Interest rates and bank lending

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Abstract

This analysis focuses on the interest rate channel and the financial accelerator issue in selected member countries of the European Monetary Union (Austria, Germany, Spain and Greece). The analysis is accomplished by structured vector autoregressive methodology using four macroeconomic variables: interest rates, bank-lending, economic growth and prices. The empirical results, based on monthly observations from 1999 to date, suggest that the counter cyclical business cycle stabilisation through the interest rate channel is effective only in Austria and Germany. A financial accelerator mechanism is observable in consumer demand in Austria and Spain, and in Greece the industries producing intermediate and capital goods are affected. In Germany there is no sign of financial acceleration, neither in the activities of households, nor in the goods producing industries.

1 Introduction

In the recent past, high interest rates have led to crises in the housing markets and the banking sector in the USA, UK, Spain and Ireland. As a consequence, economic activity was affected all over the world and a synchronized downturn of the global business cycle was observed. Therefore, also economies with a healthy housing market or financial/banking sector have experienced a dramatic downturn. For example, the Austrian economy suffered from the swift decline in foreign demand. Exports dropped sharply, with the activities in the machinery/vehicle and the intermediate goods sector declining the most. The sharp economic downturn started in 2008 and bottomed in 2009. Since the beginning of 2010 economic conditions have been improving, due to

historic low interest rates and stimulus spending by governments. However, despite the favourable economic conditions experience of past financial crises indicates that economic recovery following severe banking crises is typically very sluggish, held back by weak private investment. In the current economic situation positive impulses may come from monetary policy. At the same time, due to the loss in net worth of companies and households, the access to foreign capital may have become more difficult.

Monetary authorities are committed to macroeconomic stabilisation and are capable of controlling nominal short-term interest rates and thereby of strongly influencing the level of aggregate activity.[1] Mishkin [1995] shows the traditional Keynesian view of how a monetary tightening is transmitted to the real economy:

$$M \downarrow \Rightarrow i \uparrow \Rightarrow I \downarrow \Rightarrow Y \downarrow,$$

where $M \downarrow$ indicates a contractionary monetary policy leading to a rise in real interest rates ($i \uparrow$), which in turn raises the cost of capital, thereby causing a decline in investment spending ($I \downarrow$), thereby leading to a decline in aggregate demand and a fall in output ($Y \downarrow$).

The financial accelerator hypothesis of Bernanke et al. [1994] refers to the idea that adverse shocks to the economy may be amplified by worsening financial market conditions. The link between the real economy and financial markets stems from firms need for external finance to engage in profitable investment opportunities. On the other hand, firms ability to borrow largely depends on the market value of their financial and tangible assets. Since lenders are likely to have little information about the creditworthiness of a borrower, they often require borrowers to set forth their ability to repay, which may take the form of collateralizing their assets. Thus, a fall in asset prices that is induced by an initial shock deteriorates the balance sheets of the firms in the sense that their net worth worsens and their ability to borrow declines. Tightening financing conditions limit their investment, which in turn reduces their economic activity or output. Finally, decreased economic activity further cuts the asset prices down which leads to a feedback cycle of falling asset prices, deteriorating balance sheets, tightening financing conditions and declining economic activity. Many economists believe today that financial accelerator framework describes well many of the financial-

[1] Many authors have addressed the measurement of the effects of monetary policy by means of the VAR methodology, e.g. Sims [1992] or Bernanke et al. [1997].

macroeconomic linkages underpinning the dynamics of The Great Depression and the ongoing subprime mortgage crisis.

A number of empirical studies have looked into the effects of economic activity and interest rates on bank lending, both in the short and in the long run. See, for example, Eickmeier et al. [2006] and more recently Eickmeier et al. [2010] and the references cited there. The aim of this study is to quantitatively measure the response of bank lending to a monetary policy shock and to a shock in output/demand. I focus on four member countries: Austria, Germany, Spain and Greece. The structured autoregressive process (SVAR) comprises four variables: industrial output or consumer demand, consumer prices, short-term real interest rates and the real stock of outstanding bank loans in the private sector.

The remainder of the paper is organized as follows: Section 2 presents the empirical model and the estimation technique applied. Section 3 introduces the data set. Section 4 provides the empirical results. Section 5 draws the conclusions.

2 Methodology

The underlying analysis is based on the structured vector autoregression (SVAR) methodology (1), consisting of four variables. The lag length of the model is determined by AIC (2). Out of 5 possibilities the best fitted model is selected. The Cholesky method is applied for the identification of the contemporaneous relationships, than the impulse responses (3) are calculated.

$$BX_t = c + \sum_{i=1}^{p} \Phi_i X_{t-i} + \epsilon_t \tag{1}$$

where X is a (4×1) vector of endogenous variables. B is the (4×4) coefficient matrix for the contemporaneous relationships. $c = (c_1, ...c_4)$ is the (4×1) intercept vector of the VAR, Φ is the $i^{th}(4 \times 4)$ matrix of autoregressive coefficients for $i = 1, 2, ..., p$, and $\epsilon_t = (\epsilon_{1t}, ..., \epsilon_{4t})$ is a (4×4) generalisation of a white noise process. t is time. p is the lag order determined by the multivariate Akaike information criterion (AIC):

$$AIC_{var} = -2\ln(|\hat{\Sigma}_p|/T) + 2pn^2/T \tag{2}$$

$|\hat{\Sigma}_p|$ denotes the determinant of the residual covariance matrix for the VAR(p), with p=1,2,...,K and pn^2 is the number of coefficient parameters. The log likelihood value is computed assuming a multivariate normal distribution.

