channel it is necessary to include all the different type of bank loans to avoid omitted variable problems which bias results when only business loans are considered. We find different effects in terms of size and timing across different type of loans, channels, and economic areas.

All in all, the results we find suggest the existence of a strong credit channel of monetary transmission and have immediate policy implications given the currently all-time low policy rates and the possible credit crunch.

The rest of the paper proceeds as follows. Section 2 reviews the literature on the credit channel. Section 3 describes the data used in the analysis, focusing on the details of the Euro Area BLS and the US SLO. Section 4 reviews the empirical strategy. Section 5 discusses the results. Section 6 summarizes the paper, discusses the policy implications and concludes.

2 Literature review

In this Section, we briefly review the literature that addresses the impact of monetary policy on bank lending highlighting the theoretical predictions and also the identification problems faced in the empirical analysis. In addition, we also review the literature that deals with the identification of monetary policy shocks in general.

Short-term interest rates affect consumption and investment (the classical interest rate channel), and, at the same time, they affect credit markets and, in particular, the banking system. Because of credit market imperfections contractive monetary policy may reduce the ability and incentive of banks to supply loans through the functioning of the "credit channel " (for a review of these mechanisms of monetary policy transmission, see Bernanke and Gertler, 1995; and Bernanke, 2007). The credit channel comprises both a bank lending and a balance sheet channel.

Due to frictions in financial markets (asymmetries of information and incompleteness of contracts), monetary policy may affect loan supply by affecting the external finance premium and, in turn, affecting real output (Bernanke and Gertler, 1995). For example, higher monetary policy rates reduce firm and bank net worth thereby increasing firm and bank external finance premium through higher costs of moral hazard, adverse selection and also through the associated screening and monitoring costs (Stiglitz and Weiss, 1981; Bernanke, Gertler and Gilchrist 1996 and 1999; Bernanke and Gertler, 1995; Holmstrom and Tirole 1997; Stein 1998; Matsuyama 2006; Bernanke 2007). In addition, since banks are “special” (Freixas and Rochet, 2008) and the banking sector is very large, then there are real effects implications from the reduction of bank loan supply.[2]

The balance sheet channel affects the quality of the borrowers. Indeed higher levels of interest rates, in addition, reduce borrowers’ net worth (Bernanke and Gertler, 1995). This reduction worsens the agency problems between banks and their borrowers, in turn, making banks lend more to high net worth firms (Bernanke, Gertler and Gilchrist, 1996 and 1999;

[2] See also Stiglitz (2001), and Stiglitz and Greenwald (2003).

Bernanke and Gertler, 1989; and Matsuyama, 2007). Lang et al. (1995) and Bernanke, Gertler and Gilchrist (1996) analyse changes in borrowing across firms in response to changes in monetary conditions. Both use size as a proxy for borrower quality and find that a monetary contraction results in more lending to larger firms. However, larger firms may start using more bank borrowing (higher bank loan demand) when monetary policy is contractive since market finance access may be more restrictive in those times (Bernanke and Gertler, 1995).

In the bank lending channel a contraction of monetary policy reduces, independently of firm quality, the loan volume that banks are able to lend (Bernanke and Blinder, 1988; Stein, 1998; and Diamond and Rajan, 2006). Bernanke and Blinder (1992) indeed find a significant decrease in bank aggregate lending volume following a contraction in the stance of monetary policy. However, this finding is also consistent with lower loan demand when interest rates are higher. To try to control for loan demand, Kashyap and Stein (2000) analyse whether there are also important cross-sectional differences in the way that banks respond to monetary policy shocks. They find that small banks with liquid balance sheets cut their lending less than other small banks following a monetary contraction. These authors do not quantify the absolute impact of monetary policy on loan and output growth, but compare the loan growth between different type of banks. In addition, bank liquidity is endogenous to the bank and to the stance of monetary policy, and also monetary policy could affect differently loan demand at banks with different size and liquidity.

The bank lending channel can also be viewed as a balance sheet channel for banks (see Bernanke, 2007, for a recent review of this literature). In addition, since it is difficult to substitute bank loans for other type of loans (even for large firms), a monetary contraction may have a negative impact on output growth by restricting lending standards (see Bernanke and Gertler, 1995, and Stiglitz, 2001).

More recently, using a VAR with data from US banks den Haan et al. (2007) find that after a monetary contraction real estate and consumer loans sharply decrease, while commercial and industrial (C&I) loans do increase. They conclude that this evidence is against the credit channel. Giannone et al. (2008) using a VAR with euro area data find similar results. Since these papers use actual credit aggregates to analyse the credit channel, they have to make assumptions in the model on how to distinguish between loan supply and demand. In our case, we use directly the lending standards and loan demand from the surveys to loan officers (bankers).

3 Data

The data that we use in this paper to identify credit supply and credit demand are the answers from the Bank Lending Survey (BLS) for the euro area and from the Senior Loan Officer Opinion Survey (SLO) for the US. The two surveys are very similar in spirit, in particular concerning the qualitative character of the survey and the questions asked. For the purpose of this paper, we use a panel of confidential data on lending standards containing answers for all euro area countries. For the US, we use the aggregate answers publicly available.

Section 3.1 describes in detail the setup of the BLS, which started only in 2003. Section 3.2 summarises the main characteristics of the US survey, which has already been used in the literature (see Lown and Morgan, 2006). Finally, in Section 3.3 the other macroeconomic series used for the analysis are described.

3.1 The euro area BLS

The national central banks of the Eurosystem collect information on bank credit standards since 2002 through the euro area BLS, a quarterly survey on banks' lending practices based on the answers of a representative sample of banks in each country. Berg, van Rixtel, Ferrando, de Bondt and Scopel (2005) describe in detail the setup of the survey. The questions asked are based on theoretical considerations on the monetary policy transmission channels and they were chosen along the lines of other central banks running similar surveys, in particular in the US and in Japan. Sauer (2009) provides an update of the most recent developments and the few changes to the survey (mainly additional information) implemented successively to the start.

3.1.1 The questionnaire

The survey contains 18 specific questions on past and expected credit market developments. Past developments refer to credit conditions over the past three months, while expected developments focus on the next three months. There are two main borrower sectors that are the focus of the survey: enterprises and households. Loans to households are further disentangled in loans for house purchase and for consumer credit, consistently with the classification of loans in the official statistics of the euro area.[3] The questions imply only qualitative answers and no figures are required.

[3] This classification is somewhat different from the classification used in the US for the Senior Loan Officer Survey where mortgage loans are further disentangled in prime and subprime loans. A subprime loan market is virtually non-existent in the euro area [CHECK}.

The answers are collected by the national central banks of the euro area countries. Typically the questionnaire is sent to senior loan officers, like for example the chairperson of the bank 's credit committee. The questionnaire is accompanied by a compilation handbook. The economists in the central banks collect the answers, check them and follow-up if necessary. The response rate has been 100% almost all the time (see Sauer (2009)).

The scope and the coverage of the Survey have changed little since its inception. Concerning the questionnaire, the regular questions have been kept fixed throughout the sample. A number of ad-hoc questions were added at times to shed light on specific issues.[4] Since the answers to these questions are available only for few quarters, we do not use them for this paper.

The questionnaire covers both supply and demand factors. Concerning the supply factors, which are addressed in ten different questions, attention is given to changes in credit standards, to the factors responsible for these changes and to credit conditions and terms. Credit standards are the internal guidelines or criteria that guide a bank's loan policy and are addressed in three questions, each referring to a different category of borrower (enterprises, households and consumers).[5] The successive set of questions give respondents the opportunity to assess how specific factors affect their bank's credit standards as applied to the approval of loans to both enterprises and households. Finally, questions concerning the terms and conditions of a loan relate to the specific obligations agreed upon by the lender and the borrower, such as the interest rate, the collateral, size and maturity.

