Loan supply shocks in Macedonia: a Bayesian SVAR approach with sign restrictions

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Abstract

This paper analyses the effects of loan supply shocks in Macedonia using a structural VAR with sign restrictions and Bayesian estimation. It also analyses other key macroeconomic and policy shocks between 2000 and 2012. The main results indicate that loan supply shocks have no significant effect on loan volumes and lending rates. In addition, monetary policy is transmitted mostly via loan volumes, while the effect on lending rates is more limited.

JEL classification: C11, C32, E51

Keywords: loan supply, Bayesian VAR, sign restrictions, Macedonia

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1. Introduction

Lending activity in Macedonia was fairly subdued in the first half of the transition process, thus contributing to a lower level of financial development than its peer countries, as well as slower economic growth. However, a period of expansion of bank lending started around 2004. Combined with the stable macroeconomic environment and absence of external shocks, the higher lending contributed to an acceleration in economic growth rates. With no significant pressures on the price level and the current account, the central bank was able to relax the monetary policy in this period, while at the same time maintaining an exchange rate peg to the euro. However, the global economic and financial crisis put an end to this process. Economic growth was either low or fairly negative since 2009, while lending growth rates are continuously in the single digits. In addition, the central bank had to fight pressures on foreign reserves by raising policy rates and implementing more restrictive policy during the first wave of the crisis. Nevertheless, as the pressure subsided, the central bank was able to relax its policy in order to support the economic growth.

This paper aims to analyse the effects of loan supply shocks in Macedonia since the early 2000s. In addition, it also aims to analyse the effects of other key macroeconomic shocks, i.e. monetary policy, aggregate demand and aggregate supply shocks. In order to do so, it applies a SVAR with sign restrictions and Bayesian estimation. Restrictions are imposed in a manner that enables proper identification of shocks and is in line with the recent theory.

The paper starts with stylised facts on bank lending and economic growth in Macedonia. Data are presented in Section 3 and sign restrictions are discussed in Section 4. Section 5 presents the results and Section 6 concludes.

2. Stylised facts

Bank lending activity in Macedonia has undergone several distinct stages since the beginning of the previous decade. From the beginning of the transition process until early 2000s, the banking sector was quite shallow and undeveloped, and went through a process of deep structural reforms. During that period, the country was also hit by several large shocks, most notably wars in the region in the 1990s and the internal conflict in 2001. Consequently, the central bank (NBRM) was mostly implementing a restrictive monetary policy in attempts to eliminate external pressures on foreign reserves and to maintain the fixed exchange rate. As a result of all these factors, economic growth was fairly volatile, and lending was lower than in the more advanced transition countries.

Major reforms of the banking system in early 2000s and subsequent changes in bank ownership, the transfer of know-how from the new foreign owners, and the introduction of international governance and banking practices contributed towards a consolidated banking sector, which was capable of supporting economic growth. On the policy side, the stable macroeconomic

environment and maintenance of the fixed exchange rate despite various periods of pressure were additional supportive factors for an acceleration of economic growth. Movements during the period (Figure 1) indicate that the expansionary stage of lending activity began around 2003 and lasted until the global economic and financial crisis. Annual growth of loans was in the double digits during this period, reaching the maximum of almost 40% in 2007. This contributed to a faster process of financial deepening, which finally started to accelerate after several years of a loan-to-GDP ratio lower than 20%, far below other transition peers. This period of strong credit growth was both a reflection and support for stronger GDP growth, averaging 5.4 % between 2006 and 2008, which is the highest growth rate for Macedonia in the transition period. However, the expansion of credit and the acceleration of growth did not result in more significant price pressures, as average inflation was fairly low and stable before the global economic crisis (1.4% between 2003 and 2007), although it did reach a high of 8.3% in 2008, mostly as a result of global price rises. While stronger economic growth in a small open economy with a fixed exchange rate such as Macedonia did create additional pressures regarding the trade deficit, continuous stable inflows of foreign currency prevented a more serious pressure on foreign reserves. Therefore, monetary policy during the latter part of this period was fairly relaxed, with policy rates reaching a then historical low of 4.8% in the end of 2007.