For the identification of the B-matrix (Choleski method) the lower triangular matrix is estimated with ones along the principal diagonal:

$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ b_{21} & 1 & 0 & 0 \\ b_{31} & b_{32} & 1 & 0 \\ b_{41} & b_{42} & b_{43} & 1 \end{bmatrix}$$

The impulse response function is the moving average representation of a SVAR. It allows tracing out the time path of the various shocks on the variables contained in the SVAR system. The accumulated response of one variable of the system after a shock of the variable itself or another variable of the system equal to one standard error (ϵ):

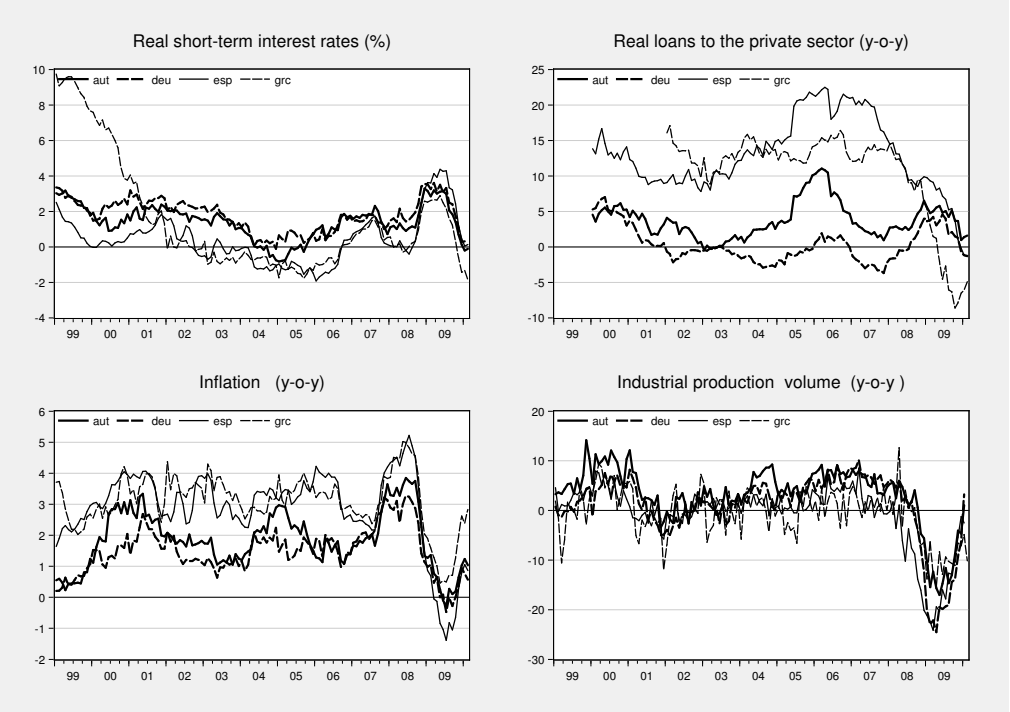
$$\sum_{i=0}^{\infty} b^i \epsilon_{t-i} \tag{3}$$

where b is the respective impact multiplier.

3 Data

The model consists of four variables: short-run interest rates ($irst$), bank lending ($loan$), economic sector (eco) and consumer prices (cpi). eco is a place holder for retail sales, total industrial production (excluding construction) and sub-sectors of industrial production, like construction, production of intermediate goods, capital goods and consumer goods. The variable bank loan is deflated by the consumer price index. The nominal interest rates are converted to real interest rates. One way of handling non-stationarity in time series is to compute first differences. Therefore, the time series $loan$, eco, cpi, were transformed to year-by-year differences, while $irst$ remained in levels. The selection and the transformation of variables is accomplished for four economies, Austria (aut), Germany (deu), Spain (esp) and Greece (grc). For a detailed description of data and its sources see page 10.

Figure 1: Data set



The data sets used for the empirical analysis are shown in Figure 1. From 1999 to date, the growth of industrial production of Austria, Germany, Spain and Greece is strongly synchronised. However, consumer prices develop differently. While in Austria and Germany inflationary pressure is low, a much stronger increase in consumer prices is observable in Spain and Greece. Therefore, in these two countries the real short-term interest rates are relatively low compared to Austria and Germany. The low cost of capital may be considered as the main reason for the strong demand for foreign capital in Spain and Greece.

The empirical analysis is based on time series with a monthly frequency. The first observation starts 120 months before the last data entry in February 2010. The observation period covers the economic upturn in 2000, followed by a recession which bottomed in 2001, followed by an expansionary period ending 2007 and the sharp economic downturn in the past two years.

The estimation of the structural relationships comprises the following

steps: the estimation of the vector autoregression, the identification, the accumulation of the impulse responses and the re-basing of the innovation to 1, such that a one-unit shock of one variable causes a response of x units of the other variables. The estimation procedure was repeated for all economic sectors: retail sales (*rets*, total industrial production excluding construction (*iptot*), the production of intermediate goods (*ipint*), capital goods (*ipcap*), and consumer goods (*ipcon*).

I assume that the transmission of a shock goes from: interest rates → bank loans → economic sector → prices.

4 Results

The main results are reported in Table 1 and 2. They contain the %-deviation from the base scenario of one variable after a one unit shock of the other variable together with the adjacent t-statistics[2]. Only 24 months after shock have been included, because with every increment of time the standard error increases. The results are comparable across countries and sectors. The first two rows of the tables report the aggregate demand of households and the total industrial production of companies excluding construction. A detailed analysis of the individual industrial sectors is reported in the rows below. The main results are shown in Figure 2 to 9.

Table 1 summarises the empirical results of the impact of monetary policy actions of the European Central Bank. In theory, changes in interest rate operate through capital costs, which in turn affect especially the investment of households and companies and thereby economic growth. The empirical outcome suggests that in Austria and Germany the counter cyclical business cycle stabilisation through monetary policy is effective in all economic sectors under consideration. However, in Spain and Greece a business cycle stabilisation through monetary policy is only effective in capital goods industries. In the Austrian industrial sector a unit increase in interest rates results in a 1.5 percent reduction of bank lending, with a probability of 90 percent. Also in Germany all economic sectors are negatively related to a shock in interest rates, however, the impact is lower compared to the Austrian results. In Spain and in Greece, a shock in interest rates has a negative impact

[2]t-statistics of 1.9 denote a significance level at 0.05, $1.7 \approx 0.1$, $1.3 \approx 0.2$, $0.7 \approx 0.5$, $0.3 \approx 0.8$.

