Fiscal and Monetary Policy Effects in South Eastern European Economies

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Abstract

This paper investigates the macroeconomic effects of monetary and fiscal policies in three South Eastern European economies: Croatia, Macedonia and Bulgaria. We employ recursive Vector Autoregressions (VARs) in order to study the interlinkages among fiscal policy, monetary policy and economic activity based on quarterly data on primary cyclically adjusted balance, monetary policy indicator, inflation rate and output gap. We obtain the following main results: *first,* domestic economic activity has significant effects on inflation, fiscal policy and, to some extent, monetary policy behavior; *second,* fiscal policy exerts limited influence on inflation and monetary policy; and *third,* the effects of monetary policy on inflation are rather modest.

JEL codes: C32, E52, E58, E62, E63.
Key words: Fiscal Policy, Monetary Policy, VAR,

1. Introduction

Traditionally, fiscal and monetary policies serve as main tools employed by macroeconomic policy makers in achieving and maintaining macroeconomic stability, reducing output fluctuations as well as bolstering economic growth. Consequently, the knowledge of the effects of monetary and fiscal policies on economic activity is of crucial importance for policy makers. In addition, it is important to know how and in what direction monetary and fiscal policy respond to changes in the output fluctuations (procyclically or countercyclically) and whether their reaction is synchronized during the business cycle (whether they are complements or substitutes).

Undoubtedly, exploring the effects of fiscal and monetary policies along with their interactions represents a relevant research issue for the transition economies, especially those with *de facto* fixed exchange rate regimes and currency boards from South Eastern Europe (SEE) such as: Croatia, Macedonia, and Bulgaria. Indeed, for these economies, fiscal and monetary policy interactions and their effects on real economic activity has been an underexplored topic. Having in mind the monetary policy regimes applied and their relatively high openness, the question of which policy has more active role in reducing business cycle fluctuations arises

naturally. For example, according to the Mundell (1963) and Fleming (1962) model, under fixed exchange rates the space for maneuver of monetary policy is quite limited due to the "impossible trinity" and hence, the fiscal policy may have greater impact on the real economy. Additionally, under the currency board regime, the effect of monetary policy actions may be even lower due to the 'loss' of the monetary independence.

This area of investigation has become even more important during the recent economic turmoil when most of the countries have relied heavily on fiscal policy because the maneuver space for the monetary policy had become very limited in the presence of the near-zero level of interest rates (Blanchard et al., 2010). Yet, some of these arguments may not hold for the SEE economies like Croatia and Macedonia due to the *de facto* fixed exchange rate regime. Hence, at the outset of the economic recession in 2009, these economies were faced with pressures on the foreign exchange market. Accordingly, the monetary policy makers had to increase or maintain the current level of the reference rates in order to restore the balance on the foreign exchange market by reducing the liquidity of the banking system. Thus, examining the interaction between monetary and fiscal policies during the recent economic downturn and assessing whether there has been any change in their behavior before and after the Crisis may provide additional useful policy implications for these economies.

This study investigates the joint effects of monetary and fiscal policies on economic activity in three SEE economies: Croatia, Macedonia, and Bulgaria. More precisely, this paper aims to examine the following issues: What is the reaction of fiscal policy to monetary policy shocks and vice versa? What is the reaction of fiscal and monetary policy to shocks in economic activity? What are the effects of fiscal and monetary policy shocks on economic activity?

The value added of this research is that (as far as we are aware) it is one of the first empirical analyses dealing with joint fiscal and monetary policy effects in SEE economies. Specifically, we provide empirical evidence on the linkages between several macroeconomic and policy variables (output, inflation, interest rates and budget surpluses) based on the impulse response functions estimated with recursive VARs. Moreover, as we focus on small open economies, our VAR incorporates the effects of foreign macroeconomic shocks on these economies. The main findings of the paper are as follows: *First,* the expansion of domestic economic activity induces countercyclical fiscal policy behavior in Croatia and Bulgari. In Macedonia, fiscal policy is procyclical, which triggers a countercyclical reaction of monetary

policy. *Second*, following a fiscal policy shock, there is a statistically significant reaction of monetary variables in Macedonia and Bulgaria. *Third*, as for the influence of domestic money market rates on inflation, the estimated results differ between the three countries, i.e. we provide some evidence of the price-puzzle in Croatia and Bulgaria, while in Macedonia inflation declines in a response to an increase in money market rates.

The rest of the paper is organized as follows: Section 2 reviews the empirical literature on the effects of monetary and fiscal policy. The data description and the estimation methods are presented in Section 3 and Section 4, respectively. The findings of the empirical study are presented in the Section 5, which is followed by the main conclusions.

2. An overview of the empirical literature

Over time a vast empirical literature has accumulated providing evidence on the effectiveness of monetary policy. Generally, these studies point to the following general findings: there is a firm relationship between money and prices in the long-run; monetary policy affects prices with a certain lag; initially, the price-puzzle phenomenon appears, which is usually due to the omitted oil price shocks; monetary aggregates or policy-controlled interest rates affect output in the short run; and monetary policy is neutral in the long-run (For instance, see Agénor and Hoffmaister, 1997; Bagliano and Favero, 1998; Baumgartner, et al., 1997; Bernanke and Blinder, 1992; Bernanke and Mihov, 1998; Christiano et al., 1996; Christoffersen and Wescott, 1999; Dewald, 1998; Gavin and Kydland, 2000; Gordon and Leeper, 1994; Hoover and Jordá, 2001; Leeper et al., 1996; Pujol and Griffiths, 1998; Ramaswamy and Sloek, 1998; Rudebusch, 1998; Sims, 1992; and Uhlig, 2005).

In contrast, the research interest in the economic effects of fiscal policy has emerged only recently. According to Fatas and Mihov (2001), this strand of the empirical literature can be grouped in three categories: *First*, studies of specific episodes of fiscal consolidations (large reductions in budget deficits); *Second*, analyses of the stabilizing features of fiscal policy variables (tax and transfer systems) with respect to idiosyncratic regional shocks or aggregate macroeconomic fluctuations; *Third*, studies of the dynamic effects of discretionary fiscal policy.

