National Bank of the Republic of Macedonia

Research Paper
2015

Can Monetary Policy Affect Economic Activity under Surplus Liquidity? Some Evidence from Macedonia[1].

Branimir Jovanovic
National Bank of the Republic of Macedonia
branimir.jovanovic@uniroma2.it

Aneta Krstevska
National Bank of the Republic of Macedonia
KrstevskaA@nbrm.mk

Neda Popovska-Kamnar
National Bank of the Republic of Macedonia
PopovskaN@nbrm.mk

Abstract

Surplus liquidity in the banking system changes the monetary transmission mechanism, reducing the effectiveness of the traditional instrument, the interest rate. In this paper we examine the real effects of several monetary-policy instruments in Macedonia, an economy characterized by surplus liquidity. We use regime-switching Vector Autoregressions and track the responses of different economic activity indicators to changes in the monetary policy instruments. Our findings suggest that the interest rate channel is weakly effective in Macedonia. The responses to the other instruments are not very sizeable, either, but are significant. This implies that monetary policy can affect economic activity through the reserve

[1] The views expressed herein are those of the authors and do not have to represent the views of the National Bank of the Republic of Macedonia. The authors would like to express their gratitude to: Anita Angelovska Bezoska, Ana Mitreska and Sultanija Bojceva Terzijan from NBRM and two anonymous referees, for their valuable comments.

requirement and the offered amount of central bank bills. These findings have implications for both the analysis and the conduct of monetary policy in economies with surplus liquidity. Regarding analysis, the implication is that the traditional approach, which considers only the role of the interest rate, is likely to lead to wrong conclusions. Regarding conduct, the implication is that monetary authorities, besides on the price impact of the interest rate, should additionally rely on the reserve requirement and other available instruments producing volume impact.

JEL Classification: E50, E52

Keywords: monetary policy, surplus liquidity, excess liquidity, VAR, Macedonia

Table of Contents

I. Introduction

Central banks should know if they can affect economic activity, be it for keeping inflation low or for stabilizing output. The mainstream approach for analysing monetary policy effectiveness is through observing if there is a link between the main instrument of the central bank, its interest rate, and real economic activity (see Sims, 1980b, Bernanke and Blinder, 1992, Leeper et al, 1996, Bagliano and Favero, 1998, Christiano et al, 1999, Kim, 1999, Peersman and Smets, 2001, Stock and Watson, 2001, Uhlig, 2005, Sims and Zha, 2006). This approach, however, often suggests that monetary policy cannot affect output in transition countries (Starr, 2005, Jovanovic and Petreski, 2014). The usual explanation is that these countries have underdeveloped financial markets, characterized with low competition and surplus liquidity (see also Gigineishvili, 2011, Mishra et al, 2010, Mishra and Montiel, 2013).

Surplus liquidity, simply put, means that commercial banks persistently hold excess reserves. In other words, banks continuously have more deposits than the credits they provide and therefore keep large liquid instruments on the assets side. It can occur for various reasons, like low competition in the banking sector (which makes banks restrict the supply of credit), or high inflow of capital in a country (due to development aid, natural resources discoveries or macroeconomic stabilization), or low technological growth (which results in a lack of good business projects). Whatever the reasons for its emergence, surplus liquidity has important implications for the conduct of monetary policy – because commercial banks do not need to borrow from the central bank, the central bank interest rate only serves as an opportunity cost for the commercial banks, not as a real cost. This then reduces the transmission effects of the monetary policy.

The implications of surplus liquidity for the monetary policy effectiveness are well acknowledged in the literature (see, for example, Ganley 2002, Saxegaard 2006). Still, the literature has remained pretty silent about the ways central banks can affect economic activity, and, through it, the inflation rate, in such circumstances.

That is the purpose of this paper – to analyse the effects of different monetary policy instruments on economic activity in an economy characterized by surplus liquidity in the financial system - Macedonia. We stress, right from the beginning, that we will not attempt to analyse the effectiveness of possibly the most important monetary instrument in Macedonia, the exchange rate. We abstract from the exchange rate for two main reasons. The first one is that since the Macedonian currency is de facto fixed to the euro, the exchange rate is not actively used as an instrument to control the real economy. The second reason is that the applied framework is not appropriate for analysing the effects of the exchange rate, because there is no dynamics in the (nominal) exchange rate in the analysed period, because the Macedonian denar has been kept at an almost identical parity to the euro (the German mark before 2002) since 1997. We also stress that we will not analyse how the monetary instruments affect the inflation, but only the economic activity. The main reason for this is that we are primarily

interested in comparing the effectiveness of the different monetary instruments, not in analysing the whole transmission process. Therefore, if an instrument is found to be more effective for the real economy, it is likely to be more effective in affecting the inflation, too.

The analysis is done in a Vector Autoregression (VAR) framework and covers the period 2000-2014. We begin with a simple monetary VAR, which includes the central bank interest rate, the inflation rate and economic activity indicator. We show that in this VAR, monetary policy shocks appear to have no effect on economic activity and inflation. We then move to a VAR that, we argue, is more appropriate for the Macedonian economy. This is a regime-switching VAR, with two regimes, corresponding to the two main different ways in which open market operations have been conducted in Macedonia: 1) with limited amount of central bank (CB) bills on the auctions and floating interest rate; 2) with fixed interest rate and unlimited amount of CB bills. In addition, the VAR includes three monetary policy variables – the interest rate, the amount of CB bills sold and the reserve requirement ratio.

The rest of the paper is structured as follows. Section II describes the monetary policy framework in Macedonia. Section III overviews the related literature. Section IV presents the empirical analysis and section V concludes.

II. Overview of monetary policy in Macedonia

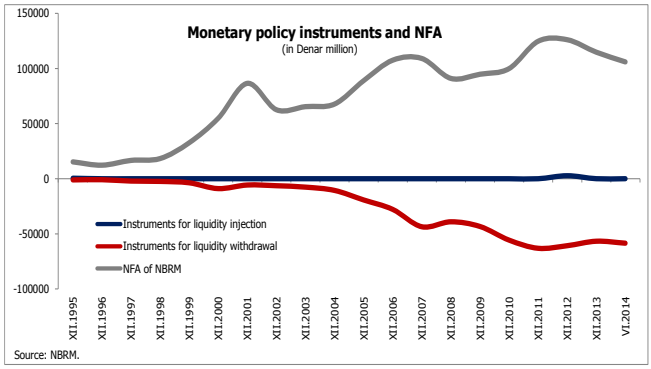
The monetary policy of the National Bank of the Republic of Macedonia (NBRM) is based on the exchange rate targeting strategy. In a small and open economy, the exchange rate is very important for the price developments as well as inflation expectations. Therefore, very soon after the monetary independence (1992), the NBRM switched from monetary targeting to exchange rate targeting (1995), at the beginning relative to German mark (DM) and afterwards relative to the euro. Besides the size and degree of openness of the economy, the importance of the stable exchange rate was also due to the DM/euro dominance in the export and import payments, the sizable degree of currency substitution (especially in the past) indicating potential balance sheet effects for the economic agents, and the narrow financial and foreign exchange market. On the side of the advantages of this strategy, one could mention that it is clear for the public and allows for daily monitoring.

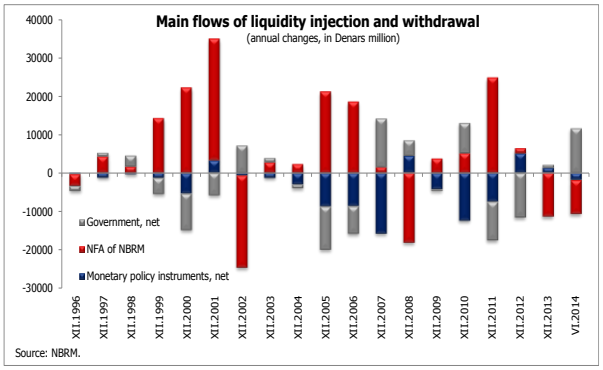
The exchange rate targeting strategy was successfully implemented for almost two decades, with only one devaluation (in July 1997) and impressive inflation record, with average inflation in the period 1996-2013 of 2.6%. Under exchange rate peg, the foreign exchange market developments as well as the foreign reserves level and adequacy are in the main focus of the policy makers. Within this framework, whenever there are inconsistencies between supply and demand of foreign currency on the foreign exchange market and, therefore, pressures over exchange rate, there are interventions by the central bank to bridge the gap on the market and/or reaction with available monetary policy instruments to influence the banks to behave in that direction. The main underlying assumption under pegged regime is that stability of the

exchange rate as intermediary target should contribute to the price stability in the economy, which in the case of the Macedonian economy appears as effective mechanism.

Similarly to other transition economies, the inflows from abroad in the Macedonian economy were mainly exceeding the outflows to abroad, resulting in positive financing gap and gradual foreign reserve increase on cumulative basis. Of course, in the periods of lower inflows than outflows, the NBRM intervened with net sale of foreign exchange on the market and/or increase in the policy rate. The inflows from abroad mainly consisted of private transfers (according to the balance of payment statistics, this item refers to foreign currency inflows in cash), FDI and loans of the public and private sector from abroad. The cash inflows in foreign currency on net basis were continuously positive, while FDI were stronger and more stable inflows only in recent period. Therefore, based on this situation on the foreign exchange market, the NBRM was mainly buying on the foreign exchange market and accordingly injecting liquidity in the system. Thus, couple of years after the introduction of the exchange rate peg, the banking system in the Republic of Macedonia turned to the *excess liquidity* position, which is still persisting, and the main instrument of the central bank, CB bills, is oriented towards liquidity withdrawal from the system. Therefore, the net foreign assets (NFA) of the NBRM is the main flow of liquidity injection in the system, while monetary policy instruments on net basis (all instruments effective for a given period of time) are used to withdraw liquidity from the banking system, or to offset (to the preferred extent) liquidity effect of the NFA, therefore keeping liquidity to the level that does not produce pressures over the exchange rate (Figure 1). In practice, another flow of liquidity is the net position of the government at the central bank that historically appeared to perform in both directions (liquidity injection or withdrawal, in different periods) and additionally influenced monetary policy instruments net stance. This specific liquidity position of the banking system creates less favourable situation for the monetary authority considering the need to mop up the excess liquidity in the banking system (and only occasionally to lend funds to some bank). Since the main policy rate is not a cost of financing but rather an opportunity cost for the banks, the interest rate channel is not very effective and it probably demonstrates only its signaling role. Yet, despite the fact that is an opportunity cost, it can affect banks' balance sheet significantly and therefore banks' behavior and their overall efficiency. Couple of papers already confirmed the low level of efficiency of the interest rate pass-through in the Macedonian economy (Jovanovski et al, 2005; Velickovski, 2006; Krstevska, 2008). However, the latest research in this area (NBRM Quarterly Report, August 2015) provides indications for relatively solid operational interest rates transmission mechanism, at very strong, almost complete transmission on the side of deposits interest rates and the interest rates for the households.

