Alternative indicator of monetary policy stance for Macedonia[1]

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Abstract

This paper applies a SVAR model which combines different monetary policy instruments to construct an alternative indicator of monetary policy stance in Macedonia. It employs the approach introduced by Bernanke and Mihov (1995, 1998) of isolating monetary policy shocks from overall policy that otherwise react to real developments. The residuals from such VAR are cleaned from the central bank's reaction function and represent true monetary policy innovations. Further, we solve the interdependence among different monetary policy instruments contained in the residuals by developing a structural model. We use the model to extract unanticipated policy stance, as alternative view on the monetary policy.

Keywords: SVAR, monetary policy stance, monetary framework

JEL classification: E50, E52

[1] The opinions and views expressed in this paper are only those of the authors and do not necessarily reflect the position and views of the National Bank of the Republic of Macedonia. We would like to thank Branimir Jovanovic for his constructive comments.

1. Introduction

Measuring the monetary policy stance enables the central bank to determine whether monetary policy is contributing to macroeconomic and financial developments in the country in a way that insures achieving the aimed combination of inflation and output stabilization.

In this paper we apply the Bernanke and Mihov (1998) methodology to Macedonia thus building a multivariable indicator for the monetary policy stance. Unlike the policy rate which represents central bank's intentions thus depicting the intended or "de jure" monetary policy stance, our indicator tends to proxy the actual or "de facto" monetary policy stance vis-à-vis the real sector after transmission takes through and commercial banks adjust their behavior to monetary policy changes, in one way or another. Our indicator has additional advantage as it captures the effect of all monetary policy instruments applied by the NBRM. As such, it can be useful in detecting disruptions in monetary policy transmission mechanism due to shocks of various types. We also analyze inflation and GDP reaction with respect to monetary policy stance thus witnessing on NBRM's ability to react counter-cyclically and stabilize domestic economy given the constraints of the applied monetary strategy of targeting the exchange rate.

The paper is organized as follows. Section 2 provides a brief overview of the monetary policy setup in the Macedonian economy covering the monetary strategy and monetary policy instruments that the central bank applies. Sections 3 to 6 discuss the data and methodology. Section 7 documents the empirical results. Section 8 concludes.

2. Monetary policy in Macedonia

In order to achieve the principal monetary policy goal – price stability – the NBRM has been implementing a monetary strategy of targeting the nominal exchange rate of the Denar against the Euro (prior 2002 against the Deutsche Mark) been effective since October 1995. Thus, the NBRM pursues the nominal exchange rate as intermediate monetary policy target.

In order to pursue its intermediate and final objectives, the NBRM applies a range of monetary policy instruments. The monetary policy instruments setup of the NBRM is determined by the exchange rate targeting framework and the specifics of the banking sector in the country as monetary policy counterpart.

As to sustain the stability of the exchange rate the NBRM performs direct interventions on the foreign exchange market by purchase/sale of foreign currency. Over the 2005–2013 period, central bank's foreign interventions were predominantly net-purchases of foreign currency, thus contributing to a significant accumulation of foreign reserves as an important element for successful exchange rate targeting strategy. Exemption was the global crisis in its acute phase of late 2008-early 2009 when NBRM suffered massive loss in gross foreign reserves as to sustain the stability of the exchange rate. The shock was short-lived with losses being largely recovered as soon as the end of 2009. Since then, gross foreign reserves are generally on a growing path thus credibly supporting the exchange rate peg.

With respect to domestic liquidity management, the NBRM uses a set of various market-based monetary instruments. The main monetary policy instruments available to the NBRM are: open market operations, reserve requirements and deposit facility. Open market operations are the most important and most flexible monetary policy instrument of the NBRM with the purpose to steer interest rates, manage liquidity conditions in the banking sector and signal monetary policy stance. The underlying instruments for open market operations include CB bills auctions, repo operations and outright transactions. Due to predominant purchases of foreign exchange, open market operations conducted by the NBRM are principally used with a view to mopping up excess liquidity in the banking sector. Hence, over 2000–2013 period, CB bills hold the main role in managing liquidity with their interest rate representing the key policy rate of the central bank. As to address short-term liquidity shortage in the banking system, NBRM conducts liquidity-providing repo operations. In conditions of short-term excess liquidity, banks may place funds with the NBRM in deposit facility. Reserve requirement as standard instrument is also applied by NBRM to directly influence money and credit supply.

3. Excess reserves – an intermediate target (commitment device) of monetary policy in Macedonia

This section represents an adaptation from Lang and Krznar (2004) and aims at explaining the rationale behind using excess reserves in our monetary policy model. A number of different monetary instruments the NBRM has used during the period under consideration makes their joint assessment in the analysis of monetary policy necessary. Since most measures were tailored to support the domestic liquidity management (base money), they can be combined. As shown below, these measures have influenced both money supply and money demand. In order to use the base money as a policy variable, it needs to be adjusted for the changes in reserve requirement, which were common during the analyzed period. Otherwise the growth of the base money that results from the increase in required reserve could be interpreted as monetary easing, while the opposite is true.

Following Lang and Krznar (2004), the connection of excess liquidity and other monetary policy instruments is explained in the following accounting framework. The framework relies on the concept of demand (Rd) and supply (Rs) of commercial banks' reserves at the NBRM:

(1) $Rd = RR(rr,RB) + ER$

(2) $\Delta Rd = \Delta RR + \Delta ER = rr^* \Delta RB + RB^* \Delta rr + \Delta ER$

The demand for reserves (Rd) is equal to required reserves (RR) and excess reserves (ER). "In a developed financial system, such as in the Eurozone, with well-functioning marginal facilities, the preferred excess reserves are zero. However, if there is a shallow and inefficient money market and standing facilities are non-existent or expensive, commercial banks may prefer to hold positive excess reserves. The (preferred) excess reserve can be modelled as a function of the cost of the use of credit facility (difference between interest rate on credit facility and money market interest rate)" [Lang and Krznar, 2004].

Excess reserves as positive deviations from required bank reserves might be used by the banks as a buffer to cover unforeseen changes in the supply of central bank money. The settlement banks usually prefer to have accounts at the central bank because this gives them direct access to the ultimate source of domestic liquidity [adaptation from Ganley, BoE Lecture Notes Series].

"If required to do so for monetary policy purposes, the banks will hold a proportion of their deposit liabilities at the central bank in either remunerated or unremunerated form. Obviously, these required bank reserves are more costly to the banks if they are unremunerated. If the central bank chooses to pay a rate of return to the banks this can be at a market or sub-market rate of interest. The cost of required reserves will also depend on their coverage, namely how much of the banks' liabilities are actually included" [Ganley, BoE Lecture Notes Series]. Therefore, monetary policy can influence the demand for reserves through the change in the rate of required reserves and the change in the scope of the reserve base. During the period under review a number of changes in both rate and scope of required reserves have been implemented in Macedonia.

Following Lang and Krznar (2004), the supply of the reserves (Rs) is the difference between the base money (M0) and autonomous factors (Af – cash in circulation and government deposits):

(3) $Rs = M0 - Af$

(4) $\Delta Rs = -\Delta Af + \Delta NFAcb + \Delta NDAcb$

$= -\Delta Af + INTb + INTg + \Delta CR + \Delta OMO$

Cash in circulation is one of the autonomous factors in reserves supply. It is defined as all central bank notes held outside the central bank. Decreases (increases) in the outstanding note issue imply credits (debits) to the banking system's accounts with the central bank; in other words, decreases in the note issue add to central bank reserves. Changes in the note issue can be volatile on a daily basis, but often have some predictable seasonality, both within-week and within-month. The main long-run determinants of currency demand are transaction variables such as GDP or private consumption and opportunity cost measures like interest rates or inflation. In addition, the second potential factor in the creation of reserves is transactions to government; this accrues through the net daily cash flows in and out of the consolidated fiscal account at the central bank. In terms of the size and volatility of the flows involved, this account may have a substantial effect on the supply of reserves [adaptation from Ganley, BoE Lecture Notes Series].