Most of the empirical studies on the effects of monetary and/or fiscal policy have been done by employing the VAR methodology. Seminal papers that analyze fiscal and monetary

policy within the VAR framework are Bernanke and Blinder (1992), Bernanke and Mihov (1998) and Blanchard and Perotti (2002) with all of them focusing on the US experience. Bernanke and Blinder (1992) impose a set of assumptions about the contemporaneous impact of policy shocks on economic variables and vice versa, followed by the application of the Cholesky decomposition. Bernanke and Mihov (1998) build a "semi-structural" VAR model, which leaves the relationships among macroeconomic variables in the system unrestricted while imposing contemporaneous restrictions on the variables related to monetary policy instruments. Blanchard and Perotti (2002) study the dynamic effects of fiscal policy shocks on economic activity using the Structural VAR (SVAR) approach. In order to identify fiscal policy shocks, they rely on institutional information about the tax and transfer systems and the timing of tax collections.

The most prominent alternative to the VAR-based studies is the narrative approach introduced by Ramey and Shapiro (1998) and Romer and Romer (2010). The former study focuses on the episodes of military expenditure build-up, while the latter paper identifies exogenous tax shocks on the basis of the historical record. Chahrour et al. (2012) show that the different findings from SVAR and the narrative approach is due to the fact that they do not catch the same tax shocks or the small-sample uncertainty. Recently, there appeared a number of studies that employ different combinations of the main policy shocks identification approaches. For example, Dungey and Fry (2007) deal with the identification of fiscal and monetary shocks by using the sign restrictions and permanent and temporary shock methodology of Pagan and Pesaran (2007). In the analysis of fiscal shocks in the USA, Caldara and Kamps (2008) employ the recursive approach, the Blanchard-Perotti approach, the sign restrictions approach and the event-study approach. Perotti (2007) modifies the event-study approach and compares it with the Blanchard-Perotti approach. Burnside et al (2004), Edelberg et al. (1999), and Ramey (2011b) are examples of VAR studies with shocks identified by the approach of Ramey and Shapiro (1998). Favero and Giavazzi (2012) argue that the structural shocks in the VARs can be identified by the narrative approach, which are orthogonal to the information set included within the VAR. Along these lines, Mertens and Ravn (2012) employ the narrative approach of Romer and Romer (2010) within the SVAR.

The empirical research has provided divergent results with respect to both the direction and the magnitude of the effects of fiscal policy shocks on macroeconomic variables (For an overview, see Hemming et al., 2002, and Ramey, 2011a). Specifically, some of the studies find

that fiscal policy shocks have clear positive effects on output, consumption and/or employment in line with the traditional Keynesian view (Fatás and Mihov, 2001; Kuttner and Posen, 2002; Galí et al., 2007; Giordano et al., 2008; Romer and Romer, 2010). In addition, some studies confirm that, typically, fiscal policy has had a stabilising role in the business cycles by running countercyclical primary deficits (Fatas and Mihov, 2001; Melitz, 1997; Taylor, 2000; Galí and Perotti, 2003). However, Barro (1981) and Aiyagari et al. (1992) argue that the effects of changes in fiscal policy depend on whether they are permanent or temporary. Similarly, Ramey (2011b), Favero and Giavazzi (2012), and Mertens and Ravn (2012) show that anticipated and unanticipated fiscal shocks produce different outcomes. Finally, Auerbach and Gorodnichenko (2012) show that output effects of fiscal policy are different in recessions and in expansions.

On the other hand, some papers provide mixed evidence regarding the debate on the Keynesian vs. non-Keynesian effects of fiscal policy, revealing that expansionary fiscal policy may produce adverse effects on some macroeconomic variables as suggested by neo-classical theoretical predictions (Ramey and Shapiro, 1998; Edelberg et al., 1999; Blanchard and Perotti, 2002; van Aarle et al., 2003; Burnside et al., 2004; Mountford and Uhlig, 2005; Perotti, 2004 and 2007; Caldara and Camps, 2008; Afonso and Sousa, 2009; Taylor, 2009; Cogan et al., 2010; Barro and Redlick, 2011; Ramey, 2011b).

The Global crisis has provoked a growing interest in the effects of fiscal policy and the interactions with monetary policy in former transition economies, too. As shown below, even the empirical studies supporting the traditional Keynesian effects of fiscal policy fail to produce quantitatively important fiscal multipliers. Moreover, some papers indicate that expansionary fiscal policy may have adverse effects on output, investment and employment in line with the neoclassical models. Overall, one may conclude that the potential of fiscal policy to stimulate economic activity in CEE countries is very limited, which is in line with the findings in Ilzetzki (2012). In the following paragraphs we briefly review the empirical evidence accumulated so far in this field.

Crespo-Cuaresma et al. (2011) find that monetary policy in CEE economies usually offsets domestic fiscal expansion, while on the other hand fiscal authorities usually accommodate the interest rate shocks. Baxa (2010) provides evidence that fiscal policy in the Czech Republic produces the traditional Keynesian effects. Caraiani (2010) studies the effects of fiscal policy in four CEE countries and finds that both output and inflation rise following an

expansionary fiscal policy, while the interest rates behave in a counteracting manner. Franta (2012) provides empirical support for the Keynesian effects of fiscal policy in the Czech Republic: a positive government expenditure shock raises output, though the effects are short-lived. In addition, expansionary fiscal policy leads to a higher inflation, while the central bank reacts as a substitute by increasing short-term interest rates. Similarly, Jemec et al. (2011) show that fiscal policy shocks in Slovenia produce the Keynesian effects on output, private consumption and investment, but they are of very small magnitude and diminish very quickly.

Baksa et al. (2010) show that the effectiveness of fiscal policy in Hungary is very limited, i.e. fiscal multipliers are low and short-lived. As for the interactions between fiscal and monetary policies, they conclude that the effects of fiscal policy are not dependent on the stance of monetary policy (accommodative or aggressive). Lendvai (2007) provides mixed evidence on the effectiveness of fiscal policy in Hungary, i.e. an increase in government expenditure has positive effects on household consumption and negative effects on the corporate sector. Due to this strong crowding-out effect, total output and employment decline. Mirdala (2009) analyzes the effects of fiscal policy shocks in several CEE and SEE economies during 2000-2008 and finds mixed results about the output effects of government expenditure shocks in different countries. Benčík (2009) provides evidence in favour of neoclassical predictions about fiscal policy effects. Specifically, he finds that fiscal consolidation (a cut in the budget deficit-to-GDP ratio) leads to an increase in output, though the effects are short-term. Based on a panel data for CEE countries during 1993-2002, Rzonca and Cizkowicz (2005) provide evidence that fiscal consolidation has strong favourable effects on output growth. Serbanoiu (2012) shows that in Romania positive government expenditure shocks lead to an increase in output, decline in private consumption and investment (crowding-out effect), initial rise in inflation and temporary decline in interest rates.