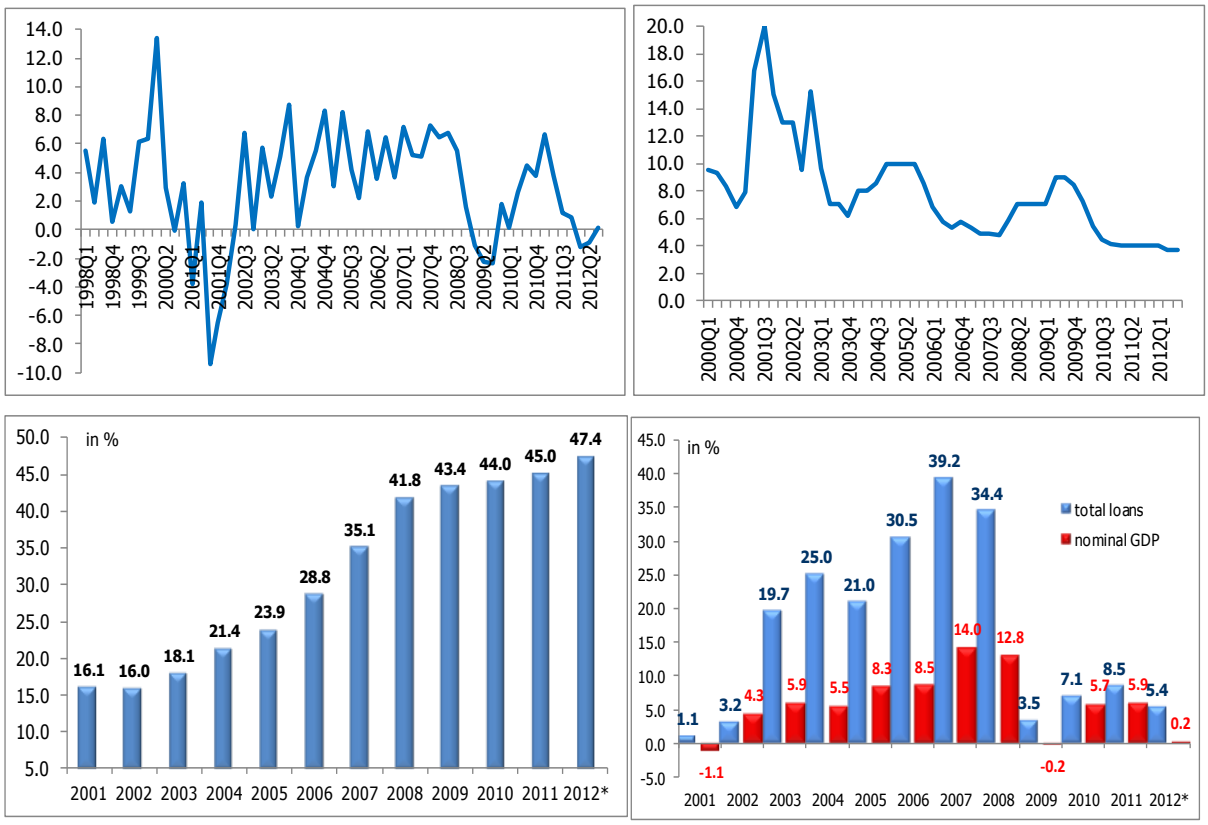

Figure 1. Year-on-year GDP growth rates (upper left), policy interest rate (upper right), share of loans in GDP (lower left) and annual growth of nominal GDP and loans (lower right)
Source: NBRM and SSO

The spill-over of the financial crisis to Macedonian economy in late 2008 ended the expansionary credit cycle that started around 2004. The first effects from the crisis were transmitted through the weakened external demand and the reduction of capital inflows, and within a couple of months the negative impact was felt on the credit and deposit markets as well. There was a sharp decline in credit growth, which signalled the new contraction phase of the credit cycle accompanying the economic slowdown, with lending growth rates in single digits after 2008. In addition, towards the end of 2008, the global uncertainty and growing negative expectations resulted in an elevated demand for foreign currency. Under such circumstances, monetary policy was facing serious challenges of preserving the confidence in domestic currency and maintaining the fixed exchange rate. NBRM managed to restore the confidence and maintain the exchange rate stability by massive interventions in the foreign exchange market. Interventions on the foreign exchange market soared to 5.1% of GDP within just five months (January to May 2009). At the same time, NBRM increased the policy rate to 9%, which was the highest level since the end of 2005. In order to discourage the demand for foreign currency, additional contractionary measures were adopted in May 2009 by increasing the reserve requirement rate for bank liabilities in foreign currency and liabilities with a foreign exchange clause.

The period after 2009 could best be described as a period of high uncertainty and volatility, with mixed signals from both global and domestic developments, and corresponding policy responses. The overall effect from the crisis for the Macedonian economy was inevitably negative in 2009; but unlike many other countries, it returned to positive growth relatively quickly. Since the external sector is a key contributor to the economic growth, the improved situation on the global markets and the terms of trade in 2010 had an important role in this regard. In addition, banks quickly responded to the more optimistic outlook and increased lending, providing additional support to the domestic demand. In 2010, NBRM made several cuts to the policy rate, thus relaxing monetary policy in order to support the ongoing economic recovery. As far as financial stability is concerned, NBRM introduced prudential measures which helped to maintain the stability of the financial system. However, the rising intensity of the sovereign debt crisis at the end of 2011 reignited pressures in the domestic banking system. This time, the banking sector had higher perceptions of credit risk and became more conservative in the lending activity, while credit demand was highly volatile and pressures on the credit portfolio quality were becoming apparent. In addition, there were also signs of deleveraging in 2012, which was however smaller than in most other countries. As a result of these factors, there was another slowdown in lending. The negative external environment and the prolonged global uncertainty made it difficult for the Macedonian economy to continue its recovery. Just after a successful year with a growth rate of around 3%, GDP growth was slightly negative in 2012. However, despite the serious challenges, the stability of the exchange rate was preserved, while foreign reserves continued to grow and the banking sector remained stable and fully functional.

2. Data

Our analysis is carried out using a structural vector auto regression (SVAR) with sign restrictions, and we employ Bayesian estimation. The choice of variables in the VAR reflects a mix of theoretical foundations and casual considerations. Indeed, we include standard macroeconomic variables that are expected to capture well the loan supply factors, as well as other key macroeconomic factors. While details vary among studies, these variables are similar to the ones used by the literature on loan supply shocks.