According to *(4)*, the change in the supply of the reserves is the sum of the (negative) change in autonomous factors, the change in the foreign assets of the central bank and the change in the net domestic assets of the central bank. The change in the net foreign assets (NFA) is equal to the amount of foreign exchange interventions (both transactions with commercial banks INTb and government INTg).

In a fixed exchange rate country, the central bank may be forced to intervene on the foreign exchange market to maintain the parity for the domestic currency. If there is downward pressure on the parity then, with non-sterilised intervention, it acquires domestic currency in exchange for net foreign assets, resulting in a reduction in the monetary base. The central bank is generally able to neutralise this effect on the monetary base by engaging in an offsetting transaction which injects domestic currency liquidity into the market to coincide with the drain of liquidity caused by the intervention. The sterilisation transaction will usually be a purchase of domestic financial assets [adaptation from Ganley, BoE Lecture Notes Series].

The change in net domestic assets (NDA) is the sum of the change of NBRM's credits to commercial banks (CR), i.e. credit facility and open market operations (OMO). OMO includes both rarely used money creating open market operations (repo), and widely used money destructing monetary operations (CB bills in Denar), which enter with a negative sign.

Following Lang and Krznar (2004), combining the demand *(1)* and supply *(3)* of the reserves, the excess reserves are equal to the difference between base money, required reserves and autonomous factors:

(5) $Rs = Rd$

(6) $ER = M0 – RR – Af$

The change in excess reserves is therefore influenced both by changes in the supply and demand of the reserves, both of which the NBRM is influencing with its monetary policy instruments:

(7) $\Delta ER = – \Delta Af + \Delta NFAcb + \Delta NDAcb – \Delta RR$

(8) $\Delta ER = – \Delta Af + INTb + INTg + \Delta CR + \Delta OMO – rr^{*} \Delta RB – RB^{*}\Delta rr$

Excess reserves are a function of interventions, open market operations, reserve requirement and autonomous factors (signs of coefficient are given in parentheses):

(9) $ER = f\ (INT\ (+),\ OMO\ (+),\ CR\ (+),\ RR\ (–),\ Af(–))$

The purchase of foreign currency results in the increase of excess reserves, i.e. monetary easing. Money creation through open market operations (or the decrease of outstanding CB bills) and the NBRM's credits also leads to monetary easing, and an increase of the required reserves leads to monetary tightening. "This definition of excess reserves is consistent with reserve targeting, but is adapted to include monetary instruments influencing both money supply and money demand. Indeed, it is an interesting measure since it combines the intention of the policymaker in the sense that its increase corresponds with monetary easing and its decrease with monetary tightening" [Lang and Krznar, 2004].

4. Constructing an indicator of monetary policy stance for Macedonia

In this chapter, the monetary transmission in Macedonia is analyzed applying a Structural Vector Autoregression (SVAR) approach on monthly data. The essential part of the analysis is to identify exogenous monetary policy shocks and to consider the transmission of such shocks to the macroeconomic variables of interest. "To separate exogenous monetary policy shocks from changes in monetary policy that correspond to central bank's endogenous response to shocks originating elsewhere in the economy, the model should include a well-specified reaction function for the central bank" [Beier and Storgaard, (2006)].

In general, "identifying a reaction function for central bank policy involves confronting two basic complex issues. First, one has to take a stand on the set of information to which the central bank responds. The central bank may have a primary goal of stabilizing inflation and output, for example. But it may (and in general does) take account of a far broader set of information than simply inflation and output" [Clarida and Gertler, (1997)]. Good examples are exchange rates and current account deficits. Also, the central bank may make use of some intermediate targets as a kind of commitment device.

As stressed by Christiano et al. (1996), without a complete structural model of the economy it is the response of variables to exogenous policy actions that must be examined in order to gauge the effects of monetary policy. This is because movements of the economy following an endogenous policy action may be due to the policy action itself or to the variable that spurred that action. Each policy equation in a VAR can be interpreted as a sum of an endogenous part, a so-called implicit rule, and an exogenous part, representing deviations from the rule or monetary shocks. The central bank's behavior behind these exogenous shocks is definitely linked to its operating actions [adaptation from Cuche, (2000)].

The indicator of monetary policy stance in Macedonia is constructed by using a structural VAR model which combines different monetary policy instruments. This approach introduced by Bernanke and Mihov (1995, 1998), has become a standard approach of isolating monetary policy shocks from the overall monetary policy that otherwise reacts to real sector developments. Following Bernanke and Mihov (1995, 1998), we develop and implement a general, VAR-based methodology in which the indicator of monetary policy stance is not assumed but rather is derived from an estimated model of the central bank's operating procedure. More specifically, we employ a VAR model that leaves the relationships among macroeconomic variables in the system unrestricted but imposes contemporaneous identification restrictions on a set of monetary variables. A similar approach was applied by Clarida and Gertler (1997) in their analysis of Bundesbank's monetary policy. Cuche (2000) applied these two papers to a small open economy in his analysis of monetary policy in Switzerland [adaptation from Lang and Krznar (2004)].

"The basic idea is, by estimating a general VAR that includes both non-policy and policy variables, to eliminate elements of monetary policy reaction functions on policy variables. More specifically, the residuals from such VAR are cleaned from dynamics that originates from the central bank reaction function and represent true monetary policy innovations. However, these residuals contain interdependence between different monetary policy instruments, which needs to be solved by a structural model of monetary policy in order to extract true monetary policy stance i.e. unanticipated monetary policy" [Lang and Krznar, (2004)].

In addition, rather than building the monetary policy model around supply and demand for bank reserves as in Bernanke and Mihov (1998) they are combined into a single measure of excess liquidity. With this respect our analysis follows Lang and Krznar, (2004). This is in line with the NBRM's policy, which influenced both demand and supply of reserves. Thus, the main monetary policy variables are the nominal exchange rate and the excess liquidity (excess reserves). Excess reserves can be observed as an intermediate indicator of monetary policy, i.e. as a kind of commitment device.

5. The model

This section is an adaptation from Lang and Krznar (2004). In order to isolate monetary shocks, it is important to make a distinction between the variables that the central bank can directly influence and other variables that it cannot directly influence. Because this definition is quite loose, we use a timing assumption to sort out variables. According to Clarida and Gertler (1997) and Bernanke and Mihov (1998) we define policy variables as variables that the central bank influences within the current considered period. In addition, because of rigidities, we know that monetary policy begins to influence non-policy variables with a lag.

Following Bernanke and Mihov, the first step is to estimate the following VAR:

$$\begin{aligned} Y_t &= \sum_{i=0}^{k} B_i Y_{t-i} + \sum_{i=0}^{k} C_i P_{t-i} + A^y v_t^y \\ P_t &= \sum_{i=0}^{k} D_i Y_{t-i} + \sum_{i=0}^{k} G_i P_{t-i} + A^p v_t^p \end{aligned} \tag{1}$$

Yt is a vector of macroeconomic (non-policy) variables and *Pt* is a vector of policy variables. System *(1)* is not econometrically identified. Without restrictions imposed on its structure, it is not possible to retrieve its coefficients after its reduced form estimation. A first step towards this identification is to break the loop of contemporaneous influences between non-policy and policy variables in this dynamic setup. In order to solve the problem we use the mentioned timing assumption again, based on the fact that central banks cannot directly influence in a timing dimension the non-policy variables. After the introduction of this assumption, system *(1)* becomes system *(2)*.