For SEE economies, there are a few studies on the effects of fiscal and monetary policies and their interactions. Muir and Weber (2013) investigate the effects of fiscal policy in Bulgaria during 2003-2011 and provide the following main results: fiscal multipliers are very low, especially for government expenditure; recently, fiscal multipliers have increased, suggesting that the impact of fiscal policy on economic activity is larger in recessions; and the size of fiscal multipliers depends on the compositon of expenditure and revenues, i.e. capital spending and direct taxes have the largest effects on output. Mirdala (2009) shows that in Bulgaria fiscal expansion has strong positive effects on output, (which dies out very quickly), but it leads to

increased inflation and higher short-term interest rates. For Albania, Mançellari (2011) shows that fiscal multipliers are very low, and positive government spending shocks lead to a slightly higher inflation.

Rukelj (2009) investigates the interactions of fiscal policy, monetary policy and economic activity in Croatia. His study shows that fiscal and monetary policy move in the opposite direction, i.e. they have been used as substitutes: fiscal shocks have a predominantly negative impact on narrow money, while monetary shocks produce negative effects on government expenditure. Ravnik and Žilić (2011) find that both government expenditure and tax revenues shocks have negative effects on output in Croatia. Also, they show that the interest rates show the strongest response to fiscal shocks, while fiscal shocks have minor and short-lived effects on inflation. Hinić and Miletić (2013) analyze the effects of fiscal and monetary policies in Serbia and show that both government expenditure and tax revenues shocks produce positive on output in Serbia, but the fiscal multipliers are much smaller than one in the short run. As for the interactions between the two policies, they find that monetary policy accommodates fiscal policy shocks and vice versa, i.e. they act as complements.

3. Data description

In modeling fiscal and monetary policy interactions in the three SEE economies with fixed exchange rate regimes (Bulgaria, Croatia and Macedonia) we use quarterly data from the first quarter of 1999 to the fourth quarter of 2011. More precisely, for Bulgaria the data set starts from the first quarter of 1999 and we do not use previous data because of the highly unstable macroeconomic environment prevailing in late 1990s. For Macedonia, the sample starts in the first quarter of 2000 due to the change in the main monetary policy instrument that occurred in the beginning of 2000. For Croatia, the sample starts from the second quarter of 2000 for two reasons: *first*, we wish to avoid the effects of the banking crisis from 1998-1999, and *second*, the money market rate data is available only from the second quarter of 2000. The variables used in the empirical research include: primary cyclically adjusted government balance (as a ratio of GDP), money market interest rate (for Croatia and Macedonia), M0-to-GDP ratio for Bulgaria, quarterly annualized inflation rate and output gap. We have done a seasonal adjustment by using the "CENSUS X-12" method of some of the data series, such as: real GDP, and the Consumer

Price Index (CPI). Inflation rate is based on CPI data. The output gap is calculated as a percentage difference between the actual and potential GDP. In estimating potential GDP and output gap we employ the Hodrick-Prescott (HP) filter method with the default lambda of 1600 (λ=1600). Arguably, this procedure may be burdened with some methodological problems, like the end point bias etc., but it continues to be one of the most commonly used statistical methods in the empirical literature.

In addition, we have conducted the following unit root tests in order to check the stationarity of the data series: Augmented Dickey-Fuller (ADF) with various lag length selection criteria (Akaike, Scwartz and Hannan-Quin), Phillips-Perron (PP), and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests. The unit root tests reveal that money market rates in Croatia and Macedonia, and the M0-to-GDP ratio in Bulgaria are all non-stationary, while the rest of the series are stationary.[1] Accordingly, after performing the same unit-root tests on the first differences of these variables we obtain stationarity and conclude that money market rates for Croatia and Macedonia, and the M0-to-GDP ratio are I(1) variables. Therefore, we proceed by working with the first differences of these variables.

The primary cyclically government balance is used as an indicator of fiscal policy. Here, we take the general government in Bulgaria and the central government in Croatia and Macedonia, because for these two countries the data for general government balance is not available for such a long time period. In both cases, primary government balance is calculated as difference between revenues and primary expenditures, i.e. interest payments are subtracted from total expenditures. The rationale for that, according to Mackiewicz (2008), is that interest payments represent an exogenous category. Ultimately, in designing the current fiscal policy and the size of expenditures, fiscal authorities cannot influence the size of interest payments and they take them as an exogenous factor, which is determined by the past fiscal policy decisions related to public borrowing (Angelovska-Bezoska et al., 2011). For consistency, the data related to fiscal revenues and expenditures, throughout the whole sample period are adjusted according the Governmental Financial Statistics (GFS) 2001 methodology set by the International Monetary Fund (IMF).

Domestic money market interest rates are used as indicators of monetary policy in Croatia and Macedonia. In spite of the fixed exchange rate regime, we believe that there is a

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[1] The results from the unit root tests are available from the authors upon request.

room for autonomous monetary policy in these two countries due to the following reasons: *First*, the interest rate parity holds only if there is perfect capital mobility where domestic and foreign assets are perfect substitutes. Obviously, these assumptions are too strong for Croatia and Macedonia; *Second*, both the Macedonian and Croatian central banks have relied on a series of non-interest rate policy tools, thus, being able to affect domestic money market rates. Certainly, the above mentioned interpretation cannot be valid for Bulgaria where, due to the features of the currency board and the full capital account liberalization, the central bank is not capable of conducting active monetary policy through the conventional tools like the interest rates (Minea and Rault, 2011). Yet, due to the excess coverage with foreign reserves the Bulgarian central bank may have very limited space for maneuver by relying on some other tools, such as the reserve requirement. In that respect, we use the M0-to-GDP ratio as some kind of a monetary policy indicator (though an imperfect one, admittedly). M0 is composed of currency in circulation plus banks' reserves (required reserves and excess reserves). We decided to use this indicator because the Bulgarian National Bank may have some influence on banks' reserves through the reserve requirement. Nevertheless, it is true that banks' reserves contain endogenous component, even when the required reserve ratio remains unchanged they may vary according with the changes in deposit volume. We are aware of the weakness of this monetary policy indicator, but we take it as a second best alternative. Consequently, in interpreting the results of the analysis based on this indicator, some of the conclusions stated should be taken with caution. Table 1 presents the summary statistics of the variables for the three economies.