The variables included in our VAR are: the seasonally adjusted quarterly GDP growth, the seasonally adjusted quarterly CPI inflation rate, the policy rate (rate on central bank bills), the quarterly change in total local currency lending and the corresponding lending rate. We also include a constant term in the VAR. Although most studies use the GDP deflator as an indicator of price movements, we decided to use consumer price inflation because it is the indicator monetary policymakers usually focus on when making policy decisions (Halvorsen and Jacobsen (2009)), which is also the case in Macedonia. Further, by using the policy rate, we deviate from most of the literature, which tends to use interbank rates as an indicator of the monetary policy stance. However, in circumstances of continuous surplus liquidity in the banking system, the role of the interbank market in Macedonia in helping banks to address temporary liquidity shocks by borrowing or lending is fairly limited, while the monetary policy stance is mainly reflected through the central bank bills rate. Besides, the data on interbank money market rates are shorter, and using them would further shorten our sample for around two years. Finally, we use the outstanding volume of total local currency loans and the corresponding interest rate as market variables. In a fixed exchange rate regime, monetary policy can only influence local currency loans, so we only include denar loans in our analysis, including local currency loans with foreign exchange clause[1]. It should be noted that most studies only focus on lending to non-financial corporations. However, this is unfeasible in our case due to data limitations, as the series on corporate lending rates only starts in 2005.

There is little agreement in the literature on the way the data should enter the VAR (except for interest rates, which generally enter untransformed, i.e. as percentage points). Empirical studies in this area employ various approaches, often with little or no explicit arguments for doing so. Busch et al. (2010), Musso (2009) and Deryugina and Ponomarenko (2011) all use seasonally adjusted log-levels. Hristov et al. (2012) use linear de-trending of all variables, including interest rates. Halvorsen and Jacobsen (2009) use a mix of detrended GDP, the inflation rate and the level of house prices. On the other hand, other studies use differenced data (e.g. Peersman (2005) or Mumtaz et al. (2012)). Bearing all this on mind, we decided to use quarterly changes of GDP and loans and the quarterly inflation rate, while interest rates enter as percentages.

We use quarterly data between 2000Q1 and 2012Q3 in our estimation. The beginning of our sample is entirely determined by the availability of data on loans and lending rate. As for the end of

[1] A sensitivity check was also made using total loans, but results did not change.

the period, the inclusion of the crisis might imply parameter instability (Busch et al., 2010). However, leaving out several of the recent years would result in a fairly short sample, consisted mostly of an expansionary stage of the business cycle in Macedonia. Indeed, the use of the maximum sample available is the approach taken by most papers in this field (e.g. Hristov et al. (2012) and Deryugina and Ponomarenko (2011). Standard information criteria indicate that a VAR of 2 lags is appropriate. We use Bayesian estimation with normal inverse Wishart prior, with 5000 Gibbs iterations, of which the last 1000 are retained.

3. Identification of structural shocks

We identify structural shocks by imposing sign restrictions on impulse responses. What we are interested in is the identification of exogenous shifts of particular factors, most notably the credit supply. Exogenous shifts are the ones which reflect factors other than the endogenous reactions to other factors incorporated in the model. For instance, credit supply shocks reflect a combination of factors from the banking sector, such as changes in the financing conditions, competition, the quality of borrowers (Hristov et al. 2012) or confidence effects.

Since we have 5 endogenous variables, we could identify at most 5 structural shocks. However, proceeding in this manner is generally not recommended, as it requires complicated identification restrictions and increases the computational burden (Busch et al., 2010). On the other hand, identifying only a few shocks can result with a large amount of unexplained movements. Bearing on mind this trade off, studies usually choose the number of shocks to identify in accordance with their main point of interest. For instance, in his seminal paper on SVARs with sign restrictions, Uhlig (2005) only identifies the monetary policy shock, noting that he is only interested in that shock. However, numerous studies identify several shocks, which enables a richer economic analysis, and can also help the identification of structural shocks (Paustian, 2007).

Studies on credit supply that also use SVAR with sign restrictions identify 2 shocks at the least: the loan supply shock and the monetary policy shock. Busch et al. (2010) support this decision with the difficulties in disentangling the two shocks, which means that identifying only one of them would make its interpretation more complicated. On the other hand, they also note that they do not identify loan demand shocks because it is difficult to separate them from aggregate demand shocks; if those two shocks were also identified, then computation in a 6-variable VAR would become very difficult. Deryugina and Ponomarenko (2011) follow Busch et al. (2010) in imposing their sign restrictions by identifying the same two shocks in a 5 variable VAR. In their study of Norway and the UK, Halvorsen and Jacobsen (2009) also identify only lending and monetary policy shocks within a 6 variable VAR. On the other hand, several studies of credit supply identify more than two shocks. For instance, Musso (2009) assess the effects of 5 shocks in a VAR of 8 variables. Besides the loan supply and monetary policy shocks, they also identify the effects of money demand and loan demand shocks to key macroeconomic variables in the euro-area and the US. Tamasi and Vilagi (2011) also identify

four shocks in a 7-variable VAR in their analysis of the Hungarian economy. Finally, in their analysis of loan supply shocks in the euro-area with a 5-variable panel VAR with sign restrictions, Hristov et al. (2012) identify four shocks: loan supply, monetary policy, aggregate demand and aggregate supply shocks.