Concerning demand factors, which are the topic of seven questions, various factors related to financing needs and the use of alternative finance are mentioned. Three questions look at borrowing demand from enterprises and four at demand from households. Finally, the survey also allows participating banks to give free-formatted comments in response to an open-ended question.

The euro area results of the survey (which are a weighted average of the results obtained for each euro area country), are published every quarter on the website of the ECB (www.ecb.europa.eu), while national results remain generally confidential although some aggregate results are published by the national central banks of the Eurosystem.

For the purpose of this paper we concentrate only on few questions from the BLS that we describe in detail in Appendix I. Since we aim at identifying credit supply and demand shocks and the different channels of transmission, we concentrate on the questions

[4] blabla

[5] In cases when foreign banks are part of the sample, the credit standards should refer to the loans' policy in the domestic market which may differ from guidelines established for the headquarter bank.

related to the factors affecting supply conditions. These factors relate to three different dimensions: 1) the balance sheet position of the banks 2) competition from other lenders 3) risk of the borrowers.

3.1.2 The sample

In order to use a balanced panel, the analysis is restricted to the 12 countries which originally comprised the euro area in 2003. The questions cover the period from the last quarter of 2002 to the last quarter of 2008. Over this period we consistently have data for 12 euro area countries (Austria, Belgium, France, Finland, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, and Spain).

The sample of banks was chosen as representative of the banking sector in each country. Therefore it comprises banks of different size, although the national guidelines express a preference to include the largest banks in each country.[6] The analysis reported in this paper is based on the aggregate answers received from a sample of around 90 banks.[7]

3.2 The Senior Loan Officer Survey

The Federal Reserve publishes the results of a quarterly survey on lending standards, the Senior Loan Officer Opinion Survey on Bank Lending Practices (SLO). The survey was introduced for the first time in 1967. Since then, however, the basic structure of the Survey has been changed several times, which rather restricts the time series that can be used effectively.

The Survey covers both business loans and household loans. Loans to business concerns commercial and industrial (C&I) loans and commercial real estate loans. Loans to households are instead separated into residential mortgage loans and consumer lending.

The questionnaire focuses on supply and demand factors, but the focus is on past developments and there are no regular questions on expectations. Since we use at the same time answers concerning supply of credit and demand for credit our time series starts in 1991 q3 when the questions related to the demand for business and households loans were included in the survey.[8] Since 1990 the officers are reporting separately on standards for small and standards for large firms (as well as demand). We use in the VAR analysis the answers related to large enterprises.[9]

[6] Of course these banks may not be classified as "large" in a euro area perspective. See Sauer (2009) for additional detail.

[7] At the start, there were 87 banks answering the survey. This figure remained almost fixed until 2007, when Slovenia entered the euro area and Slovenian banks entered in the survey. Successively, in 2008, this figure reached 112 with the inclusion of Cyprus, Malta and an enlarged sample for Italy and Germany.

[8] Questions related to the demand for consumer loans were included only in 1995 q4.

[9] The series on lending standards for large and small enterprises have a correlation of 96%. The series

The current sample is composed of around 60 banks, usually the largest in each of the 12 Federal Reserve Districts. The Survey is implemented by the Research Departments of the district Federal Reserve Banks involved. They send the questionnaire to the loan officers, check the answers, follow up if necessary and transmit them to the Federal Reserve Board economists. The response rate is virtually 100%. More information on the setup of the survey is in Lown and Morgan (2006). The results of the survey are available at http://www.federalreserve.gov/boarddocs/SnLoanSurvey.

For the purpose of this paper we concentrate only on few questions from the SLO that we describe in detail in the Appendix.

3.2.1 Aggregate statistics

The questions of the BLS and of the SLO are multiple-choice with 5 possible answers. The five possible answers refer to the intensity of the tightening (for questions related to changes in credit standards) and to the strength of the increase in demand (for questions related to the demand for loans).

For the purpose of this paper we use aggregate statistics in the form of *net percentages,* that is the form in which the results of both surveys are published. The net percentage is the percentage of banks in each country reporting an increase in the tightening of standards (for questions related to the supply of loans) or an increase in the demand (for questions related to the demand for loans) minus the percentage of banks reporting a softening of credit standards (for questions related to the supply of loans) or a decrease in loans' demand (for questions related to the demand for loans). Therefore, for the supply of credit, a positive figure indicate a net tightening and a negative figure a net easing of credit standards. Concerning the questions on demand, a positive figure indicate a net increase in the demand for loans and a negative figure a net decrease in the demand for loans.[10]

3.3 Macroeconomic data

In addition to the answers from the surveys on lending standards our VAR analysis include four additional variables: real GDP, GDP deflator, short-term interest rate and volume of

on demand for loans from large and small enterprises have a correlation of 93%.

[10] The use of this statistics has the consequence that no distinction is made as the degree of tightening/easing of credit standards or increase/decrease of demand in the replies. To take care of this issue, diffusion indices can be calculated. They are balanced statistics where also the intensity of the tightening is taken into account. In particular, a weight of 0.5 is given to the percentage of banks answering that they have tightened somewhat and a weight of 1 to the percentage of banks that have tightened considerably. We do not report results relative to the use of diffusion indeces, but they do not differ qualitatively from the results obtained with net percentages.

loans.

For the euro area we include data on real GDP and the GDP deflator. For the short-term interest rate we use generally the EONIA rate, but also the 3-month Euribor, and the overnight interest swap rate on EONIA (OIS). The volume of loans is the flow of loans to non-financial corporations, households for house purchase and consumer loans.

For the United States, we also used data on GDP and GDP deflator. The short-term rate is the federal funds rate and loans are divided in loans to enterprises, real estate loans and consumer loans.[11] These data have been used in the macro and monetary literature, in particular Christiano, L.J., Eichenbaum, M., Evans, C.L., (1999) and Den Haan (2007).

4 Empirical methodology

The quantification of the credit channel of the monetary policy transmission mechanism is based on standard Vector autoregressive (VAR) models:

$$Y_t = A(L)\, Y_{t-1} + \varepsilon_t \tag{1}$$

where $t = 1, .., T$ denotes time, Y_t is an m–dimensional vector of endogenous variables, $A(L)$ is a matrix polynomial of order p in the lag operator L, and ε_t is a vector of white noise residuals. $Y_t = [Y_{1t}', r_t, Y_{2t}']'$ where Y_{1t} is a $(k_1 \times 1)$ vector with elements whose contemporaneous values are in the information set of central bank, r_t is the monetary policy rate (the federal funds rate for the US and the EONIA rate for the euro area) and Y_{2t} is a $(k_2 \times 1)$ vector with elements whose contemporaneous values are not in the information set of the central bank.

While for the US our time span covers almost twenty years of quarterly observations (1993:1-2008:4), for the euro area the sample is rather short (2002:4-2008:4), and any model estimated at the aggregate level may produce highly imprecise estimates. Therefore, for the euro area we estimate a VAR on a panel data set of the 12 countries comprising the euro area in 2002, with a fixed-effects approach, which allows us to pool diverse information from all countries, while controlling for heterogeneity in the constant term.[12]

Our benchmark specification is a VAR where the vector Y_t is composed of three sets of variables: the macroeconomic variables (GDP and price levels), the credit variables (the year-on-year change in the stock of loans, the net percentage of loan officers reporting tightening of standards, and the net percentage of officers reporting an increase in the

[11] Real estate loans include both commercial and household mortgage loans.