Figure 1 – Monetary policy instruments and flows of liquidity





The open market operations in Macedonia are conducted with short term securities issued by the Central Bank (CB bills), with 28-day maturity in the last several years. There have been two different ways of conducting CB bills auctions. In the first one, sometimes called *active* way (see Axilrod, 1996), the central bank limits the amount of CB bills, while the interest rate on the CB bills is allowed to fluctuate freely. When the second type, also called *passive*, is at force, the central bank fixes the interest rate in advance, while the amount of CB bills is allowed to fluctuate. When the passive approach has been followed, the amount of CB bills has been limited sometimes, and in those cases the actual amount of CB bills bought by the banks has been at the maximum offered amount most of the time[2], due to the excess liquidity in the system. Hence, it seems more appropriately to classify the conduct of the monetary policy in Macedonia into two regimes – one in which the amount of CB bills is limited and the interest rate may or may not fluctuate, and one in which the amount of CB bills is unlimited and the interest rate is fixed. *The crucial distinction between the two regimes is that during the limited CB bills regime, the amount of CB bills offered on the auctions can be considered as a monetary policy instrument.* Table 1 shows the periods during which the two regimes have been in force.

[2] From the approximately 120 auctions with these features, the actual amount of CB bills purchased by the banks has exceeded 90% of the offered amount approximately 65% of the auctions. Furthermore, the demand for CB bills has exceeded the supply by 12%, on average.

Table 1 – Different types of open market operations

Time	Regime
01.2000 – 05.2000	Unlimited CB bills
06.2000 – 03.2001	Limited CB bills
04.2001 – 06.2002	Unlimited CB bills
07.2002 – 01.2004	Limited CB bills
02.2004 – 03.2004	Unlimited CB bills
04.2004 – 05.2004	Limited CB bills
06.2004 – 10.2005	Unlimited CB bills
11.2005 – 02.2008	Limited CB bills
03.2008 – 03.2012	Unlimited CB bills
04.2012 - ongoing	Limited CB bills

Source: NBRM.

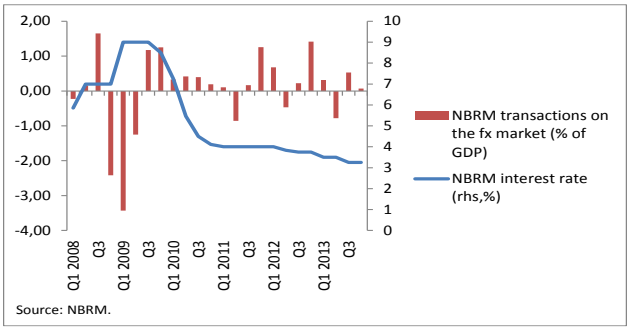
Apart from the CB bills, there are also other available instruments of the NBRM that are actively used in the operational management of liquidity in the system. The most actively used of these is the reserve requirement ratio. Since mid-2009, it is implemented by using different ratios regarding currency[3]. There are also available deposit and lending facilities (overnight lending upon request by the banks). The overnight deposits and seven days deposits at the NBRM have been introduced in April 2012, within a larger modification of the operational framework. Also, regular (weekly) repo operations have been introduced in 2012. Additionally, a bill for 6-month deposit facility at the NBRM existed for a limited period of time during 2011 (introduced for specific purposes for bank's liquidity management and thereafter discontinued).

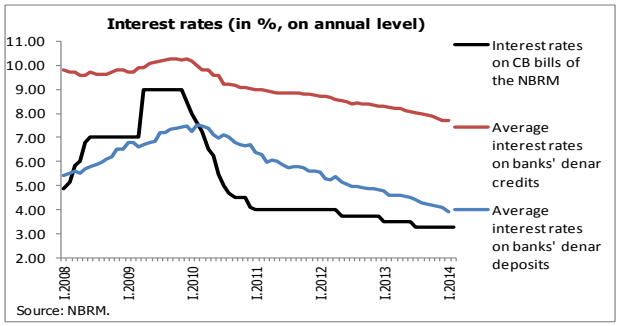
The last global crisis imposed many challenges for central bankers worldwide, including use of mix of standard and non standard measures towards fulfilling their objectives. This period is especially illustrative for the monetary policy implementation in the Macedonian economy, under excess liquidity in the banking system. At the beginning of the crisis, the main policy rate was increased considering the unfavourable developments on the foreign exchange market, opposite than the interest rate in the Eurozone, as a peg area, pointing to the specifics of the implemented strategy, which prevents the central bank to support the economy during periods

[3] There are different ratios for denar deposits, foreign exchange deposits and denar deposits with foreign exchange clause.

of capital outflows, in order to prevent jeopardizing the fixed exchange rate regime. Following stabilization on the foreign exchange market, from end-2009 and further on, the policy rate followed a declining trend, reaching historically lowest level of 3.25% in mid-2013. The changes in the policy rate during the analyzed period seem to have been significantly transmitted to the banks' interest rates and in both directions (when going up and going down) with stronger almost complete pass-through on deposit interest rates. Also, significant pass-though was registered by the lending interest rates, but with smaller intensity comparing with deposit interest rates (NBRM Quarterly Report, August 2015). Stronger declining tendency in banks' deposit interest rates was mainly due to higher credit risk and fall in profitability.

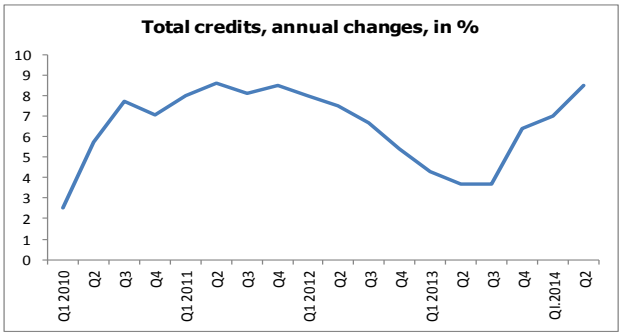
Figure 2 – Interest rates and FX interventions



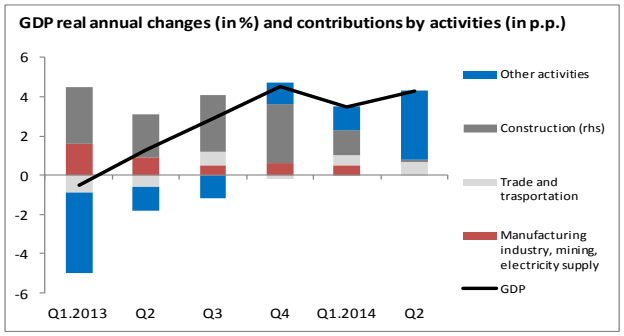


With stable exchange rate and inflation mainly influenced by the external supply-side factors, the main challenge in recent years was to support credit growth and therefore the real sector of the economy. Deposits are the main source of financing of Macedonian banks. In addition, during the crisis period, the banks also had available foreign credit lines. However, they had relatively low credit/deposit ratio (around 90%), while credit growth registered significant slowdown in mid-2012, mainly in view of the risk perceptions of the banks regarding crisis evolution and its consequences. On the other hand, the changes in the banks' assets structure were in favour of the risk free investments (mainly government's securities, since the amount of CB bills offered on the auctions was limited). Under these circumstances, considering the low effectiveness of the interest rate channel, the NBRM employed a range of changes in the other instruments or other measures towards credit growth enhancement and support of the economic recovery. This package of measures incorporated a temporary release of the reserve requirement for loans to vulnerable sectors (export and energy sector), introduction of zero reserve requirement for liabilities to non residents and further differentiation of ratios by currency (in favour of domestic currency liabilities), gradual reduction of interest rates on deposit facilities, changes in the prudential measures regarding liquidity and credit risk aiming at additional relaxation for the banks as well as some changes in the operational procedures.

Figure 3 – Credit growth and GDP



Source: NBRM.



Source: SSO.

This period was some sort of test if the monetary policy under surplus liquidity in the banking system can influence the real economy. As a matter of fact, since end-2013 there was some revival in the credit growth rates, accompanied with rather solid rates of GDP growth. To be fair, the recovery of the economic activity started earlier and was supported by strong investments and exports, driven by a fiscal stimulus and FDI inflows, in addition to the provided monetary stimulus. The construction, manufacturing industry and trade and transportation were the main economic activities that contributed to this economic revival (at the same time absorbing a large portion of the credits extension). On average, these three activities in the analysed period contributed with more than 50% of the GDP growth.

Anyway, descriptive statistics do not provide enough clear evidence for the monetary policy impact over real economy. The remainder of this paper should focus exactly on this issue - to provide arguments for the ability of the monetary policy of the NBRM to influence the real economy under surplus liquidity.

III. Overview of related literature

Monetary policy effectiveness is nowadays commonly analysed in a VAR framework. The simplest model includes three variables – economic activity, inflation and the central bank interest rate (see, for example, Stock and Watson, 2001). Apart from simplicity, the appeal of this model lies in the notion that it loosely corresponds to the simple three-equation New Keynesian model, which has an IS curve (i.e. equation for the output gap), Phillips curve (i.e. equation for the inflation) and monetary policy rule (i.e. equation for the central bank interest rate); see Woodford (2003, Chapter 3), Walsh (2003, Chapter 5) and Gali (2008, Chapter 3). The IS curve links developments in the output gap to developments in the interest rate. The Phillips curve links the inflation to the output gap. The monetary policy rule relates the interest rate to the developments in inflation and the output gap.