We decided to closely follow Hristov et al. (2012) and the literature surveyed therein in the identification of shocks and sign restrictions in our study for two main reasons. First, we are interested in a richer economic analysis. Imposing several shocks will thus enable us to disentangle their separate effects on key macroeconomic variables and to explain a bigger share of their developments. Second, Hristov et al. (2012) impose the sign restrictions based on a careful survey of the key studies and their findings on macroeconomic relations, particularly DSGE-studies. Therefore, we also identify the following four shocks (Table 1): aggregate supply, monetary policy, aggregate demand and loan supply shocks, while there is also a fifth, unidentified shock that picks up the effect of other factors. We only impose contemporaneous restrictions on impulse responses, whereas Hristov et al. (2012) impose restrictions for two quarters. Most other studies also impose restrictions over several quarters, including more elaborate restrictions such as delayed reactions of some variables (eg Busch et al. (2010)). On the other hand, Halvorsen and Jacobsen (2009) include contemporaneous restrictions only. We believe that contemporaneous restrictions are sufficient to impose the structure and our priors, so we proceed in this manner.

Restrictions for the identification[2] of aggregate supply, aggregate demand and monetary policy shocks draw on the VAR studies by Peersman (2005) and Fratzscher et al., (2009), as well as standard DSGE studies by Straub and Peersman (2006) and Canova and Paustian (2010). The aggregate supply shock is identified by imposing restrictions so that GDP growth and inflation move in opposite directions, i.e. a positive price shock leads to a contemporaneous fall of GDP. As a reaction to these movements, the central bank reacts with a more restrictive monetary policy. While having the same impact on GDP and prices, these aggregate supply shocks can be of various nature: shocks to the production function or production factors, shocks to the price-setting behaviour, technology shocks or oil shocks (Musso, 2009). The monetary policy shock is identified via a positive restriction on the policy rate i.e. a tighter monetary policy, which causes a contemporaneous fall of GDP and prices. This restriction on prices is important as it separates the monetary policy from the aggregate supply shocks; otherwise the two would be indistinguishable. In addition, other studies also identify monetary policy shocks in a similar manner (Busch et al. 2010). Finally, in order to identify an aggregate demand shock, we restrict GDP growth and inflation to move in the same direction (i.e. they both fall). In such a case, the policy rate also falls as the central bank reacts to the negative aggregate demand shock by an expansionary monetary policy. In addition, the negative aggregate demand shock is also accompanied by a contemporaneous fall of lending rates, for two main reasons. First, lower aggregate demand probably causes lower demand for loans, which is generally accompanied by lower lending rates. Second, the lower policy rate in the wake of the negative

[2] This and the following paragraph draw heavily on Hristov et al. (2012).

demand shock will also cause lower lending rates, even with incomplete transmission of monetary policy. It should also be noted that this restriction on the movement of lending rates serves to distinguish the aggregate demand shock from the loan supply shock.

The identification of loan supply shocks also relies on the relevant VAR and DSGE literature. There is a general agreement in the theoretical and empirical literature that loan supply shocks move the loan volume and the lending rate in different directions, and this is the approach taken by all the SVAR studies mentioned above. That is, in the case of adverse loan supply shocks, the volume of outstanding loans falls, whereas the lending rate rises contemporaneously. This ensures that loan supply shocks can be distinguished from aggregate demand shocks, since in the latter the lending rate also falls. Further, based on DSGE models with financial frictions and credit markets[3], GDP growth also falls in the wake of loan supply shocks. On the other hand, there is some disagreement regarding the reaction of monetary policy and prices. Most studies find that the central bank also relaxes its policy and prices fall in cases of loan supply shocks. Therefore, we also impose a restriction for the monetary policy to react to loan supply shocks and the accompanying economic slowdown by lowering the policy rate. Besides being in line with the theoretical findings, this also enables an identification of loan supply shocks, i.e. their distinction from aggregate supply and monetary policy shocks (which are accompanied by rising policy rates). No restrictions are imposed on price movements since other restrictions are sufficient for shock identification, and the relevant literature is ambiguous about the reaction of prices.

Shocks	**GDP growth**	**inflation**	**policy rate**	**lending rate**	**loan volume change**
Aggregate supply	–	+	+		
Monetary policy	–	–	+		
Aggregate demand	–	–	–	–	
Loan supply	–		–	+	–

Table 1: Contemporaneous sign restrictions imposed to identify structural shocks

4. Results

In this section we present the results of our analysis. We present the median impulse responses for each of the four shocks over a horizon of 20 quarters, as well as the 68% confidence interval (i.e. the 16% and the 84% quantiles). The estimation was carried out using the code and the

[3] See the survey in Hristov et al. (2011)

handbook in Blake and Mumtaz (2012)[4]. In the estimation, we use Bayesian estimation with a Normal inverted Wishart prior, 5000 Gibbs iterations and 1000 retained draws.

Figure 2 shows impulse responses to an aggregate supply shock. In line with the restrictions imposed, an aggregate supply shock causes higher prices and lower GDP, with the central bank reacting to the shock by increasing the policy rate. The reaction of GDP and prices is quite short-lived, as their response quickly becomes insignificant. The restrictive monetary policy is however more persistent and lasts for slightly less than a year. In addition, lending rates increase on impact, and are also higher for a considerable period following an aggregate supply shock, while the reaction of the loan volume is insignificant.

