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WORKING PAPER NO. 413

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September 2015

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Economic Activity and Credit Market Linkages: New Evidence from Italy

V. Chiorazzo[*], V. D'Apice[*], P. Morelli[*] and Giovanni W. Puopolo[**]

Abstract
We investigate the interactions between the business cycle and credit markets in Italy, focusing on how macroeconomic shocks affect the banking sector (i.e. the real effect) and in turn how the financial system's reaction influences the economic activity (i.e. the feedback effect). We find evidence of both effects, with the former conveyed primarily by the creditworthiness of large firms. Moreover, using data from the Bank Lending Survey provided by the ECB, we disentangle credit supply shocks due to factors inside the banking sector (the bank lending channel), from those outside the banking sector (the borrower's balance-sheet channel), finding that both types of shocks have a significant impact on the real economy. Our results have far reaching implications for financial stability.

JEL Classification: E32; E44; G28, G01, G21

Keywords: Real effect, Feedback effect, Bank Lending Channel, Balance-Sheet Channel, VAR, Business Cycle.

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1. Introduction

The Great Financial crisis of 2008 has witnessed an increasing degree of interaction between the real economy and financial markets, in particular with the banking sector (see among others, Claessens et al., 2010; Stiglitz, 2010; D'Apice and Ferri, 2010; Fiordelisi et al., 2014). Over the years, in fact, deregulation led significant changes on the financial system, allowing financial companies and other intermediaries to expand the aims of their businesses and, at the same time, to explore new profitable opportunities. As a result, the financial sector has rapidly grown in size and in terms of its contribution to overall economic activity. By contrast, such deregulated environments can also be more volatile, contributing to the build-up of financial imbalances, which, in turn, can easily generate macroeconomic instability. Unsurprisingly, the presence of factors that have increased the vulnerability of the macro-economy to financial system stress pushed several governments and central banks to foster the development of measured aimed at re-gaining financial stability for overall macroeconomic performance.

Understanding the transmission channels that exist between the real and financial sectors of the economy is of primary importance when assessing financial stability, especially when the goal of policy makers and regulators is to determine the overall impact of development and policy actions on the state of the economy. In fact, on the one hand, the state of the business cycle affects incomes, profits and, thus, by extension, the balance sheets and the creditworthiness of various economic players. On the other hand, financial conditions of banks and other intermediaries have a clear influence on the overall economy.

The purpose of this paper is precisely to investigate the linkages between the real economy and credit markets in the Italian economy. More precisely, we study how the business cycle influences credit markets and in particular the risk of the banks' loan portfolio (i.e. the real effect) and, in turn, how credit shocks affects the real economy (i.e. the feedback effect). By estimating a linear vector autoregression model (VAR), we find evidence of both real and feedback effects in Italy. In particular, with regard to the real effect, we find that the sensitivity of the default rate to the business cycle is conveyed primarily by the creditworthiness of large firms, whereas, on the contrary, the sensitivity of the households-based default rate to the business cycle is not statistically significant. Moreover, to further analyze the main sources of linkages between the real economy and credit markets, we consider two different types of credit supply shocks. More precisely, using data from the Bank Lending Survey provided by the ECB, we distinguish the supply shifts

originated by factors inside the banking sector (i.e. the bank lending channel), from those originated by factors outside the banking sector (i.e. the borrower's balance-sheet channel). In this regard, we find that both types of credit linkages generate a significant impact on economic growth, exhibiting a quite similar magnitude. However, when considering credit to firms, credit supply shocks originated by factors inside the banking sector have greater effects on the economic growth than outside factors-induced shocks. On the contrary, when considering credit to households, we find stronger effects in the case of outside factors-driven shocks.

Several papers have investigated the interactions between the macroeconomic system and financial markets, finding that the role of credit markets in driving business cycles varies substantially according to the class of models considered. Specifically, in models with no frictions and complete markets, shocks originating in credit markets play only a minor role in explaining business cycles, whereas, on the contrary, when financial imperfections are present, financial shocks can translate into much larger cyclical fluctuations in the real economy due to the wealth effect operating through firms and households' balance sheets.[1] To the best of our knowledge, the empirical evidence about the interactions between the macroeconomic system and the banking sector in Italy is quite limited. In this regard, a first attempt to fill this gap is Marcucci and Quagliariello (2008). Using a linear VAR-model, they estimate the real and the feedback effect in the Italian banking sector from 1985 to 2005, finding clear evidence that supports the presence of the former, but only little evidence in favor of the latter. Our paper is different from this paper along several dimensions. First, our sample period, i.e. 1990-2012, covers the worst recession occurred in Italy since the Great Depression. Second, using data from the Bank Lending Survey, we distinguish two types of credit supply shocks and shed more lights on the feedback effect.

Outside Italy, many empirical papers have focused on the bilateral relationship between the dynamics of business cycles and shocks to credit markets, focusing in particular on the real effect. For example, Pesola (2001) highlights that the banking crises in the Nordic countries were remarkably affected by the high level of both corporate and households' indebtedness along with a GDP growth below the forecasts. Similar evidence is provided in cross-country comparisons by Bikker and Hu (2002), Laeven and Majoni (2003) and Valckx (2003). Moreover, Gambera (2000) provides evidence of the link between a small number of macroeconomic variables and non-performing loan ratio in the US. Similarly, Hoggarth et al. (2005) report that both UK banks' total and corporate write-offs are significantly related to the state of the business cycle. Regarding the

[1] In other words an increase – respectively decrease – in asset prices improves the agent's net worth thus improving – respectively reducing – her ability to borrow, invest and spend.

Spanish economy, instead, Salas and Saurina (2002) show that during economic booms intermediaries tend to expand their lending activity, often relaxing their selection criteria, whereas during downturns bad loans remarkably increase.

On the contrary, the empirical evidence documenting the existence of a feedback effect using macro data is less abundant. In fact, not only the precise mechanisms behind the transmission of banking distress to the macroeconomic system are not completely clear, but often researchers have assumed (rather than demonstrated) that such feedback effect is a consequence of the real channel effect. For instance, Bernanke and Lown (1991) acknowledge that credit crunch affects negatively borrowers, however they do not find any significant evidence in favor of worsening the recessionary conditions. On the contrary, Peek et al. (2003) find that several real-macroeconomic variables, in particular the GDP components that are more dependent on banks loans, such as inventories, are influenced by loan supply shocks. Moreover, Bordo and Haubrich (2010), by analyzing cycles in money, credit and output from 1875 and 2007 in the United States, show that financial stress events worsen cyclical downturns.

For what concerns the information content of the euro area Bank Lending Survey for aggregate credit and output growth, de Bondt et al. (2010) find evidence in favor of the existence of a bank lending, balance sheet, and risk-taking channel of the monetary policy. They also suggest that price as well as non-price conditions and terms of credit standards do matter for credit and business cycles. Moreover, Ciccarelli et al. (2010) separate credit supply and demand in the euro-area using Bank Lending Surveys provided by the ECB. Their VAR model highlights that: (1) the credit channel is active through the balance-sheets of households, firms and banks; (2) the credit channel amplifies the impact of a monetary policy shock on GDP and inflation; (3) for business loans, the impact through the (supply) bank lending channel is higher than through the demand and balance-sheet channels. For household loans the demand channel is the strongest; (4) during the crisis, credit supply restrictions to firms in the Euro area and tighter standards for mortgage loans in the US contributed significantly to the reduction in GDP.

Regarding the Italian economy, Angeloni et al. (1995) and Gambacorta (2001) are the first to provide some evidence in favor of the credit channel, whereas Gambacorta and Mistrulli (2004) find that well-capitalized banks are better in shielding their credit supply from monetary shocks and that their lending policies are less procyclical. Moreover, using a panel of Italian banks, Quagliariello (2004) finds that loan loss provisions and bad debts increase in bad macroeconomic times, whereas Filosa (2008) provides an application of macro stress testing to the Italian banking

system to explore the sensitivity of Italian banks to selected macro shocks, finding that the behavior of non-performing loans is only weakly procyclical. More recently, Del Giovane et al. (2011) give an assessment of the relative importance of loan supply and demand factors during the period of credit contraction in 2008-2009, by combining micro-data on loan prices with information on credit standards from the Italian banks participating to the ECB's Bank Lending Survey. They find that both demand and supply have played a relevant role, especially for lending to firms. Albertazzi and Bottero (2014) exploit disaggregated bank-firm data to investigate the dynamics of foreign vs. domestic credit supply in Italy around the period of the Lehman collapse, showing that foreign lenders restricted credit supply more sharply than their domestic counterparts.[2] Finally, Bonaccorsi di Patti and Sette (2012), by employing Italian bank lending data to firms, study the transmission of shocks affecting bank balance sheets to the volume and cost of credit granted to business borrowers and to the probability of banks accepting loan applications from new borrowers during the 2007-2008 financial crisis. Their results indicate that supply conditions worsened most for the banks that were most exposed to the interbank market and for those that made the most use of securitization. While the initial capital position of banks did not significantly affect their lending, the deterioration of bank capitalization as proxied by charge-offs and profitability had a significant impact.

The remainder of the paper is structured as follows. In Section 2 we present our model, whereas in Section 3 we discuss the empirical evidence, focusing in particular on the real and feedback effects. Section 4 looks in more details at the feedback effect, whereas the stability of parameters is analyzed in Section 5. Finally, Section 6 offers conclusions and indicates the policy implications.

2. Methodology

In order to investigate the interactions between the real and banking sectors in the Italian economy we employ a VAR methodology. Unlike panel or cross-section models, such approach captures the interactions among real and financial variables, allowing us to perform a stress-test scenario in order to quantify the effect of the shocks.

Specifically, using Italian data from 1990-2012 at the quarterly frequency, we estimate the following model:

[2] Albertazzi and Marchetti (2010) analyze the effects of the recent financial crisis on credit supply finding evidence of a contraction of credit supply associated to low bank capitalization and scarce liquidity. They also document that larger less-capitalized banks reallocated loans away from riskier firms, thus contributing to credit pro-cyclicality.

$$\mathbf{Y_t} = \mathbf{c} + \boldsymbol{\varphi_1}\,\mathbf{Y_{t-1}} + \boldsymbol{\varphi_2}\,\mathbf{Y_{t-2}} + \boldsymbol{\theta_1}\,\mathbf{X_{t-1}} + \boldsymbol{\theta_2}\,\mathbf{X_{t-2}} + \boldsymbol{\varepsilon_t}, \qquad (1)$$

where $\mathbf{Y_t}$ is the 4-dimensional vector of endogenous variables described below, $\mathbf{X}$ is a 2-dimensional vector representing the exogenous variables,[3] $\mathbf{c}$ is the 4-dimensional vector of intercepts, $\boldsymbol{\varphi_1}$ and $\boldsymbol{\varphi_2}$ (respectively $\boldsymbol{\theta_1}$ and $\boldsymbol{\theta_2}$) are the 4-by-4 (respectively 4-by-2) matrices representing the coefficients of the lagged endogenous (respectively exogenous) variables, and $\boldsymbol{\varepsilon_t}$ is the vector of error terms.[4]

We consider the following vector of endogenous variables: $\mathbf{Y_t}$ = **[gdp_growth infl default_rate spread]'**, whereas the vector of exogenous variables is given by $\mathbf{X_t}$ = **[policy_rate exchange_rate]'**. This choice derives from the fact that Italy, for the larger part of the sample (i.e. 1999-2012), is part of the euro area and thus the *policy_rate* and the *exchange_rate* do not react to the specific developments in the domestic economy. To some degree, this is also true during the first period of the analysis (i.e. 1990-1999) since Italy was inside the exchange rate mechanism known as EMS. In particular, the variables *gdp_growth*, *infl*, *policy_rate* and *exchange_rate* are meant to capture the structure of the macroeconomic system, in line with earlier literature (see, among others, Hoggarth et al., 2005), whereas the variables *default_rate* and *spread* refer to the banking sector. More precisely, as shown in Table 1, these variables are:

-- *gdp_growth* is the quarter over quarter annualized variation of the real domestic product. In our sample *gdp_growth* has a mean equal to 0.7 (see Table 2 and Figure 1), a maximum of 5.6% (in the first quarter of 2000) and a minimum of -14.5% (in the first quarter of 2009).