Table 1: Response of aggregate bank lending to a one unit shock of short-term interest rates, %-deviation from the base scenario after 24 months and t-statistics

	aut		deu		esp		grc	
retail sales	-1.48	-1.5	-0.74	-1.0	0.62	0.4	0.49	0.2
ip-all	-1.57	-1.5	-0.53	-0.8	-0.12	-0.1	-0.22	-0.1
ip-construction	-1.48	-1.5	-0.52	-0.9	-0.25	-0.2	0.16	0.3
ip-interm. goods	-1.52	-1.6	-0.57	-0.9	0.02	0.0	-0.39	-0.2
ip-capital goods	-1.45	-1.5	-0.65	-1.0	-0.88	-0.6	-1.44	-0.7
ip-consumer goods	-1.44	-1.5	-0.57	-0.8	-0.16	-0.1	-0.97	-0.5

note: ip=industrial production, interm.=intermediate, ip-all does not include construction.

only on the growth in the goods producing industries, however, with a low significance level.

In the financial accelerator mechanism net worth of companies and households as well is an important determinant for the access to finance. Deteriorating balance sheets thus hamper their creditworthiness. Table 2 shows the response of aggregate bank lending to a one unit shock of short-term interest rates. A positive relationship of the two variables suggests that a decline in economic activity will lead to a decline in bank lending and this leads to a further decline in investment. In all countries the responses of bank lending to a shock in household demand or industrial production is rather weak and in most cases insignificant. In Austria a positive relationship is observable in the retail sector and in the industries producing consumer goods. In Spain the retail and the construction sector show the pattern of acceleration. In Greece in particular the industries producing intermediate and capital goods are affected. In Germany there is no sign of financial acceleration, neither in the activities of households, nor in the goods producing industries. This result corresponds with the findings of Eickmeier et al. [2010].

5 Conclusions

This analysis focuses on the interest rate channel and the financial accelerator issue in four member states of the European Monetary Union, namely Austria, Germany, Spain and Greece. The analysis is accomplished by applying

Table 2: Response of aggregate bank lending to a one unit shock of demand/output, %-deviation from the base scenario after 24 months and t-statistics

	aut		deu		esp		grc	
retail sales	0.17	1.3	-0.07	-0.5	0.20	0.9	-0.01	-0.1
ip-all	-0.07	-0.6	-0.03	-0.3	0.08	0.5	0.12	0.9
ip-construction	-0.06	-1.2	-0.02	-0.7	0.07	1.2	-0.01	-0.4
ip-interm. goods	-0.09	-1.0	-0.05	-0.4	0.06	0.5	0.10	1.0
ip-capital goods	0.00	0.1	0.01	0.1	0.01	0.1	0.06	1.0
ip-consumer goods	0.05	1.0	-0.08	-1.1	0.04	0.6	-0.02	-0.5

note: ip=industrial production, interm.=intermediate, ip-all does not include construction.

structured vector autoregressive methodology (SVAR) using four macroeconomic variables: interest rates, bank-lending, economic sector and prices. The economic sector is either household demand or industrial production. The empirical analysis is based on time series with a monthly frequency. The first observation starts 120 months before the last data entry in February 2010.

In theory, changes in interest rate operate through capital costs, which in turn affect especially the investment of households and companies and thereby economic growth. The empirical outcome suggests that the counter cyclical business cycle stabilisation through the interest rate channel is effective in Austria and Germany. However, in Spain and Greece a business cycle stabilisation is only effective in the capital goods industries. In the Austrian industrial sector a unit increase in interest rates results in a 1.5 percent reduction of bank lending, with a probability of 90 percent. Also in Germany all economic sectors are negatively related to a shock in interest rates, however, the impact is weaker compared to the Austrian results. In Spain and in Greece, a shock in interest rates has a negative impact only on the growth in the goods producing industries.

In the financial accelerator mechanism net worth of companies and households as well is an important determinant for the access to finance. Deteriorating balance sheets thus hamper their creditworthiness. A positive response of the aggregate bank lending after a shock in the growth one economic sector points to financial acceleration. In Austria such a positive relationship

is observable in the retail sector and in the industries producing consumer goods. In Spain the retail and the construction sector show the pattern of acceleration. In Greece in particular the industries producing intermediate and capital goods are affected. In Germany there is no sign of financial acceleration, neither in the activities of households, nor in the goods producing industries. This result corresponds with the findings of Eickmeier et al. [2010].

References

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Description of data and sources

- Variables for Austria:
  - Bank claims on private sector, stock in million euro at current prices, not seasonally adjusted, International Monetary Fund
  - Retail sales, deflated turnover, total volume, not seasonally adjusted, Eurostat
  - Industrial production - total (excluding construction), volume, not seasonally adjusted, International Monetary Fund
  - Industrial production - construction, volume, not seasonally adjusted, Eurostat
  - Industrial production – intermediate goods, volume, not seasonally adjusted, Eurostat
  - Industrial production – capital goods, volume, not seasonally adjusted, Eurostat
  - Industrial production – consumer durables, volume, not seasonally adjusted, Eurostat
  - Consumer prices, not seasonally adjusted, National statistics.
  - Interbank rate 3 months average, Austrian National Bank
- Variables for Germany:
  - Bank claims on private sector, stock in million euro at current prices, not seasonally adjusted, International Monetary Fund
  - Retail sales, deflated turnover, total volume, not seasonally adjusted, Eurostat
  - Industrial production - total (excluding construction), volume, not seasonally adjusted, International Monetary Fund
  - Industrial production – construction, volume, not seasonally adjusted, Eurostat
  - Industrial production – intermediate goods, volume, not seasonally adjusted, Eurostat
  - Industrial production – capital goods, volume, not seasonally adjusted, Eurostat

  - Industrial production – consumer durables, volume, not seasonally adjusted, Eurostat
  - Consumer prices, not seasonally adjusted, National statistics
  - FIBOR 3 months average, German National Bank