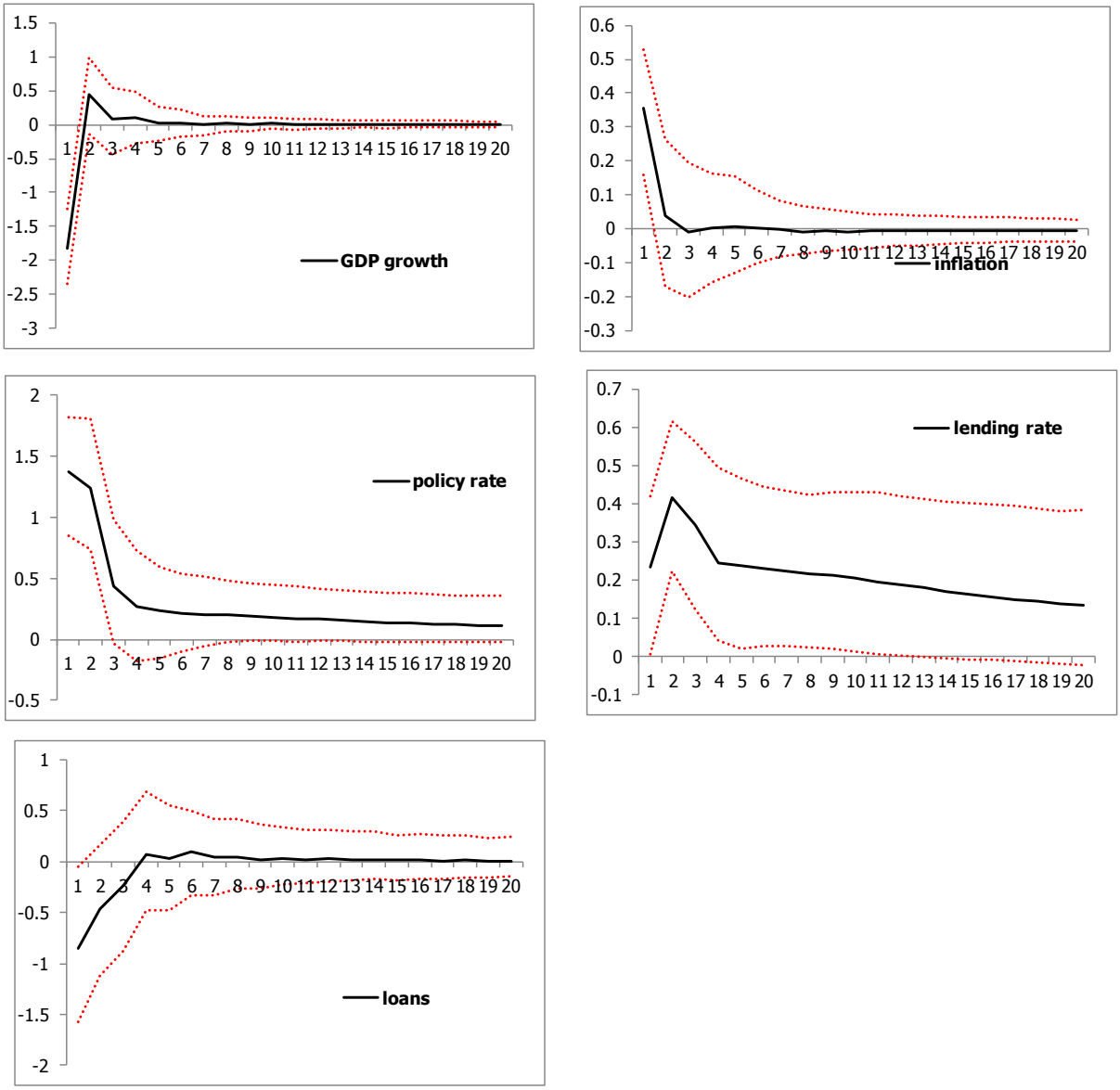

Figure 2. Impulse responses to an aggregate supply shock.

[4] We also rely on the code provided by and the direct communication with Haroon Mumtaz of the Bank of England.

Next we analyse the response to a restrictive monetary policy shock (Figure 3). In line with the sign restrictions, the policy rate rises on impact, and this reaction is maintained for a couple of quarters. In addition, prices fall on impact, and remain significantly lower for about a year, whereas the reaction of GDP is insignificant beyond the period of the restriction. What is more interesting is the reaction of lending variables, which are left unrestricted. According to these results, banks react to monetary policy shocks mostly by lowering their lending activity for almost a year. They also increase lending rates, but this is mostly a temporary reaction.