Table 1: Summary statistics of the variables used in the analysis

Country:	Variable:	Observations	Mean	Median	Minimum	Maximum	Std. Dev.
Bulgaria:	Outputgap_BG	52	-0.21	-0.95	-3.88	6.98	2.23
	Primbalance_BG	52	2.21	2.81	-8.53	8.26	4.06
	Moneymarketrate_BG	52	2.57	2.42	0.22	5.71	1.49
	Infl_BG	51	5.77	5.62	-9.50	18.34	6.67
Croatia:	Outputgap_CR	48	-0.18	-0.63	-2.76	6.14	2.05
	Primbalance_CR	48	0.48	0.05	-4.81	5.44	2.53
	Moneymarketrate_CR	47	3.47	2.71	0.90	13.71	2.44
	Infl_CR	47	3.18	2.94	-8.56	18.51	4.53
Macedonia:	Outputgap_MK	48	-0.06	-0.22	-7.77	9.76	2.93
	Primbalance_MK	48	0.34	0.17	-8.14	7.34	3.20

Moneymarketrate_MK	48	7.11	6.75	2.06	17.87	3.67
Infl_MK	47	2.58	2.25	-5.67	13.54	4.06

Source: Authors' own calculations based on the data from EUROSTAT, ministries of finance, central bank web-sites and state statistical offices of the respective countries.

4. Estimation method

Recently, VAR models have become the main econometric tool for assessment of the effects of monetary and fiscal policy shocks. The main advantage of this methodology lies in its simplicity and its well-suited tools (impulse response functions and variance decomposition) for tracing the dynamic interactions between a set of endogenous variables. In general, there are three basic types of VAR models: reduced form VAR, recursive VAR and SVAR. More details about each type of the VAR specifications can be found in Stock and Watson (2001), Enders (2010) and Lutkepohl and Kratzig (2004).

We apply the recursive VAR for modelling the interactions between domestic economic activity in the three economies and their fiscal and monetary policies and, consequently, for imposing the restrictions on the contemporaneous impact of each of the variables included in the model. The rationale for using recursive VAR models is done is as follows: *First,* these models are seen as most appropriate choice when the model consists of endogenous variables and the possible two way causation among the variables. *Second,* they enable us to estimate impulse response functions that indicate the interrelations and the transmission mechanism of the imposed shocks in each equation to the rest of the variables in the model. *Third,* these methods enable us to include restrictions about the contemporaneous impact of the variables in the model.

Related to the objectives of our research, from a practical point of view, VARs are appropriate for analysing how monetary and fiscal policies affect macroeconomic variables as well as how the policymakers react to the developments in the economy. In these regards, Blanchard and Perotti (2002) and Muscatelli et al. (2002) argue that VAR models are more appropriate for analysing the fiscal transmission mechanism than monetary policy shocks. For instance, fiscal policy actions are motivated by various reasons other than stabilisation purposes. In addition, due to the presence of long decision and implementation lags, fiscal policy cannot react to current changes in the economy. As a result, fiscal shocks in VARs can be treated as truly exogenous. However, the main problems with this methodology are related to the

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identification of policymakers' preferences and the estimation of theory-based structural reaction functions. The latter usually requires imposing certain identifying restrictions, which, often, are more or less arbitrary, especially for fiscal policy rules. In this sense, the estimation of fully-fledged structural models of fiscal and monetary reaction functions and the use of VAR models to identify fiscal policy shocks is still at a rather embryonic stage (Muscatelli et al., 2002). In addition, there are other challenges, too: it is difficult to disentangle pure fiscal policy shocks from the automatic response of fiscal policy variables to the business cycle or monetary policy shocks; due to the implementation lags, fiscal policy shocks are often anticipated leading to biased impulse responses; there are several competing definitions of fiscal policy shocks (Mountford and Uhlig, 2005). Finally, the practical implementation of VAR techniques for analysing fiscal policy is dependent on the existence of reliable and sufficiently long quarterly data, which is not always available as well as on other technical issues, such as the use of cash-basis or accrual-basis data etc. (Giordano et al., 2008).

The general specification of the recursive VAR models can be written as follows:

$$Ay_t = A^* \mu + \sum_{i=1}^{p} A^* L^i y_t + B\varepsilon_t \qquad (1)$$

where y is a $Kx1$ vector of endogenous variables, A^* is a KxK coefficient matrix, μ is a vector of constants, L is the lag operator, ε is the vector of structural errors, t is a time operator. A is a lower triangular matrix that specifies the instantaneous relations between the variables in the model and B is a KxK identity matrix.

In order for the model (1) to be estimated, first we need to estimate its reduced form version, presented as follows:

$$y_t = A^{-1}A^* \mu + \sum_{i=1}^{p} A^{-1}A^* L^i y_t + u_t \qquad (2)$$

where the same symbols of equation (1) apply to equation (2), with the major difference of u which are reduced form disturbances to the structural shocks ε from equation (1). The relationship between u and ε is as follows:

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

Model (1) is known in the literature as AB model and it is used to estimate the short-run relationship among the variables (the short-run model). In order for models (1) and (3) to be

identified and the structural disturbances ε to be orthogonal, certain restrictions of the parameter matrices A and B have to placed. More precisely, in order models (1) and (3) to be exactly identified, at least $K(K-1)/2$ restrictions need to be imposed on A and B matrices respectively, or in total $K(3K-1)/2$ restrictions, where K is the number of endogenous variables in the model (Lutkepohl and Kratzig, 2004). In our case, B being identity matrix, the restrictions are imposed on matrix A alone.

The dependent variables in the VAR are: y_f, i_f, π_f, y_d, F_d, i_d and π_d. The variables containing the superscript f are foreign variables, while those with the superscript d are domestic variables. Thus, the variables: y_f, i_f and π_f represent the output gap, money market rate (the 3-month Euribor) and inflation rate in the euro-zone, respectively. The variables y_d, F_d, i_d and π_d indicate the output gap, fiscal policy variable, the money market rate and inflation in the domestic economy, respectively. Although we are not interested primarily on the effects of foreign shocks on domestic macroeconomic variables, our VAR incorporates explicitly foreign shocks for reasons explained below. We estimate the VARs separately for the three economies (Bulgaria, Croatia and Macedonia).