Thus, system *(1)* can be rewritten as ordinary VAR, introducing restriction that monetary policy does not immediately influence non-policy variables (C0 = 0).

$$\begin{aligned} Y_t &= \sum_{i=0}^{k} B_i Y_{t-i} + \sum_{i=1}^{k} C_i P_{t-i} + A^y v_t^y \\ P_t &= \sum_{i=0}^{k} D_i Y_{t-i} + \sum_{i=0}^{k} G_i P_{t-i} + A^p v_t^p \end{aligned} \tag{2}$$

Non-policy and policy variables are orthogonal by construction, i.e.

$$A = \begin{bmatrix} A^Y & 0 \\ 0 & A^P \end{bmatrix} \tag{3}$$

Matrix *A* allows the various structural shocks, also split into non-policy and policy shocks, to enter each equation with the single restriction that we do not allow the monetary world shocks to independently enter the non-policy sphere. They certainly affect the economy but only through the effects on policy variables. This assumption is not too restrictive, because we can imagine processes generating these shocks as totally independent of each other (e.g. with an independent central bank, we can assume such a disconnection). Composite residuals for each variable, or more precisely for each equation in the system, are then a mix of the different individual structural shocks.

System *(2)* constitutes the base for the second step. In order to retrieve true monetary policy shocks *vs*, it is necessary to model the relationship between different monetary instruments. In fact we directly use the VAR residuals from *(1)* and express them in terms of true structural disturbances. This is the so called *without extraction approach* [Cuche, (2000)]. Alternatively, we can extract from the residuals of the policy variables in the first SVAR new series that are the portion of VAR residuals in the policy block that is orthogonal to the VAR residuals in the non-policy block. This is the way with extraction. So, following the method without extraction we use NBRM's operating procedures to model two equations representing the central bank's behavior in innovation form. We thus proceed with the policy section.

In order to retrieve true monetary policy shocks *vs*, it is necessary to model the relationship between different monetary instruments. "Bernanke and Mihov do this by modelling the market for bank reserves by distinguishing between borrowed and non-borrowed reserves. Cuche applies their analysis for small open economy models demand and supply for reserves, as well as exchange rate" [Lang and Krznar, (2004)].

$$u_s^{mon} = u_d^{mon} \tag{4}$$

$$u_s^{mon} = \lambda v^d + \varphi v^x + v^s \tag{5}$$

$$u_d^{mon} = \rho u^i + v^d \tag{6}$$

$$u^x = \delta u^i + v^x \tag{7}$$

"Money supply (5) is a function of demand shock and exchange rate shock, as well as true money supply shock (true monetary policy shock). Money demand (6) is a function of interest rates, i.e. the opportunity cost of holding money, and demand shock. Exchange rate (7) is also a function of interest rate (interest rate parity) and exchange rate shock. This system can be solved by the GMM estimator" [Lang and Krznar, (2004)].

Still, due to short data series and relatively stable monetary policy instruments, following Lang and Krznar (2004), a simpler model was used for Macedonia, consisting of only two different monetary instruments: exchange rate and excess liquidity. This means that supply and demand shocks are combined, which is in line with the conduct of monetary policy in Macedonia:

$$\begin{aligned} u^x &= v^x \\ u^l &= \varphi u^x + v^s \end{aligned} \tag{8)–(9}$$

"Exchange rate *ux* in terms of innovations is a function of the exchange rate shock (8). Monetary policy variable *ul* (excess liquidity) in terms of innovations is a function of shock in exchange rate *ux* (monetary policy reacts to changes in exchange rate, i.e. exchange rate targeting) and unanticipated shock in monetary policy *vs* (9). This system of equations can be solved by using the GMM method. It is just-identified; there are three known variables: variances and covariance of *ux* and *ul*; and three unknown variables: variances of *vx* and *vs* (their covariance by construction equals zero) and reaction parameter φ. The true monetary policy shock *vs* is constructed from equation (9). Finally, the indicator of (unanticipated) monetary policy stance is constructed by summing up previous unanticipated monetary policy shocks *vs*:" [Lang and Krznar, (2004)]. Namely, the absolute level of *vs* is of no specific meaning, only relative movements give an indication of changes in the policy stance. An upward movement represents a tightening of the policy stance, and, a downward movement an easing. Accumulation smoothes the series so that the final series gives a clear indication of the direction of the policy shift [adaptation from Höppner].

$$MP_t = \sum_{i=0}^{t} v_{t-i}^{s} \qquad (10)$$

6. Data description

Data selection and the rationale behind the interpolations entirely follow (Lang and Krznar, 2004). Quarterly GDP data (y) is interpolated to monthly frequency using industrial production series. The GDP series is integrated of order 1.

Core inflation (p) is used as the price variable in order to control for an increase of administered prices that had major effect on the overall price dynamics in the low inflation environment. The price series is integrated of order 1.

The third non-policy variable is the external imbalance, described by the current account (ca). Current account is constructed as a ratio of current account balance and nominal GDP, and is interpolated to monthly frequency by the series of net payments abroad, which is used for the construction of the balance of payments statistics. The current account series is stationary.

The exchange rate variable (e) is the average monthly nominal exchange rate MKD/EUR. Note that increase in exchange rate describe depreciation. The variable is stationary.

In line with the discussion earlier in this paper, the excess liquidity/reserves (l) is used for modelling monetary policy of the NBRM. It is expressed as the ratio of excess reserves to required reserves (monthly averages). The variable is also stationary.

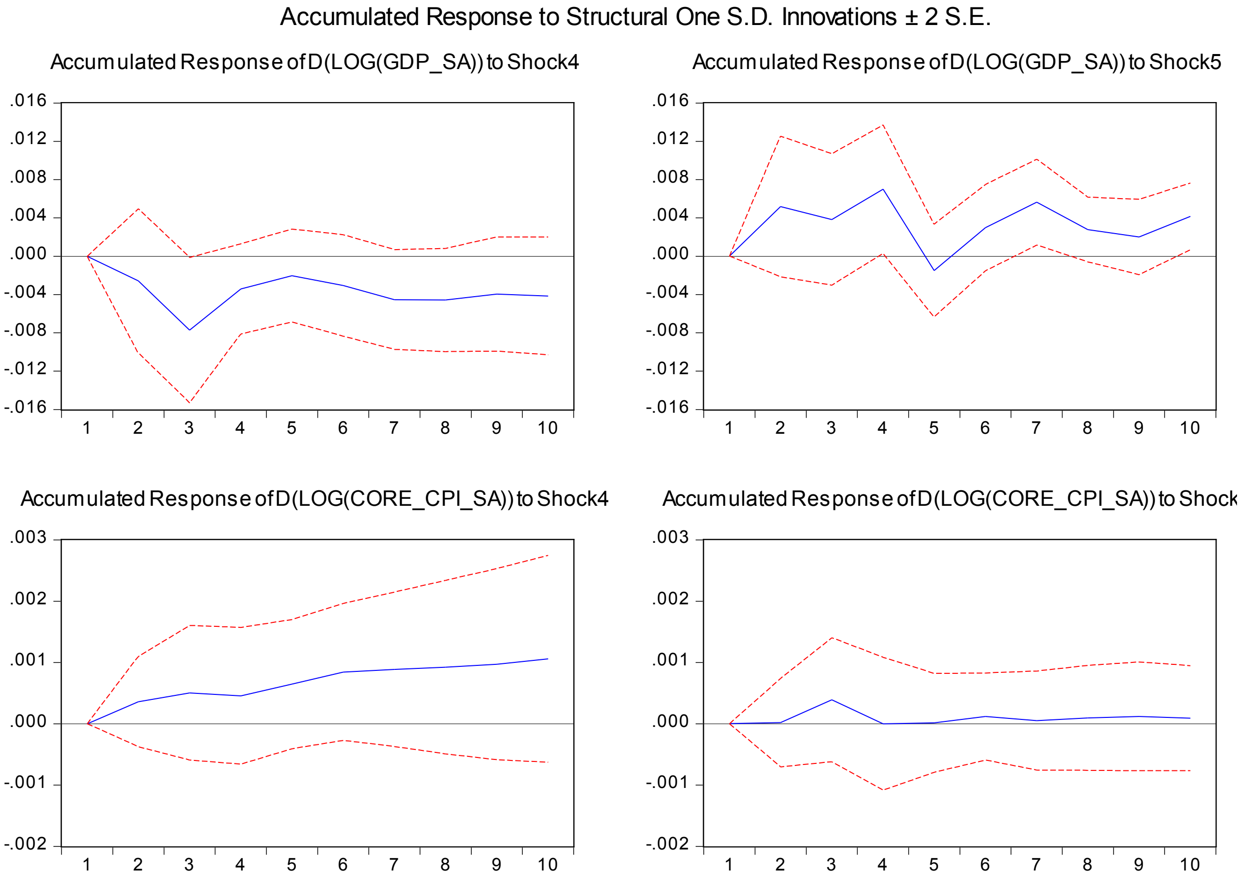
All variables are seasonally adjusted (including the exchange rate). GDP, prices, and the exchange rate are in logs, while the ratio of the current account and the excess liquidity are in percentage points. In order to have stationary series, the first differences of real activity and prices are used. Unit root tests are given in the Appendix 2. The analysis covers the period that starts in December 2005 and ends in June 2013.