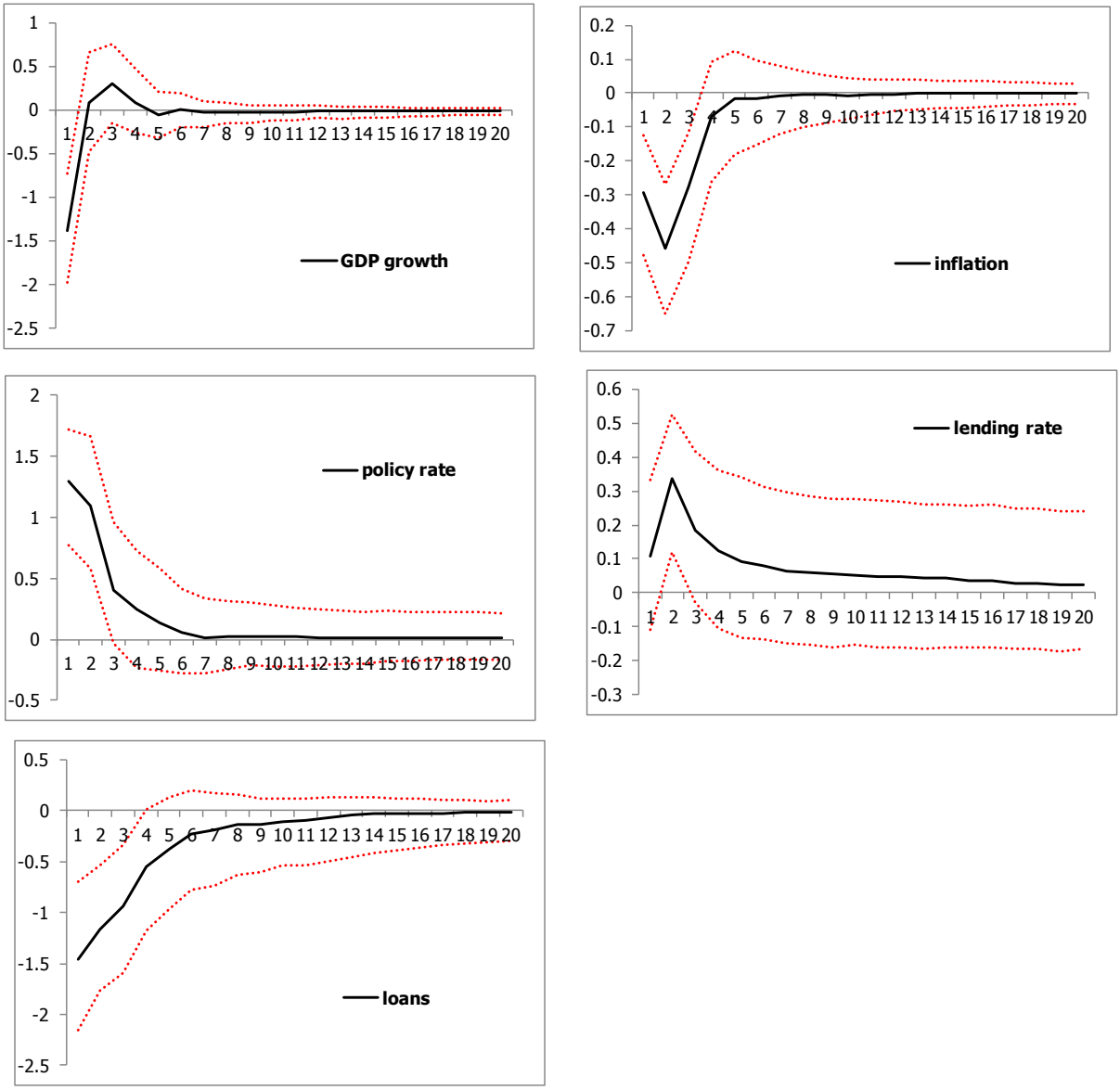

Figure 3. Impulse responses to a monetary policy shock.

Figure 4 shows impulse responses to an adverse aggregate demand shock. GDP falls on impact, in line with the restrictions imposed, but immediately jumps back the following quarter before becoming insignificant. Also in line with the restrictions imposed, both prices and the policy rate fall on impact, but their reaction becomes insignificant soon after. The lending rate falls on impact, and this reaction is quite persistent, as it remains significant for over two years. The positive response of the loan volume is somewhat surprising, as one would expect it to fall due to lower demand for loans. However, this reaction is consistent with the persistent fall in lending rates, which might contribute to a marginally higher loan demand. In any case, outstanding loans only rise on impact, but then quickly become insignificant.