The recursive VAR is based on the so-called triangular structure of the ordering of the variables where the first ordered variable has a contemporaneous impact on each successive variable, whereas each successive variable in the model does not have contemporaneous impact on the previous variables. As a consequence, recursive VARs are sensitive to the ordering of the variables though the order of the variables is usually done according to the theoretical underpinnings while not according to researchers' individual judgment. However, we decided to pay central attention to the estimates of the recursive VAR instead of SVAR with imposing additional restrictions because as Bernanke (1986) argues:

".....overidentified models will not in general yield perfectly orthogonal u's[2], so the problem of how to order variables in variance decompositions and IR functions re-emerges (albeit in a relatively minor way, since if the overidentifying restrictions are not rejected, the departure from orthogonality is small). Third, in practice one rarely enjoys the luxury of having many substantive overidentifying restrictions; indeed, some of the assumptions needed to identify are typically "auxiliary" assumptions, in that they are not strongly

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[2] Here, Bernanke (1986) refers to the orthogonal disturbances of the recursive and SVAR models that in our paper are presented as ε in equations (4) and (5).

implied by the basic theory. (For example, it may be assumed that the disturbances associated with certain structural equations are uncorrelated.) The use of just-identified models in practice thus tends to minimize the number of auxiliary assumptions employed.", pp. 10-11.

The specification of the recursive VAR model expressed in a matrix form is as follows:

$$
\begin{bmatrix}
1 & 0 & 0 & 0 & 0 & 0 & 0 \\
\alpha_{21} & 1 & 0 & 0 & 0 & 0 & 0 \\
\alpha_{31} & \alpha_{32} & 1 & 0 & 0 & 0 & 0 \\
\alpha_{41} & \alpha_{42} & \alpha_{43} & 1 & 0 & 0 & 0 \\
\alpha_{51} & \alpha_{52} & \alpha_{53} & \alpha_{54} & 1 & 0 & 0 \\
\alpha_{61} & \alpha_{62} & \alpha_{63} & \alpha_{64} & \alpha_{65} & 1 & 0 \\
\alpha_{71} & \alpha_{72} & \alpha_{73} & \alpha_{74} & \alpha_{75} & \alpha_{76} & 1
\end{bmatrix}
\begin{bmatrix}
u_t^{yf} \\
u_t^{if} \\
u_t^{\pi f} \\
u_t^{yd} \\
u_t^{Fd} \\
u_t^{Id} \\
u_t^{\pi d}
\end{bmatrix}
=
\begin{bmatrix}
1 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1
\end{bmatrix}
\begin{bmatrix}
\varepsilon_t^{yf} \\
\varepsilon_t^{if} \\
\varepsilon_t^{\pi f} \\
\varepsilon_t^{yd} \\
\varepsilon_t^{Fd} \\
\varepsilon_t^{Id} \\
\varepsilon_t^{\pi d}
\end{bmatrix}
$$

(4)

According to the presented structure of the recursive VAR, we have imposed the following restrictions: *a)* foreign variables (output gap, money market rate and inflation in the euro-zone) have contemporaneous impact on each of the variables in the three sample countries while the opposite relationship is precluded; *b)* economic activity (output gap) in the euro-zone and in the three analysed countries contemporaneously influence the policy variables (fiscal and monetary policy), while the policy variables do not have a contemporaneous impact on economic activity because they affect the 'real' sector with a certain time lag (see Blanchard and Quah, 1989). The last restriction implies that economic activity and policy variables in both the euro-zone and domestic economies of the three countries have contemporaneous impact on inflation while inflation does not have contemporaneous feedback on these variables. As can be seen, we build our empirical model on the assumption that euro-area macroeconomic variables affect exogenously the sample economies. This assumption arises quite naturally given that we focus on small open economies, which are integrated with the EU. Moreover, in order to fully incorporate the small open economy assumption, we follow Cushman and Zha (1997) and Aysegul (2004) by imposing the block-exogeneity restrictions in the model. Specifically, in the baseline unrestricted VAR, the lags of foreign variables are included in the equations of domestic variables, while the lags of domestic variables are excluded from the equations of foreign variables.

After explaining the estimation methods used and the restrictions included in the VAR models, we now briefly explain our estimation strategy:

1. We first specify an unrestricted VAR model in order to determine the optimum number of lags of the variables used. Here, will select the most parsimonious model due to the relatively limited number of observations compared to the number of variables included. The selection of the lag length is done on two basis: *a)* lag length selection criteria such as: Akaike (AIC), Schwarts (SIC), Hannan-Quinn (H-Q), Sequential modified likelihood ratio test statistic (LR) and Final prediction error (FPE) and *b)* residual-based diagnostic tests (explained in the bullet number four).

2. After specifying the maximum number of lags by the aforementioned lag length selection criteria, in the cases where more than one lag is suggested, then, due to the limited number of observations relative to the number of variables used, we do a subset model selection by dropping those lags of the variables of the unrestricted VAR that may improve the criterion value. In doing this we employ the so-called "top-down" procedure in selecting the number of lags in each individual equation in the VAR (for more details see Lutkepohl et al., 2006).

3. We estimate the unrestricted VAR model by the feasible generalized least squares (FGLS) estimator;

4. In order to explore whether the unrestricted VAR model is correctly specified and stable, we also conduct residual-based diagnostic tests, such as: Portmanteau and Breusch-Godfrey LM tests for autocorrelation, the Jarque-Bera normality test, and the Autoregressive conditional heteroskedasticity test (ARCH-LM). If the selected model by the steps 1 and 2 satisfy these residual-based diagnostic tests, we proceed further with them. Otherwise, we re-specify the unrestricted VAR by reducing or increasing the number of lags until the residual-based diagnostic tests provide satisfactory results.

5. We tests for the stability of the estimated coefficients of the unrestricted VAR by employing several structural break tests for unknown breakpoint: the cumulative sum of the recursive residuals (CUSUM) and the squared cumulative sum of the recursive residuals (CUSUM SQ), suggested by Brown et al. (1975).

6. If we find no structural breakpoint then we proceed by estimating the recursive VARs by employing maximum likelihood (ML) estimator with scoring algorithm (Amisano and Giannini, 1997).