-- *infl* is the quarter over quarter annualized variation of consumer price index. Its mean is 3% and its standard deviation is 1.6 percentage points (hereafter pp).

-- *policy_rate* is the policy rate of the Bank of Italy up to 1999 and of the ECB afterwards. In our sample, *policy_rate* has a mean equal to 4.9%, a maximum of 15% (in the second quarter of 1992) and a minimum of 0.8% (in the second quarter of 2012).

-- *exchange_rate* corresponds to the quarter over quarter annualized variation of the real effective exchange rate and proxies the competitiveness of the country. Its mean is -0.6% and its standard deviation is 8.8 pp.

[3] The *X* variables are called exogenous (or independent) variables because they appear only in the right-hand-side of the system (1), whereas, on the contrary, the *Y* variables are called endogenous because they are determined inside the system of interest.

[4] We choose two lags based on the Schwarz' Bayesian Information Criterion. Moreover, we also include a dummy variable capturing the effects due to the introduction of the Euro.

-- *default_rate* is the ratio of banks' new bad debts at time *t* over the bank's performing loans at time *t-1*.[5] This ratio, in fact, measures the bank borrowers' default rate and captures the incidence of the real effect on bank's portfolio risks. In particular, we use the flow of new non-performing loans rather than the stock of non-performing loans to better highlight the effect of the economic cycle. In our sample, *default_rate* has a mean equal to 1.9%, a maximum of 3.3% and a minimum of 1%.
-- *spread* corresponds to the difference between the average interest rate on short-term loans and the interest rate paid by the most creditworthy borrowers (10th percentile of the distribution of short-term loans with respect to the interest rate) at aggregate level, and captures the feedback effect. It can be considered as a good proxy for the overall credit supply conditions of the banking system since the widening of this spread indicates an increase of the risk of average borrower, which, in turn, reduces the propensity of banks to supply credit and vice versa. In our sample, its value ranges from 1.8 to 4.1 pp, with a mean of 2.9 pp.

Consistently with the analysis reported in the Bank Lending Survey (BLS) provided by the ECB, and in contrast to some literature, such as Marcucci and Quagliariello (2008) and Filosa (2008), in our model we do not include an indicator of the banks' capital. In fact, as shown in Figure 2, the correlation between our variable *spread* and the BLS lagged lending standard index is particularly high (73%). Specifically, since the credit constraint index of the BLS includes both outside and inside determinants of the banking sector, and hence the level of banking capital, we prefer to include in the VAR model (1) only the spread, proxing the credit supply, and not the banks' capital which could be, indeed, redundant. This aspect will be explored in more details in the next sections.

3. Empirical Evidence

In order to understand the linkages between the real economy and credit markets and, in particular, how the economic activity and the banking sector react in response to some external shocks, we compute the impulse response function associated to our VAR model (1). More specifically, we employ the generalized impulse response function (GIRF) proposed by Pesaran and Shin (1998) instead of the orthogonalized impulse response function (OIRF), since the former is invariant to the reordering of the variables in the VAR, whereas the latter is not. Our choice, indeed,

[5] We compute this variable in two ways: 1) as the number of new bad debts at *t* over the number of performing loans at *t-1*; 2) as the value of new bad debts at *t* over the value of performing loans at *t-1*. For both measures, our results do not change.

is consistent with the fact that the interactions between the financial system and the real economy have not been rigorously identified from a theoretical perspective, thus making the use of GIRF more appropriate.

Results of the generalized impulse response function are shown in Figure 3. In the first column we report the effects of a one-standard-deviation shock to the error term of the gdp growth equation. Interestingly, we notice that the gdp growth reaches its maximum in the first quarter, and then comes back to the pre-shock value after 3 quarters. As a result of this shock, and in line with our expectations, the default rate drops significantly: in other words, the incidence of the real effect is particularly significant, reaching its trough (-0.05 pp) after 4 quarters. Finally, the elasticity between the gdp growth and the default rate, evaluated in correspondence of their maximum points, is about 2.4%. These results confirm the importance of the business cycle on banks' loan portfolio risks.

We can now investigate the existence of the feedback effect. In this regard, the last column of Figure 3 reports the effects of a one-standard-deviation shock to the error term of the *spread* equation, that is our proxy for the credit supply. The impact upon the gdp growth is immediately significant, reaching the highest departure from its pre-shock value, i.e. -1.1 pp, in the first quarter, and lasts about 3 quarters. This is a clear evidence of the feedback effect, in which a reduction of credit supply has a negative impact on the business cycle.

3.1 Firm-based default rate

In this section we use our VAR model to investigate the sensitivity of different borrowers' types to the business cycle. We start by focusing on the production side of the economy. More specifically, here we compute the default rate not taking into account the whole economy's bank loans, as done in the previous section, but only considering the set of bank loans granted to firms, whereas the other variables of the system of equations (1) do not change. The corresponding variable is *default_firms*, and in our sample it has a mean equal to 2.3%, a maximum of 3.4% and a minimum of 1.5% (see Table 1 and Figure 1).

Figure 4 shows the generalized impulse response function corresponding to a shock to the error term of the gdp growth equation. In line with our expectations, the firm-based default rate drops significantly: again, the real effect is particularly pronounced, being significant from the second to the fifth quarter after the shock, and reaches its minimum (-0.08 pp) after 4 quarters,

whereas the elasticity between the gdp growth and the default rate, evaluated in correspondence of their maximum points, is about 3.8%.

Next, we divide all the bank loans granted to firms in two subsamples based on whether the amount lent is higher or lower than €500,000; then, for each sub-group, we compute the corresponding default rate. In this way, the variable *default_large_firms* proxies the default rate of large corporations (i.e. loans higher than €500,000); whereas *default_small_firms* proxies the default rate of small corporations (i.e. loans lower than €500,000). It is noteworthy that the default rate of large firms is not only higher on average (2.8% vs. 2.2%) but also more volatile than the default rate of small firms. In fact, the standard deviation of *default_large_firms* is equal to 1 pp whereas the standard deviation of *default_small_firms* is equal to 0.5 pp (see Table 1).

Figure 5 shows the generalized impulse response function associated to the setting in which the default rate is computed taking into account only firms' loans higher than €500,000. The incidence of the real channel becomes even higher: the effect of the gdp growth shock on the large-firm's default rate is significant from the first to the seventh quarter and reaches its strongest effect (-0.2 pp) after 5 quarters. Here, the elasticity between the gdp growth and the default rate, evaluated in correspondence of their maximum points, is about 9.5%.

Figure 6, instead, exhibits the generalized impulse response function associated to the setting where only firms' loans lower than €500,000 are used to compute the default rate. In this case, the impact of a exogenous shock to the gdp growth on such small-firm default rate is significant from the third to the fifth quarter after the shock and reaches its minimum (-0.06) after 6 quarters, whereas the elasticity between the gdp growth and the default rate, evaluated in correspondence of their maximum points, is about 2.9%.

3.2 Household-based default rate

In this section we investigate the interactions between the macroeconomic system and that part of the banking sector which involves households. Specifically, here we compute the default rate taking into account only the bank's loans granted to households. The resulting variable, i.e. *default_households*, has a mean equal to 1.8%, a maximum of 4.4% and a minimum of 0.7% (see Table 1 and Figure 2). Figure 7 shows that, in this setting, the incidence of the real effect is not statistically significant. In fact, by computing the generalized impulse response function, we find that the impact of a shock to the gdp growth does not produce significant effects on the household-based default rate.

Overall, our results indicate that the sensitivity of the default rate to the business cycle is conveyed primarily by the creditworthiness of the firms, whereas, on the contrary, the sensitivity of the households-based default rate to the business cycle is not statistically significant. Furthermore, we find that the size of the loan matters: large firms, in fact, exhibit the highest sensitivity to the business cycle. From a financial stability perspective two observations are worth mentioning here. First, our findings regarding the firm-based default rate are in line with the recent development of sectorial credit risk in Italy. Second, most likely, these results are not driven by the risk of individual firms, but, on the contrary, are driven by the risk of banks' loans portfolios, taking into account the correlation between single default events. More precisely, we believe that the higher correlation among the large-firms default is the main explanation for this higher business cycle sensitivity.

4 Inside the credit channel

In the previous section we have considered the credit supply as a unique mechanism of influence, without any distinction between the sources of supply shocks. On the contrary, in this section, we are interested in opening the black box and understanding better the main sources of linkages between the real economy and credit markets, focusing in particular on the feedback effect. To this end, we consider two different cases of credit supply linkages: the bank lending channel and the borrowers' balance-sheet channel. The first sub-channel is related to supply curve shifts originated by factors inside the banking sector such as, for example, liquidity and capital problems, difficulties to access the wholesale funding markets and so forth. As the quality of potential borrowers is held constant, these shifts are called "pure" supply shocks (or "credit crunch"). On the contrary, the second sub-channel is related to supply curve shifts originated by factors outside the banking sector such as, for example, higher borrowers default probability due to lower economic growth or negative industry specific outlook. In this case, the shifts of supply curve are due to the change in the quality of potential borrowers and their effects on the real economy get through the borrower's net worth, cash flow and liquidity.

The variable *spread* used in Section 2 is not appropriate anymore in this setting, since it does not allow to disentangle the shifts of credit supply attributable solely to the behavior of banks (i.e. the inside factors) from those due to the evolution of the real economy on the borrowers' balance sheets (i.e. the outside factors). As a consequence, to overcome this drawback, in this section we use the data from the Bank Lending Survey published by the ECB.

4.1 The Bank Lending Survey

Since January 2003, the national central banks of the Eurozone, in cooperation with the ECB, have been conducting a survey on the conditions of supply and demand for credit, known as the ECB Bank Lending Survey - BLS. More specifically, bank loan officers are asked for their views about the tightening of credit supply of their banks and the influence of various factors affecting the supply of credit to: i) firms (question 2); ii) households for house purchase (question 9); and iii) households for consumer credit (question 11). In particular, given the type of questions characterizing the survey, such factors can be divided in two groups. The first one, based on the answers to questions 2A, 9A and 11.A[6], is a proxy for factors inside the banking system and that influence directly the credit supply. On the contrary, the second group of factors, based on the answers to questions 2C, 9C and 11C, is a proxy for factors outside the banking system and that affect the credit supply through the changes in the quality of the borrowers. Using the answers to the previous groups of questions provided by the Italian banks in the BLS, we compute two diffusion indices, that is: i) *inside*, which captures the factors inside the banking system, thus proxing the bank lending channel, and ii) *outside*, which instead captures the factors outside the banking system, and thus proxies the borrower's balance sheet channel. These indexes are calculated as follows. First, the five possible answers[7] of the relevant questions are transformed into an ordinal scale ranging from 1, in the case of "contributed considerably to tightening of credit standards" answer to -1, in the case of "contributed considerably to easing of credit standards" answer, with steps of 0.5. Then, each diffusion index is computed as the weighted average of these values with weights equal to the percentage of response to each possible answer (see Table 1 and Figure 1C). Given our conversion scale of the answers, the possible range of these two indices goes from -1 to +1.

4.2 Empirical Evidence

[6] See the Appendix for detailed information about the questionnaire for loans or credit lines to enterprises and households charactering the ECB Bank Lending Survey.

[7] Each question belonging to the Bank Lending Survey allows for five possible answers, and more precisely: (1) contributed considerably to tightening of credit standards; (2) contributed somewhat to tightening of credit standards; (3) contributed to basically unchanged credit standards; (4) contributed somewhat to easing of credit standards; (5) contributed considerably to easing of credit standards.

In order to understand the sources of linkages between the real economy and credit markets, we include the variables *inside* and *outside* described above in the following VAR model:

$$\hat{\mathbf{Y}}_t = \mathbf{c} + \varphi_1 \hat{\mathbf{Y}}_{t-1} + \varphi_2 \hat{\mathbf{Y}}_{t-2} + \theta_1 \mathbf{X}_{t-1} + \theta_2 \mathbf{X}_{t-2} + \varepsilon_t, \qquad (2)$$

where $\hat{\mathbf{Y}}_t$ = **[gdp_growth infl inside outside]'** is the vector of endogenous variables, and $\mathbf{X}_t$ = **[policy_rate exchange_rate]'** is the vector of exogenous variables. In particular, in equation (2), we do not include the variable capturing the default rate, since in this section we prefer to concentrate only on the nature of credit supply shocks.