7. Estimation and results

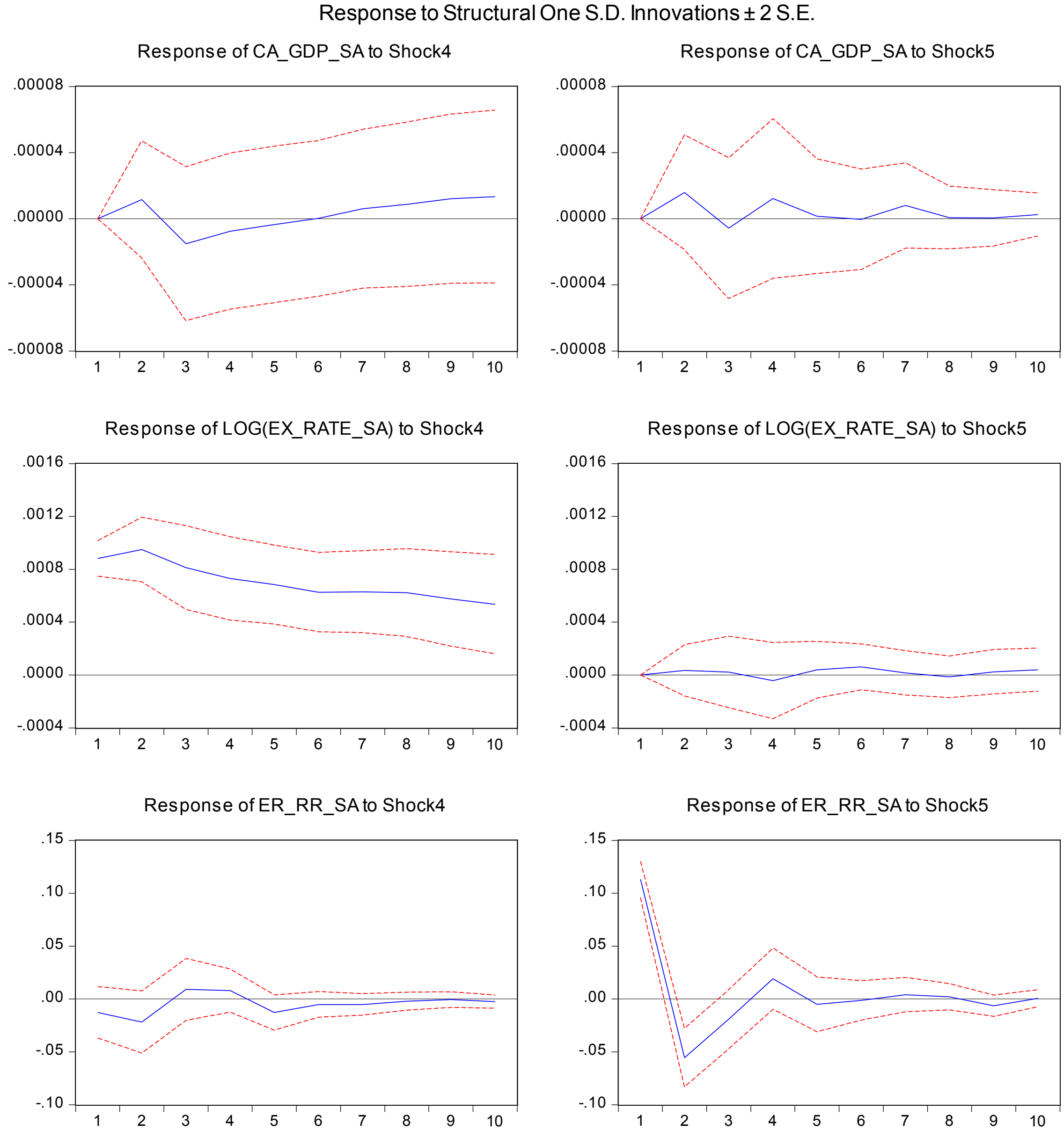
As described above, the initial step was to estimate a SVAR in form *(2)*. Non-policy variables are changes in real GDP (Δy), changes in prices (Δp), and the ratio of current account to GDP (ca). Policy variables are exchange rate (e) and excess liquidity (l). Three lags are chosen for the final SVAR specification.

Although the purpose of this benchmark SVAR is to retrieve the residuals free of monetary policy reaction, we find observing the impulse response functions informative. Therefore, just to give a brief insight of the responses of this benchmark system derived by appropriate structuralization of VAR residuals, impulse responses in the changes of GDP and prices are shown below (due to first difference of GDP and prices, effects of shocks are accumulated for those variables). With this respect, we must take one point of reservation into account, primarily because VAR analyses of the effects of monetary policy have more significant meaning when unanticipated monetary policy stance is included as an element in the VAR. Therefore, further in this section we contrast the dynamic responses of this benchmark system with those derived from a VAR which contains an alternative indicator of monetary policy.

SVAR impulse responses of shock in monetary policy (Shock 4 refers to exchange rate shock; Shock 5 refers to liquidity shock) Graph 1



SVAR impulse responses of shock in monetary policy (Shock 4 refers to exchange rate shock; Shock 5 refers to liquidity shock) *(cont)* Graph 1



Source: Authors' calculations.

Excluding large confidence bands, results, although very small in size, show that exchange rate depreciation negatively affects GDP, which using the analogy of Lang and Krznar (2004) can probably be explained by a decrease in disposable income (increased Denar value of loan repayments because of currency clauses in loan agreements) and probably by a weak response of exports to the exchange rate. Namely, a most probably smaller positive elasticity of exports to exchange rate shock could be related to the substantial share that export-processing firms account for in Macedonia's foreign trade. Processing trade relies heavily on imported intermediate inputs; therefore, a depreciation of the Denar may on the other hand increase the input costs for processing exporters. Still, for stronger conclusions on this particular issue, a conduct of comprehensive micro study which would consider almost every potential effect of currency depreciation, including both intensive (quantity and price) and extensive (entry, exit, and product scope) adjustments would be necessary.[2]

Results in addition, although not statistically significant and again very small in size, show that the increase in liquidity may positively influence GDP, which is a typical parallel with the usual finding that a reduction in interest rates stimulates aggregate demand.