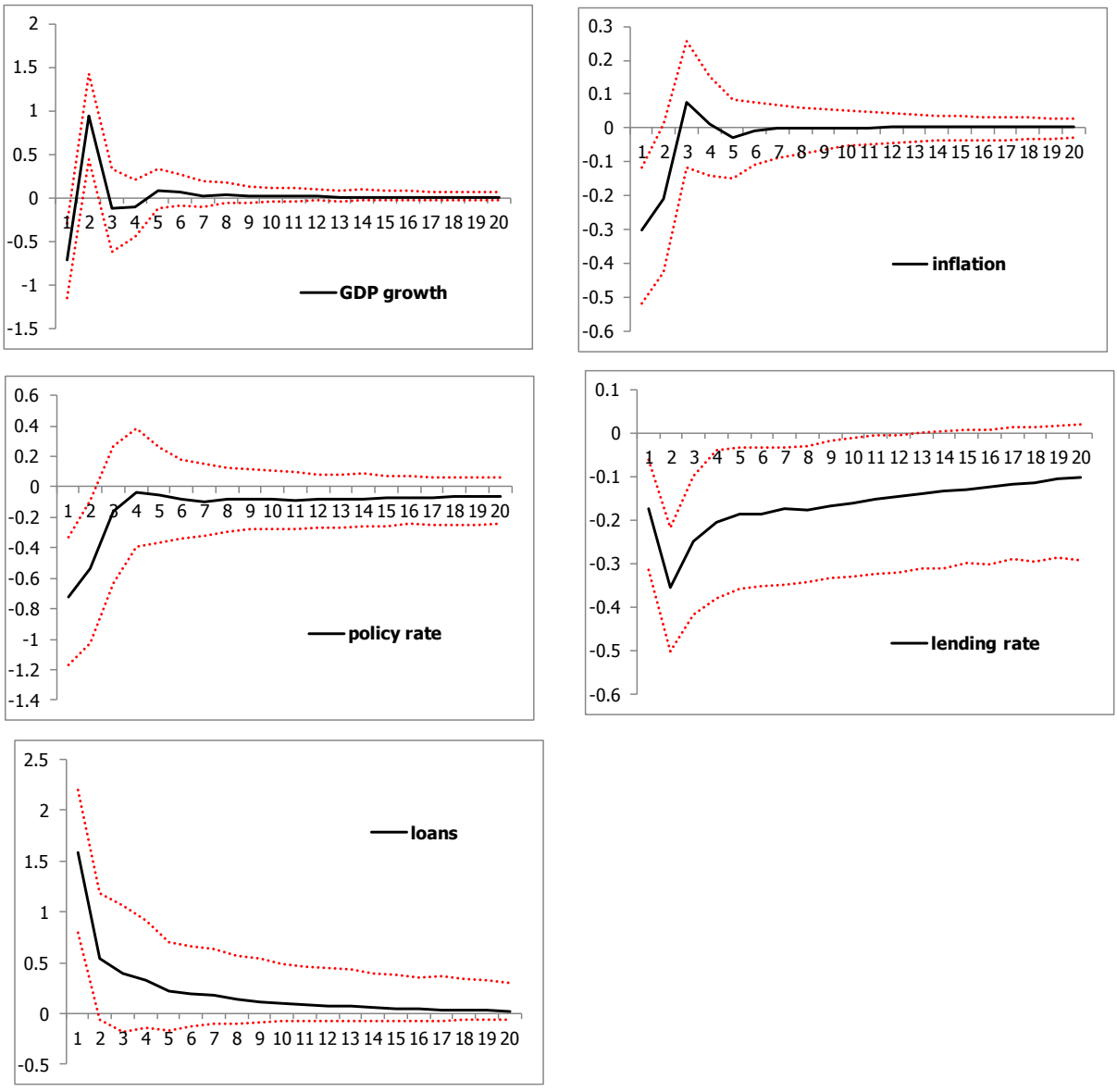

Figure 4. Impulse responses to an aggregate demand shock.

Finally, figure 5 shows the reaction to a negative loan supply shock. In line with the sign restrictions, the loan supply shock causes opposite movements of loan volumes and rates. The effect appears quite prolonged, as loan volumes are lower and lending rates are higher for quite a long period, although they both appear to become insignificant fairly quickly. The impact on other variables is quite limited. GDP falls on impact due to the restriction, but is insignificant thereinafter. The response of inflation, which is left unrestricted, is insignificant throughout the period. Monetary policy reacts with lower rates on impact due to the sign restrictions, but its reaction also becomes insignificant thereinafter.