The simplest three-variable VAR is often extended. Many authors also include a monetary aggregate in the VAR (Sims, 1980b, Litterman and Weiss, 1985, Bernanke and Blinder, 1992, Leeper et al, 1996, Kim, 1999). Many go even further and include also borrowed and non-borrowed reserves (Strongin, 1995, Leeper et al, 1996, Bagliano and Favero, 1998, Bernanke and Mihov, 1998, Christiano et al, 1999, Uhlig, 2005). It is also very common to include variables for various exogenous shocks, like commodity prices and foreign output (Sims, 1980a, Leeper et al, 1996, Bagliano and Favero, 1998, Christiano et al, 1999, Peersman and Smets, 2001, Uhlig, 2005). Some papers analyse different economic activity indicators, not just the GDP (Bernanke and Blinder, 1992, Leeper et al, 1996, Christiano et al, 1999). Some papers also include the exchange rate (Leeper et al, 1996, Christiano et al, 1999, Peersman and Smets, 2001, Sims and Zha, 2006).

Several papers have so far analysed the effectiveness of monetary policy in Macedonia in a VAR framework. They all find that the output response to interest rate (or money) movements is insignificant. Vrboska (2006) analyses if Macedonian industrial production during 1993-2004 has responded to changes in the interest rate, finding a small and insignificant reaction. Fetai and Zeqiri (2010) estimate a VAR for the Macedonian economy for the period 1997-2008, and find that shocks in the M1 monetary aggregate produce insignificant response in the GDP. Velickovski (2013) also estimates a VAR for Macedonia for 1997-2011, finding that the interest rate is insignificant for the economic activity, as well as Trenovski (2014), whose analysis covers 2000-2011, and finds that the response of GDP to interest rate shocks is insignificant.

Two more papers obtain similar results by estimating IS curves, using Generalized Method of Moments. Melecky and Najdov (2010) estimate an IS curve for Macedonia for 1997-2007, finding that the central bank interest rate is significant for the output gap, but the effect seems to be rather small. Jovanovic and Petreski (2014) estimate an IS curve for 28 countries from South-East Europe and the Commonwealth of Independent States, using panel GMM techniques, for the period 2002-2011. They find that the interest rate is insignificant for output gap dynamics. Only Jovanovic and Petreski (2012) find that the interest rate is significant for the output gap, when they estimate a New Keynesian model for Macedonia, for the period 1997-2011.

Other related studies include Besimi et al. (2006), who find that the interest rate is less effective for the inflation in Macedonia than the exchange rate and the money supply, Jovanovski et al. (2005), Velickovski (2006) and Petrevski and Bogoev (2012), who find that the interest rate pass through is weak.

Hence, it could be concluded that the existing empirical literature seems to suggest that the ability of monetary policy to affect economic activity in Macedonia is rather limited. This could be explained by the surplus liquidity in the Macedonian banking system. Namely, Macedonian banks have constantly more deposits than credits and keep high liquid reserves. For this reason, they do not need to borrow from the central bank, but just invest the excess reserves in CB bills. This means that the central bank interest rate serves only as an opportunity cost for the commercial banks, which weakens its relationship with the commercial banks' actions.

Literature on monetary policy effectiveness under surplus liquidity is scarce. Saxegaard (2006) analyses monetary policy effectiveness in three Sub-Saharan economies (the CEMAC region, Nigeria and Uganda) characterised by excess liquidity. He distinguishes between excess reserves held for precautionary motives and involuntary excess reserves, and uses a regime-switching VAR, with two regimes, corresponding to periods with high and low involuntary reserves. He finds that monetary policy is more effective when the involuntary reserves are low. Similar analysis and findings are present in Bathaluddin et al (2012), for Indonesia. These two papers, however, do not discuss the effectiveness of alternative monetary policy instruments. Hence, this paper will fill an important gap in the existing literature.

IV. Econometric analysis

The previous discussion points out that proper attempts to analyse effectiveness of monetary policy in Macedonia should take into account several specificities. **The first** refers to the notion that the interest rate is not the only instrument that the central bank uses in its efforts to affect the economy. As was already mentioned, the reserve requirement is used standardly, while banks also have access to overnight deposits and credits and seven-day deposits at the NBRM. **The second feature** is related to the surplus liquidity in the banking system. Due to the surplus liquidity, monetary policy operations are conducted with the purpose to withdraw liquidity from the system, not to inject. This has as a further implication that rationing the amount of CB bills offered on the auctions can leave commercial banks with more reserves that they wish to hold. Banks may then use these reserves to extend credit. In other words, due to the surplus liquidity, the amount of CB bills offered on the auctions can be considered as a monetary policy instrument. **The third specificity** arises from the fact that during the analysed period there have been two main types of CB bills auctions. In the first type, the central bank limits the amount of CB bills and usually allows the interest rate to fluctuate. Under the second type, the central bank fixes the interest rate, but leaves the amount of CB bills on the auctions unlimited. The two types of CB bills auctions imply that there may be differences in the monetary policy transmission to the real economy between the two regimes, and that the appropriate way to analyse monetary policy would be in a framework that allows for this, i.e. in a regime-switching framework.

IV.A. Methodology

As standard in the literature, we analyse the effectiveness of monetary policy in Macedonia in a VAR framework. The main advantage of the VAR over some alternative techniques (e.g. the Generalized Method of Moments) is that it allows tracking the relationships between the endogenous variables dynamically, i.e. over time, through the impulse responses.

If Y_t is a vector of endogenous variables, the VAR model can be expressed as:

$$Y_t=DX_t + C(L)Y_t + \varepsilon_t \quad (1)$$

where X_t is a vector of exogenous variables, D is a matrix with coefficient on the exogenous variables, ε_t is a vector of the residuals with variance-covariance matrix Σ, *and* C(L) is a lag polynomial, i.e.:

$$C(L)Y_t = C_1y_{t-1} + C_2y_{t-2} + \dots + C_py_{t-p} \quad (2)$$

where p is the number of lags of the endogenous variables.

The VAR is identified in the following way:

$$u_t=B^{-1}A\,\varepsilon_t \quad (3)$$

where u_t is a vector of the structural shocks, B is a diagonal matrix, A is a matrix which shows the contemporaneous relationships between the endogenous variables, and $A\Sigma A'=BB'$.

As was mentioned, for illustration purposes, we begin the analysis with the simplest three-variable monetary VAR with GDP, inflation and the central bank interest rate. The identification of the monetary policy shock is done by the Choleski decomposition of the variance-covariance matrix of the VAR residuals (Σ), with ordering GDP-inflation-interest rate. Formally, equation (3) in this case becomes:

$$\begin{bmatrix} u^{GDP} \\ u^{inf} \\ u^{IR} \end{bmatrix} = \begin{bmatrix} b_{11} & 0 & 0 \\ 0 & b_{22} & 0 \\ 0 & 0 & b_{33} \end{bmatrix}^{-1} \begin{bmatrix} 1 & 0 & 0 \\ a_{21} & 1 & 0 \\ a_{31} & a_{32} & 1 \end{bmatrix} \begin{bmatrix} \varepsilon^{GDP} \\ \varepsilon^{inf} \\ \varepsilon^{IR} \end{bmatrix} \quad (4)$$

where *a's* and *b's* are coefficients that need to be estimated. The matrix A, which gives the contemporaneous (i.e. in one-month time) relationships between the variables is read in the following way. The *first column* shows how the first variable in the system (GDP) affects the other variables, the second column shows how the second variable (inflation) affects the other variables etc. Similarly, the *first row* shows how the first variable (GDP) depends on the other variables in the system, the second row how the second variable depends on the other variables etc. Hence, the identification from equation (4) posits that GDP can affect inflation and the interest rate contemporaneously, inflation can affect the interest rate, and the interest rate cannot affect neither GDP nor inflation in the current month, due to time lags in the conduct and transmission of monetary policy.

In the second stage of the analysis, we move to a VAR that in our opinion captures the above-mentioned three specific features of the monetary policy conduct in Macedonia. This is a regime-switching VAR of the following form:

$$Y_t=I_1[D^1X_t + C^1(L)Y_t]+ I_2[D^2X_t + C^2(L)Y_t] + \varepsilon_t \quad (5)$$

I_1 *and* I_2 are indicator functions, taking a value of 1 if the economy is the regime 1 and 2, correspondingly. The regimes are determined exogenously, depending on the type of the CB bills auction at the time. Regime 1 refers to periods with limited amount of CB bills offered on

the auctions, while regime 2 refers to periods with unlimited amount. Table 1 shows the incidence of the two regimes.

Besides the two regimes, this VAR differs from the previous VAR in another respect. It includes several monetary policy variables, in order to reflect the first two features identified above. More precisely, instead of just the interest rate, the VAR now includes three monetary policy variables – the amount of CB bills sold on the auctions, the interest rate and the reserve requirement ratio. We exclude the inflation in this case, for two reasons. The first refers to parameter proliferation. The estimated version of the VAR has 77 parameters, estimated on 160 observations. If we include inflation, the number of parameters would increase to 104, which seems too high for efficient estimation with 160 observations. As a result, there is a risk that the obtained impulse responses would be insignificant. The second reason is that we are primarily interested in comparing the effectiveness of the different monetary instruments, not in analysing the whole transmission process. Therefore, if an instrument is found to be more effective for the real economy, it is likely to be more effective in affecting the inflation, too. Omitting the inflation should not represent a major problem econometrically, as long as the effects of past values of inflation are captured by the lags of the included variables and as long as the current shocks to inflation are uncorrelated with the monetary policy shocks.

Similarly, we omit from the analysis the foreign reserves or the pressures on the foreign exchange market. Existing studies on Macedonian monetary policy have found that the foreign reserves are important for the monetary policy (see Jovanovic and Petreski, 2012). Similarly, developments on the foreign exchange market may affect the choice of the type of the auction. But, this does not imply that the foreign exchange reserves or the foreign exchange interventions affect the real economy or the transmission process. As long as they do not, there is no need to include them explicitly in the VAR, in light of the increased number of parameters.