- Variables for Spain:
  - Bank claims on private sector, stock in million euro at current prices, not seasonally adjusted, International Monetary Fund
  - Retail sales, deflated turnover, total volume, not seasonally adjusted, Eurostat
  - Industrial production - total (excluding construction), volume, not seasonally adjusted, International Monetary Fund
  - Industrial production – construction, volume, not seasonally adjusted, Eurostat
  - Industrial production – intermediate goods, volume, not seasonally adjusted, Eurostat
  - Industrial production – capital goods, volume, not seasonally adjusted, Eurostat
  - Industrial production – consumer durables, volume, not seasonally adjusted, Eurostat
  - Consumer prices, not seasonally adjusted, National statistics
  - Interbank rate 3 months average, Spanish National Bank

- Variables for Greece:
  - Bank claims on private sector, stock in million euro at current prices, not seasonally adjusted, International Monetary Fund
  - Retail sales, deflated turnover, total volume, not seasonally adjusted, Eurostat
  - Industrial production - total (excluding construction), volume, not seasonally adjusted, International Monetary Fund
  - Industrial production – construction, volume, not seasonally adjusted, Eurostat

– Industrial production – intermediate goods, volume, not seasonally adjusted, Eurostat

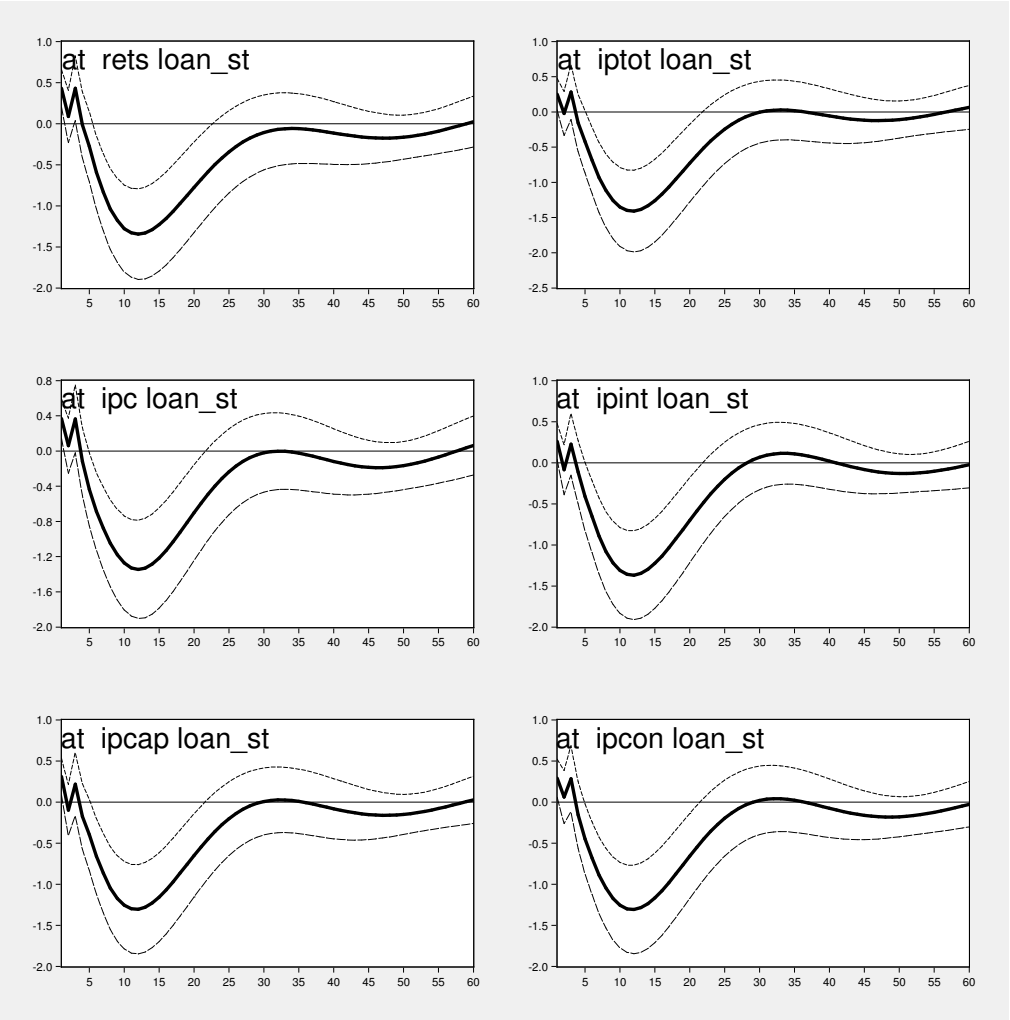
– Industrial production – capital goods, volume, not seasonally adjusted, Eurostat

– Industrial production – consumer durables, volume, not seasonally adjusted, Eurostat