[12] Even though there is no official CEPR dating of the euro area business cycle after the 1990s, the euro area four-quarter growth rates of the countries in the sample show from 2001 to 2008 the features of a complete cycle. Heterogeneity across countries are nevertheless sufficient to ensure reliable estimates from a panel strategy.

demand of loans) and the policy rate. It is typically assumed in the literature that the credit variables are ordered after the macro variables, with credit standards before the volume of loans (see e.g. Lown and Morgan, 2006). We follow this approach for our benchmark VAR analysis of the US economy. For the euro area, in the benchmark model we follow the assumption that the monetary authority responds to all the contemporaneous information. This identification of the monetary policy shock assumes that the central bank not only observe current output and price level, but also take into account the current volume of loans and the current responses of loan officers, when they choose the policy rate. Therefore, all these variables do not change at time t in response to a time t policy shock, and the policy rate is ordered after both the macro and the credit variables. The choice of this ordering is justifiable with the fact that the euro area monetary policy strategy is based on a two-pillar approach and explicitly takes into account information from credit aggregates. Nevertheless, we conduct several robustness checks using different orderings of variables in Y_t.

The dynamic responses of Y_t should be invariant to the ordering of the variables in the macro and credit block. The non-policy shocks to GDP, price and loans and the associated impulse response functions have no economic interpretations. The shocks to the BLS variables, instead, are assigned an economic meaning by their same definition. Hence, we interpret an innovation to credit standards as a (negative) shock to loan supply and an innovation to the demand factors as a (positive) shock to loan demand. Supply is ordered after demand following the assumption that restrictions to the supply of loans do not affect contemporaneous demand for loans. However, the results shown are invariant to this specification. The VARs include one lag for each variable.

5 Results

5.1 Monetary shock

Figure 1 plots the responses of real GDP, the price level and the monetary policy rate after a one-standard deviation shock to the monetary policy rate. The mean response is shown along with 1-standard error confidence intervals (computed with Bayesian techniques with flat priors on the parameters). The results are in line with what found in the literature. The GDP response is significantly negative and it remains negative throughout the estimation period. It displays a hump-shaped dynamics with a peak occurring after two years in the euro area and three years in the US. The short-term rate initially increase (by around 80 basis points in the US and around 25 basis points in the euro area, not shown) but the effect of the shock vanishes it after around 6 quarters. The behaviour of the price level suffers from the price puzzle, a result found in most of the related literature (see Christiano et al.., 1999 and den Haan et al.., 2007).

The existence of a credit channel of monetary transmission implies that a monetary shock has an effect on the supply of loans and that this in turn affects the real economy. Figure 2 shows the response to a monetary shock of the demand for loans and of the supply of loans as measured by the responses to the BLS and the SLO. It shows that while demand for loans reacts negatively to an increase in interest rates in both economies, supply is tightened (higher values means tightened standards) in the euro area but not in the US. The US responses are consistent with the results of Lown and Morgan (2006). However, their sample starts in 1968 and they do not include responses on the loans' demand. Den Haan, Sumner and Yamashiro (2007) study the portfolio allocation of bank loans following a monetary tightening and find that different kind of loans (business, consumer and real estate loans) react differently to an increase of the short-term rates. we analyse this issue by including in the VAR also the demand and the supply for all the different type of loans.

Figure 3a and 3b show the responses of demand and supply of the different types of loans in the US and in the euro area. First, when including all loans, the impact of a monetary tightening on the supply of loans is significant in both areas. Thus, taking into account the entire portfolio allocation of loans is important for the identification of the monetary shock on the supply of credit. However, this impact of portfolio seems more important in the US compared to the euro area where results for loans to non financial corporations do not change. In addition, our results suggest that, while the responses differ somewhat in size and in timing, the direction of the shock is the same for all type of loans. This may seem to contradict the results of Den Haan, Sumner and Yamashiro (2007), who argue that a monetary shock has a dampening impact only on real estate and consumer loans. This difference may depend on the difficulty in disentangling demand and supply effects when using data on actual loans. Surveys data refer to new loans and do not include, for example, the impact of previously committed credit lines which may temporary increase loans' volume in response to a monetary tightening.

Concerning the size of the shock, in the euro area the impact of a monetary tightening on the supply of loans is larger than the response of the demand. The impact peaks with a lag of 3 to 5 quarters for loans to non-financial corporations, loans for house purchase and for consumer loans respectively. The impact on the actual volume of loans (not shown) arises at a longer lag, reflecting a delay between the definition of credit standards on new loans and the impact on actual credit which includes also committed credit lines. Loans start declining after 4 quarters and the contraction peaks after 2 years.

In the US the size of a monetary shock on supply is larger for home mortgage loans and for consumer credit. The impact peaks after 6 quarters for loans to non financial corporations and mortgages and after 2 years for consumer loans.

5.2 Shock to credit standards (demand and supply)

Next we analyse the direct impact of a tightening in the supply of loans on GDP, to see if restrictions on credit have a dampening effect on real activity. Figure 4a and Figure 4b plot the responses of GDP and prices to a tightening in the supply of credit in the euro area and in the US, respectively.

The responses differ somewhat across the type of loans and the geographical region. In the euro area the response of GDP to a restriction to the supply of consumer loans is not significant which may reflect the relatively low importance that this segment of the credit market plays in most of the euro are countries, notwithstanding significant rates of increase over the last few years. In the US, a tightening of constraints to consumer loans has a significant impact on GDP. At the same time, a restriction in the supply of home mortgage loans doesn't affect significantly real GDP.

The next step is to analyse how restrictions to supply affect the demand for loans. Figure 5 shows the impulse response functions of the demand for loans from non-financial corporations to a tightening of credit standards for the same type of loans. Both in the euro area and in the US demand for loans declines almost immediately when credit constraints are tightened and the impact lasts for around 6 quarters. The dampening impact on demand is broadly similar for all loans, except in the US for home mortgage loans (not shown).

Finally, Figure 6a and 6b plot the responses of real GDP and prices to shock to the demand for loans to non-financial corporations, for home mortgages and consumer loans. An increase in the demand for loans to non-financial corporations and - to a lesser degree - for house purchase boost real GDP in the euro area. In the US, the impact is stronger for loans to individuals, but results are subject to a high degree of uncertainty.

All in all the results show that a contraction of monetary policy tightens bank loan supply for all kind of loans both in the US and in the euro area, albeit with some differences in size and timing of the impacts. In turn, the tightening of bank loan supply reduces real GDP directly, through the effect of the credit channel, and indirectly, by reducing loan demand and thus affecting also the interest rate channel of monetary policy. Therefore, a credit channel is active and relevant in both economic areas.

5.3 Balance-sheet vs bank-lending channel

In the second part of the paper, we analyse the importance of the different channels of transmission of monetary policy. To disentangle demand for loans from supply of loans we have used the correspondent responses from the surveys. The next step is to use the responses relative to the reasons why banks have changed their credit standards.

In particular, we assess the importance of two main credit channels, the *bank lending channel* and the *balance sheet channel*. For the identification of these mechanisms of transmission we use the answers from the surveys related to the factors "pure supply" and "borrower's quality." (see Appendix for a detailed description of these factors in the two surveys). The pure supply factors are related to the capital and liquidity position of the banks and thus relate to the ability of banks to grant loans . In the current context of the financial crisis, a thorough understanding of these mechanisms seems of a particular importance since central banks are intervening with standard and non-standard measures of monetary easing to improve the liquidity and the capital position of the banks and thus contrast the ongoing deleveraging process and the consequent credit crunch.

The factors related to borrower's quality are instead linked to the quality of the collateral and the firm/industry outlook and thus relate to the willingness of banks to lend to riskier borrowers.

Figure 7 plots the responses of demand and supply of loans to non financial corporations to a monetary tightening in the euro area and in the US through the bank lending and the balance sheet channel. In the euro area both supply channels are active and the impact is comparable. In the US, responses are subject to a higher degree of uncertainty. However, the impact of a monetary contraction seems more relevant for the bank lending channel, while the response of shock to factors of the bank lending channel is generally not significant.

In the euro area the peak of the impact is reached after around 1 year, while in the US after 2 years.