The identification of this VAR is done as follows. Under the first regime, with limited CB bills, equation (3) becomes:

$$\begin{bmatrix} u^{GDP} \\ u^{bills} \\ u^{IR} \\ u^{RR} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}^{-1} \begin{bmatrix} 1 & a_{12} & 0 & a_{14} \\ a_{21} & 1 & 0 & a_{24} \\ a_{31} & a_{32} & 1 & a_{34} \\ a_{41} & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \varepsilon^{GDP} \\ \varepsilon^{bills} \\ \varepsilon^{IR} \\ \varepsilon^{RR} \end{bmatrix} \quad (6)$$

Under the second regime, with unlimited CB bills, equation (3) becomes:

$$\begin{bmatrix} u^{GDP} \\ u^{bills} \\ u^{IR} \\ u^{RR} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}^{-1} \begin{bmatrix} 1 & a_{12} & 0 & a_{14} \\ a_{21} & 1 & a_{23} & a_{24} \\ a_{31} & 0 & 1 & 0 \\ a_{41} & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \varepsilon^{GDP} \\ \varepsilon^{bills} \\ \varepsilon^{IR} \\ \varepsilon^{RR} \end{bmatrix} \quad (7)$$

Equation (6) implies that, with limited CB bills, GDP can affect all the monetary policy instruments contemporaneously, same as before. The amount of CB bills sold can affect economic activity contemporaneously, because banks will have more/less money for extending credits. The amount of CB bills sold can affect the interest rate, too, because banks bid with the interest rate. The interest rate affects none of the included variables contemporaneously –

economic activity takes time to respond, the amount of CB bills is pre-determined (because the realized amount is usually the maximum allowed) and the reserve requirement is assumed to evolve independently. The reserve requirement affects all the other variables contemporaneously – the GDP and the CB bills through the available money, and the interest rate, because it is not pre-determined.

With unlimited CB bills, there are some differences in the contemporaneous relationships between the monetary instruments, as can be seen from equation (7). The first difference refers to the notion that now the amount of CB bills cannot affect the interest rate, because the interest rate is now pre-determined (third row, second column in matrix A). The second difference is that the interest rate can affect the amount of CB bills now (second row, third column in matrix A), because the amount of CB bills is not limited. The final difference is that the reserve requirement cannot affect the interest rate in this regime (third row, fourth column), because the interest rate is pre-determined.

All the VARs will include EU industrial production (current value and one lag), as exogenous variable, to proxy for foreign economic activity. All the VARs will also include a deterministic trend, to ensure stability in presence of potentially non-stationary variables. The number of lags in the VARs is determined on the grounds of the Schwarz information criterion. In the initial VAR, with only the interest rate as a monetary instrument, the Schwarz criterion suggested two lags, while in the other VARs, it suggested only one lag.

The assessment of the monetary policy effects will be done on the grounds of the impulse response functions.

IV.B. Data

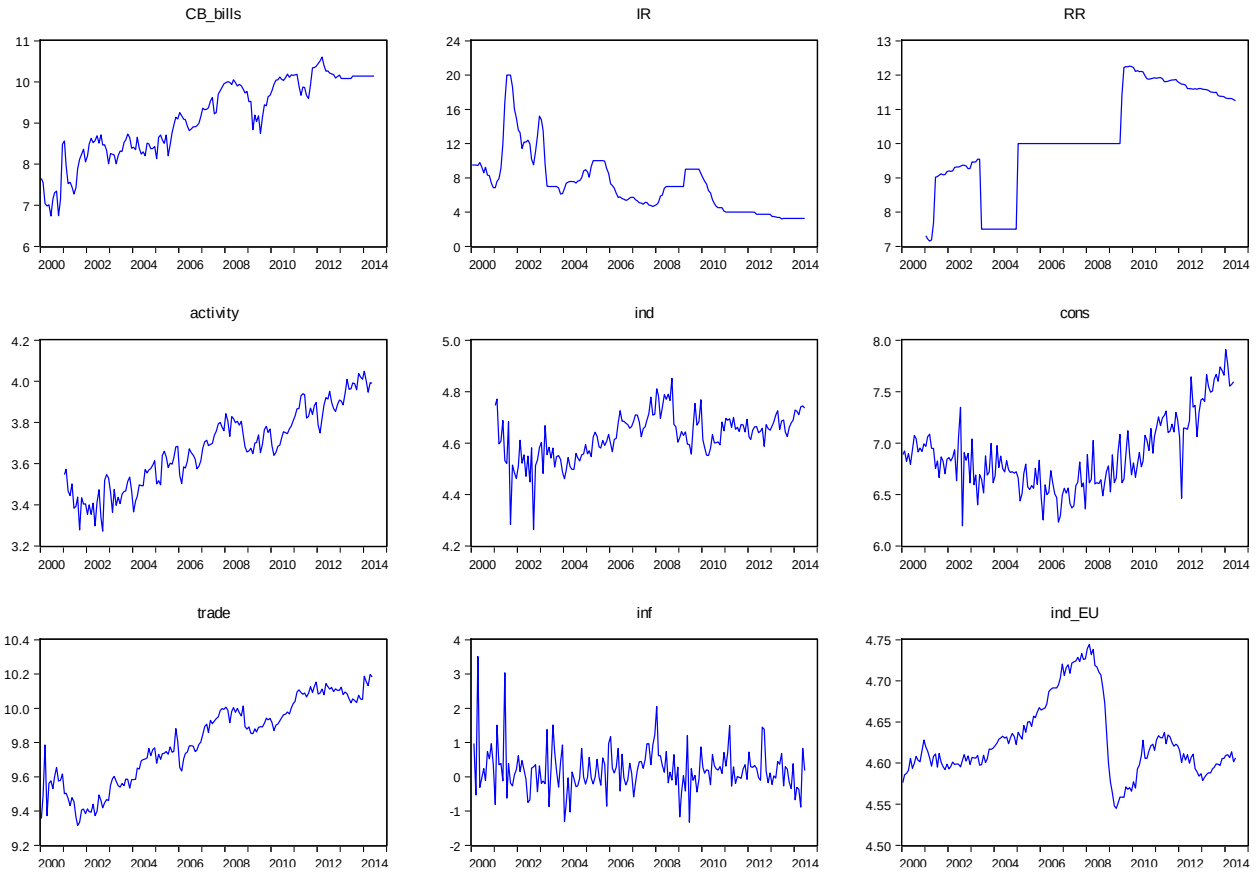
Monthly data are used in the analysis, to increase the number of observations. Since GDP data are unavailable on a monthly frequency, we will use an indicator of the economic activity, constructed from the three main economic sectors in Macedonia on which there are reliable monthly data – industrial production, turnover in trade and value of completed construction works. These three sectors constitute approximately 45% of the total value added in the economy and absorb around 50% of the bank credits. The three series are seasonally adjusted, using the Census X12 method, assuming multiplicative seasonal factors. Data on trade and construction are nominal and are transformed into real, by dividing with the consumer price index (CPI). The three series are then expressed as indices, with the value from January 2001 set as the base value (i.e. equal to 1). Then, the aggregate indicator is constructed as a weighted average of the three series, with weights equal to the shares of the three sectors in GDP in the corresponding periods. The final series enters the regressions in its log-form.

The data on industry, trade and construction are from the State Statistical Office of the Republic of Macedonia (SSORM). CPI is also from SSORM. Inflation, which enters the initial VARs, is month-on-month CPI inflation. EU industrial production is from Eurostat and refers to EU-28.

In addition to the specification with the aggregate economic activity indicator, we will also estimate VARs with each of the individual indicators, to see if different sectors respond differently to monetary policy.

The three monetary instruments variables are from the National Bank of the Republic of Macedonia. The basic monetary policy instrument of the NBRM is the key interest rate of the NBRM, which is the interest rate on the Central Bank bills. It includes the bills with all maturities. The analysis also includes the amount of CB bills bought on the auctions, because in the regime with limited CB bills, the amount can be considered as an instrument, as previously explained. The third monetary instrument that is taken into consideration is the reserve requirement ratio, which obliges the banks and savings houses to allocate funds on the accounts with the central bank, and hence, affects banks' ability to extend credit. The variables are presented in Figure 4.

Figure 4 – Variables used in the analysis



Sources: State Statistical Office of the Republic of Macedonia, National Bank of the Republic of Macedonia and Eurostat.
Notes: **CB_bills** stands for the amount of CB bills sold on the auctions in the corresponding time period. **IR** is the average interest rate on those auctions. **RR** is the reserve requirement ratio. **Inf** is the month-on-month CPI inflation. All these variables are expressed as percent. **Activity** is the index of economic activity. **Ind** is the Macedonian industrial production index. **Cons** is the value of completed construction works. **Trade** is the turnover in total trade. **Ind_EU** is the EU-28 industrial production index. These variables are expressed as natural logarithms.

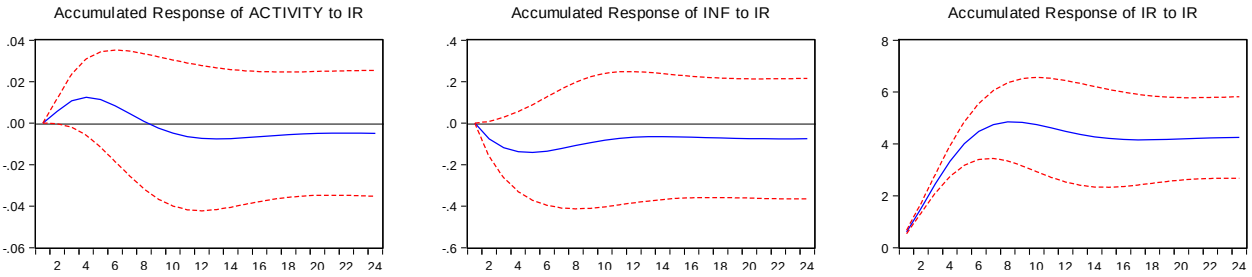
IV.C. Results

The impulse responses to a one-standard deviation shock in the interest rate obtained from simple three-variable VAR are presented first, in Figure 5. In the first row, the aggregate economic activity indicator is used. The error bands at the first two panels (left and centre) are very wide and always include the zero line, suggesting that the responses of the economic activity and the inflation to exogenous shifts in the central bank interest rate are insignificant.