The results indicate very small, positive effect on the current account in response to exchange rate depreciation. However, the positive effects are preceded by an initial worsening of the current account (the impact of devaluation may take time to have effect on the demand; in the short term, demand may be inelastic, but over time demand may become more price elastic and have a bigger effect). An improvement in the current account on the balance of payments depends upon the elasticity of demand for exports and imports. Generally, if the sum of both, the price elasticity of exports demand and the price elasticity of imports demand is higher than one, then a devaluation will improve the current account.

The reaction of prices to exchange rate depreciation, although not statistically significant, arguments in favor of the existence of pass-through. Inflation is likely to occur, first because imports are more expensive causing cost push inflation, and second, with exports becoming cheaper manufacturers may have less incentive to cut costs and become more efficient.

An increase in liquidity, on the other hand, although very small, has mostly positive effect on the current account. Following Lang and Krznar (2004) findings, we can point out that this result is counter-intuitive because under these circumstances one would expect a decrease in interest rates, which might in parallel boost imports backed by higher credit activity. Still, we should have in mind that a predominant part of our sample covers the period of the global financial crisis – a period in which we observed some worsening of the market sentiment, as well as a situation when banks have being hesitant about making loans.

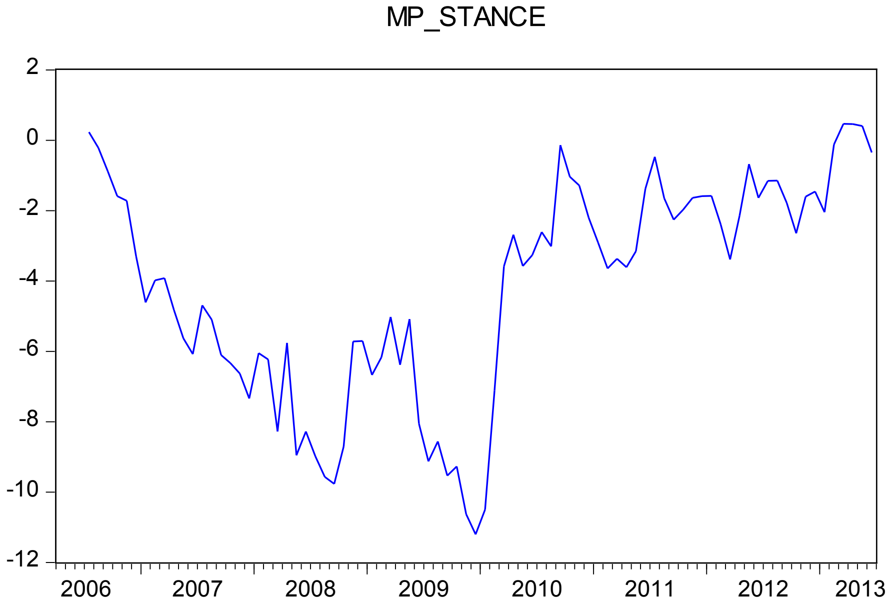
Adapting Lang and Krznar (2004) findings, we can conclude that due to the policy response, the exchange rate does not react much to the liquidity shocks. On the other hand, liquidity decreases after depreciation, as a result of the NBRM's non-sterilised foreign exchange intervention reaction to exchange rate change. However, we need to very carefully interpret these findings as our VAR analysis produces results that are not robust enough to reliably determine the effects of potential exchange rate depreciation on various macroeconomic variables. This is due to the impulse responses that are very small in size with rather large confidence bands. Therefore, we should interpret these results more like an indication of what can be one of the possible, still not exclusive way, through which a potential exchange rate depreciation may affect domestic economy.

[2] In other words, firms' responses to exchange rate shocks are not limited to the adjustment in intensive margins (i.e., quantity and price). Recent literature has emphasized the importance of the extensive margins of trade, which accounts for a large share of the variation in imports and exports across nations (Bernard *et al.* 2009).

As stated earlier, the indicator of monetary policy stance is configured as a sum of all (autonomous) shocks of monetary policy. The indicator of monetary policy stance is shown in Graph 2.

Monetary policy stance indicator (increase in the indicator represents monetary tightening)

Graph 2



Source: Authors' calculations.

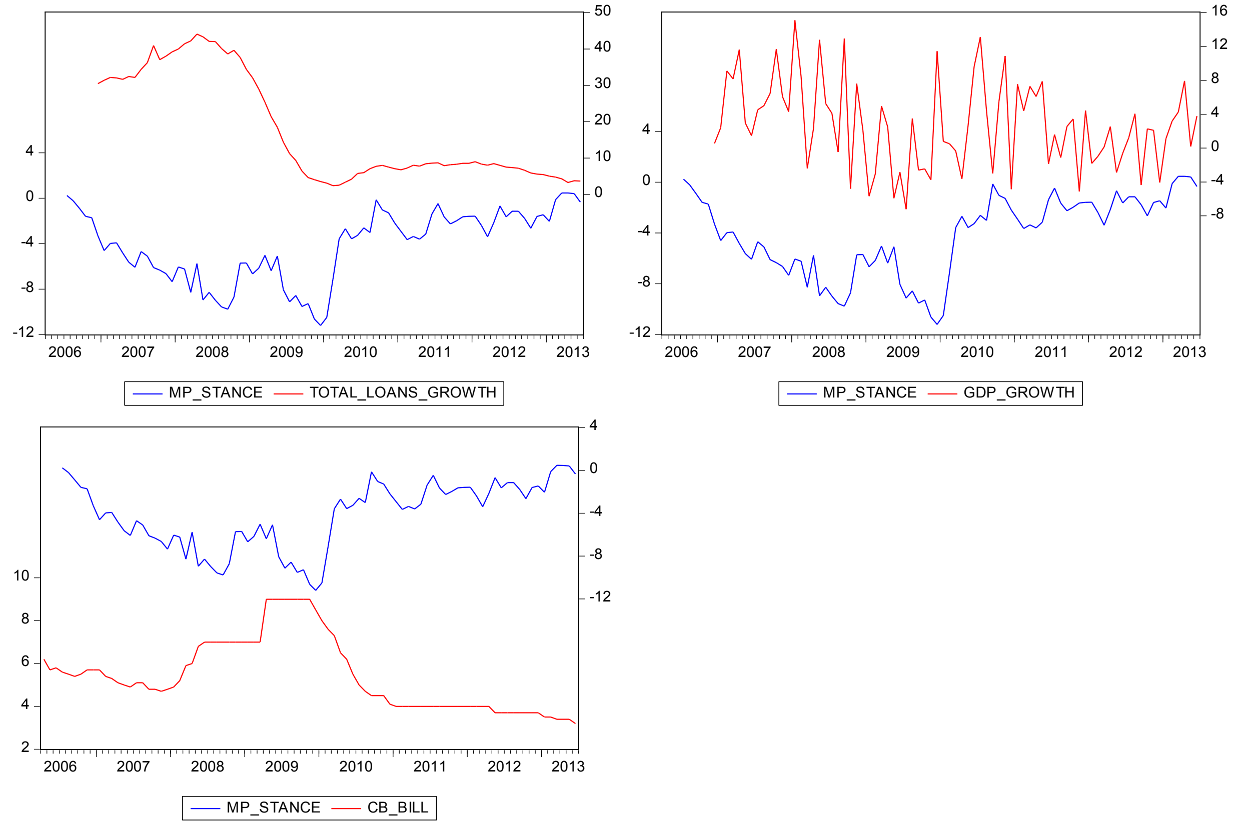
For the pre-crisis period covering 2006–2008 the constructed indicator of monetary policy stance is broadly in line with NBRM's policy rate dynamics suggesting to a well functioning monetary transmission. For the second period covering the global crisis it shows a sharp monetary tightening that started at the end of 2009 and lasted until the end of the first quarter of 2013 while this was a period when NBRM undertook bold measures as to ease the monetary policy stance. These findings suggest to a diminished monetary transmission in the recent monetary easing cycle. That is to say that low funding costs and abundant bank reserves produced by monetary policy in this period have not resulted in significant, broad-based loan growth.