Figure 8a and 8b plot the responses of GDP and prices to a shock to pure supply and borrower's quality factors for the euro area and for the US. In the euro area the two supply channels are active and their size is comparable. The peak of the impact is reached after 4 quarters. In the US only shocks to pure supply factors have a significant impact on GDP, while the balance sheet channel seems not active. This difference between the responses in the euro area and in the US may reflect differences in the banking structure of the two regions. In particular, the corporate sector in the US is less reliant on external financing via bank loans and thus firms ' access to bank credit may depend less on changes of short-term rates.

6 Concluding remarks

We are experiencing an important financial crisis. Policy rates are at all-time low on both sides of the Atlantic not only charted to stimulate investment but also to counter a deepening credit crunch. Hence, it is maybe more important than ever to know whether monetary policy really affects loan supply. We empirically address the following questions: (1) is there a credit channel of monetary policy? In other words, does the stance of monetary policy affect loan supply? And does this have real effects? (2) If there is a credit channel, what are the mechanisms by which monetary policy affects loan supply? What are the relative strengths of the (firm) balance sheet versus the bank lending channel?

Our contribution lies in disentangling the impact of loan demand and loans supply by using the answers from the confidential Bank Lending Survey of the Euro Area and the Senior Loan Officer Opinion Survey for the US. National central banks and regional Feds respectively request from a sample of 90 and 60 banks quarterly information on the lending standards they apply and on the loan demand they receive. Using this rich information, we find robust evidence that (i) a monetary contraction tightens bank loan supply both for business, mortgage and consumer loans; (ii) the tightening of bank loan supply reduces real GDP both directly and, indirectly through reducing loan demand; (iii) the credit channel works both through the bank lending and the balance sheet channels; and (iv) to test the credit channel it is necessary to include all the different type of bank loans to avoid omitted variable problems which bias results when only business loans are considered. We find different effects in terms of size and timing across different type of loans, channels, and economic areas.

All in all, our results suggest the existence of a strong credit channel of monetary policy transmission and have immediate policy implications given the currently all-time low policy rates and the possible credit crunch.

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7 Appendix I

List of questions used in the paper:

Bank Lending Survey (BLS)

QUESTION	MARKET SEGMENT	INDICATOR	DEFINITION
Supply of loans			
A. Over the past three months, how have your bank's credit standards as applied to the approval of loans...	or credit lines to enterprises changed? (Q1) to households for house purchase changed? (Q8) to households for consumer credit and other lending changed? (Q8)	Net percentage of banks reporting to have tightened their credit standards	Difference between the sum of the percentages answering "tightened considerably" and "tightened somewhat" and the sum of the percentages answering "eased somewhat" and "eased considerably."
Demand for loans			
D. Over the past three months, how has the demand for loans or credit lines to [...] changed at your bank, apart from normal seasonal fluctuations?	enterprises (Q4) households for loans for house purchase (Q13) households for loans for consumer credit and other lending (Q 13)	Net percentage of banks reporting that demand for loans has increased.	Difference between the sum of the percentages for "increased considerably" and "increased somewhat" and the sum of the percentages for "decreased somewhat" and "decreased considerably."

Source: ECB

Note: Q* indicates the question number in the survey

Factors affecting credit standards

QUESTION	FACTORS	VARIABLE
Over the past three months, how have the following factors affected your bank's credit standards as applied to the approval of loans or credit lines to enterprises…(Q2)	**A. Costs of funds and balance sheet constraints**	Pure supply = average of the responses to A and B
	Costs related to your bank's capital position	
	Your bank's ability to access market financing (e.g. money or bond market financing)	
	Your bank's liquidity position	
	B. Pressure from competition	
	Competition from other banks	
	Competition from non-banks	
	Competition from market financing	
	C. Perception of risk	Borrower's risk = average of the responses to C
	Expectations regarding general economic activity	
	Industry or firm-specific outlook	
	Risk on the collateral demanded	

Source: ECB

Note: Q* indicates the question number in the survey

Senior Loan Officer Survey (SLO)

QUESTION	MARKET SEGMENT	INDICATOR	DEFINITION
Supply of loans			
A. Over the past three months, how have your bank's credit standards for approving applications…	for C&I loans or credit lines - other than those to be used to finance mergers and acquisitions - to large and middle-market firms changed? (Q1) from individuals for mortgage loans to purchase homes changed? (Q9) for consumer loans other than credit card loans changed? (Q15)	Net percentage of banks reporting to have tightened their credit standards	Difference between the sum of the percentages answering "tightened considerably" and "tightened somewhat" and the sum of the percentages answering "eased somewhat" and "eased considerably."
B. If your bank has tightened or eased its credit standards or its terms for…	for C&I loans or credit lines over the past three months, how important have been the following possible reasons for the change? (Q3)	Net percentages of banks reporting that each of these factors has contributed to the tightening of standards	Difference between the sum of the answers "contributed considerably to tightening" and "contributed somewhat to tightening" and the sum of the banks answering "contributed somewhat to easing" and "contributed considerably to easing."
Demand for loans			
D. Apart from normal seasonal variation, how has demand for…	C&I loans changed over the past three months? (Q4) mortgages to purchase homes changed over the past three months (Q10) consumer loans of all types changed over the past three months (Q18)	Net percentage of banks reporting that demand for loans has increased.	Difference between the sum of the percentages for "increased considerably" and "increased somewhat" and the sum of the percentages for "decreased somewhat" and "decreased considerably."

Source: Federal Reserve Board

Note: Q* indicates the question number in the survey

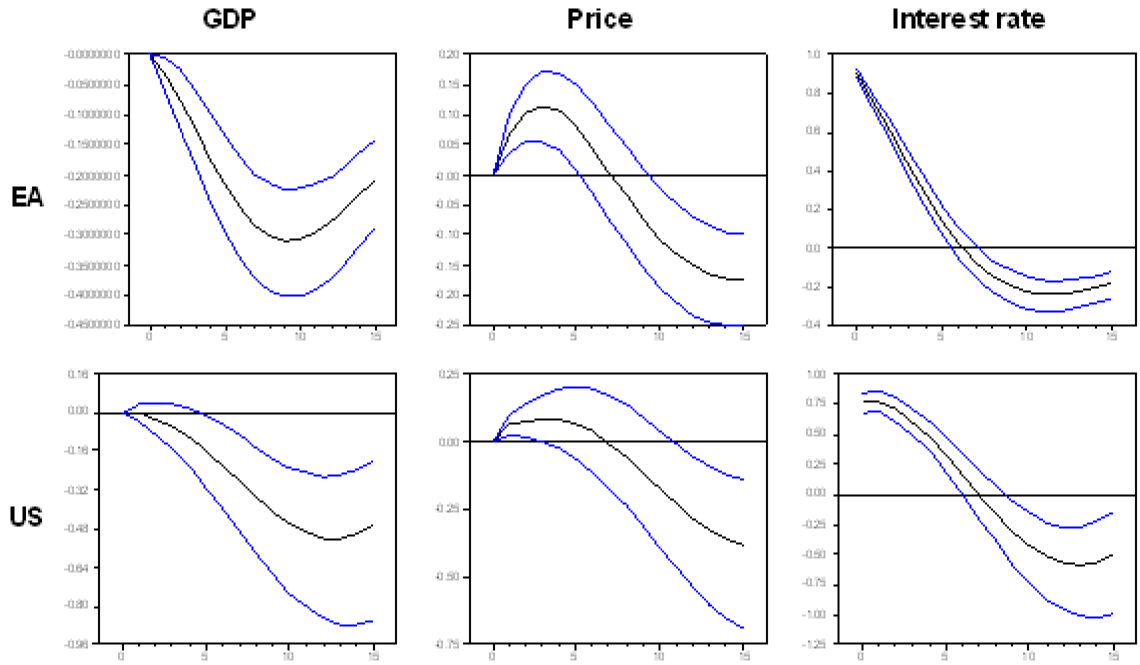
Factors affecting credit standards

QUESTION	FACTORS	VARIABLE
If your bank has tightened or eased its credit standards or its terms for C&I loans or credit lines over the past three months, how important have been the following possible reasons for the change? (Q3)	**A. Current or expected capital position** **B. Economic outlook and its uncertainty** **C. Industry specific problems**	Pure supply = responses to A Borrower's risk = average of the responses to B and C