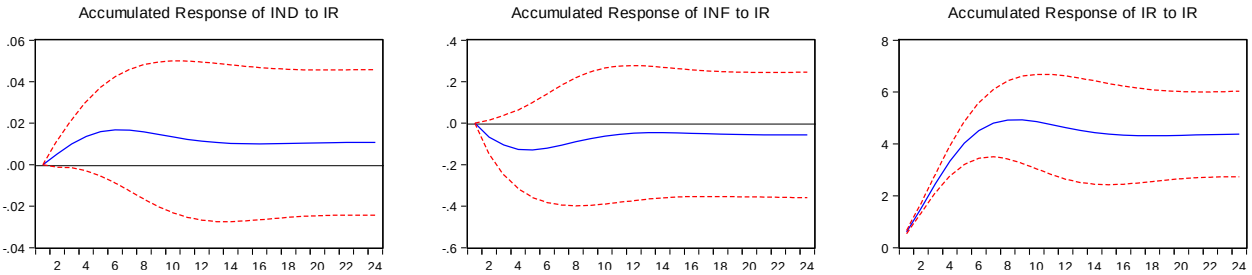
In the next three rows in Figure 5, we replace the aggregate activity indicator with the sectoral indicators. More precisely, in the second row, economic activity is proxied by the industrial production, in the third, by the turnover in trade, while in the fourth, by the construction. In all three cases the responses are almost identical to the initial ones with the aggregate index. In other words, based only on these VARs, one would conclude that monetary policy in Macedonia cannot affect real economic activity, that we argue is not the complete answer.

Figure 5 – Impulse responses to shocks in the interest rate (three-variable VAR)

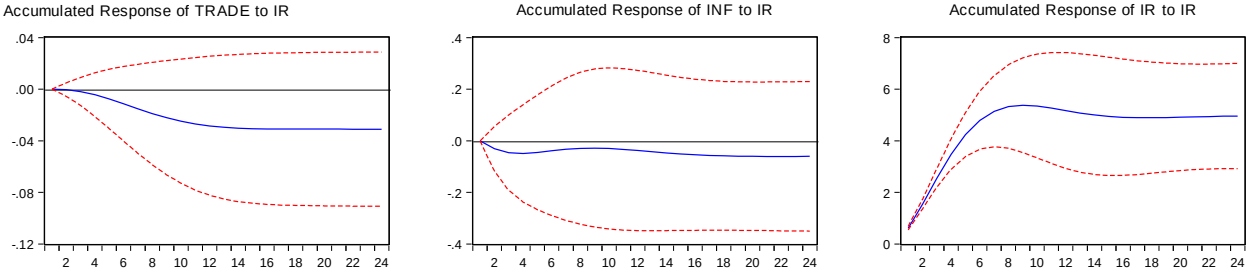
VAR with aggregate activity indicator



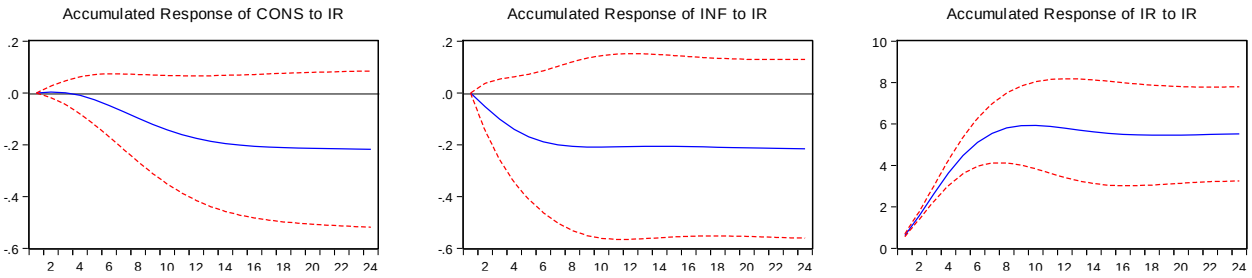
VAR with industrial production



VAR with trade

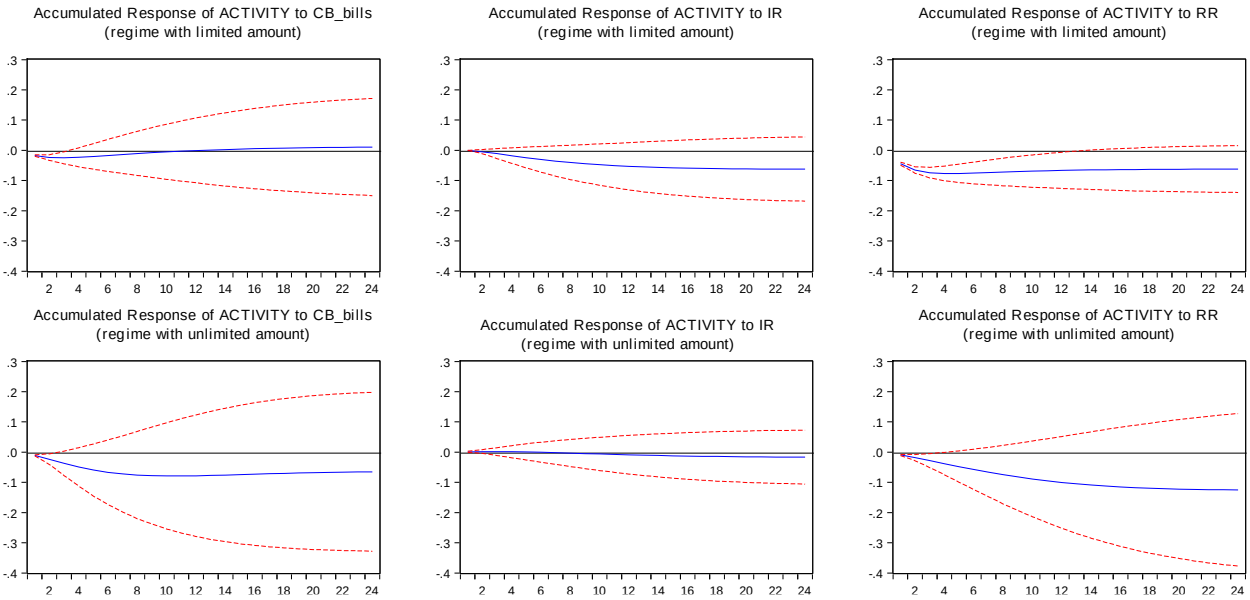


VAR with construction



The impulse responses from the second, regime-switching VAR are presented next. For clarity, we present only the responses of the economic activity variable to the three monetary-policy variables. We begin with the aggregate activity indicator, in Figure 6. The first row of the figure responds to the first regime (limited CB bills), while the second row responds to the second regime (unlimited CB bills). Several things are worth noting from this Figure. The first one is that the responses to the interest rate (middle column) are insignificant in both the regimes, just as in Figure 5. This implies that the central bank interest rate is indeed not very effective for the economic activity. The second thing is that there are notable differences in the responses to the other two instruments between the two regimes. The CB bills effect (first column) is significant for longer period of time under the first regime (3 periods vs. 1 period). This is hardly surprising – with auctions with limited amount of CB bills (the first regime), the amount of CB bills acts as a monetary instrument – if the central bank offers less CB bills, commercial banks are likely to remain with some excess reserves. This will result in more money for credit activity, which will eventually lead to higher economic activity for several months. With auctions with unlimited amount of CB bills (the second regime), on the other hand, this mechanism is largely absent. Similarly, the reserve requirement effect (third column) is much more pronounced in the first regime, when it seems to have effects on economic activity for 12 months, differently from the second regime, when it has only a temporary effect that is significant for only one month. It means that the decrease of reserve requirement ratio under limited CB bills auctions should better transmit into credit supply and consequently over economy considering limitation on CB bills as alternative placement for the banks. These differences between the regimes suggest that the regime under which the amount of CB bills is limited is likely to result in a more effective monetary policy. Therefore, central banks operating under surplus liquidity in the banking system should switch to this often-called active type of open market operations. The third thing to note from the figure is that from the three analysed instruments, the reserve requirement is likely to have strongest effects on economic activity, leading to the implication that the reserve requirement should be actively used by the monetary authorities when they operate under excess liquidity.

Figure 6 – Responses of aggregate economic activity to changes in CB bills, IR and RR



We next present the responses from the VARs with the sectoral indicators. Figures 7, 8 and 9 show the impulse responses of industrial production, construction and trade, respectively, to the monetary instruments. The picture is qualitatively very similar to the one about the aggregate activity indicator. One thing that can be noticed when one compares the three figures is that the responses of the construction seem to be strongest. For example, the response of the construction to the reserve requirement under the first regime goes to approximately -0.5 (Figure 8, top right panel), while the corresponding responses of the industry and trade are about -0.1. This could happen if commercial banks place the reserves they unwillingly left with in mortgages, not in consumer loans (historically, data on banks' credits confirm a gradual increase in the share of mortgage lending to households, as well as stronger lending to construction corporate sector, although both still being at a moderate level).