5. Model selection and discussion of the results

In this section we present the model selection of the unrestricted VAR and then we continue by explaining the estimated results (mainly the impulse response functions – IRFs) from the recursive VARs for each country separately.

5.1. Model specification

As already explained in Section 4, we have selected the unrestricted VAR model for each of the three sample economies according to the lag length selection criteria and the residual-based diagnostic tests presented in Table 2:

Table 2: Lag-length selection criteria, residual-based test results in selecting the unrestricted VAR model for each economy, and structural stability tests.

Country:	Bulgaria	Croatia	Macedonia
Lag-length selection criteria	/	SIC, H-Q and FPE	/
Number of lags selected	2	1	1
Residual-based diagnostic tests (p-value)			
Portmanteau autocorrelation test	0.09	0.13	/
Breusch-Godfrey LM tests	0.38	0.12	0.07
Jarque-Bera normality test	0.11	0.02	0.23
ARCH-LM	0.60	0.42	0.68
Structural stability tests			
CUSUM	No break	No break	No break
CUSUMSQ	Only for the money market rate	No break	No break

Source: Authors' own calculations performed in JMulti.

As can be seen in Table 2, the lag length selection criteria (SIC, H-Q and FPE) indicated one lag for Croatia whereas they do not point to any specific number of lags for Bulgaria and Macedonia. Precisely, for these two countries the results tended to select always the last lag included in the lag length selection, according to which the result varied to the maximum number of lags included. Therefore, in the cases of Bulgaria and Macedonia we have decided to select the number of lags according to the residual-based diagnostic tests. In these regards, we were led

by the non-rejection of the null hypothesis of no serial correlation, normal distribution of the residuals and homoskedastic error terms at least at 5% level of significance.

Having determined the number of lags used in the unrestricted VAR, we proceed with estimating the unrestricted VAR and conducting the structural stability tests: CUSUM and CUSUMSQ. The results are presented in Table 2.[3] The structural stability test results for Croatia and Macedonia indicated that there has not been any structural break during the sample period for any of the variables included. For the case of Bulgaria the test results also indicated to the same conclusion for almost all of the variables used, with the exception of the money market rate for which mixed results are obtained. Namely, the CUSUM test suggests no structural break while the CUSUMSQ test indicates one structural break in the beginning of 2008. Because the results are mixed between the two methods and there is no a priori reason why we would expect a structural break of the money market rate in the period suggested, we proceed by estimating the recursive VARs as there is not structural break.

5.2. Discussion of the estimated IRFs from recusrsive VARs

In this section we interpret the cummulativeimpulse responses from the recursive VARs. In assessing the IRFs we also calculate the 95% confidence bands of Efton (Efton and Tibshirani, 1993) and Hall (1992), estimated with bootstrap method of 100 replications. The impulse IRFs of the variables from the recursive VAR are provided in the Appendix and are ordered according to the variable from which the impulses are generated.

The IRFs of the fiscal policy variable to a shock in the output gap (see panel A in the Appendix) show that the increase in domestic economic activity in Bulgaria and Croatia leads to higher cyclically adjusted budget surpluses. This suggests that fiscal policy behavior in these two economies is countercyclical indicating that fiscal policy makers are actively adjusting the fiscal revenues and expenditures according to the changes in the economic cycle. In other words, fiscal policy authorities use the periods of economic expansion to save more by increasing the budget surplus or reducing the budget deficit and vice versa when the economy is in the downward stage. This type of reaction of the fiscal policy makers occurs with a time lag of one quarter in Bulgaria and lasts up to eight quarters. In Croatia, fiscal policy authorities react countercyclically

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[3] The detailed charts for the stability tests are available upon request from the authors.

with a delay of two quarters. The countercyclical fiscal policy reaction is greater in Bulgaria where a shock of one standard deviation in the domestic output gap leads to a higher cyclically adjusted budget surplus of 5 percentage points. On the other hand, the reaction of fiscal policy authorities in Croatia is quite modest, i.e. the structural budget surplus (as a share in GDP) increases by only 0.6 percentage points as a reaction to a positive shock in the domestic production gap with a magnitude of one standard deviation. Further on, in both countries, the reaction of fiscal policy is quite persistent. These findings are in line with some studies that confirm that, typically, fiscal policy has a stabilising role in the business cycles by running countercyclical primary deficits (Fatas and Mihov, 2001; Melitz, 1997; Taylor, 2000; Galí and Perotti, 2003). Also, they are consistent with Crespo-Cuaresma et al. (2011) who have also found a countercyclical behavior of fiscal policy in Central European economies. In contrast, these conclusions do not hold in the case of Macedonia, where the estimated IFRs imply a procyclical fiscal policy behavior. Therefore, Macedonian fiscal policy makers fail to use the god times to improve public finances. Instead, when the positive output gap increases, the fiscal authorities worsens the structural budget surplus, thus, adding to output fluctuations. This reaction of the fiscal policy makers occurs with a delay of six to seven quarters and the procyclical fiscal policy reaction is moderate (around 1 percentage point). This evidence for a procyclical behavior of fiscal policy in Macedonia is contrary to the findings of Angelovska-Bezoska et al. (2011) who have found a countercyclical behavior, which may be due to the differences in the sample and the estimation method used.

The IRFs for the monetary policy variable reveal a statistically significant reaction only in Macedonia where a positive shock in the output gap leads to a rise in the money market rate thus, suggesting a countercyclical reaction of the central bank. This occurs with a delay of two quarters and the reaction of the monetary policy makers lasts up to the fourth quarter. The reaction of the monetary policy makers to shocks in the output gap is estimated around 0.9 percentage points. In addition, this reaction on the part of the central bank may be explained by its efforts to counteract the procyclical behaviour of fiscal authorities, as have been explained above. Taken together, these two results suggest that fiscal and monetary policies in Macedonia act as strategic substitutes in the conduct of the stabilization policy. Further on, the above finding suggests that, in contrast to Bulgaria and Croatia, the Macedonian central bank exhibits some degree of autonomy in the conduct of monetary policy due to the fact that its capital account is

not fully liberalized. This is in line with our prior expectations that demand-side pressures caused by the increased economic activity may lead to greater imports of goods and services. This will deteriorate the current account balance thus, causing pressures on the foreign exchange market. Accordingly, the central bank will react by increasing the key policy rate, whose effects will be quickly transmitted on money market rates.