Source: Federal Reserve Board

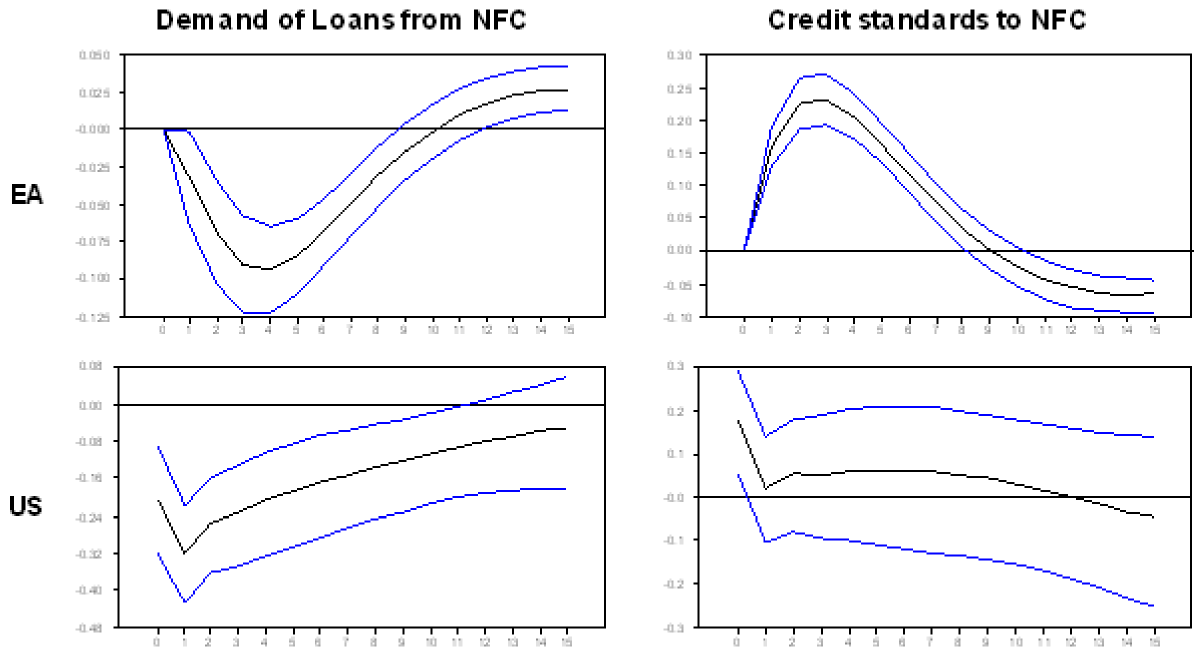
Note: Q* indicates the question number in the survey

Figure 1: Responses of the real GDP, the interest rate and the price level



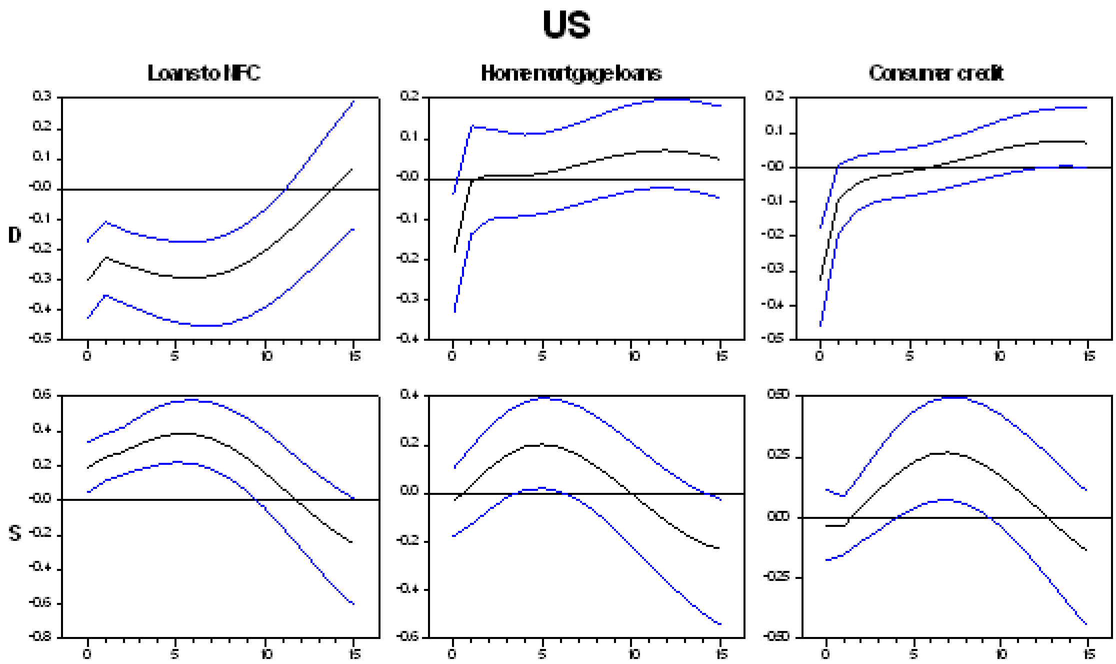
Note: these graphs plot the response of the indicated variables to a one-standard deviation shock to the EONIA rate (for the euro area, EA) and to the federal funds rate (for the US). The confidence bandsare 68% Bayesian credible bands.

Figure 2: Responses of demand for loans and credit standards for loans to non-financial corporations



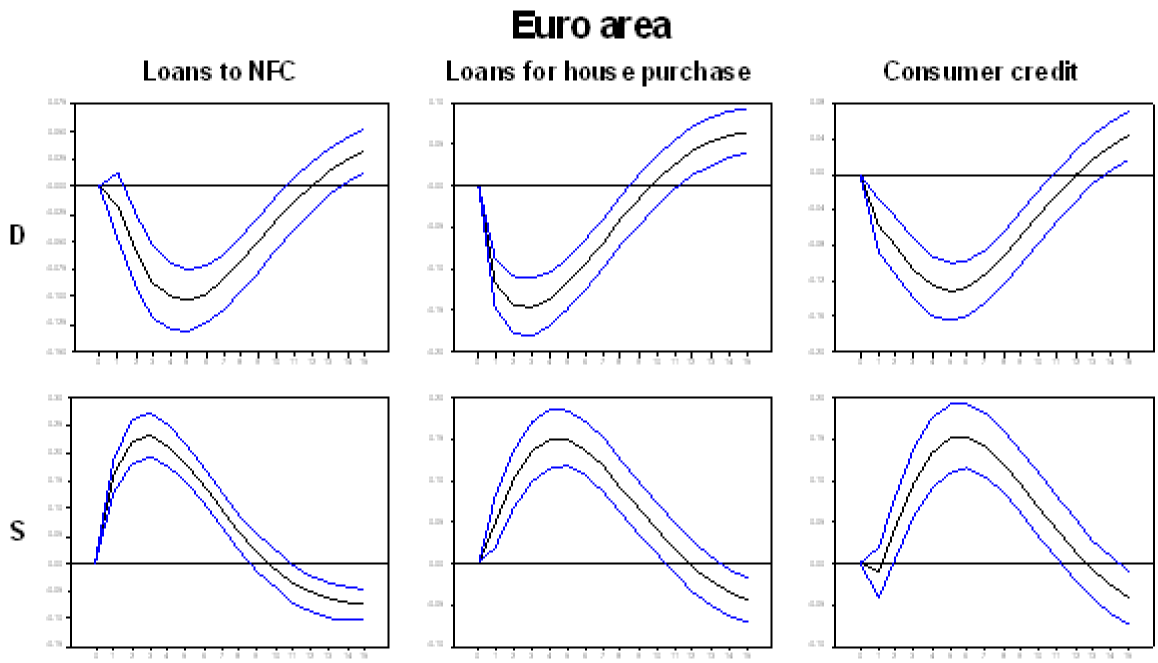
Note: these graphs plot the response of the indicated variables to a one-standard deviation shock to the EONIA rate (for the euro area, EA) and to the federal funds rate (for the US). The confidence bands are 68% Bayesian credible bands.