Figure 7 – Responses of industrial production to changes in CB bills, IR and RR

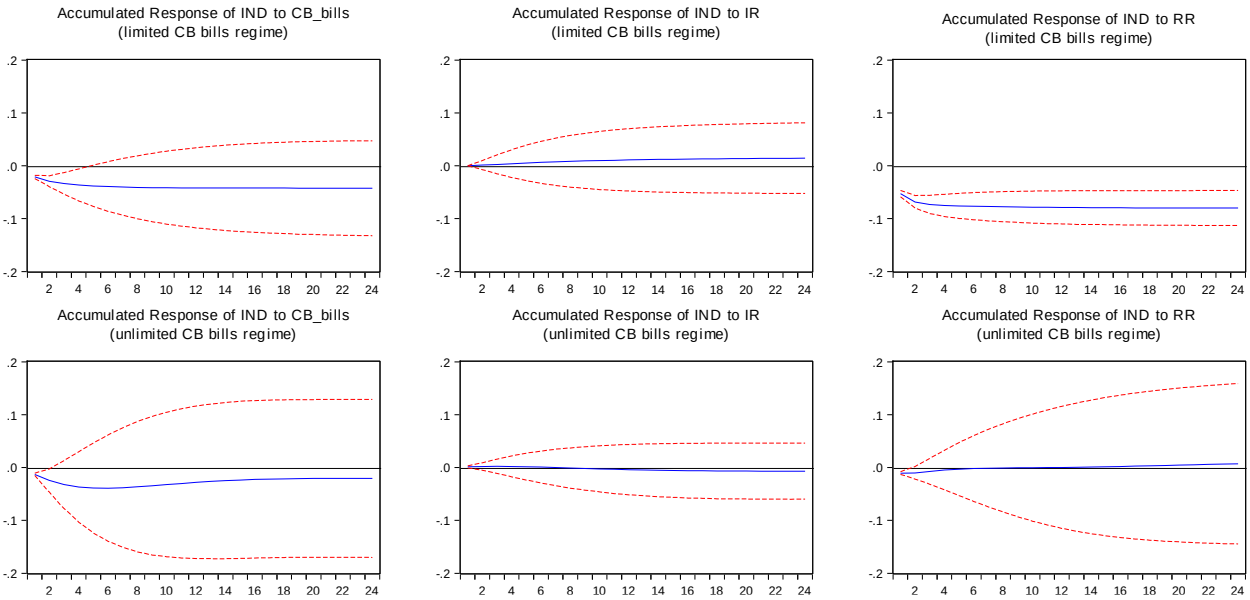


Figure 8 – Responses of construction to changes in CB bills, IR and RR

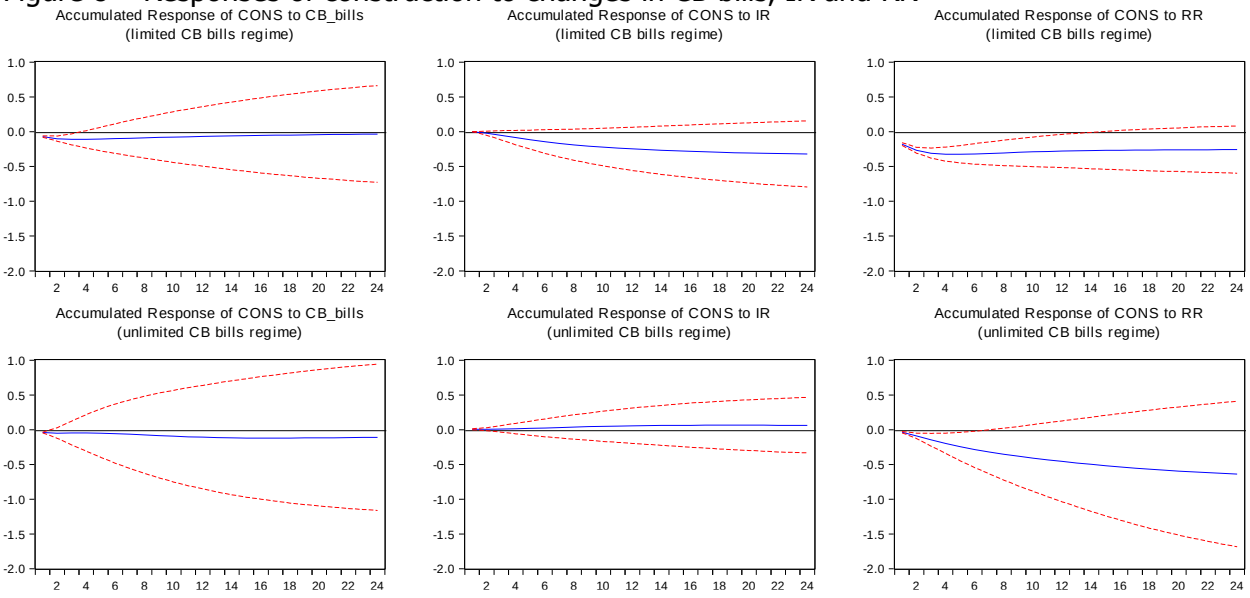
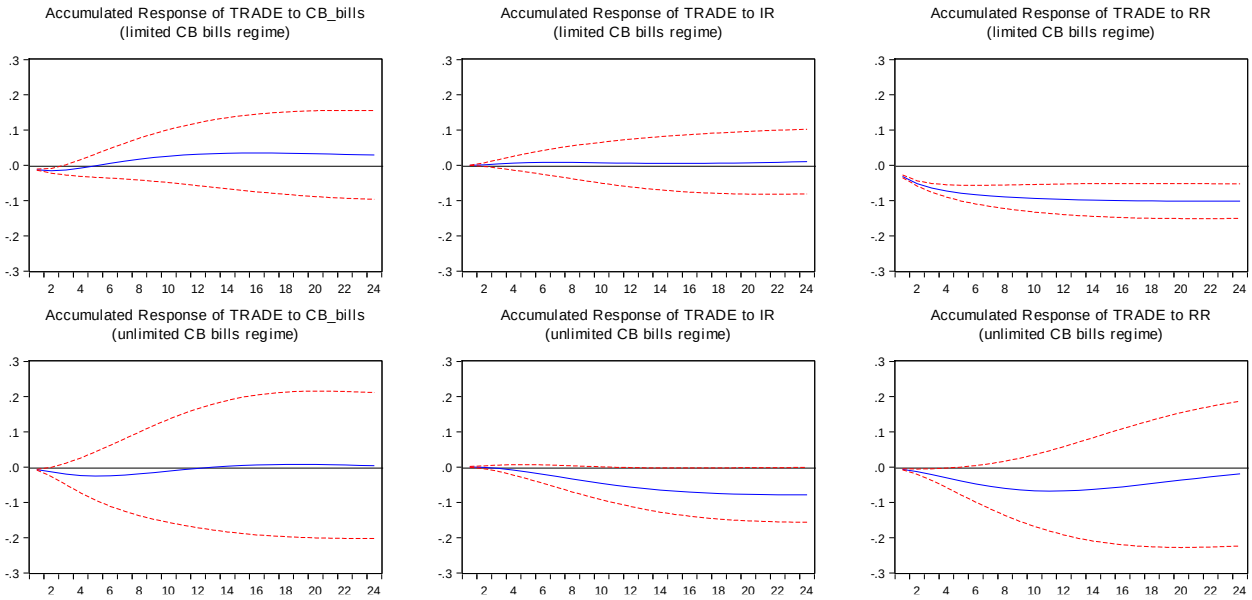


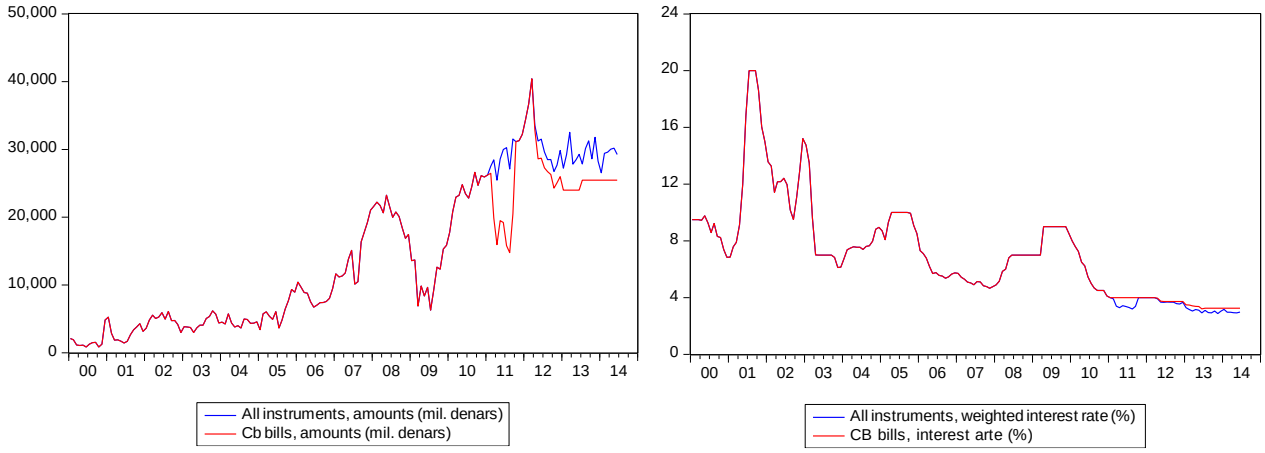
Figure 9 – Responses of trade to changes in CB bills, IR and RR



IV.D. Robustness

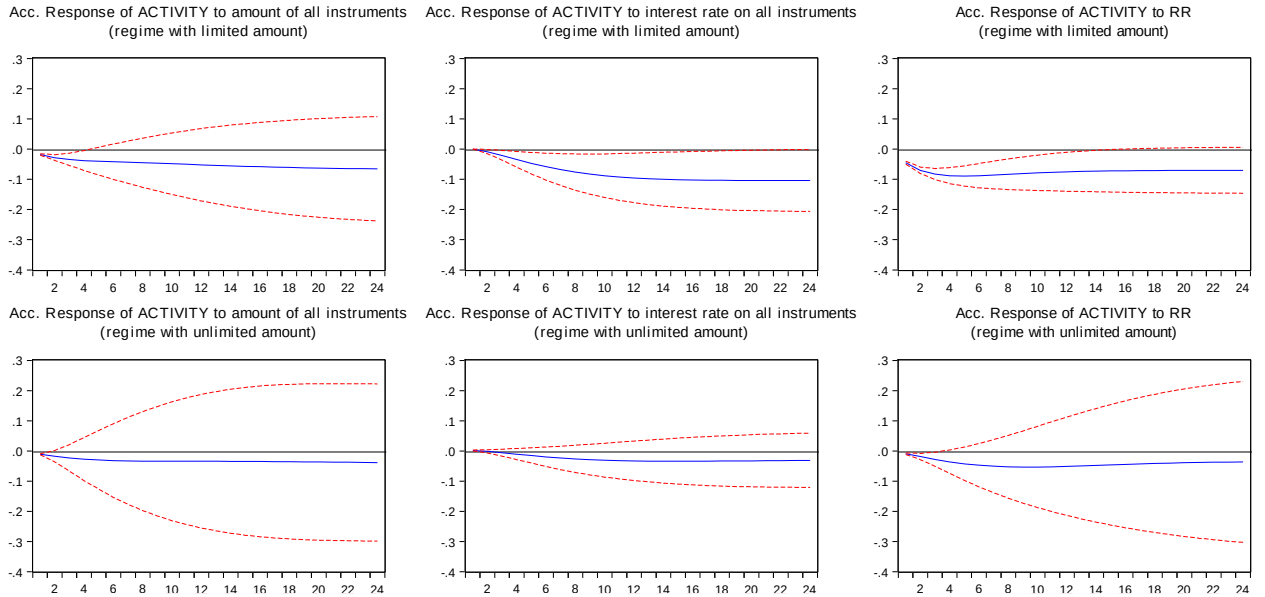
We do three robustness checks. In the first one, we include all the monetary instruments that the NBRM uses instead of just the three that were included so far. As was mentioned in section II, during 2011 there was a 6-month deposit facility, which was abandoned towards the end of the year. The overnight and 7-day deposit facilities were introduced in April 2012. Also, 2011 saw the start of the repurchasing operations scheme of the NBRM, which were used rather regularly in 2012-2014. Although these instruments are still relatively small compared to the CB bills, they should not be neglected. For example, during 2011, the amount of CB bills was lowered at the expense of the 6-month deposits, as a result of which the amount of 6-month deposits at the NBRM in August 2011 was quite close to the amount of CB bills that the banks held. Looking at the CB bills only, therefore, one would conclude that during 2011, monetary policy was accommodative, because the liquidity withdrawn from the system through the CB bills was declining. Looking at the CB bills and the 6-month deposits together, however, one would conclude the opposite, because their joint amount was increasing, because the liquidity was withdrawn mainly through the 6-month deposits. A comparison between the amount and interest rates on the CB bills and on all the instruments is shown in Figure 10. It can be noticed that, since 2011, the amount of all the instruments is almost always higher than the amount of CB bills. The opposite holds for the interest rates, i.e. the weighted interest rate on all the instruments is marginally lower than the interest rate on the CB bills.