Figure 8 reports the results of the generalized impulse response function associated to our VAR model (2). Also in this framework, the incidence of the feedback effect is relevant: in fact, both types of supply shocks, proxied respectively by the *inside* and *outside* banking system's factors, have a negative and significant effect on gdp growth. In particular, from a financial stability angle, supply shocks due to outside factors are similar to banking system pro-cyclical episodes[8], whereas supply shocks due to inside factors are similar to credit crunch episodes.[9] To compare the relative impact of the two types of shocks, Figure 9 shows that a tightening of *outside* by 0.1 causes a fall in the gdp growth that reaches a minimum of -2.9 pp after two quarters. On the contrary, an equivalent tightening of *inside* determines a fall in the gdp growth that reaches a minimum of -2.5 pp after two quarters.

In other words, leftward shifts of the credit supply curve due to both factors, that is inside the banking system such as capitalization or liquidity problems, and outside the banking system such as an increase of the bank's costumers default probability, have negative effects on gdp growth.

4.3 Firm-based supply shocks

Consistently with the analysis performed in the previous section, and taking into account the two sources of credit supply described above, here we concentrate our attention on the sensitivity of different sectors to the business cycle. Again, we start by focusing on the production side of the economy. To this end, by restricting the factors proxing both types of credit supply shocks only to

[8] In which, for example, lower economic growth increases the default probability of borrowers. In turn, this reduces the supply of credit which leads to even lower economic growth.
[9] In which, for example, bank funding problems lead to a direct reduction of credit supply, thus affecting the economic growth.

bank loans provided to the firms, i.e. using respectively answers to questions 2.A and 2.C, we compute the two diffusion indices *outside_firms* and *inside_firms.* Next, employing such variables in the VAR model (2) in place of *inside* and *outside*, we can compute the resulting generalized impulse response function. Figure 10 shows that a contraction of the credit granted to firms, due to both inside and outside factors of the banking system, has negative and significant effects on gdp growth. In addition, to compare the relative impact of the two types of shocks, Figure 11 shows that a tightening of *outside_firms* by 0.1 causes a fall in the gdp growth that reaches a minimum of -2 pp after two quarters. On the contrary, an equivalent tightening of *inside_firms* determines a fall in the gdp growth that reaches a minimum of -2.5 pp after two quarters. Finally, from a financial stability perspective, it is important to notice that the value of the variable gdp growth resulting after an initial shock to *inside_firms* is always lower than the value after an initial shock to *outside_firms*, implying that, in terms of accumulated response, the effects of *inside_firms* shocks on gdp growth are stronger.[10]

4.4 Households supply shocks

In this section we investigate the relationship between households credit market and economic activity. To this end, we compute the two diffusion indices *outside_households* and *inside_households* by restricting the factors proxing the two types of supply shocks only to bank loans provided to households, i.e. using respectively answers to questions 9.A-11.A and 9.C-11.C. Figure 12 shows that a contraction of the credit granted to households, due to both inside and outside factors of the banking system, have negative and significant effects on gdp growth. In addition, to compare the relative impact of these two types of shocks, Figure 13 shows that a tightening of *outside_households* by 0.1 (tightening) causes a fall in the gdp growth that reaches a minimum of -3 pp after two quarters. On the contrary, an equivalent tightening of *inside_households* determines a fall in the gdp growth that reaches a minimum of -1.6 pp after two quarters.

Our results highlight two important aspects in terms of financial stability. First, credit shocks due to factors inside the banking system have a higher impact on credit provided to firms than outside factors; situations typically defined as credit crunch episodes. On the contrary, credit shocks due to factors outside the banking system have a higher impact on credit provided to households.

[10] More precisely, an increase of 10% in *outside_firms* has an accumulated effect on gdp growth of -7.3 pp, whereas an equivalent shock to *inside_firms* has an accumulated effect on gdp growth of -10.3 pp.

5. Stability of parameters

In this section we focus on the stability of parameters of our models. In fact, since the data sample covers the recent financial crisis, the estimated parameters may not be constant over time. To address this issue, we use the CUSUM test[11] on recursive residuals. Figure 14 shows the corresponding results for the VAR model (1). We notice that none of the equations presents evidence of a significant parameters' instability. More importantly, starting from 2008, the gdp growth equation starts exhibiting a tendency towards instability, which implies a possible overestimation of economic growth. However, this tendency is never significant in our sample period. On the contrary, the specification of the default rate and the spread equations seems quite stable over time.

Finally, we also compute the CUSUM test to VAR model (2). Again, as shown in Figure 15, none of the equations exhibits a significant instability of the parameters, that is the specifications of the variables gdp growth and the two proxies of credit supply linkages (i.e. *inside* and *outside*) appear quite stable over time.

6. Conclusions and policy implications

In this paper we investigate the interactions between the real economy and credit markets in Italy, and, in particular, how the business cycle influences the risks of the banks' loan portfolio (i.e. the real channel), and, in turn, how shocks to the credit market affect the real economy (i.e. the feedback effect). Moreover, using data from the Bank Lending Survey provided by the ECB, we also disentangle credit supply shocks due to factors inside (i.e. the bank lending channel) and outside (i.e. the borrower's balance-sheet channel) the banking system.

We find evidence of both real and feedback effects. In particular, with regard to the real effect, we find that the sensitivity of the default rate to the business cycle is conveyed primarily by the creditworthiness of large firms, whereas, on the contrary, the sensitivity of the households-based default rate to the business cycle is not statistically significant. Furthermore, focusing on the bank lending channel and the borrower's balance-sheet channel, we find that both types of credit supply

[11] The CUSUM test (Brown, Durbin, and Evans, 1975) is based on the cumulative sum of the recursive residuals. Such test detects the parameters' instability if the cumulative sum goes outside the area defined by the two confidence-interval lines.

linkages generate a significant impact on economic growth, with a quite similar magnitude. Finally, when considering credit to firms, supply shocks due to inside factors have greater effects on the economic growth than supply shocks due to outside factors, whereas, on the contrary, when considering credit to households, stronger effects are determined by outside factors.

Our results have many policy implications in terms of financial stability. First, we highlight the resilience of a typical traditional banking system, even when one of the most severe real shock (e.g. the 2008-2009 great recession, with a fall in real GDP of 5.5%) is taken into account. This result confirms previous studies and provides additional empirical evidence to the benefits of traditional banking business models in term of macro and financial stability (see, among others, Caprio et al. 2014; D'Apice et al. 2014).

Second, we find clear evidence that credit market have a significant effect on the real economy. In fact, both inside (i.e. bank lending channel) and outside factors (i.e. borrower's balance sheet channel) to the banking system have a significant effect on the real economy through the supply of credit. Thus, on the one hand, it seems necessary to rebalance the financial structure of firms, when it is excessively biased towards the bank credit. On the other hand, it seems necessary to eliminate all types of restriction that amplify the effects of losses on bank balance sheets (e.g. unfavorable tax treatment of credit losses).

Third, to reduce credit crunch situations, on the one hand, effective supervisory actions aimed at preventing adverse movement in the variables that affect the endogenous factors of credit supply (e.g. capital, liquidity and access to markets) are necessary; on the other hand, it should be avoided that the regulation itself creates artificial situations of imbalance, such as the so-called "capital exercise" conducted by the EBA in 2011 (Draghi, 2012).

Finally, our VAR model highlights that the credit risk of households is not influenced by the business cycle, that is we do not find any real effect for this sector. On the contrary, the credit risk of firms is sensible to the business cycle, but small-sized enterprises seem less exposed than large firms. This result supports the adoption of a financial regulation which allows for lower capital requirements in the case of loans granted to small enterprises (that is, the so-called SMEs Supporting Factor considered by the new CRD4/CRR).

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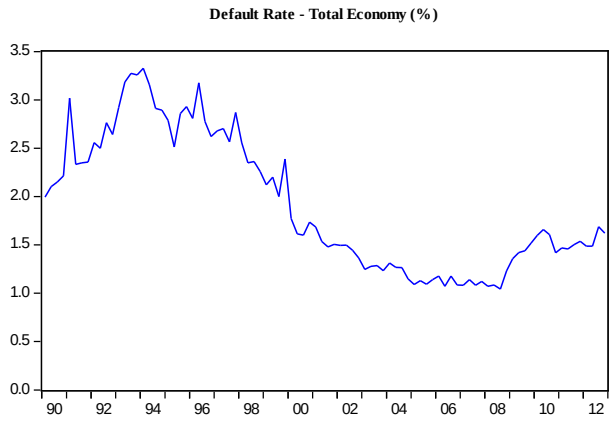
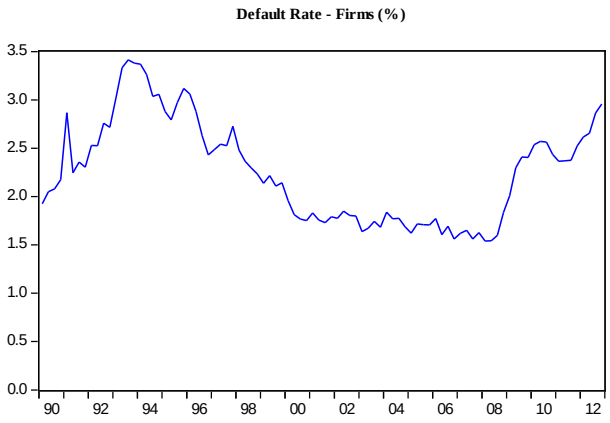
Figure 1A: Macroeconomic Variables Dynamics

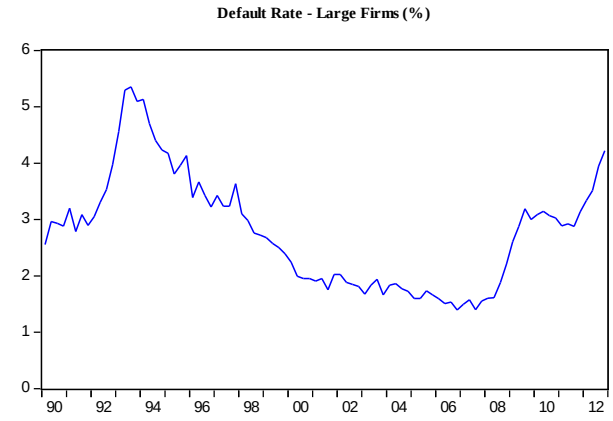
The Figures below plot the dynamics of the macroeconomic variables used in the paper. See Table 1 for definitions and sources and Table 2 for summary statistics.

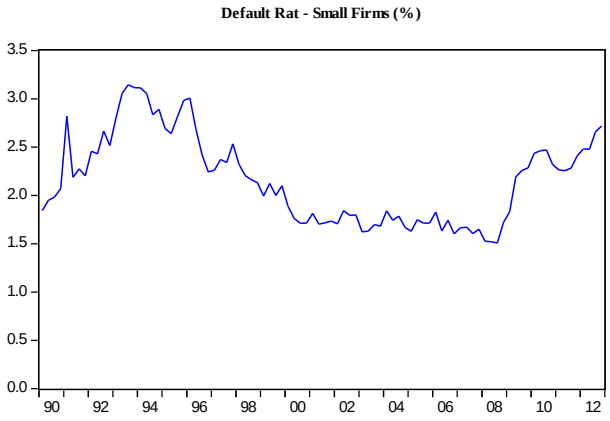
Figure 1B: Banking Variables Dynamics

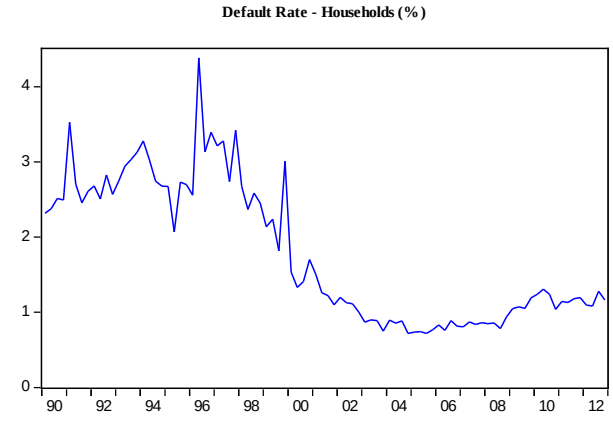
The Figures below plot the dynamics of the banking variables used in the paper. See Table 1 for definitions and sources and Table 2 for summary statistics.