– Consumer prices, not seasonally adjusted, International Monetary Fund

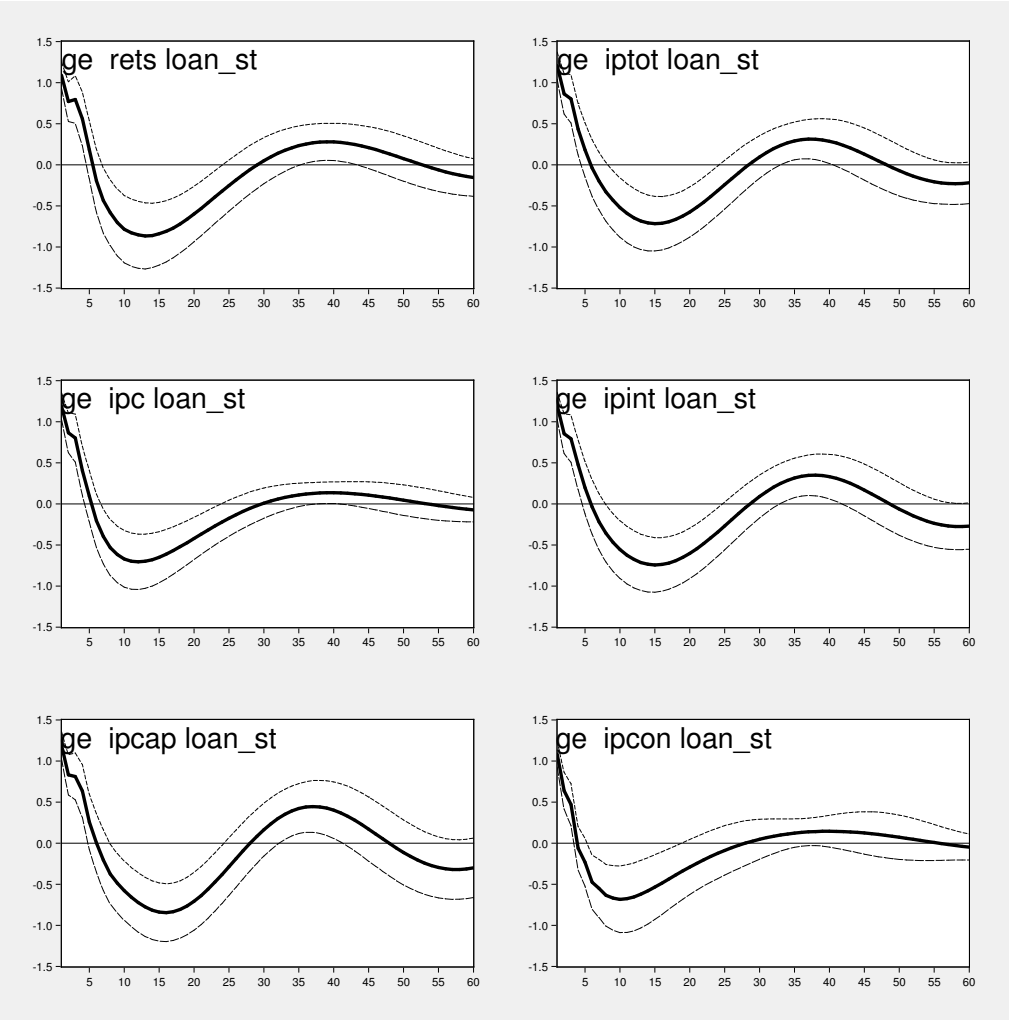
– Interbank rate 3 months average, National Bank of Greece

Figure 2: Austria: Response of aggregate bank lending to a one unit rise in short-term interest rate with standard error band



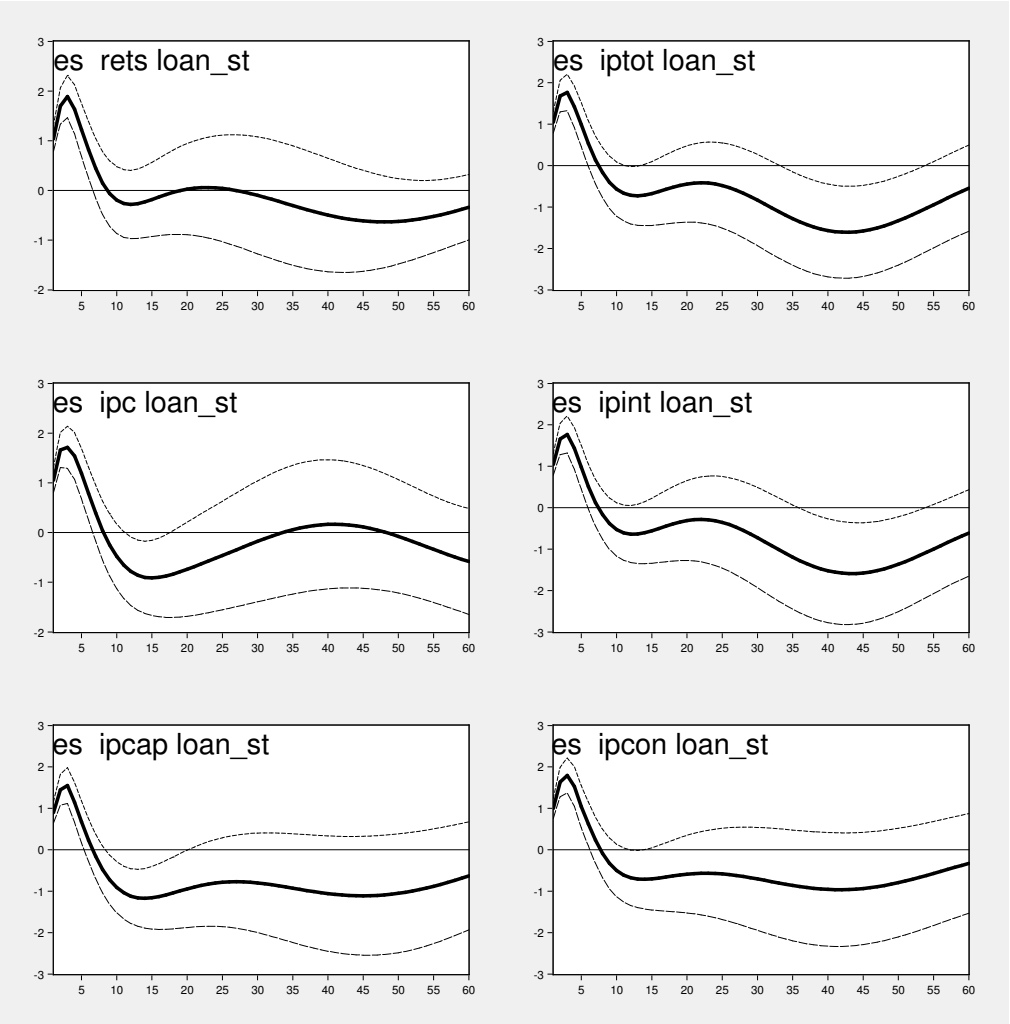
vertical axis: %-deviation from the base scenario; horizontal axis: months after the shock

Figure 3: Germany: Response of aggregate bank lending to a one unit rise in short-term interest rate with standard error band