Figure 10 – Comparison between amounts and interest rates on CB bills and on all instruments



The results from the VAR with all the instruments are presented in Figure 11. The impulse responses are very similar to those from before, signifying robustness of the findings. The only difference from Figure 6 is that the response to the interest rate in the regime with limited amount (middle panel, top row) is now significant. This suggests that the additional instruments that have been introduced since 2011 contributed to the strength of the price impacts of the overall instruments (although the effect is small and period of their implementation is relatively short to make stronger conclusions).

Figure 11 – Responses of aggregate activity indicator to changes in monetary policy, VARs with all instruments



In the second exercise, we shorten the sample on which we do the analysis. First, we eliminate the first three years (approximately 20% of the observations), so that the sample then becomes 2004-2014. In this way we eliminate the period of internal conflict in Macedonia, from 2001. Then, we eliminate the last three years, so that the sample then becomes 2001-2011, eliminating big part of the Great Recession. The results, presented in Figures 12 and 13, seem to suggest no major differences between these responses and the previous ones.

Figure 12 – Responses of aggregate activity indicator to changes in monetary policy, shortened sample (2004-2014)

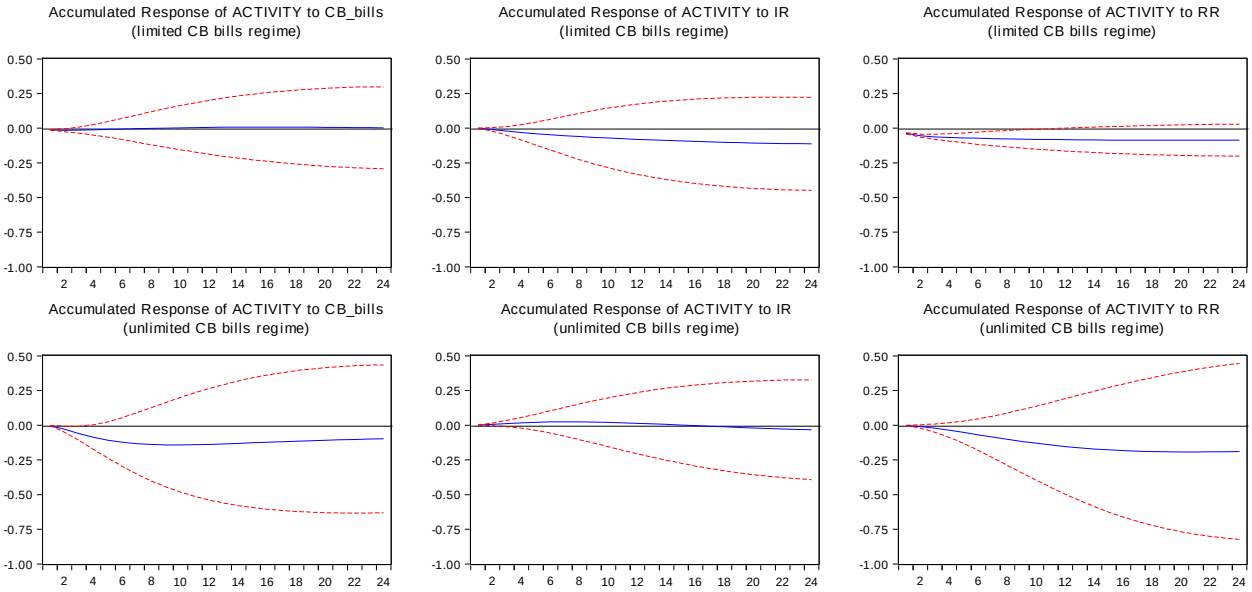
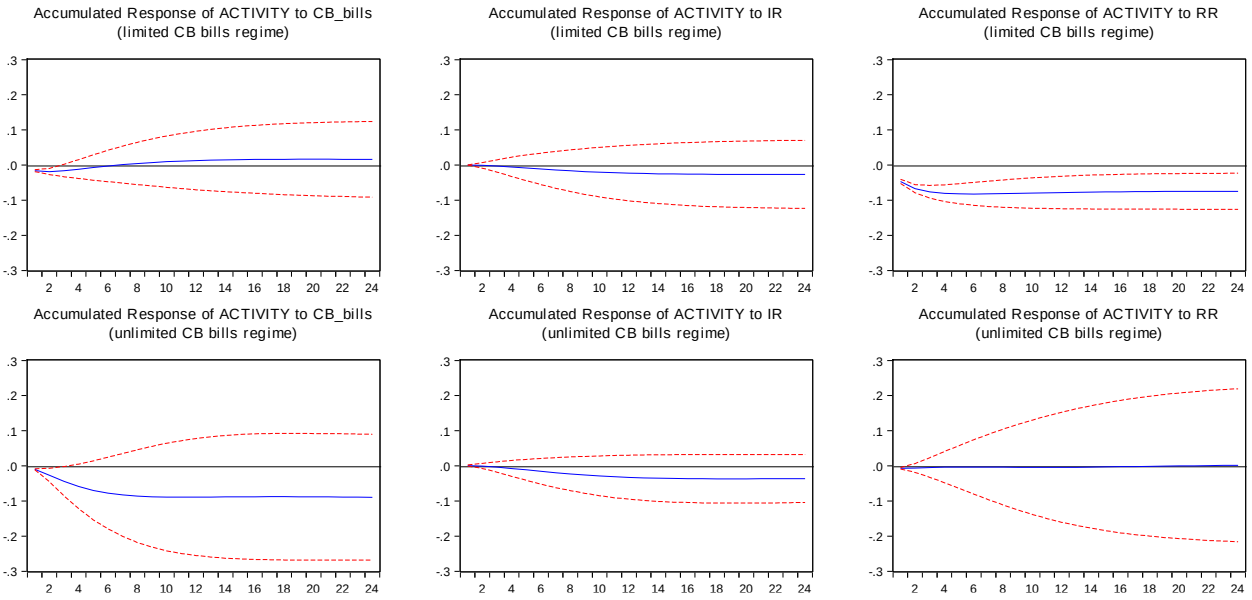
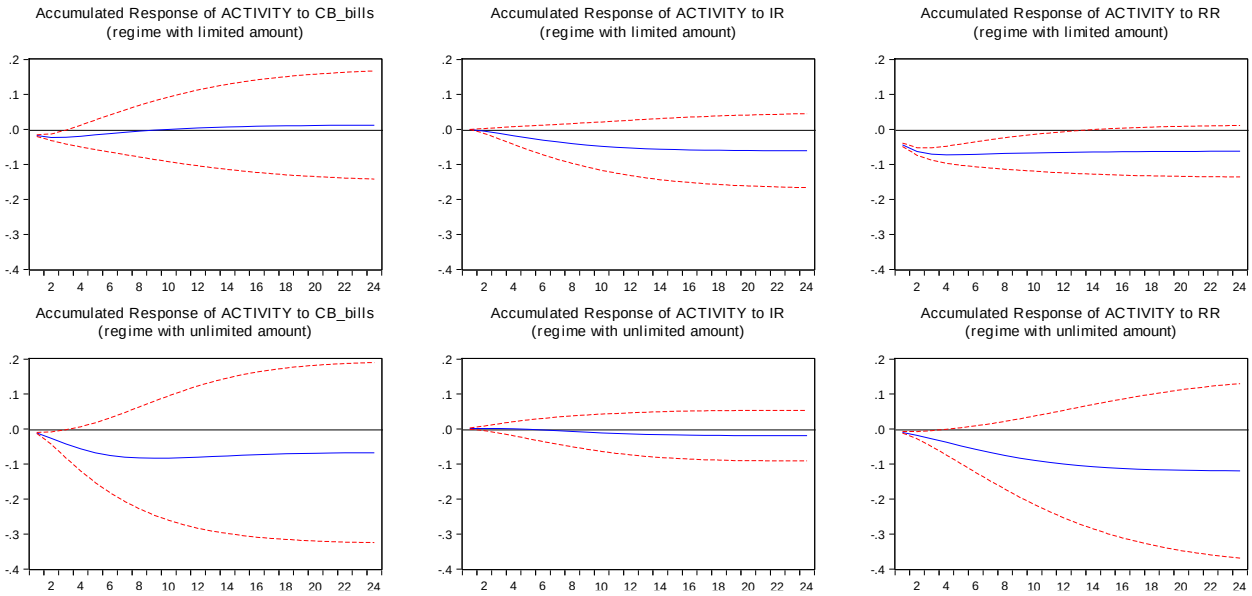


Figure 13 – Responses of aggregate activity indicator to changes in monetary policy, shortened sample (2001-2011)



In the third exercise, we add the ECB main refinancing rate as additional exogenous explanatory variable. The ECB rate should be correlated with the set of Macedonian monetary instruments. If it also somehow correlated with Macedonian economic activity through some channel which is not already included in the VAR, it may affect the results. The impulse responses obtained from this specification are shown in Figure 14. As can be seen, results are virtually unchanged.