The state of the banking system is central to this picture. It means some bankable loan demand is not being met in spite of ample liquidity. There are a number of reasons why credit flows via banks have been weak. They can be categorized under two headings: demand and supply. Here are some factors which most probably have restrained the demand for bank credit. Larger businesses might have been aggressively controlled costs and exploited productivity gains. In parallel, they might prefer engaging their own funds or engaging in alternative funding through inter-company loan transactions or through borrowing funds from capital markets. All this has added up to relatively weak loan demand. On the other hand, it is very likely that smaller businesses haven't yet seen much revenue growth and remain cautious about borrowing. In addition, households continue the process of deleveraging, and, as a consequence, consumer loan demand, broadly defined, has been soft [adaptation from Lockhart, (2012)].

As for the supply of bank credit, here are some factors that bankers have been living. As a result of the global financial crisis and the recession, underwriting standards across all loan categories have been tightened. In other words, due to the perceived uncertainty, banks refrain from growing their balance sheets even if there were stronger loan demand. Consequently, it can be argued that because of the interplay of demand and supply factors, the interest rate sensitivity and in general, the response of the Macedonian banking sector to monetary changes, has been dampened [adaptation from Lockhart, (2012)].

Monetary policy stance vs selected variables

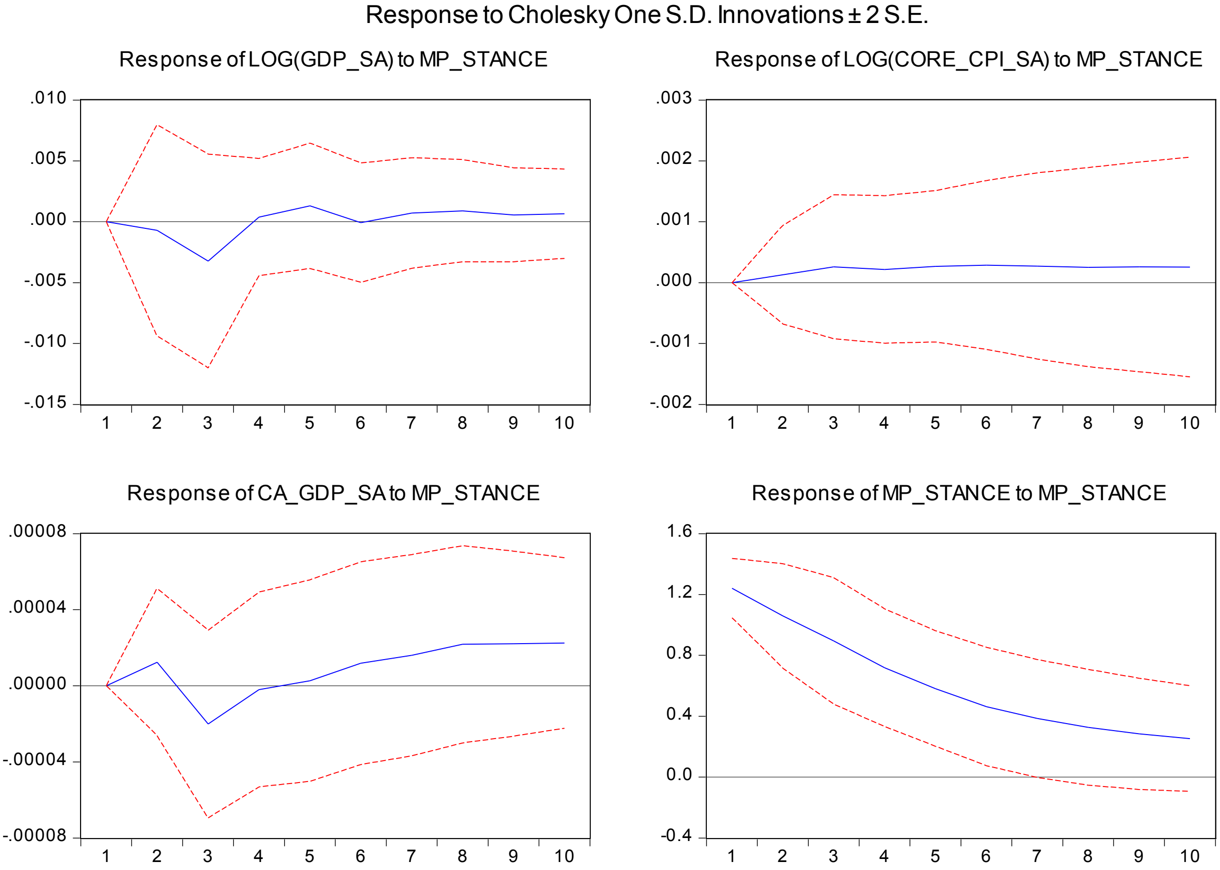
Graph 3



Source: NBRM, SSO and authors' calculations.

In this sub-section, the impulse response functions of the indicator of monetary policy to real sector variables are displayed.

Impulse responses of shock of indicator of monetary policy stance Graph 4



Source: Authors' calculations.

The reported responses, although statistically insignificant and small in size, imply that in the actual operating framework, the central bank's efforts to reduce external imbalance may, in addition to a decrease in the GDP, incur an additional cost, i.e. price increase. More precisely, monetary policy tightening is likely to have an initial negative effect on aggregate demand, which arguments in favor of the idea that counter-cyclical monetary policy setting in Macedonia is possible. Monetary policy tightening, however, seems to have a permanent positive effect on the price level which is an evidence on price puzzle.

"Price puzzle implies that cost channel is an important part of monetary policy transmission mechanism. As oppose to the conventional views of monetary transmission which focus on the demand side effects (monetary tightening initially reduces output and then prices), the cost channel of monetary transmission stresses that supply side or cost effects probably dominate the usual demand side effects. Therefore, monetary tightening could be followed by an increase in prices. In this view, a rise in interest rates increases the cost of funds. This cost shock pushes up prices" [adaptation from Javid and Munir, (2010)]. As already pointed out in Lang and Krznar (2004), this type of seemingly unreasonable outcome can be associated with the exchange rate targeting regime. Namely, in order to stem the depreciation pressures on the parity, the NBRM sells foreign currency which coincides with a drain of bank's Denar liquidity, i.e. monetary tightening. Accordingly, the exchange rate depreciation is found to be negatively correlated with excess liquidity and positively correlated with the monetary policy stance indicator (monetary tightening). So, the correlation between monetary tightening and an increase in prices is also positive.

However, there are some important limitations with this analysis. Reported responses are very small in size and also statistically insignificant thus undermining the reliability of the results. Given these pitfalls, we believe that our analysis fails to credibly test the price puzzle hypothesis. This suggests that further investigation is needed before drawing any conclusions on the price puzzle presence in Macedonia.

8. Conclusion

Macedonia’s central bank, the National Bank of the Republic of Macedonia, has employed a range of different instruments in the implementation of its monetary policy. This complicates the identification of the NBRM’s monetary policy stance as one has to bond the effects of all monetary measures to appropriately assess the monetary policy stance. We therefore follow Lang and Krznar (2004) in constructing a new measure of monetary policy stance. Our framework nests model that uses VAR residuals to identify monetary policy and produce overall stance indicator. One remarkable feature of our measure is that it tends to proxy the actual or ”de facto” monetary policy stance vis-à-vis the real sector after transmission takes through and commercial banks adjust their behavior to monetary policy changes, in one way or another. It also considers the effect of all monetary policy instruments applied by the NBRM. As such, it could prove useful for both analysis and conduct of monetary policy thus enriching monetary policy analytical framework.