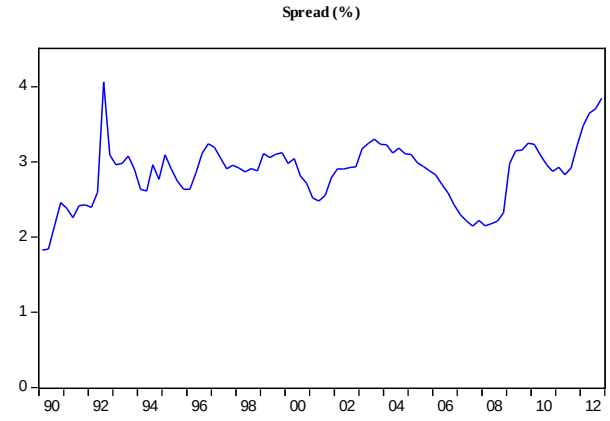


Figure 1C: Bank Lending Survey Variables Dynamics

The Figures below plot the dynamics of the Bank Lending Survey variables used in the paper. See Table 1 for definitions and sources and Table 2 for summary statistics.

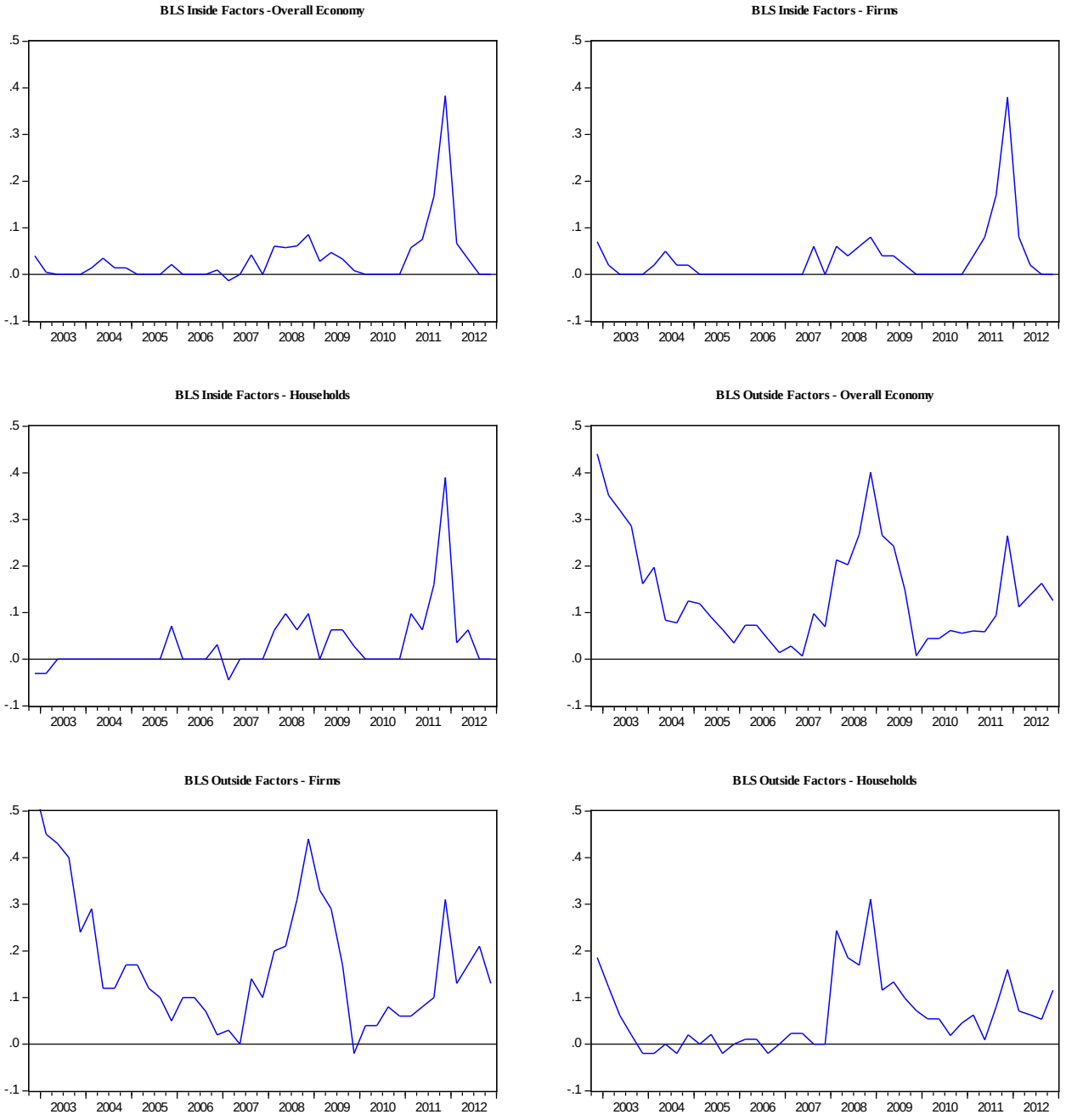


Figure 2: BLS Lending Standard vs. *spread*

The Figure below plots the variation of *spread* and the BLS lending standard index lagged of one period.

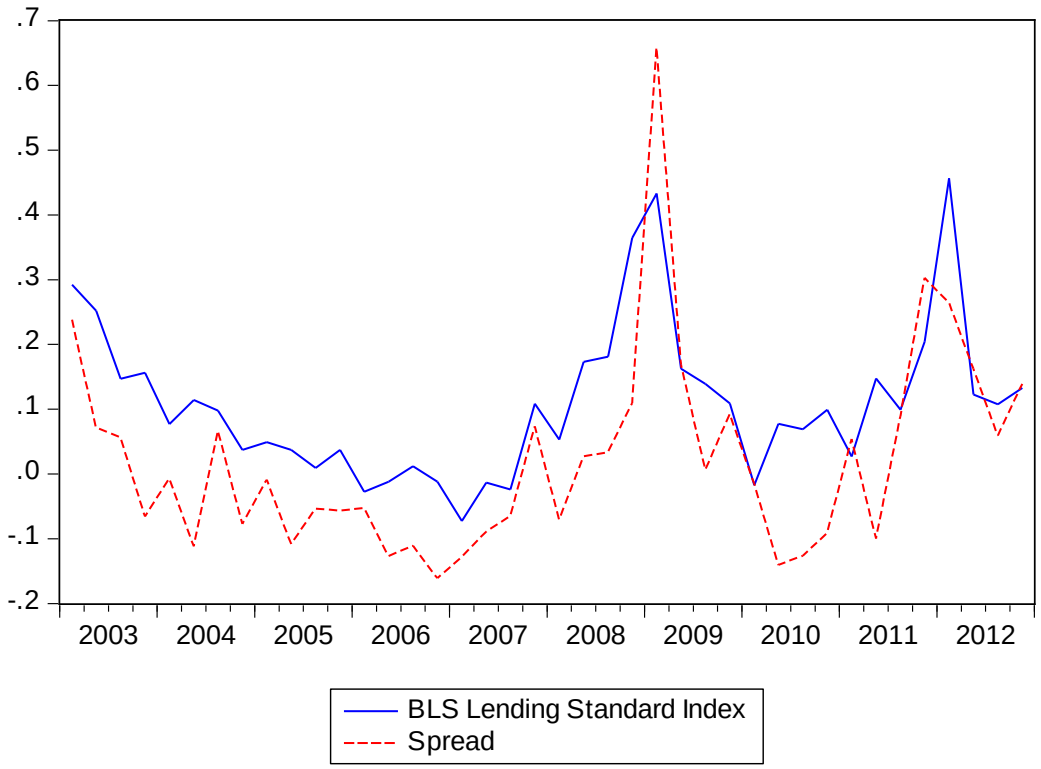


Figure 3: Generalized Impulse Response Function - VAR model (1) (*default_rate*)

The Figures below show the Generalized Impulse Response Function associated to the VAR model (1). Specifically, they plot the response to a generalized one-standard-deviation innovation (+/- 2 standard errors) in the variables. The specification of the VAR model includes 6 variables, that is: gdp_growth infl default_rate spread exchange_rate and policy_rate. See model 1 in Section 1 and Table 1 for a detailed definition of the variables.

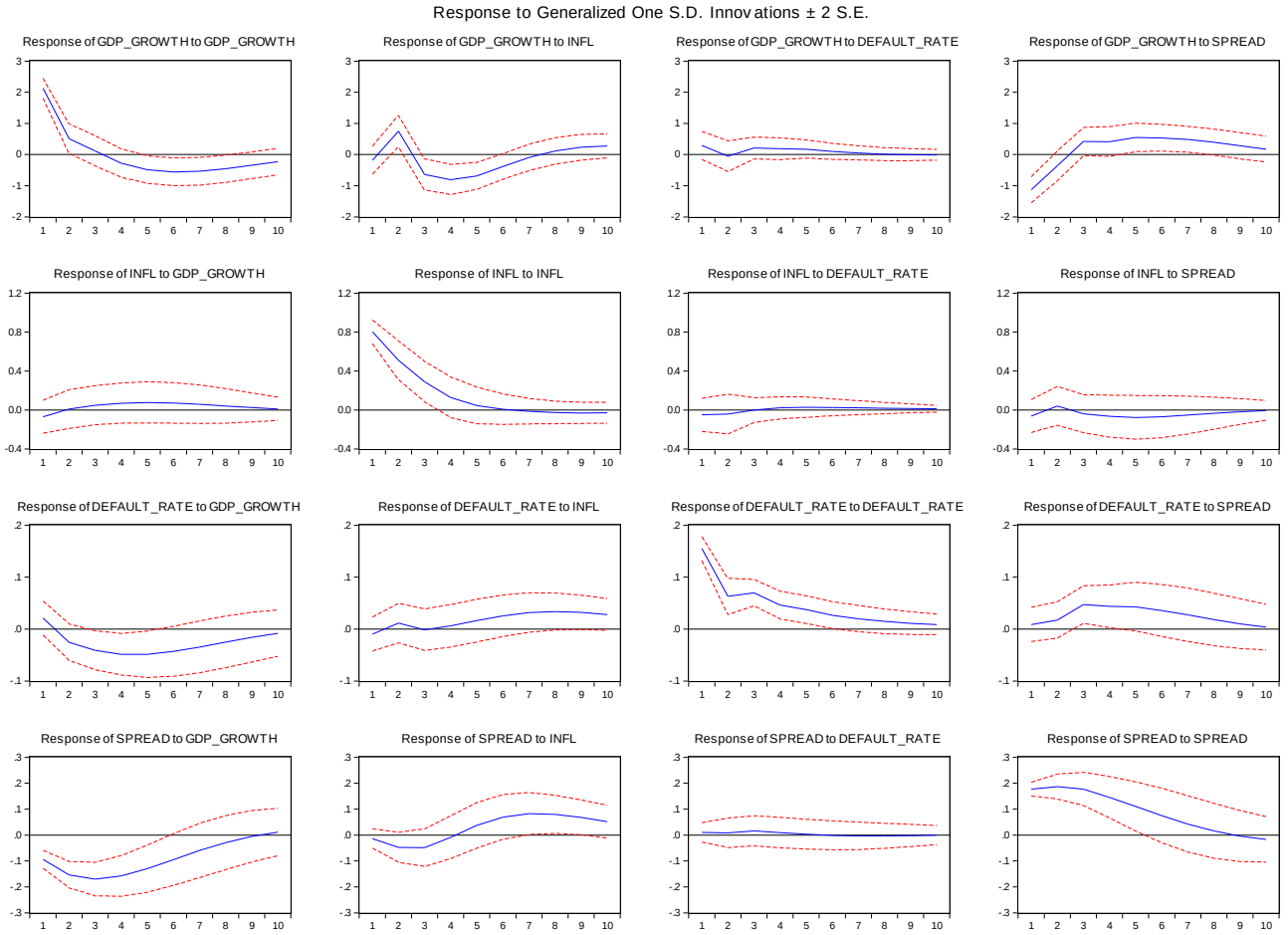


Figure 4: Generalized Impulse Response Function – Firm-based default rate (*default_firms*)

The Figures below show the Generalized Impulse Response Function associated to the VAR model (1) in which the default rate is computed taking into account only bank loans granted to firms. Specifically, they exhibit the response to a generalized one-standard-deviation innovation (+/- 2 standard errors) in the variables. The specification of the VAR model includes 6 variables, that is: gdp_growth infl default_firms spread exchange_rate and policy_rate. See model 1 in Section 2 and Table 1 for a detailed definition of the variables.