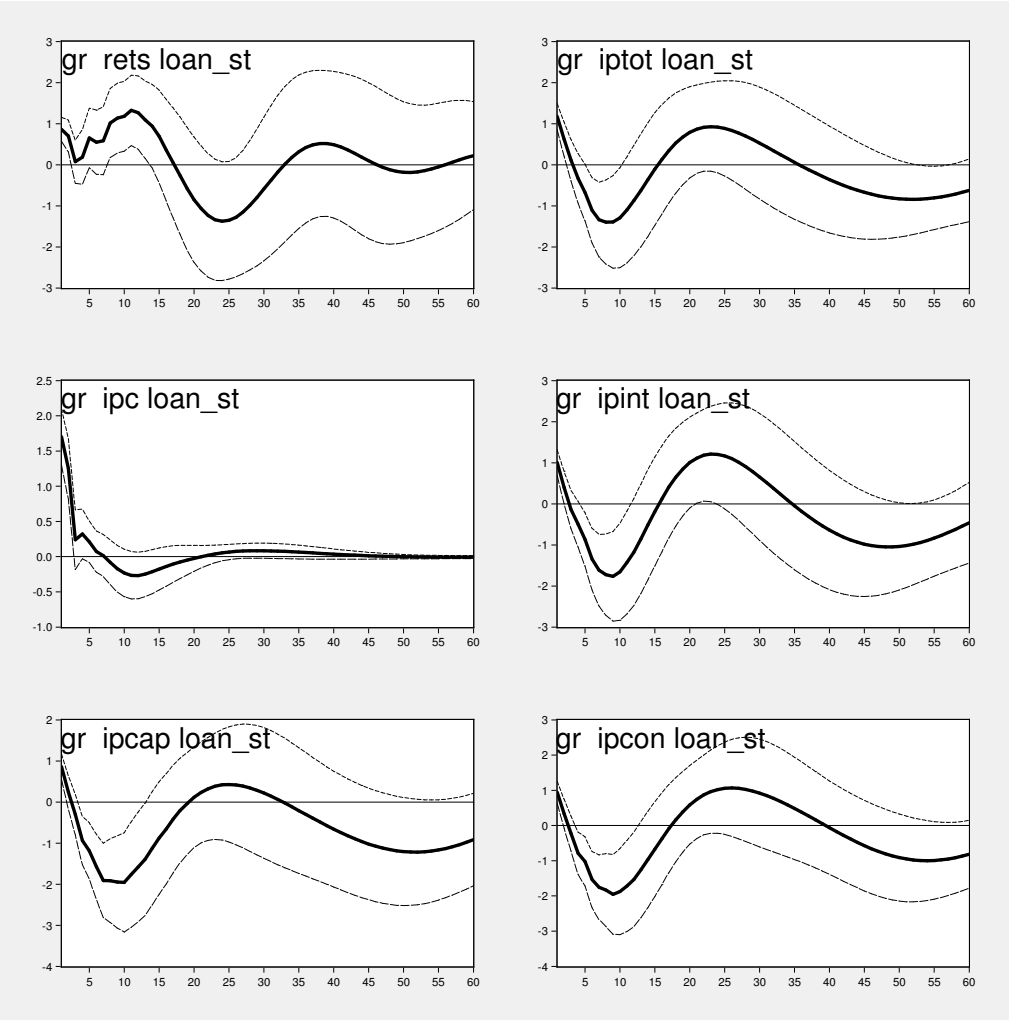
vertical axis: %-deviation from the base scenario; horizontal axis: months after the shock

Figure 4: Spain: Response of aggregate bank lending to a one unit rise in short-term interest rate with standard error band



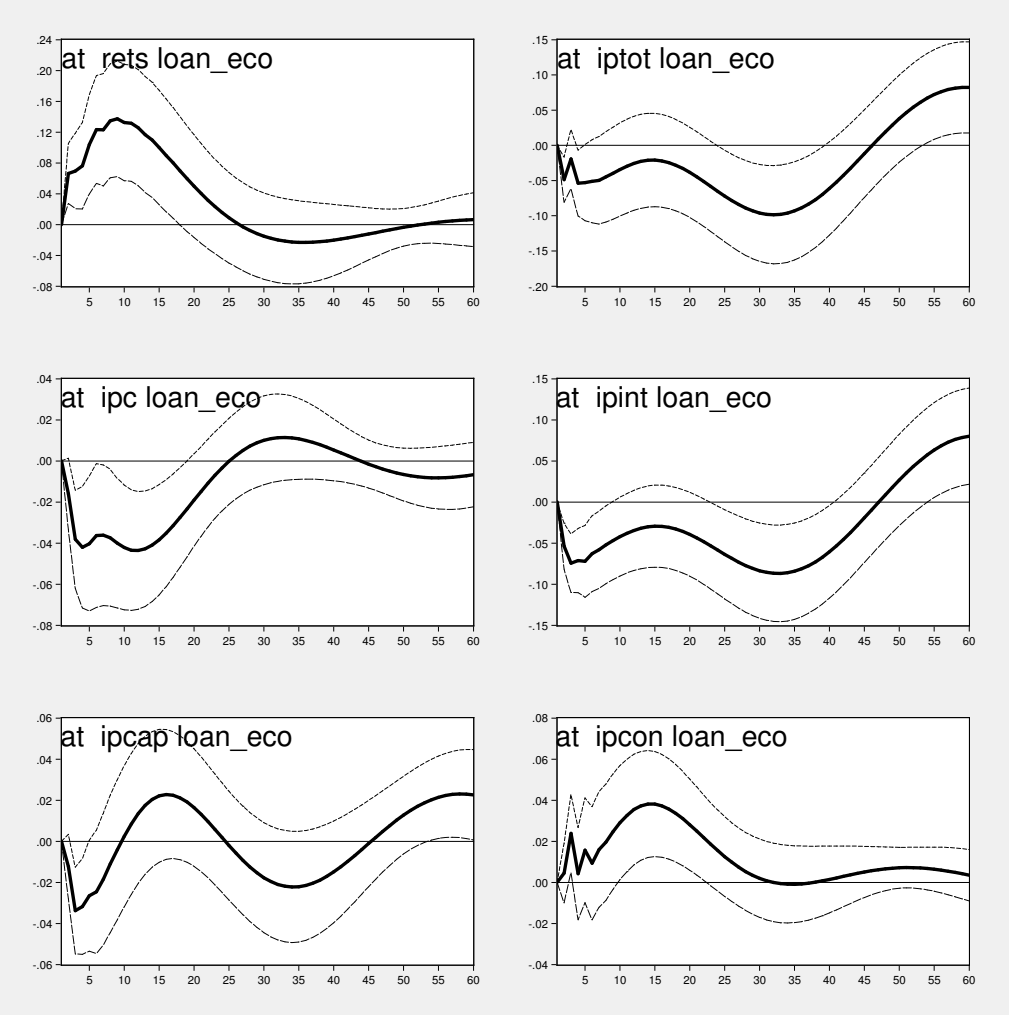
vertical axis: %-deviation from the base scenario; horizontal axis: months after the shock