Figure 3a: Responses of demand for loans and supply of loans, US



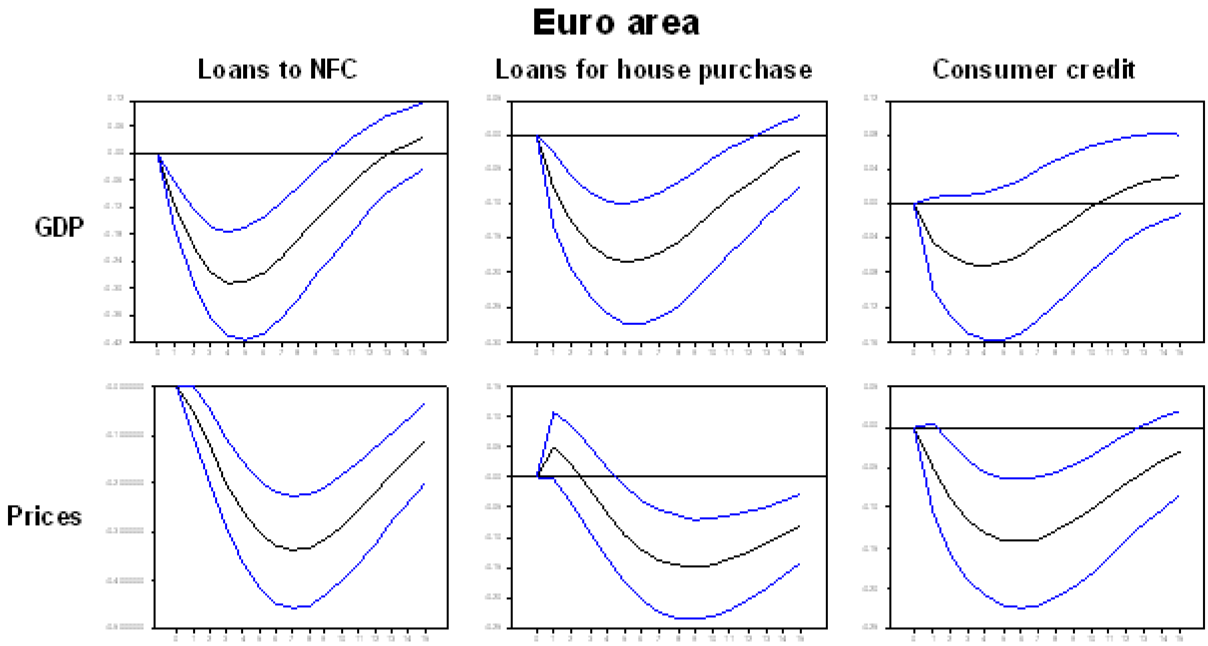
Note: these graphs plot the response of the demand for loans (D) and supply of loans (S) to a one-standard deviation shock to the federal funds rate.
Loans are to non-financial corporations, to individuals for home mortgages and for consumer credit.
The confidence bands are 68% Bayesian credible bands.

Figure 3b: Responses of demand for loans and supply of loans, euro area



Note: these graphs plot the response of the demand for loans (D) and supply of loans (S) to a one-standard deviation shock to the EONIA rate.
Loans are to non-financial corporations, to individuals for home mortgages and for consumer credit.
The confidence bands are 68% Bayesian credible bands.

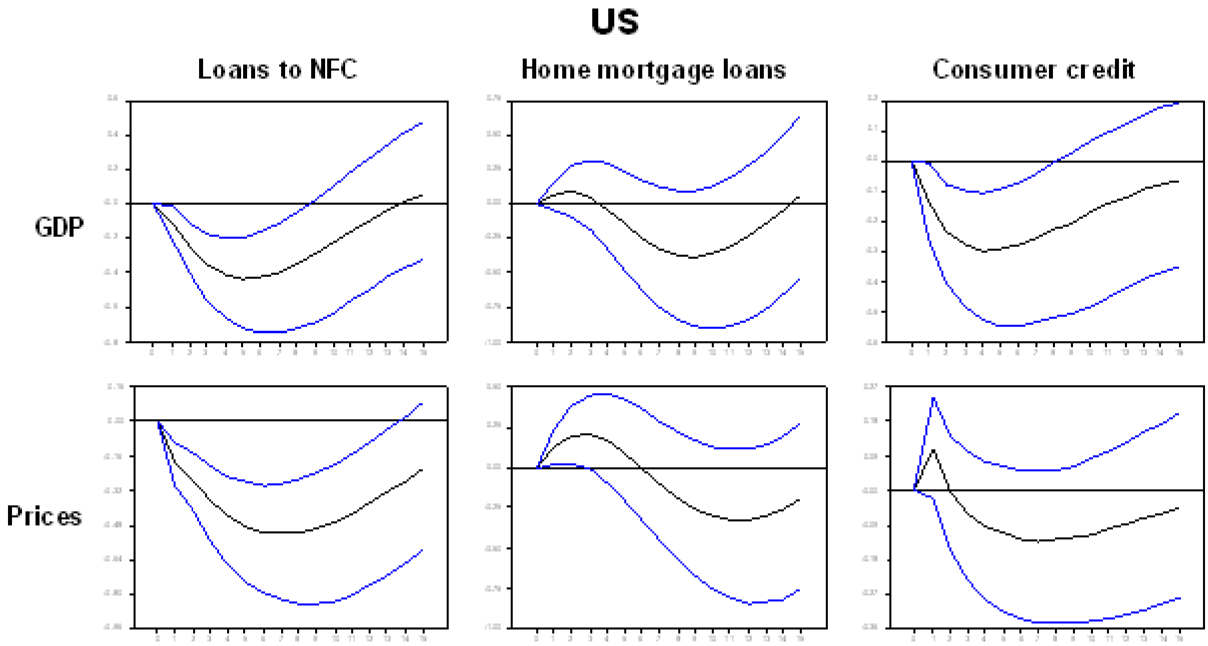
Figure 4a: Responses of GDP and prices, euro area



Note: these graphs plot the response of log real GDP and prices to a one-standard deviation shock to the supply of loans to non-financial corporations, loans for house purchase and loans for consumer loans.

The confidence bands are 68% Bayesian credible bands.