Regarding the IRFs of domestic inflation to a shock in the output gap (panel A in the Appendix) it can be observed that there is a significant and positive reaction of inflation in all three countries. The reaction of inflation to a positive shock in the output gap occurs with a delay of two quarters in Croatia whereas in Bulgaria and Macedonia this time lag is greater around four quarters. The magnitude of the reaction of inflation to a shock of one standard deviation in output gap is quite similar among the three countries: it is somewhat stronger in Croatia and Bulgaria (around 2.5 percentage points) and a bit lower in Macedonia (around 2 percentage points). The effects of output gap on inflation suggest that, besides foreign inflation, domestic consumption, too, seems to be an important source of inflationary pressures in SEE countries.

Within this block of IRFs, we are especially interested in the macroeconomic effects of fiscal and monetary policies. Panel B of the Appendix shows the response of monetary policy indicators and inflation to a fiscal policy shock (an increase in the cyclically adjusted budget balance). Regarding monetary policy indicators, there is a statistically significant reaction in Macedonia and Bulgaria only. Here, a positive shock in the cyclically adjusted budget balance in Macedonia leads to a decline in the money market rate of 0.3 percentage points. This reaction, though small, once again, supports the notion that the central bank attempts to counteract the procyclical behaviour of fiscal authorities. Hence, this finding serves as additional evidence that monetary and fiscal policies act as strategic substitutes in the conduct of stabilization policy. In Bulgaria, a positive shock to the cyclically adjusted balance results in an increase in the M0-to-GDP ratio with a magnitude of 1.8 percentage points, which starts with a lag of four quarters and persists over the next six quarters. This result may be related to the countercyclical behaviour of fiscal policy: the attempts of fiscal authorities to counteract the positive output gap have favourable effects on inflationary expectations, leading to an increase in the demand for money. For Croatia, the lack of statistically significant response of domestic money market rates to fiscal policy may reflect the reliance on foreign borrowing as a source of financing budget deficits (see Kraft, 2003, and Vujčić, 2003).

As for the response of domestic inflation to changes in the fiscal policy stance, we can notice that in Macedonia the increase in cyclically adjusted budget balance leads to a lower inflation of around 0.6 percentage points in the fourth and sixth quarter. This result is consistent with the above mentioned procyclical behaviour of fiscal policy, which tightens during the downward stage of the business cycle, thus reducing further aggregate demand and lowering inflation. In the case of Bulgaria we can notice an opposite reaction which is a bit puzzling, whereas in Croatia there is not any significant reaction of inflation to changes in the fiscal policy stance, which is consistent with the findings in Ravnik and Žilić (2011). Also, this is in line with the similar results obtained for the response of money market rates to fiscal policy shocks.

Finally, we examine the IRFs of domestic inflation following a shock in domestic monetary policy indicator (see panel C in the Appendix). *A priori*, for Croatia and Macedonia we expect a negative reaction of inflation to the increase in money market rates via the interest rate channel (see de Bondt, 2005) and the bank lending channel of monetary policy transmission mechanism (see Bernanke and Blinder, 1988). In our recursive VAR model, the expected negative response of inflation can be observed in both countries, yet it is statistically significant only in Macedonia, where it is relatively low (0.5 percentage points). Overall, the results obtained from our recursive VAR imply that the possibility to fight inflation in Croatia and Macedonia by means of the conventional monetary policy tools (the interest rate policy) is quite limited. This finding is consistent with the evidence provided in some studies on the interest rate and bank lending channel of monetary policy (Petrevski and Bogoev, 2012; and Bogoev, 2011). As for Bulgaria, we expect a positive reaction of inflation to an increase in the M0-to-GDP ratio, because the higher liquidity creates demand side pressures, which eventually results in greater inflation. As can be seen, the IRFs show that, following a monetary shock, inflation begins to rise with a lag of three quarters reaching the peak after four quarters (with a magnitude of 0.6 percentage points), when it starts to decay gradually and reverts to its trend ten quarters after the initial shock.

6. Conclusions

The major research task of this study is to examine the effects of monetary and fiscal policies in SEE economies: Bulgaria, Croatia and Macedonia. Specifically, we conduct an empirical

investigation in the linkages between several macroeconomic and policy variables (output, inflation, interest rates and budget surpluses) based on the impulse response functions estimated with recursive VARs.

We find that domestic economic expansion leads to positive structurally adjusted primary balance in Croatia and Bulgaria (countercyclical fiscal policy), and procyclical fiscal policy behavior in Macedonia. On the other hand, a positive shock in the output gap leads to a statistically significant increase in domestic money market rates only in Macedonia, which implies a contracyclically reaction of monetary policy. This type of behaviour of monetary policy can be explained by the attempts of central banks to curb potential adverse effects of domestic economic expansion to the sustainability of the fixed exchange rate regimes. In addition, our empirical analysis show that domestic economic expansion results in higher domestic inflation in all the three sample economies, suggesting that domestically-induced inflationary pressures matter, too.

A valuable finding of this paper concerns the interrelations between monetary and fiscal policies. Here, following a fiscal policy shock, there is a statistically significant reaction of monetary policy indicators in Macedonia and Bulgaria only. Specifically, in Macedonia, a positive shock in the cyclically adjusted budget balance leads to a decline in the money market rate, implying that monetary and fiscal policies act as strategic substitutes in the conduct of stabilization policy. In Bulgaria, a positive shock in the cyclically adjusted balance results in an increase in the M0-to-GDP ratio, which may reflect the favourable effects of the countercyclical behaviour of fiscal policy on inflationary expectations and the demand for money, respectively. For Croatia, the lack of statistically significant response of domestic money market rates to fiscal policy may reflect the reliance on foreign borrowing as a source of financing budget deficits. As for the influence of domestic money market rates on inflation, we find the expected negative impact only in Macedonia. Similarly, we find the expected positive reaction of inflation to the increase in the M0-to-GDP ratio in Bulgaria.

Overall, we can conclude that economic activity exerts significant influence on inflation and to some extent on the behavior of fiscal and monetary policies. Also, we can conclude that domestic fiscal policy affect monetary policy and inflation whereas conventional monetary policy tolls (interest rates) produce limited effects on inflation in the three SEE economies.