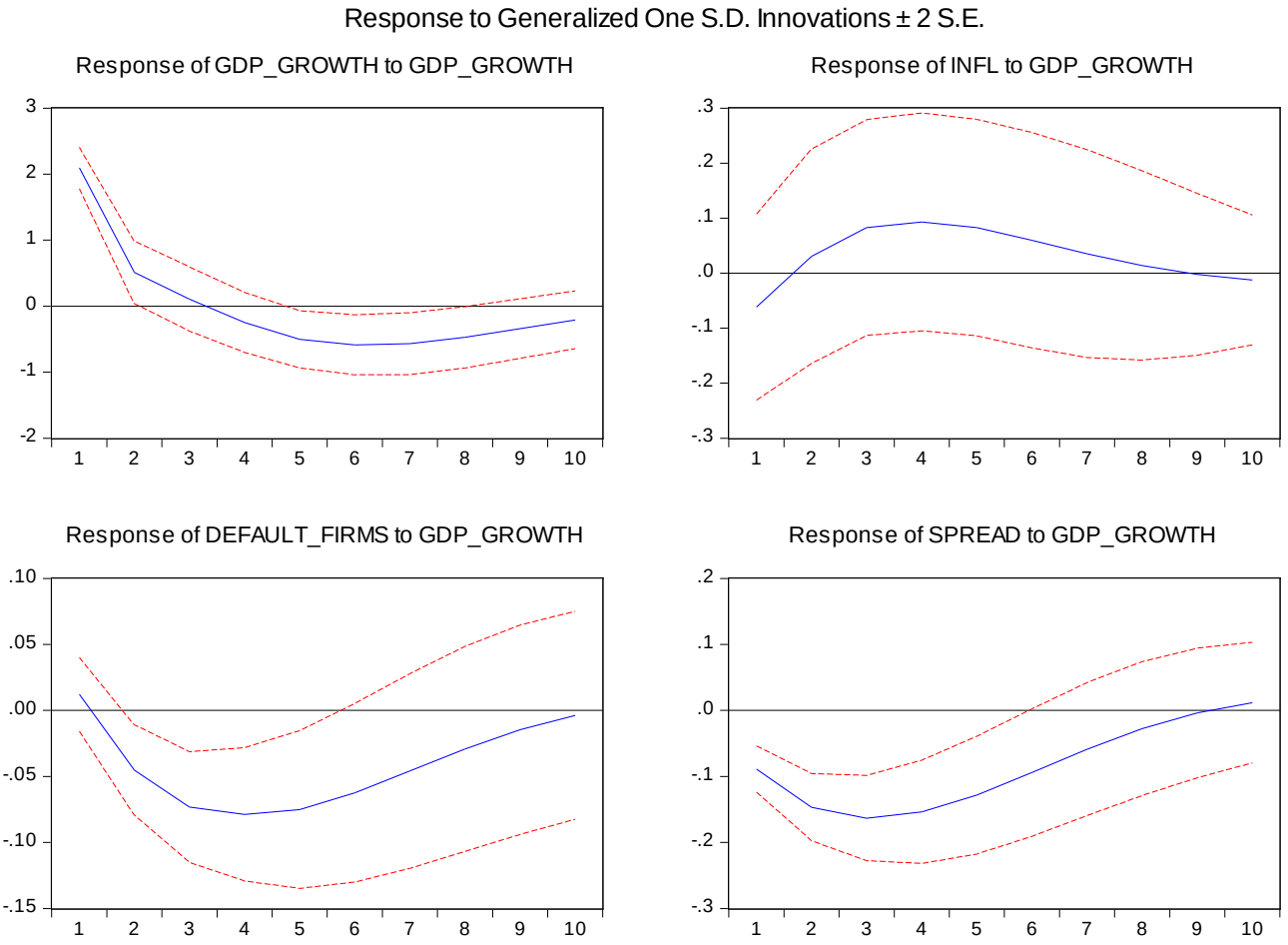


Figure 5: Generalized Impulse Response Function – Large Firm-based default rate (*default_large_firms*)

The Figures below show the Generalized Impulse Response Function associated to the VAR model (1) in which the default rate is computed taking into account only bank loans granted to large firms. Specifically, they exhibit the response to a generalized one-standard-deviation innovation (+/- 2 standard errors) in the variables. The specification of the VAR model includes 6 variables, that is: gdp_growth infl default_large_firms spread exchange_rate and policy_rate. See model 1 in Section 2 and Table 1 for a detailed definition of the variables.

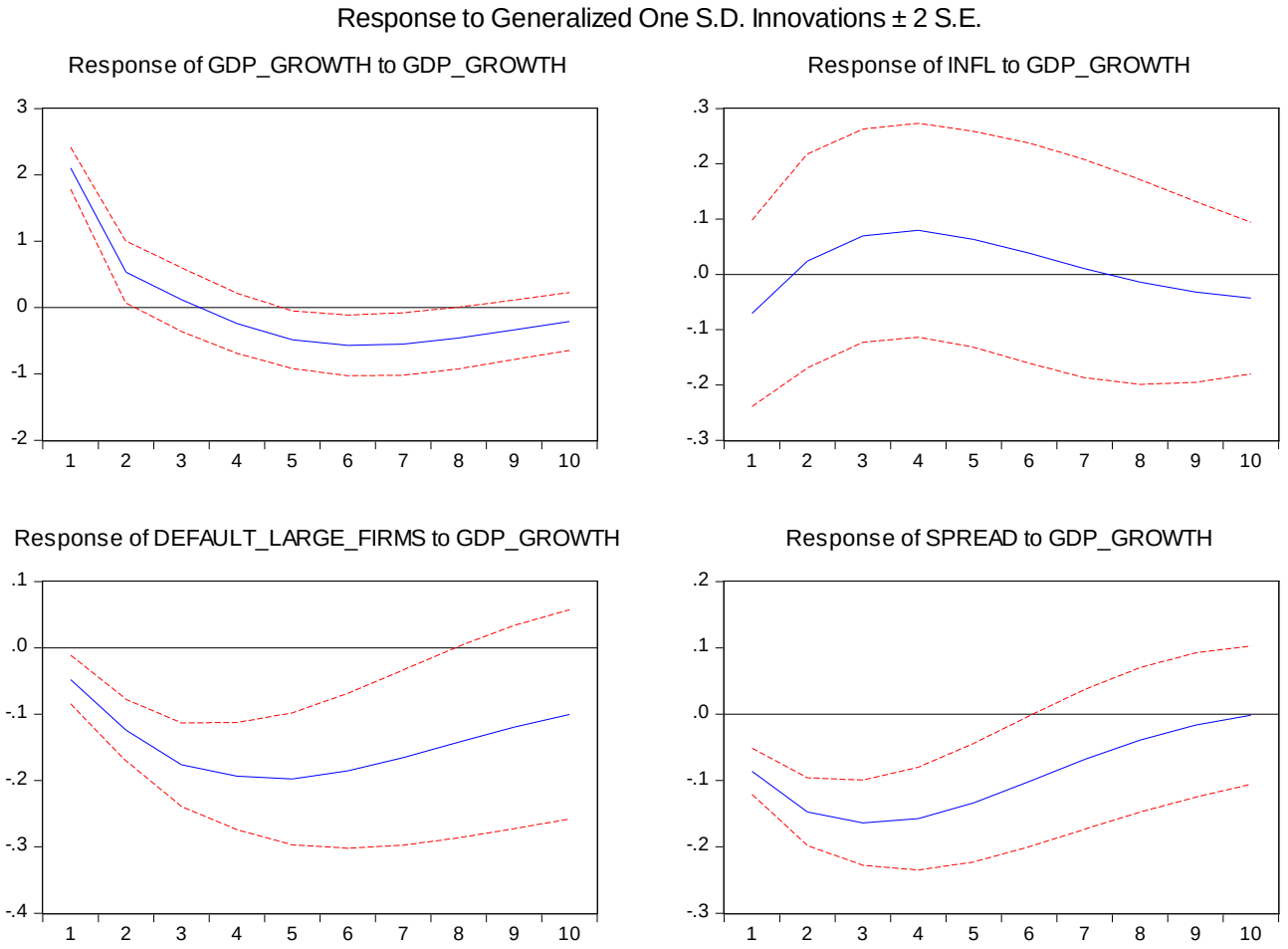


Figure 6: Generalized Impulse Response Function – Small Firm-based default rate (*default_small_firms*)

The Figures below show the Generalized Impulse Response Function associated to the VAR model (1) in which the default rate is computed taking into account only bank loans granted to small firms. Specifically, they exhibit the response to a generalized one-standard-deviation innovation (+/- 2 standard errors) in the variables. The specification of the VAR model includes 6 variables, that is: gdp_growth infl default_small_firms spread exchange_rate and policy_rate. See model 1 in Section 2 and Table 1 for a detailed definition of the variables.

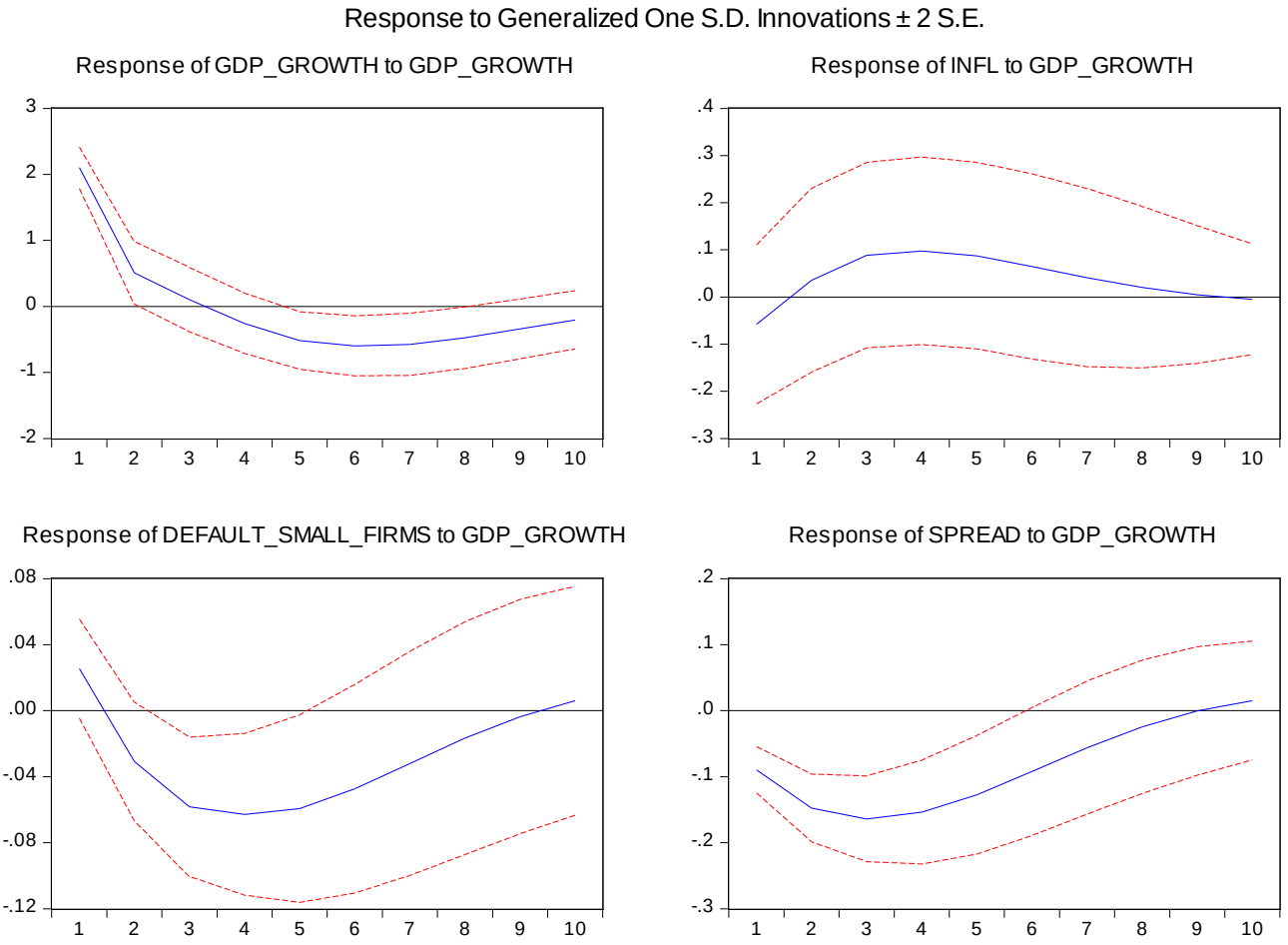


Figure 7: Generalized Impulse Response Function – Household-based default rate (*default_households*)