The indicator of monetary policy stance constructed in this paper suggests monetary easing in the pre-crisis period which is broadly in line with NBRM’s policy rate dynamics as main monetary policy instrument used for signaling monetary policy stance. Results point to proper monetary policy transmission with monetary policy changes being effectively delivered to the real sector. On the other hand, for the period following the crisis our indicator strongly diverges from NBRM’s actual intentions with respect to monetary policy stance. It shows sharp tightening starting the end of 2009 that lasts until the first quarter of 2013 while this was a period that witnessed a truly proactive role by the NBRM as to ease monetary policy stance. This suggests that the global crisis has been conducive for heightened risk aversion and most likely has impaired the monetary policy transmission mechanism.

This paper also sheds some light on monetary policy effectiveness as stabilizing tool. Our findings support conduct of counter-cyclical monetary policy as to correct external imbalances. However, the scope for maneuver is limited given the constraints of the exchange rate peg. Thus, every attempt of the central bank to decrease the external imbalances will in addition to a decrease in GDP growth incur an additional cost of price increase. The main drawbacks of this study are mainly related to the reliability and the statistical significance of some of the results. So, one must be aware of this pitfalls when interpreting the results and threat them with great caution, particularly when it comes to policy conclusions and recommendations.

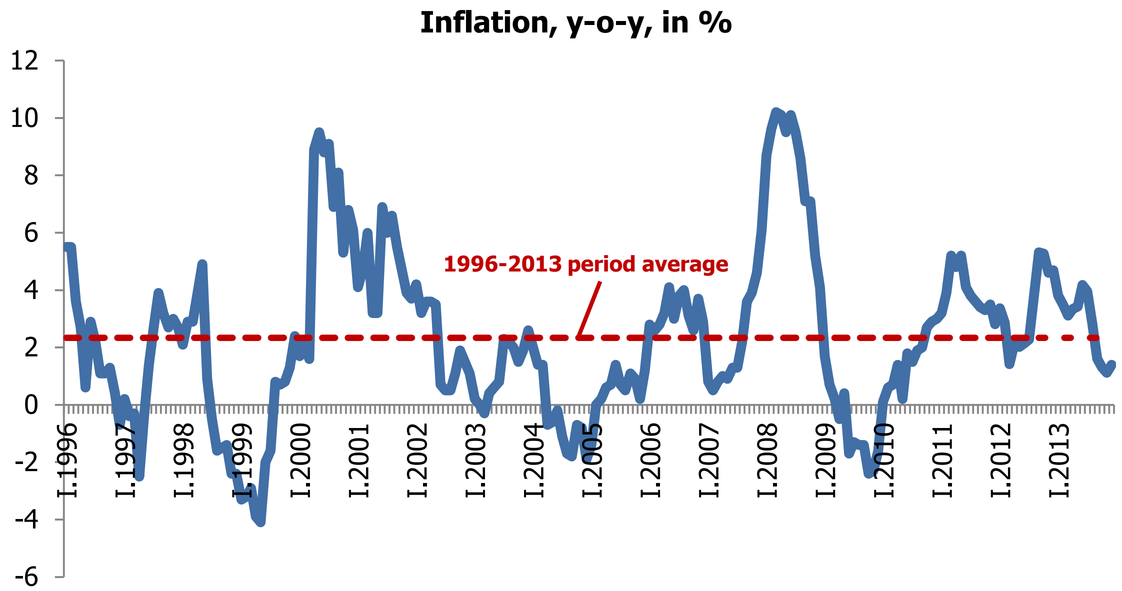
Appendix 1: Monetary policy framework

Main economic indicators

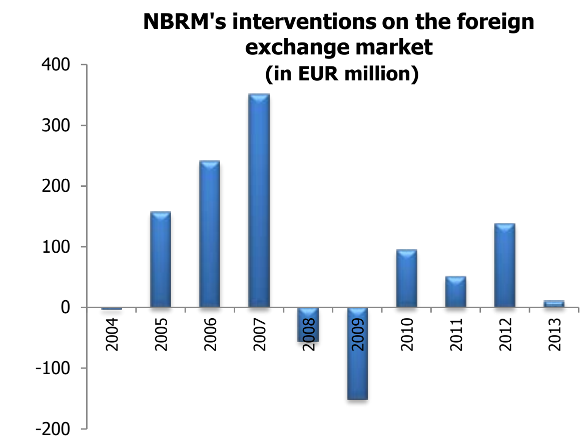
Table 1

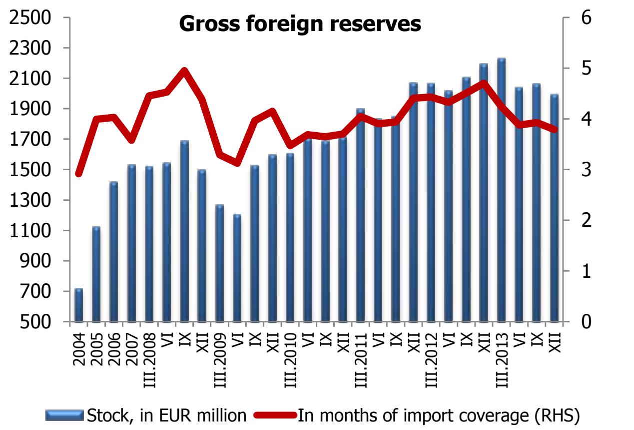
	2005	2006	2007	2008	2009	2010	2011	2012	2013
GDP (real growth rates)	4,4	5,0	6,1	5,0	-0,9	2,9	2,8	-0,4	/
Inflation (average, on cumulative basis,in %)	0,5	3,2	2,3	8,3	-0,8	1,6	3,9	3,3	2,8
Unemployment rate (in %)	37,3	36,0	34,9	33,8	32,2	32,0	31,4	31,0	/
Government budget balance (Central budget and Funds budget balance as % of GDP)	0,2	-0,5	0,6	-0,9	-2,7	-2,4	-2,5	-3,9	/
Money supply M4 (y-o-y, in %)	15,0	25,0	29,3	11,2	6,0	12,2	9,7	4,4	5,3
Bank and savings houses credits to the private sector (y-o-y, in %)	21,0	30,5	39,2	34,4	3,5	7,1	8,5	5,4	6,4
Average exchange rate MKD/EUR	61,30	61,19	61,18	61,27	61,27	61,51	61,53	61,53	61,58
Current account balance (as % of GDP)	-2,5	-0,4	-7,1	-12,8	-6,8	-2,0	-2,5	-3,0	/
Gross foreign reserves (stock, end of period in EUR million)	1.122,9	1.416,7	1.524,4	1.494,9	1.597,5	1.714,5	2.068,9	2.193,3	1.993,0
Gross external debt (as % of GDP)	52,5	47,9	47,6	49,2	56,4	58,2	64,9	69,4	/

Source: NBRM, SSO and MoF.

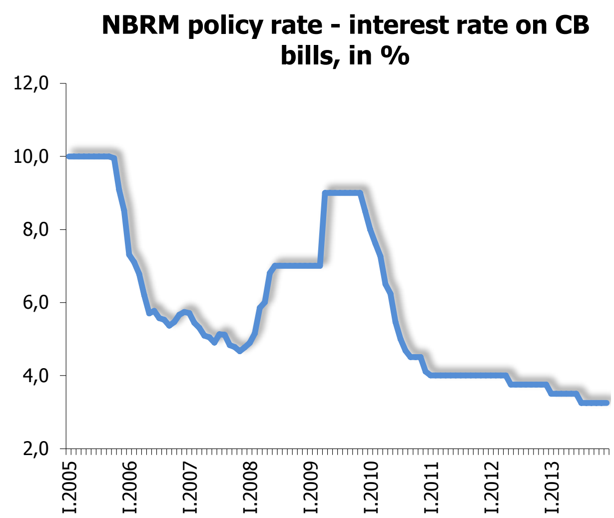


Source: State Statistical Office of the Republic of Macedonia.