Figure 14 – Responses of aggregate activity indicator to changes in monetary policy, with ECB rate included



V. Conclusions and policy recommendations

The economies with liquidity surplus in the banking system represent a specific environment for monetary policy implementation. With surplus liquidity banks have strong liquidity position and no need to borrow from the central bank. Therefore the policy rate for them is not a financing cost, but only an opportunity cost. This further hurts the monetary policy transmission via interest rate channel and raises questions about possible other channels or instruments through which monetary policy could influence the real sector of the economy.

Macedonian banking system is also characterized by surplus liquidity. In this paper, we tried to provide arguments for the ability of the monetary policy of the NBRM to influence the real economy under surplus liquidity, when taking into account all available monetary policy instruments – the reserve requirement, the policy rate and the amount of CB bills offered on the auctions. We used regime-switching VAR, with two regimes, corresponding to the two main different ways in which open market operations have been conducted in Macedonia – with limited amount of CB bills on the auctions and floating interest rate, and with fixed interest rate and unlimited amount of CB bills. We then investigated the responses of economic activity to changes in the policy instruments.

The results have shown that, as expected, the interest rate is ineffective regarding the aggregate economic activity and the sectoral indicators (industry, trade and construction), or only weakly effective when taking into account all instruments in place. On the other hand, we found that the amount of CB bills sold as well as reserve requirements ratio influenced the

economic activity indicators and these results remained robust after the tests that we conducted. However, it should be taken into account that in some cases the effects are rather small and borderline significant, therefore providing only indication for the relative effectiveness among different instruments over economy. From the operational viewpoint, it is worth to mention the links among different instruments and their specific position within the overall set of instruments that could vary in different periods. The indicated advantage of the instruments producing the volume impact could be expected considering possibility for direct impact over banks' funds that probably is valid regardless of the type of monetary policy framework. Anyway, in the banking system with already existing excess liquidity, the direct impact over banks' funds would possibly trigger stronger impact over banks' behavior considering the costs of operation and their overall efficiency under excess liquidity.

These findings have implications both for the analysis and the conduct of monetary policy in economies with surplus liquidity. Regarding analysis, the implication is that the traditional approach, which considers only the role of the interest rate in the monetary policy transmission, is likely to lead to wrong conclusions. Regarding monetary policy implementation, the implication is that monetary authorities, besides on the price impact of the interest rate, should additionally rely on the reserve requirement and other available instruments producing volume impact.

This paper is focused only on the part of the monetary policy transmission that goes from the monetary policy to the economic activity. Since the main interest of the central bank is to keep inflation low and stable, it would be worthwhile investigating the inflation in this context, and that should be a topic for some future work.

References

Axilrod, S. H., 1996. Transformations to open market operations: Developing economies and emerging markets (Economic issues), DC: International Monetary Fund

Bagliano, Fabio C. and Favero, Carlo A., 1998. "Measuring monetary policy with VAR models: An evaluation," European Economic Review, Elsevier, vol. 42(6), pages 1069-1112, June.

Bathaluddin, M. Barik, Nur M., Adhi P. and Wahyu A.W., 2012. "The Impact Of Excess Liquidity On Monetary Policy", Bulletin of Monetary Economics and Banking, January 2012, Bank Indonesia

Bernanke, Ben S. and Blinder, Alan S., 1992. "The Federal Funds Rate and the Channels of Monetary Transmission," American Economic Review, American Economic Association, American Economic Association, vol. 82(4), pages 901-21, September.

Bernanke, Ben S. and Ilian Mihov, 1998. "Measuring Monetary Policy," The Quarterly Journal of Economics, MIT Press, MIT Press, vol. 113(3), pages 869-902, August.

Besimi, F., G. Pugh and N. Adnett, 2006. "The monetary transmission mechanism in Macedonia: implications for monetary policy", Working Paper No. 02/2006, Institute for environment and sustainability research

Christiano, Lawrence J. and Eichenbaum, Martin and Evans, Charles L., 1999.
"Monetary policy shocks: What have we learned and to what end?," Handbook of Macroeconomics, Elsevier, in: J. B. Taylor and M. Woodford (ed.), Handbook of Macroeconomics, edition 1, volume 1, chapter 2, pages 65-148
Elsevier.

Fetai, Besnik and Izet Zeqiri, 2010. "The Impact Of Monetary PolicyAnd Exchange Rate Regime On Real GDP And Prices In The Republic Of Macedonia," Economic And Business Review, Vol. 12, No. 4, pp. 263–284

Gali, J., 2008. Monetary Policy, Inflation and the Business Cycle: An Introduction to the New Keynesian Framework. Princeton University Press, Princeton, NJ.

Ganley, Joe, 2002. "Surplus Liquidity: Implications for Central Banks", Lecture Series No. 3, Bank of England

Gigineishvili, Nikoloz, 2011. "Determinants of Interest Rate Pass-Through,"
IMF Working Papers 11/176, International Monetary Fund.

Jovanovic, Branimir and Petreski, Marjan, 2012. "Monetary policy in a small open economy with fixed exchange rate: The case of Macedonia," Economic Systems, Elsevier, vol. 36(4), pages 594-608.

Jovanovic, Branimir and Marjan Petreski, 2014. "Monetary policy, exchange rates and labor unions in SEE and the CIS during the financial crisis," Economic Systems, Volume 38, Issue 3, September 2014, Pages 309-332

Jovanovski, Z., Krstevska, A., Mitreska, A., Bojceva-Terzijan, S., 2005. "Monetarna transmisija preku kamatni stapki vo Republika Makedonija," NBRM Working paper 13, Skopje.

Kim, Soyoung, 1999. "Do monetary policy shocks matter in the G-7 countries? Using common identifying assumptions about monetary policy across countries," Journal of International Economics, Elsevier, vol. 48(2), pages 387-412, August.

Krstevska, Aneta, 2008. "The effectiveness of the transmission channels of the monetary policy in the Republic of Macedonia", International Journal of Economic Policy in Emerging Economies, Vol. IV, 2008;

Leeper, Eric M. and Christopher A. Sims and Tao Zha, 1996. "What Does Monetary Policy Do?," Brookings Papers on Economic Activity, Economic Studies Program, The Brookings Institution, vol. 27(2), pages 1-78.

Litterman, Robert B and Weiss, Laurence M, 1985. "Money, Real Interest Rates, and Output: A Reinterpretation of Postwar U.S. Data," Econometrica, Econometric Society, Econometric Society, vol. 53(1), pages 129-56, January.

NBRM Quarterly Report, August 2015, Appendix 1. Analysis of the monetary transmission through the interest rates in the Republic of Macedonia.

Melecky, Martin and Evgenij Najdov, 2010. "Comparing constraints to economic stabilization in Macedonia and Slovakia: macroestimates with micronarratives," Applied Financial Economics, Taylor and Francis Journals, Taylor and Francis Journals, vol. 20(9), pages 681-699.

Mishra, Prachi, Peter Montiel and Antonio Spilimbergo, 2010. "Monetary Transmission in Low Income Countries," IMF Working Papers 10/223, International Monetary Fund.

Mishra, Prachi and Montiel, Peter, 2013. "How effective is monetary transmission in low-income countries? A survey of the empirical evidence," Economic Systems, Elsevier, vol. 37(2), pages 187-216.

Peersman, Gert and Smets, Frank, 2001. "The monetary transmission mechanism in the euro area: more evidence from VAR analysis," Working Paper Series, European Central Bank 0091, European Central Bank.

Petrevski, Goran and Bogoev, Jane, 2012. "Interest rate pass-through in South East Europe: An empirical analysis," Economic Systems, Elsevier, vol. 36(4), pages 571-593.

Saxegaard, Magnus , 2006. "Excess Liquidity and the Effectiveness of Monetary Policy," IMF Working Papers 06/115, International Monetary Fund.

Sims, Christopher A, 1980a. "Macroeconomics and Reality," Econometrica, Econometric Society, Econometric Society, vol. 48(1), pages 1-48, January.

Sims, Christopher A, 1980b. "Comparison of Interwar and Postwar Business Cycles: Monetarism Reconsidered," American Economic Review, American Economic Association, American Economic Association, vol. 70(2), pages 250-57, May.

Sims, Christopher A. and Zha, Tao, 2006. "Does Monetary Policy Generate Recessions?," Macroeconomic Dynamics, Cambridge University Press, Cambridge University Press, vol. 10(02), pages 231-272, April.

Starr, Martha A., 2005. "Does money matter in the CIS? Effects of monetary policy on output and prices," Journal of Comparative Economics, Elsevier, vol. 33(3), pages 441-461, September.

Stock, James H. and Mark W. Watson, 2001. "Vector Autoregressions," Journal of Economic Perspectives, American Economic Association, vol. 15(4), pages 101-115, Fall.

Strongin, Steven, 1995. "The identification of monetary policy disturbances explaining the liquidity puzzle," Journal of Monetary Economics, Elsevier, Elsevier, vol. 35(3), pages 463-497, June.

Trenovski, Borce, 2014. "Analiza na interakciite i efektite od monetarnata i fiskalnata politika vo Makedonija", Unpublished Doctoral Thesis. Faculty of Economics, University "Ss. Cyril and Methodius", Skopje.

Uhlig, Harald, 2005. "What are the effects of monetary policy on output? Results from an agnostic identification procedure," Journal of Monetary Economics, Elsevier, Elsevier, vol. 52(2), pages 381-419, March.

Velickovski, I., 2006. "Monetarna transmisija preku kanalot na kamatni stapki i finansiski pazari vo Makedonija: sto napravivme, sto ostvarivme i sto naucivme?" NBRM Working paper, Skopje.

Velickovski, I., 2013. "Assessing Independent Monetary Policy in Small, Open and Euroized Countries: Evidence from Western Balkan". Empirical Economics 45 (1) p. 137-156.

Vrboska, Ana, 2006. "Opredeluvanje na optimalna monetarna strategija za mal ii otvoreni ekonomii," Unpublished Master's Thesis. Faculty of Economics, University "Ss. Cyril and Methodius", Skopje.

Walsh, C.E., 2003. Monetary Theory and Policy. The MIT Press, London.

Woodford, M., 2003. Interest and Prices: Foundations of a Theory of Monetary Policy. Princeton University Press, Princeton, NJ.