Figure 5: Greece: Response of aggregate bank lending to a one unit rise in short-term interest rate with standard error band



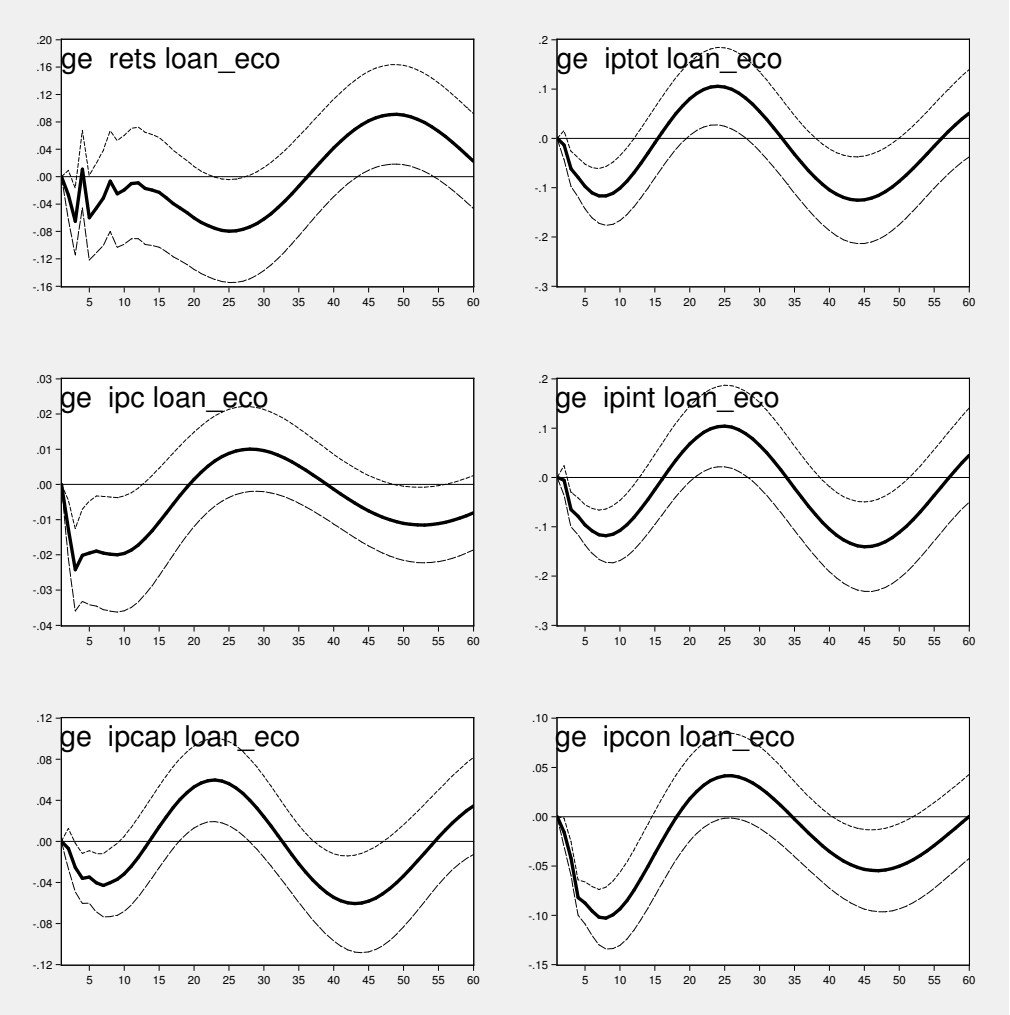
vertical axis: %-deviation from the base scenario; horizontal axis: months after the shock

Figure 6: Austria: Response of aggregate bank lending to a one unit rise in economic activity with standard error band