The Figures below show the Generalized Impulse Response Function associated to the VAR model (1) in which the default rate is computed taking into account only bank loans granted to households. Specifically, they exhibit the response to a generalized one-standard-deviation innovation (+/- 2 standard errors) in the variables. The specification of the VAR model includes 6 variables, that is: gdp_growth infl default_households spread exchange_rate and policy_rate. See model 1 in Section 2 and Table 1 for a detailed definition of the variables.

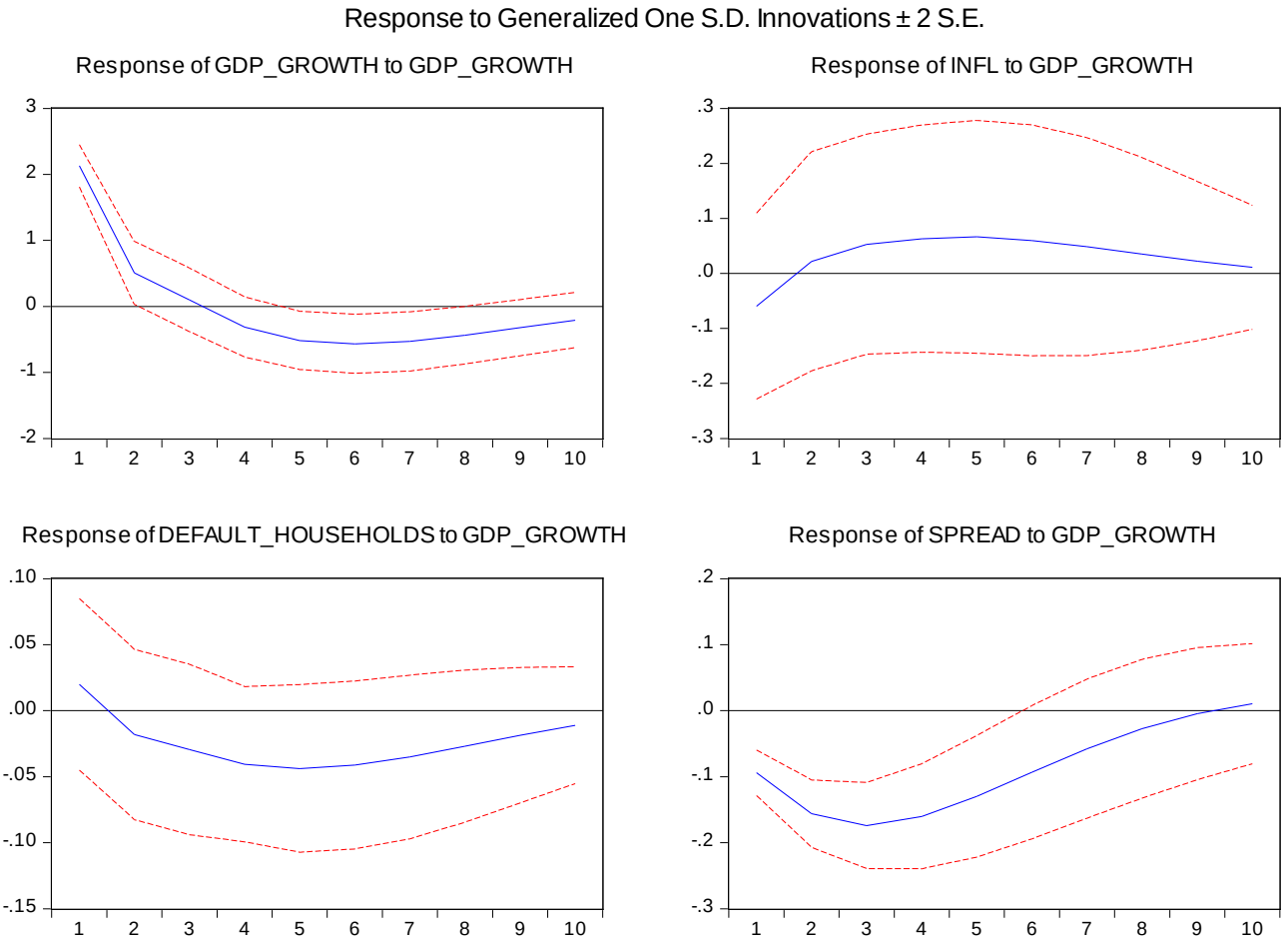


Figure 8: Generalized Impulse Response Function – Bank Lending Survey VAR model (2)

The Figures below show the Generalized Impulse Response Function associated to the VAR model (2). Specifically, they plot the response to a generalized one-standard-deviation innovation (+/- 2 standard errors) in the variables. The specification of the VAR Model includes 6 variables, that is: gdp_growth infl outside inside exchange_rate and policy_rate. See Var Model 2 in Section 4 and Table 1 for a detailed definition of the variables.

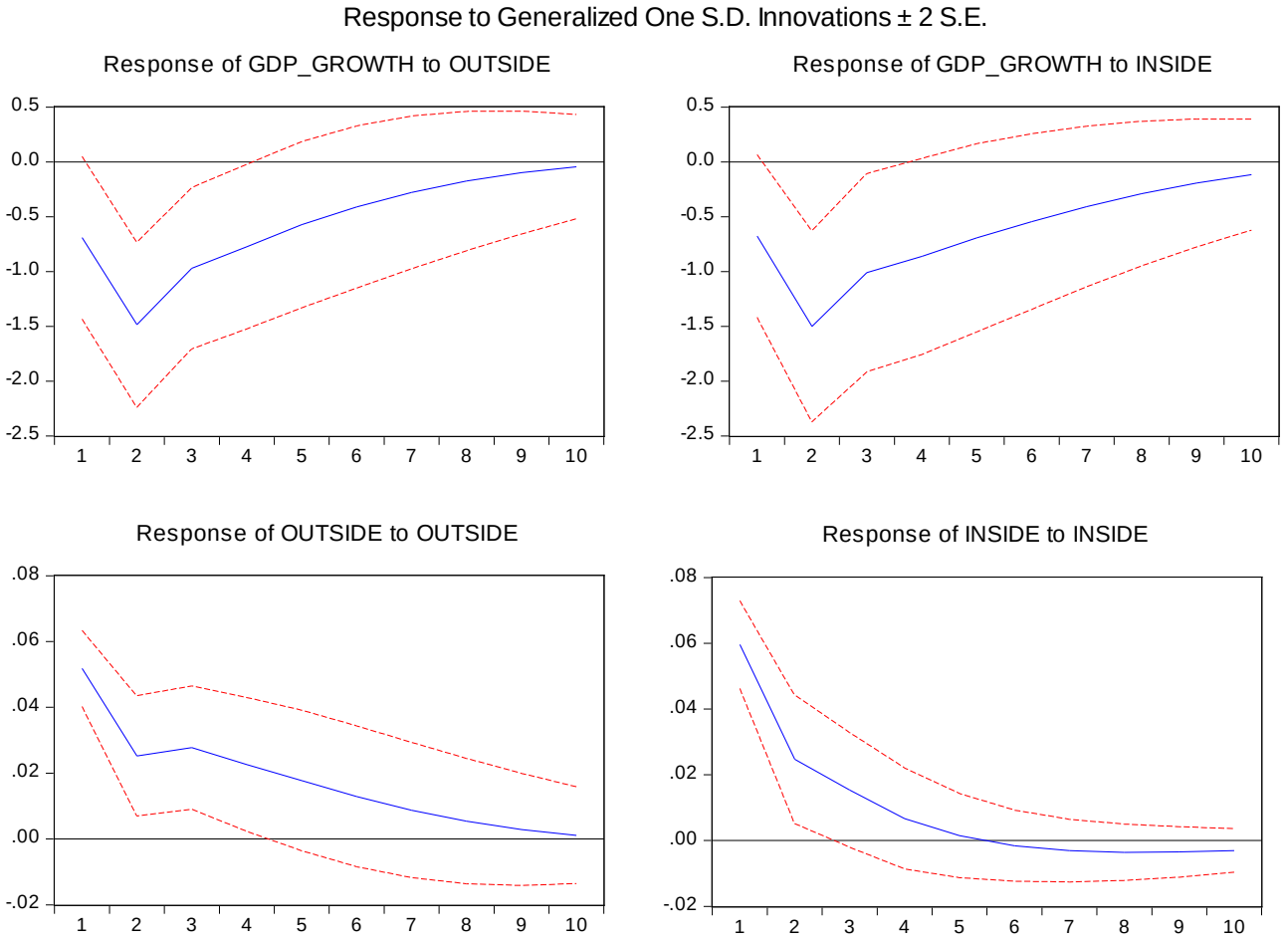


Figure 9: Response of GDP growth to 0.1 tightening in *outside* and *inside* variables

The Figure below shows the response of *GDP growth* to a 0.1 increase in the diffusion indices of *outside* and *inside*. The specification of the VAR includes 6 variables: gdp_growth infl outside inside exchange_rate and policy_rate. See VAR Model 2 in Section 4 and Table 1 for a detailed definition of the variables.