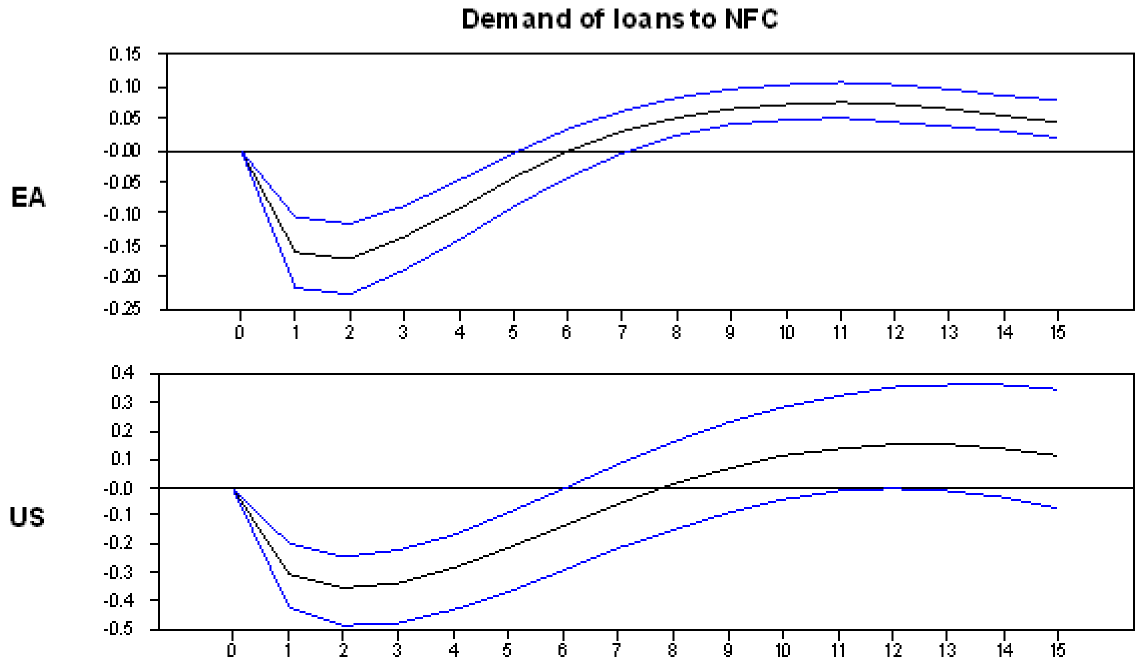
Figure 4b: Responses of GDP and prices, US



Note: these graphs plot the response of log real GDP and prices to a one-standard deviation shock to the supply of loans to non-financial corporations, home mortage loans and consumer loans.

The confidence bands are 68% Bayesian credible bands.

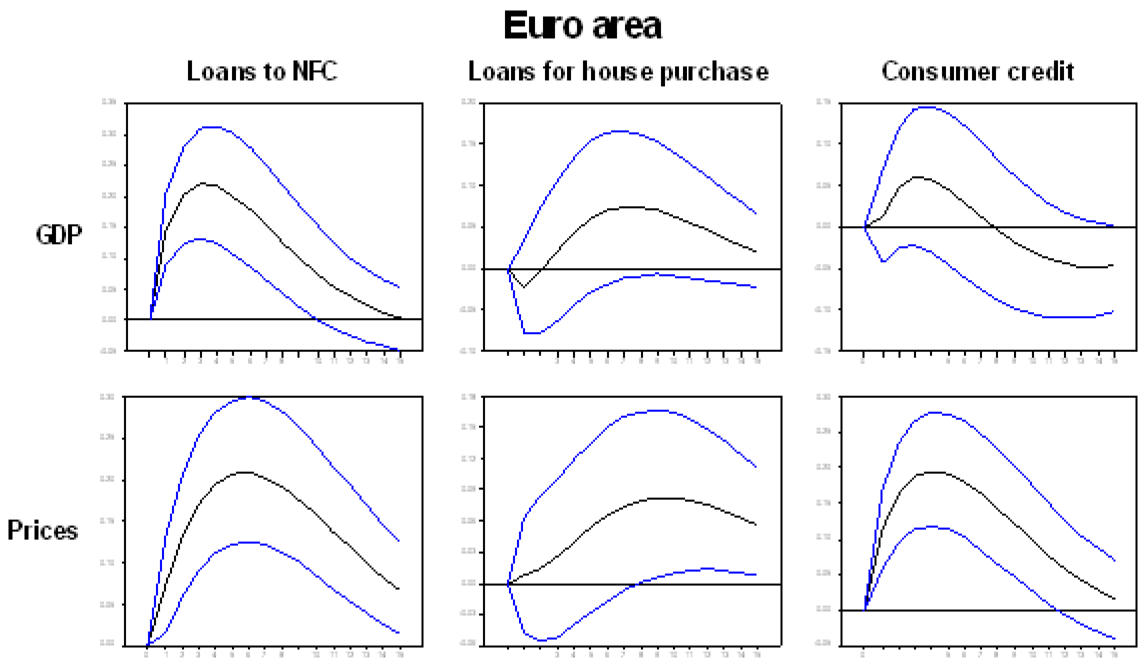
Figure 5: Responses of demand for loans from non-financial corporations



Note: these graphs plot the response of demand for loans from non-financial corporations to a one-standard deviation shock to the supply of loans to non-financial corporations for the euro area (EA) and the US.

The confidence bands are 68% Bayesian credible bands.

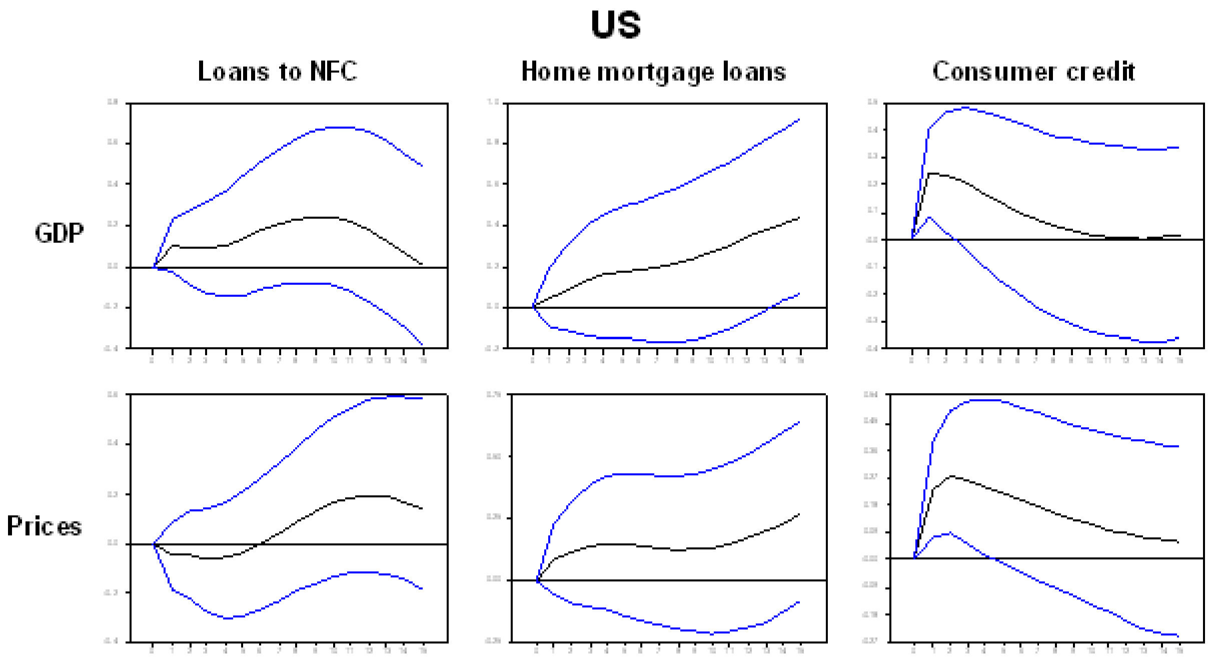
Figure 6a: Responses of real GDP and prices, euro area



Note: these graphs plot the response of real GDP and prices to a one-standard deviation shock to the demand of loans from non-financial corporations, for house purchase and for consumer loans.