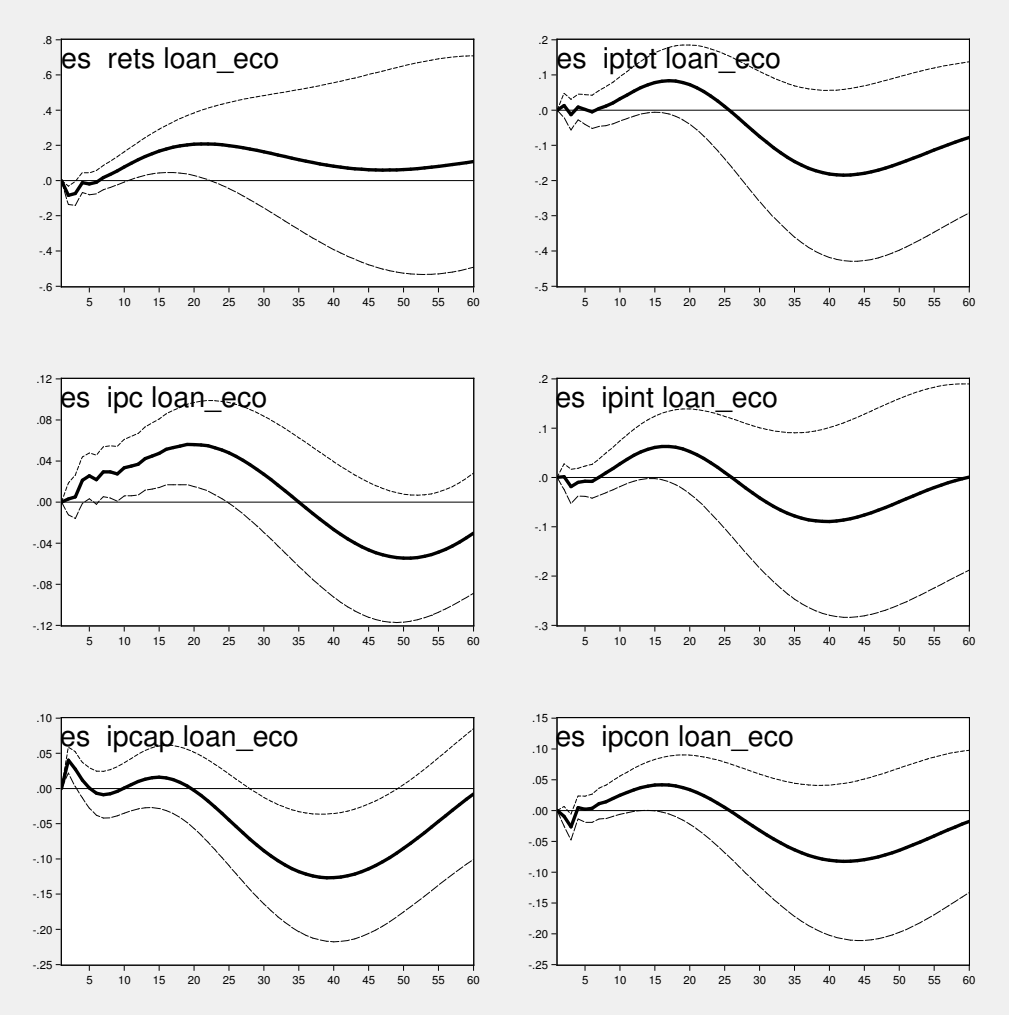
vertical axis: %-deviation from the base scenario; horizontal axis: months after the shock

Figure 7: Germany: Response of aggregate bank lending to a one unit rise in economic activity with standard error band



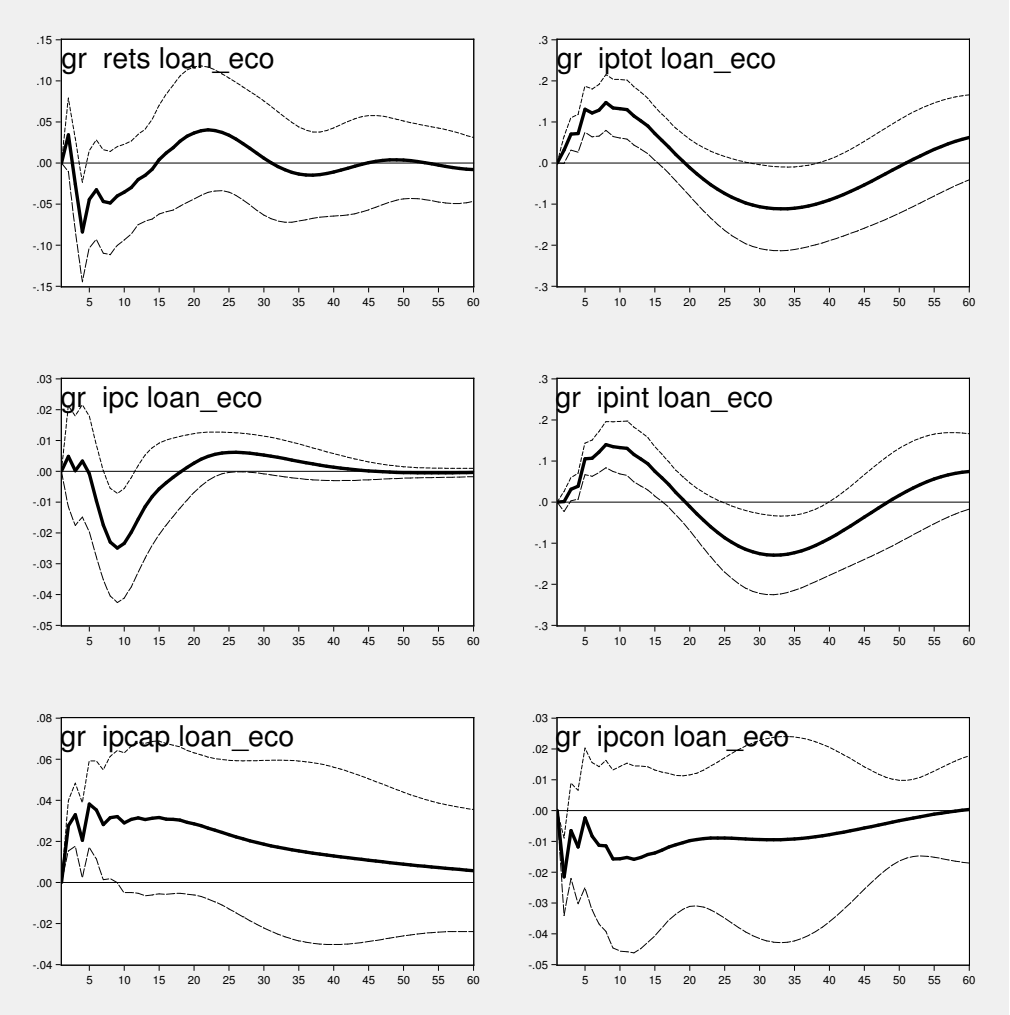
vertical axis: %-deviation from the base scenario; horizontal axis: months after the shock

Figure 8: Spain: Response of aggregate bank lending to a one unit rise in economic activity with standard error band



vertical axis: %-deviation from the base scenario; horizontal axis: months after the shock

Figure 9: Greece: Response of aggregate bank lending to a one unit rise in economic activity with standard error band



vertical axis: %-deviation from the base scenario; horizontal axis: months after the shock