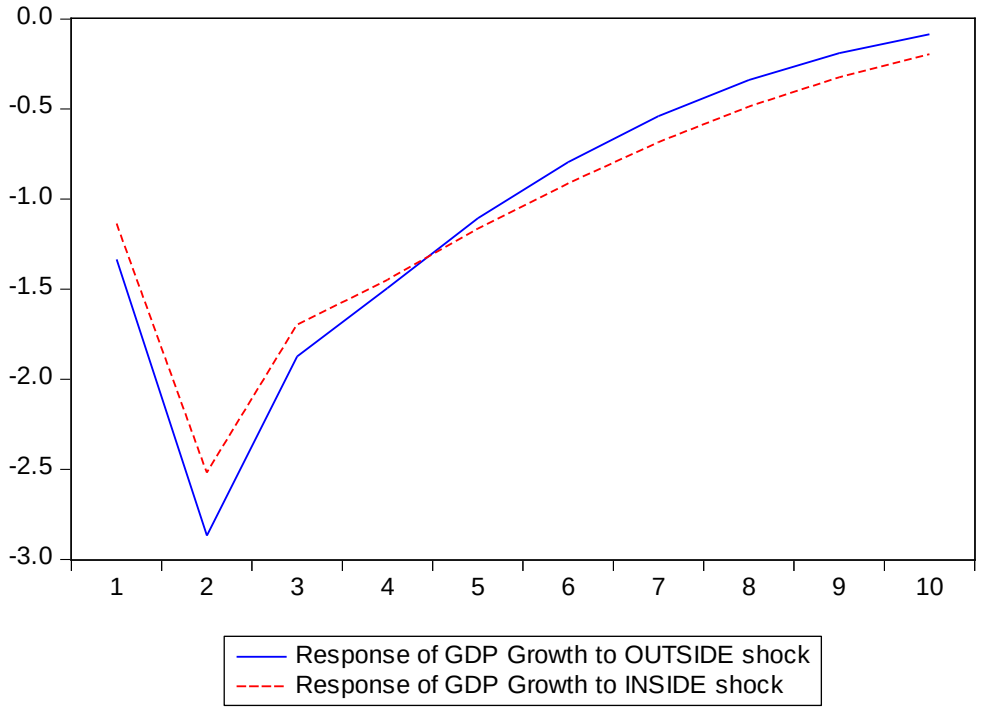


Figure 10: Generalized Impulse Response Function – Bank Lending Survey Model

Firm-based supply shocks

The Figures below show the Generalized Impulse Response Function associated to the VAR model (2) in which the factors proxing demand and supply are restricted only to bank loans provided to the firms. Specifically, they plot the response to a generalized one-standard-deviation innovation (+/- 2 standard errors) in the variables. The specification of the VAR model includes 6 variables, that is: gdp_growth infl outside_firms inside_firms exchange_rate and policy_rate. See Var Model 2 in Section 4 and Table 1 for a detailed definition of the variables.

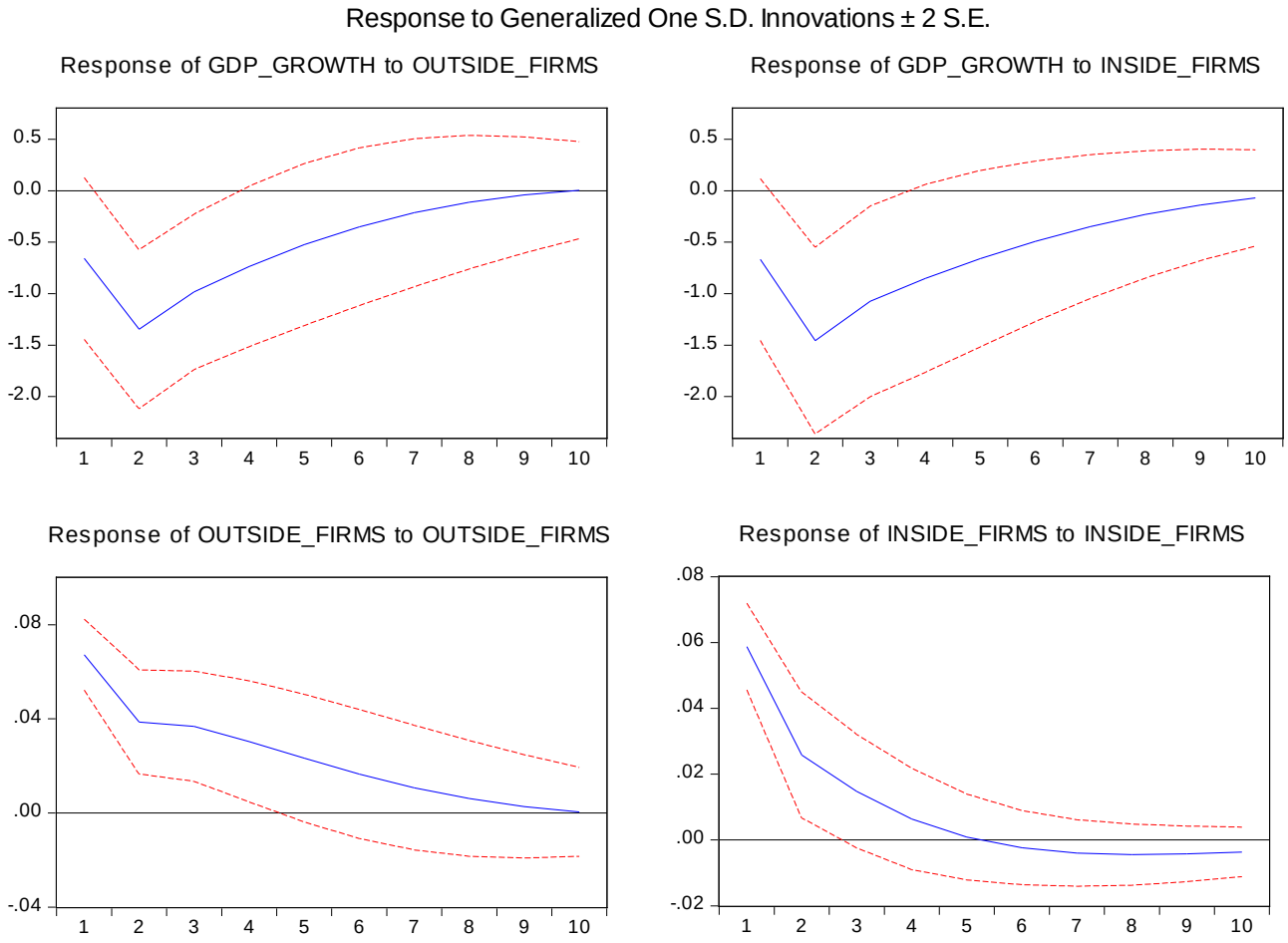


Figure 11: Response of GDP growth to 0.1 tightening in *outside_firms* and *inside_firms*

The Figure below shows the response of *GDP growth* to a 0.1 increase in the diffusion indices of *outside_firms* and *inside_firms*. The specification of the VAR model includes 6 variables, that is: gdp_growth infl outside_firms inside_firms exchange_rate and policy_rate. See VAR Model 2 in Section 4 and Table 1 for a detailed definition of the variables.

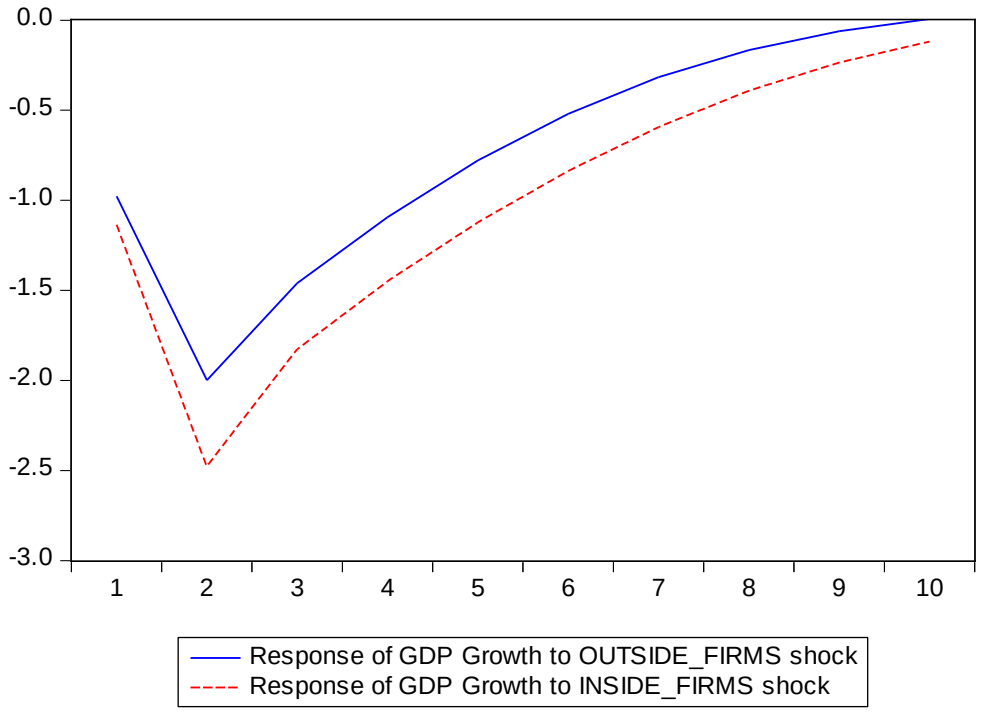


Figure 12: Generalized Impulse Response Function – Bank Lending Survey Model

Household-based -supply shocks

The Figures below show the Generalized Impulse Response Function associated to the VAR model (2) in which the factors proxing demand and supply are restricted only to bank loans provided to households. Specifically, they plot the response to a generalized one-standard-deviation innovation (+/- 2 standard errors) in the variables. The specification of the VAR model includes 6 variables, that is: gdp_growth infl outside_households inside_households exchange_rate and policy_rate. See VAR Model 2 in Section 4 and Table 1 for a detailed definition of the variables.

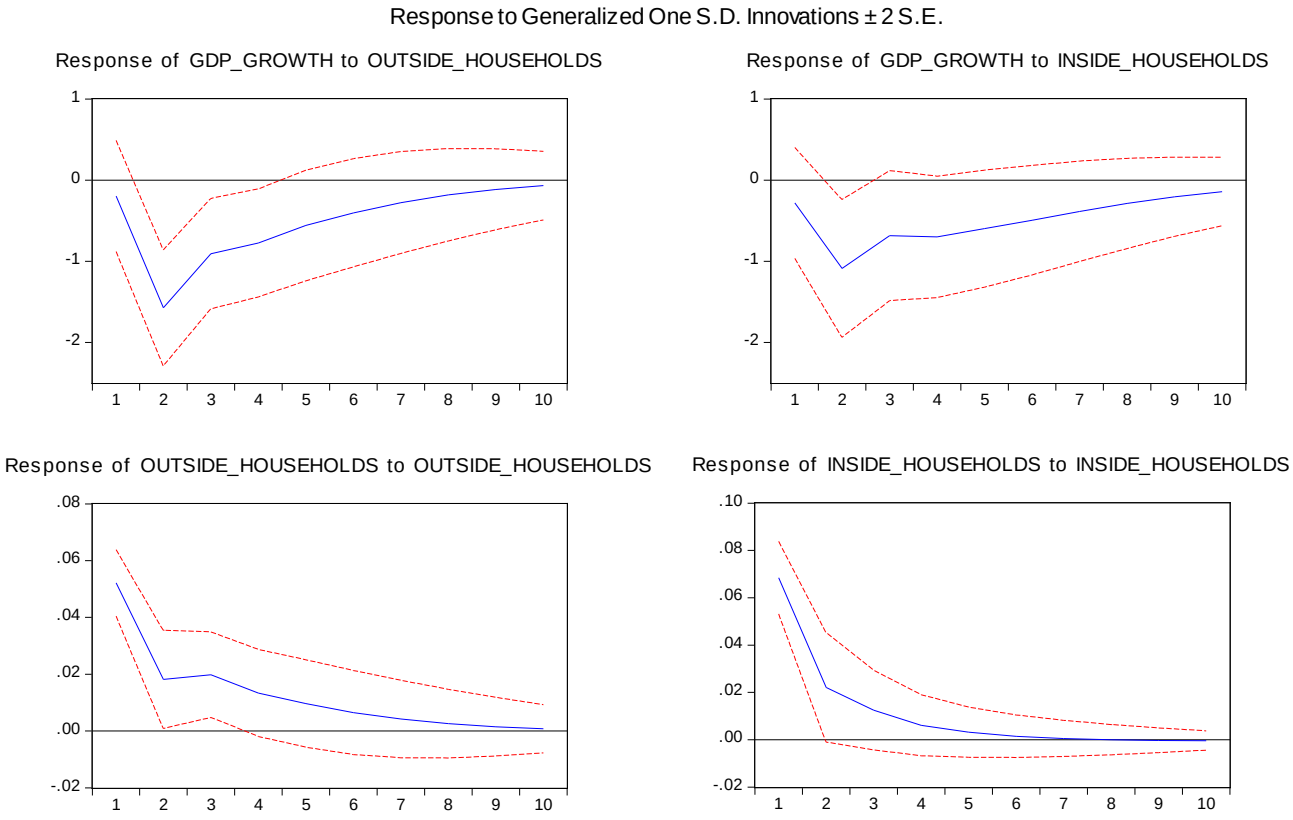


Figure 13: Response of GDP growth to 0.1 tightening in *outside_household* and *inside_household*

The Figure below shows the response of *GDP growth* to a 0.1 increase in the diffusion indices of *outside_household* and *inside_household*. The specification of the VAR model includes 6 variables, that is: gdp_growth infl outside_household inside_household exchange_rate and policy_rate. See VAR Model 2 in Section 4 and Table 1 for a detailed definition of the variables.