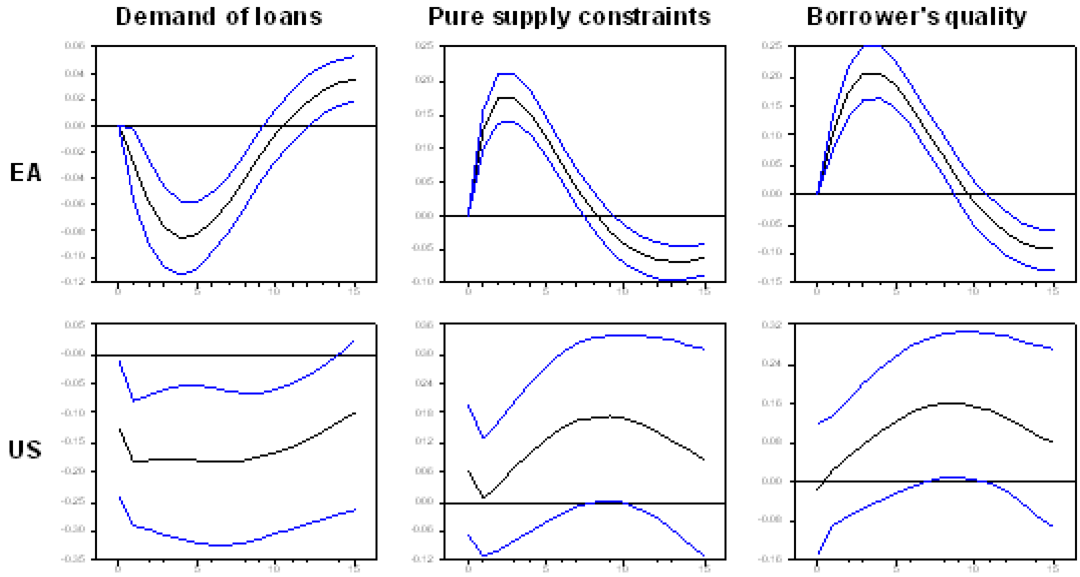
The confidence bands are 68% Bayesian credible bands.

Figure 6b: Responses of real GDP and prices, US



Note: these graphs plot the response of real GDP and prices to a one-standard deviation shock to the demand of loans from non-financial corporations, for house purchase and for consumer loans.
The confidence bands are 68% Bayesian credible bands.

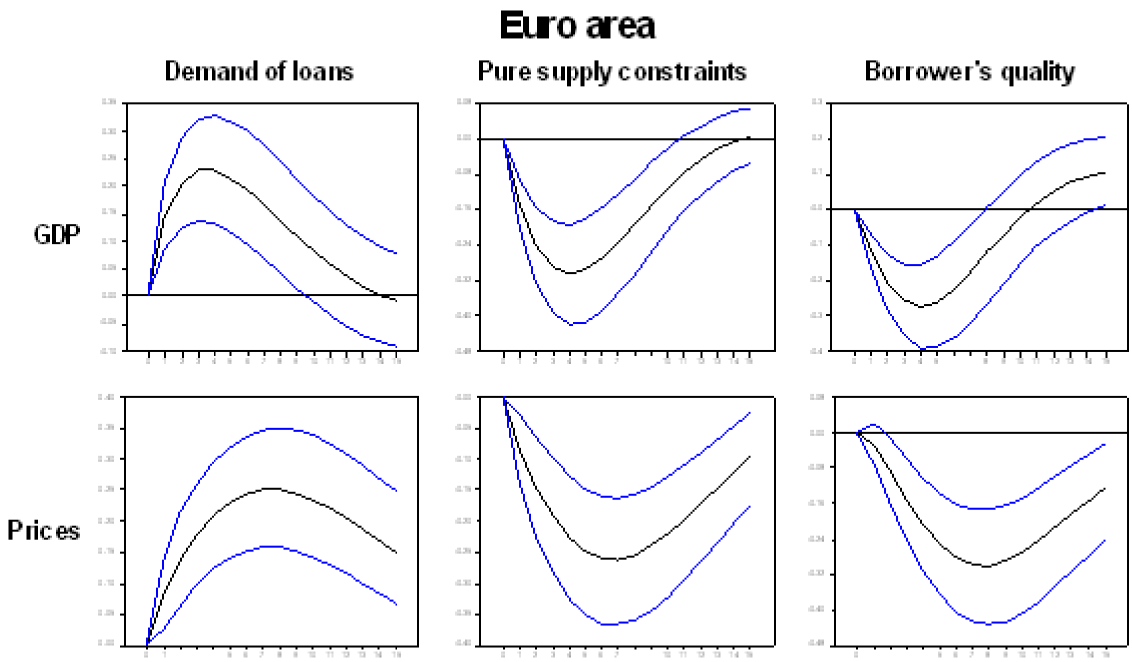
Figure 7: Responses of demand and supply of loans to non-financial corporations



Note: these graphs plot the response of demand and supply of loans to non-financial corporations to a one-standard deviation shock to the EONIA rate for the euro area (EA) and to the federal funds rates for the US.

The confidence bands are 68% Bayesian credible bands.

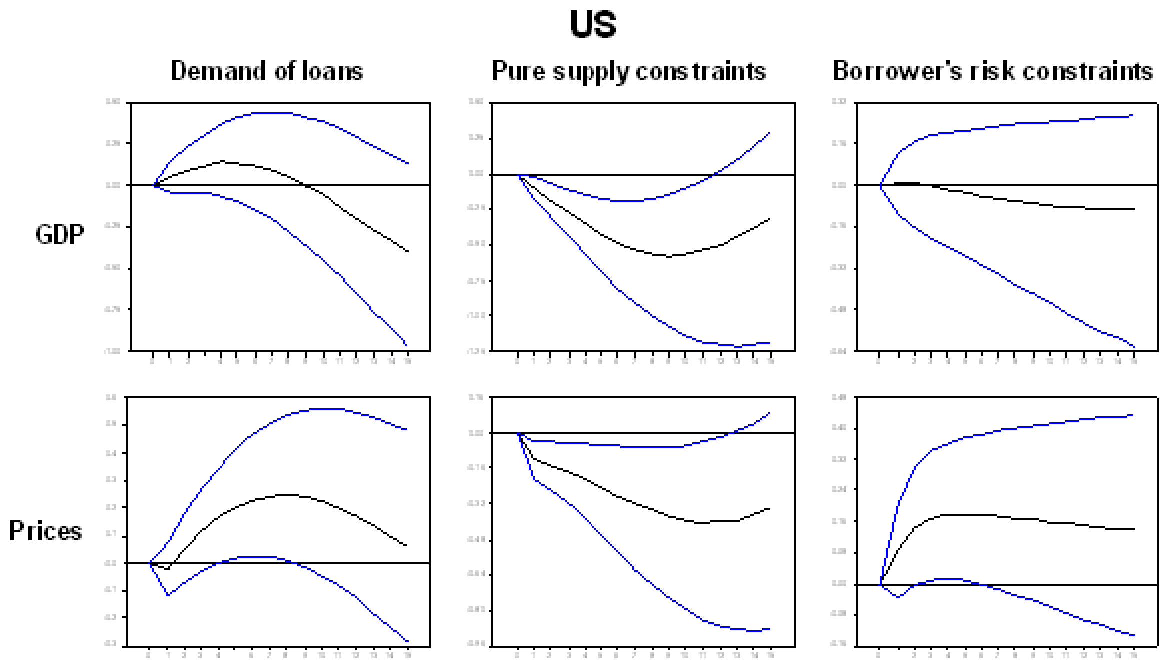
Figure 8a: Responses of GDP and prices, euro area



Note: these graphs plot the response of GDP and prices to a one-standard deviation shock to the demand for loans to non-financial corporations, to the pure supply factors and to the borrower's quality factors.

The confidence bands are 68% Bayesian credible bands.

Figure 8b: Responses of GDP and prices, US



Note: these graphs plot the response of demand and supply of loans to non-financial corporations to a one-standard deviation shock to the EONIA rate for the euro area (EA) and to the federal funds rates for the US.

The confidence bands are 68% Bayesian credible bands.