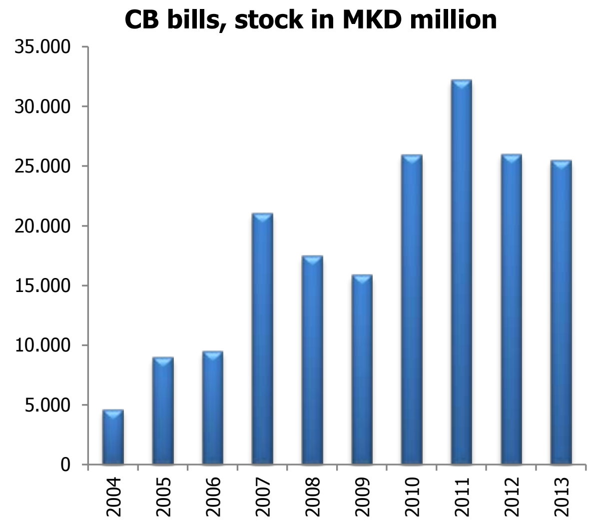




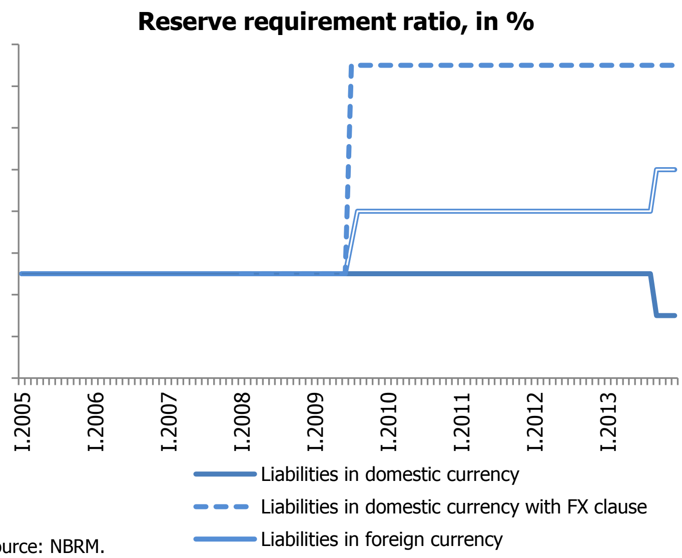
Source: National Bank of the Republic of Macedonia.



Source: NBRM.



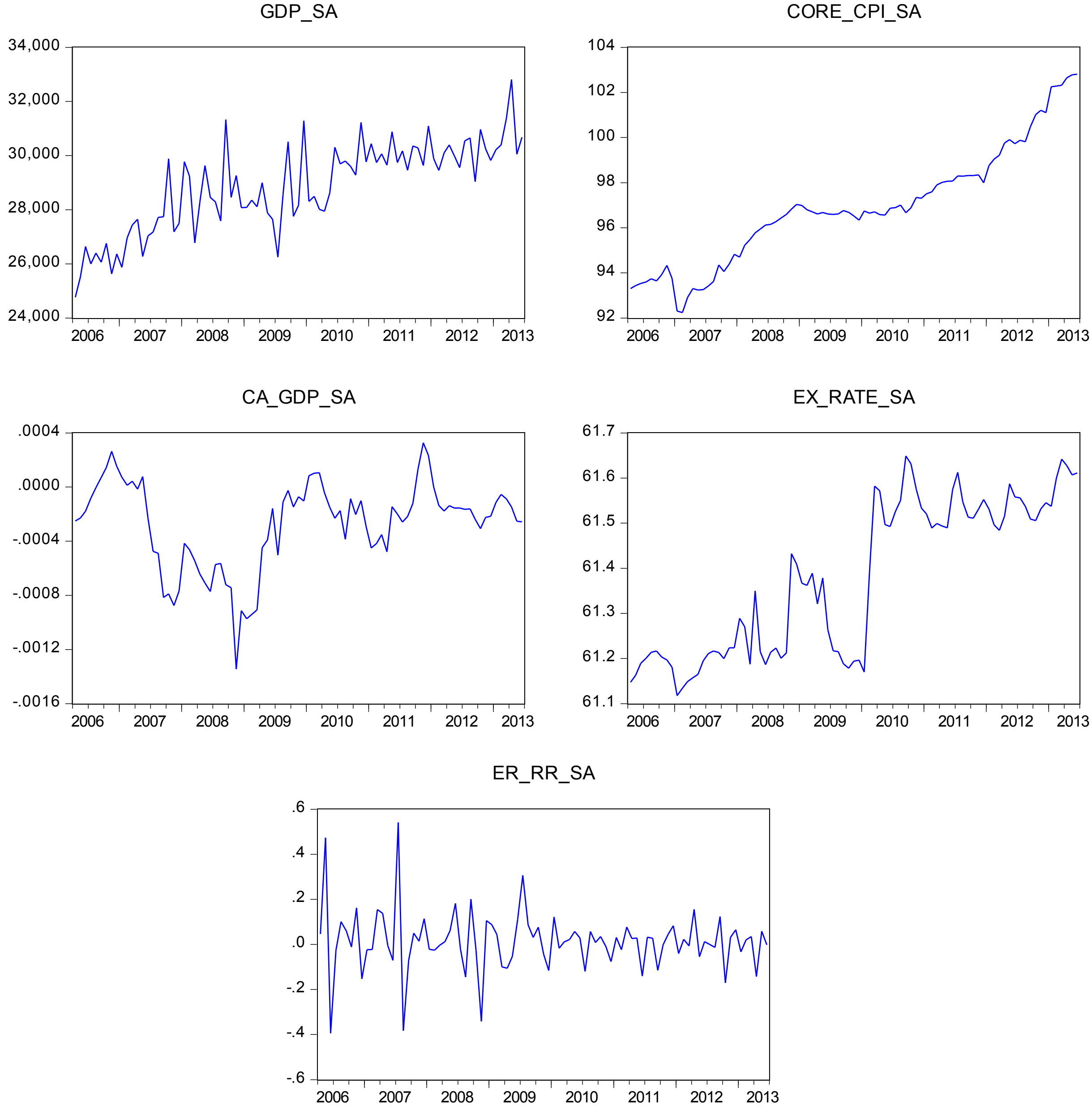
Source: NBRM.



Source: NBRM.

Appendix 2: Data

Data Graph 1



Source: NBRM, SSO and authors' calculations.

Unit root tests

Table 1

	ADF value	ADF value	KPSS value	KPSS value
	Constant included	Constant and trend included	H0 Stationary around a level	H0 Trend stationary
y	2.3096	–1.9340	0.9414	0.0411**
dy	–16.1130**	–16.4531**	0.2617**	0.2471**
p	0.9648	0.4846	1.0948	0.1418*
dp	–9.7635**	–9.7967**	0.1868**	0.0905**
ca	–2.5408***	–2.5960	0.2153**	0.1330**
e	–1.3370	–3.2638***	1.1722	0.0626*
l	–10.0714*	–10.2291**	0.3669	0.1739

Note: **, and * indicate no unit root at 1% and 5% significance. *** indicate no unit root at 10% significance.

y – real GDP

dy – change in real GDP

p – core prices

dp – core inflation

ca – current account / GDP

e – nominal exchange rate MKD/EUR

l – liquidity (excess reserves/required reserves)

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