Figure 14: CUSUM Test on VAR model (1)

The Figures below plots the CUSUM test based on the cumulative sum of the recursive residuals together with the 5% significance lines. The test finds parameter instability if the cumulative sum goes outside the area between the two critical lines. The specification of the VAR model (1) includes the variables: gdp_growth infl default_rate spread exchange_rate and policy_rat. See VAR Model (1) in Section 2 and Table 1 for a detailed definition of the variables.

Figure 15: CUSUM Test on VAR model (2)

The Figures below plots the CUSUM test based on the cumulative sum of the recursive residuals together with the 5% significance lines. The test finds parameter instability if the cumulative sum goes outside the area between the two critical lines. The specification of the VAR model (2) includes the variables: gdp_growth infl outside inside exchange_rate and policy_rat. See VAR Model (2) in Section 4 and Table 1 for a detailed definition of the variables.

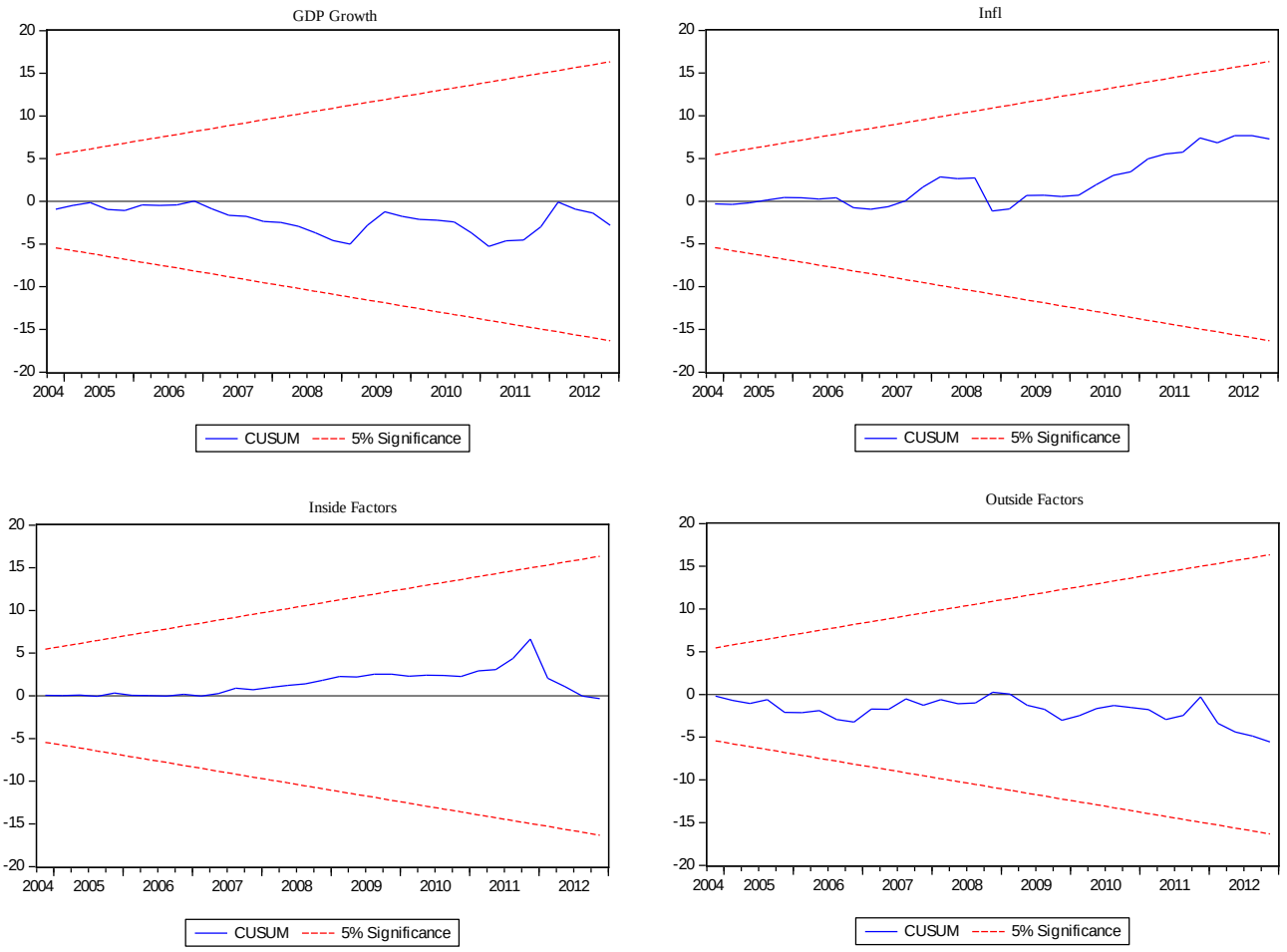


Table 1: Variables and Sources

Table 1 below provides the description of all the variables employed in our empirical analysis together with their sources.

Variables	Definitions	Sources
Economic Activities		
gdp_growth	GDP (quarter over quarter annualized variation)	Istat
Prices		
infl	Consumer Price Index (quarter over quarter annualized variation)	Istat
Interest rates		
policy_rate	Policy rate of the Bank of Italy up to 1999 and of the ECB afterwards.	Bank of Italy - ECB
Exchange rates		
exchange_rate	Real effective exchange rate of the Italian lira up to 1999 and the euro after that (quarter over quarter annualized variation)	IMF
Default (real channel)		
default_rate	Ratio of the number of loans classfied as bad debts in t to the outstanding numeber of performing loans in t-1 (flows, total economy)	Bank of Italy
default_firms	Ratio of the number of loans classfied as bad debts in t to the outstanding numeber of performing loans in t-1 (flows, firms)	Bank of Italy
default_large_firms	Ratio of the number of loans classfied as bad debts in t to the outstanding numeber of performing loans in t-1 (flows, large firms)	Bank of Italy
default_small_firms	Ratio of the number of loans classfied as bad debts in t to the outstanding numeber of performing loans in t-1 (flows,small firms)	Bank of Italy
default_households	Ratio of the number of loans classfied as bad debts in t to the outstanding numeber of performing loans in t-1 (flows, households)	Bank of Italy
default_rate_am	Ratio of the amount of loans classfied as bad debts in t to the outstanding amount of performing loans in t-1 (flows, total economy)	Bank of Italy
Credit supply (Broad credit channel)		
spread	Difference between the average and the minimum rate on bank's short-term loans.	Bank of Italy
Credit supply (bank lending channel)		
inside	Mean of the diffusion index related to cost of funds and bank balance sheet constraints that affected bank's credit standards as applied to the approval of loans or credit lines to enterprises (2.A), to the approval of loans to households for house purchase (9.A) and o the approval of consumer credit and other lending to households (11.A). See appendix 1 for further details.	ECB
inside_firms	Mean of the diffusion index related to cost of funds and bank balance sheet constraints that affected bank's credit standards as applied to the approval of loans or credit lines to enterprises (2.A). See appendix 1 for further details.	ECB
inside_households	Mean of the diffusion index related to cost of funds and bank balance sheet constraints that affected bank's credit standards as applied to the approval of loans to households for house purchase (9.A) and to the approval of consumer credit and other lending to households (11.A). See appendix 1 for further details.	ECB
Credit supply (borrower's balance sheet channel)		ECB
outside	Mean of the diffusion index related to perception of risk in the approval of loans or credit lines to enterprises (2.C); in the approval of loans to households for house purchase (9.C) and in the approval of consumer credit and other lending to households (11.C). See appendix 1 for further details.	ECB
outside_firms	Mean of the diffusion index related to perception of risk in the approval of loans or credit lines to enterprises (2.C). See appendix 1 for further details.	ECB
outside_households	Mean of the diffusion index related to perception of risk in the approval of loans to households for house purchase (9.C) and in the approval of consumer credit and other lending to households (11.C). See appendix 1 for further details.	ECB

Table 2: Summary Statistics

Table 2 below provides the summary statistics of the variables used in the paper (see Section 2 and Table 1 for further details).

Variables	Mean	Median	Max.	Min.	Std. Dev.	Obs.	Stationary
gdp_growth	0.7	1.0	5.6	-14.5	2.9	91	yes
infl	3.0	2.6	7.2	-0.9	1.6	91	yes
policy_rate	4.9	3.8	15.0	0.8	3.7	91	yes
exchange_rate	-0.6	0.0	26.4	-43.3	8.8	91	yes
default_rate	1.9	1.6	3.3	1.0	0.7	91	yes
default_firms	2.3	2.2	3.4	1.5	0.5	91	yes
default_large_firms	2.8	2.9	5.4	1.4	1.0	91	yes
default_small_firms	2.2	2.2	3.1	1.5	0.5	91	yes
default_househlds	1.8	1.3	4.4	0.7	0.9	91	yes
default_rate_am	2.1	1.9	6.5	0.7	1.0	91	yes
spread	2.9	2.9	4.1	1.8	0.4	91	yes
inside	0.0	0.0	0.4	0.0	0.1	41	yes
inside_firms	0.0	0.0	0.4	0.0	0.1	41	yes
inside_households	0.0	0.0	0.4	0.0	0.1	41	yes
outside	0.1	0.1	0.4	0.0	0.1	41	yes
outside_firms	0.2	0.1	0.6	0.0	0.1	41	yes
outside_households	0.1	0.0	0.3	0.0	0.1	41	yes

APPENDIX

In the Appendix we provide useful information about the content of the variables *inside* and *outside* used in Section 4, and more precisely, we report questions 1, 2, 8, 9 and 11 of the questionnaire for loans or credit lines to enterprises and households provided by the ECB Bank Lending Survey (BLS). See Berg et al. (2005) for further details.

Bank lending survey (BLS) for the euro area: The questionnaire for loans or credit lines to enterprises

Please rate the contribution of the factors to the tightening or easing of credit standards using the following scale:

– – = contributed considerably to tightening of credit standards

– = contributed somewhat to tightening of credit standards

○ = contributed to basically unchanged credit standards

+ = contributed somewhat to easing of credit standards

+ + = contributed considerably to easing of credit standards

NA = not applicable

Question 1: 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?

Question 2: 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 (as described in question 1)?

A) Cost of funds and balance sheet constraints

a1 - Costs related to your bank's capital position

a2 - Your bank's ability to access market financing (e.g. money or bond market financing, incl. true-sale securitisation)

a3 - Your bank's liquidity position

B) Pressure from competition

b1 - Competition from other banks

b2 - Competition from non-banks

b3 - Competition from market financing

C) Perception of risk

c1 - Expectations regarding general economic activity

c2 - Industry or firm-specific outlook

c3 - Risk on the collateral demanded

D) Other factors, please specify

Question 8: Over the past three months, how have your bank's credit standards as applied to the approval of loans to households changed?

Question 9: Over the past three months, how have the following factors affected your bank's credit standards as applied to the approval of loans to households for house purchase (as described in question 8)?

A) Cost of funds and balance sheet constraints

B) Pressure from competition

b1 - Competition from other banks

b2 - Competition from non-banks

C) Perception of risk

c1 - Expectations regarding general economic activity

c2 - Housing market prospects

D) Other factors, please specify

Question 11: Over the past three months, how have the following factors affected your bank's credit standards as applied to the approval of consumer credit and other lending to households (as described in question 8)?

A) Cost of funds and balance sheet constraints

B) Pressure from competition

b1 - Competition from other banks

b2 - Competition from non-banks

C) Perception of risk

c1 - Expectations regarding general economic activity

c2 - Creditworthiness of consumers

c.3 - Risk on the collateral demanded

D) Other factors, please specify