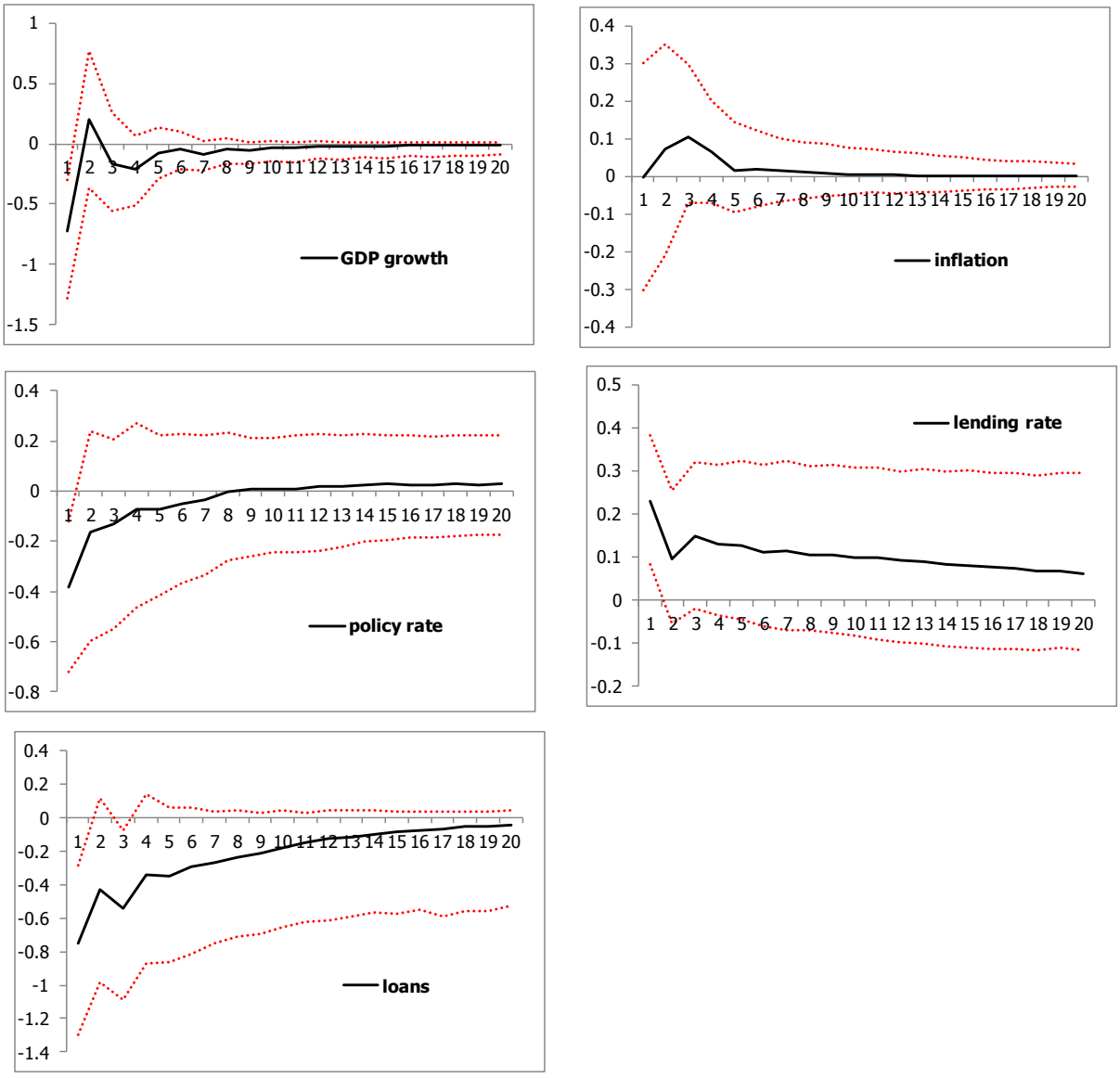

Figure 5. Impulse responses to a loan supply shock.

Several attempts were made to check the sensitivity of these results. For instance, we replaced the headline inflation with base inflation, i.e. inflation without energy and food prices. In

another alternative we replaced local currency with total loans and lending rates. While such a definition is not typical in most studies, in the case of Macedonia it might be more appropriate due to the high euroisation in the economy and the fact that monetary policy decisions also affect the portfolio mix between local and foreign currency holdings. However, neither of these changes had any considerable effect on the results.

5. Conclusion

This study examined the dynamics of loan supply and relations to macroeconomic and policy factors in Macedonia by using a Bayesian VAR with sign restrictions. The paper relied on the available theoretical and empirical literature to identify four structural shocks and their effects on key macroeconomic, policy and lending variables.

Our main result are as follows. First, monetary policy affects lending primarily by affecting loan volumes, while the effect on lending rates is comparatively more limited. Monetary policy also has a relatively strong effect on inflation. Second, adverse aggregate demand shocks result in a short-lived response by monetary policy, but a more significant and prolonged fall of lending rates. Finally, somewhat surprisingly, loan supply shocks have no significant effect on either loan volumes or lending rates.

References

Blake, A. and Mumtaz, H. (2012). Applied Bayesian econometrics for central bankers. Bank of England, CCBS Technical Handbook No.4.

Busch, U., Scharnagl, M. and Scheithauer, J. (2010). Loan supply in Germany during the financial crisis. Deutsche Bundesbank Economic Studies Discussion Paper No. 05/2010.

Canova, F. and Paustian, M. (2010). Measurement with Some Theory: a New Approach to Evaluate Business Cycle Models. Barcelona Graduate School of Economics Working Paper No. 511.

Deryugina, E. B. and Ponomarenko, A. A. (2011). Identifying structural shocks behind loan supply fluctuations in Russia. BOFIT Discussion Paper No. 20/2011.

Fratzscher, M., Saborowski, C. and Straub, R. (2009). Monetary Policy Shocks and Portfolio Choice. ECB Working Paper Series No. 1122.

Halvorsen, J. I and Jacobsen, D. H. (2009). Are bank lending shocks important for economic fluctuations. Norges Bank Working Paper No. 2009/27.

Hristov, N., Hülsewig, O. and Wollmershäuser, T. (2012). Loan Supply Shocks During the Financial Crisis: Evidence for the Euro Area. *Journal of International Money and Finance,* 31(3):569-592.

Mumtaz, H., Solovyeva, A. and Vasilieva, E. (2012). Asset prices, credit and the Russian economy. Joint Research Papers 1, CCBS, Bank of England.

Musso, A. (2009). Money and credit over the business cycle. *Mimeo.*

Paustian Matthias, 2007. Assessing Sign Restrictions. *The B.E. Journal of Macroeconomics*, 7(1): 1-33.

Peersman, G. (2005). What caused the early millennium slowdown? Evidence based on vector autoregressions. *Journal of Applied Econometrics*, 20(2): 185-207.

Straub, R. and Peersman, G. (2006). Putting the New Keynesian Model to a Test. IMF Working Paper No. 06/135.

Tamási, B and Világi, B. (2011). Identification of credit supply shocks in a Bayesian SVAR model of the Hungarian economy. Magyar Nemzeti Bank Working Paper No. 7/2011.

Uhlig, H. (2005). What are the effects of monetary policy on output? Results from an agnostic identification procedure. *Journal of Monetary Economics,* 52(2): 381-419.