Some additional issues remain open for further research. For example, it will be interesting to investigate the macroeconomic effects of fiscal policy and monetary-fiscal interactions by considering budget revenues and budget expenditure separately. This will enable us to estimate the fiscal multipliers on both the revenue and expenditure side and, thus, to compare the effects of these two fiscal policy instruments for stabilisation purposes. In addition, working with budget revenues and expenditure separately will give us further insights into the fiscal-monetary interactions because fiscal policy might respond differently to monetary policy shocks on the revenue and the expenditure side.

Appendix: IRFs of recursive VAR with 95% confidence intervals of Efton and Hall, respectively.

A: Impulses generated from a shock to the output gap

Impulse responses of fiscal policy:

Bulgaria	Croatia	Macedonia
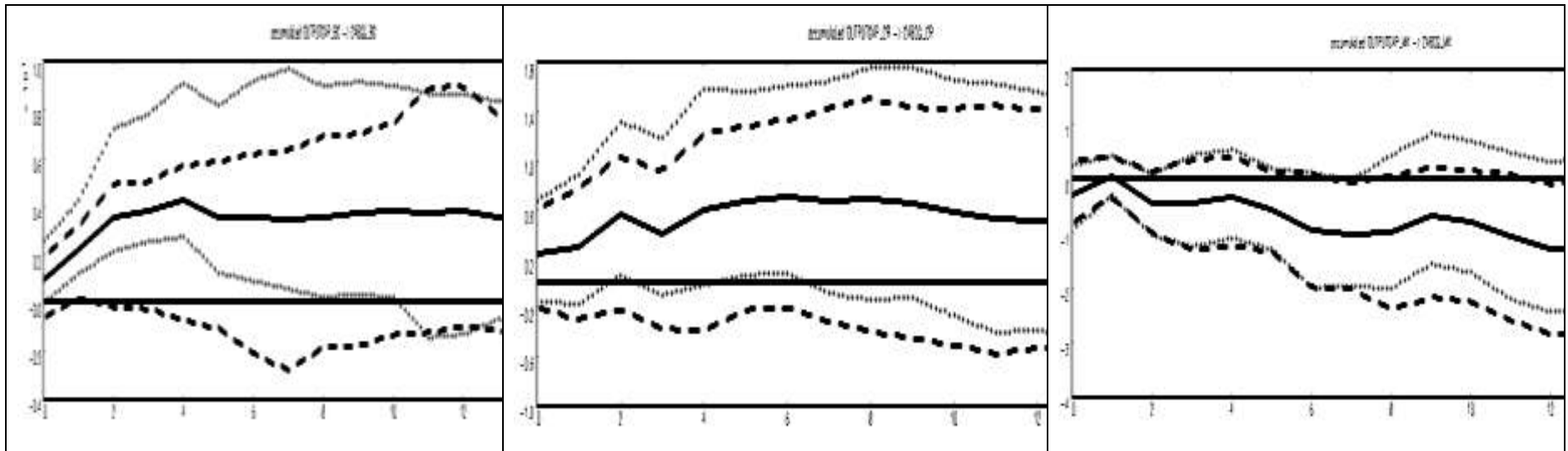
Impulse responses of the domestic monetary policy indicator:
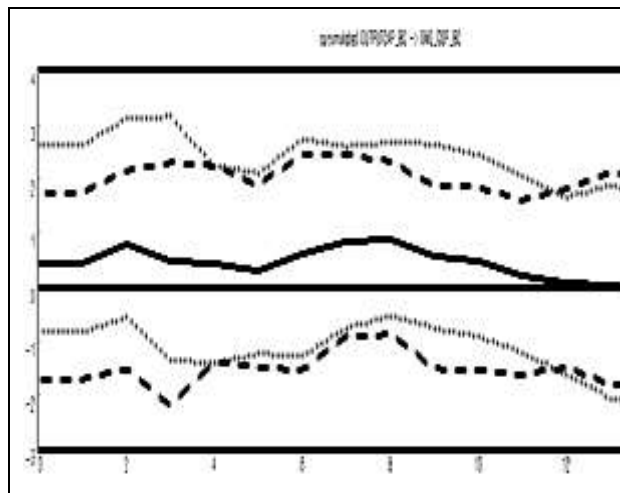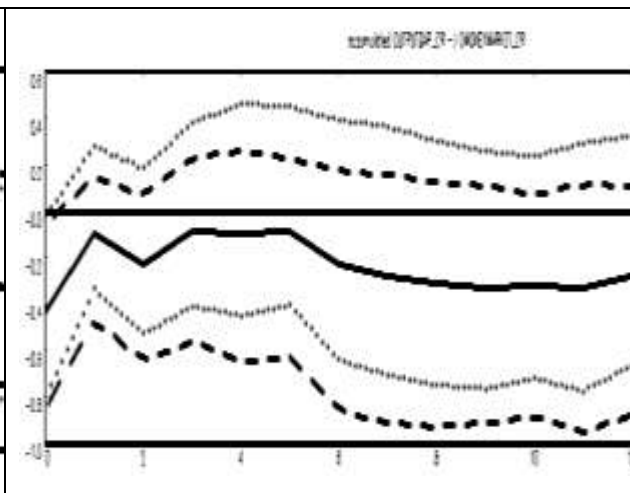
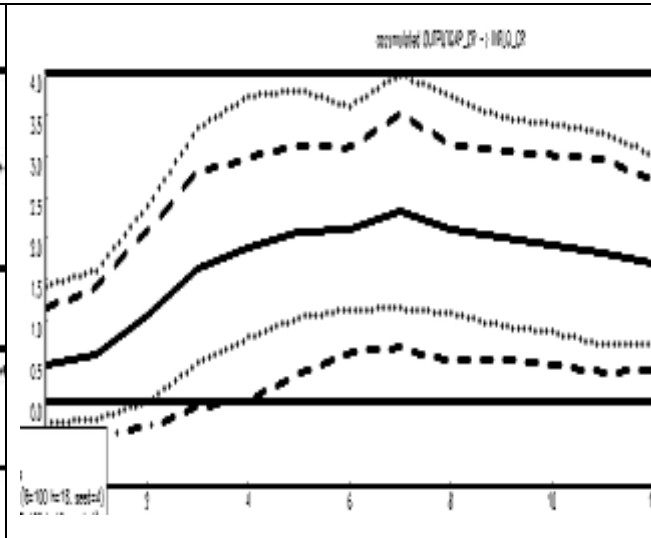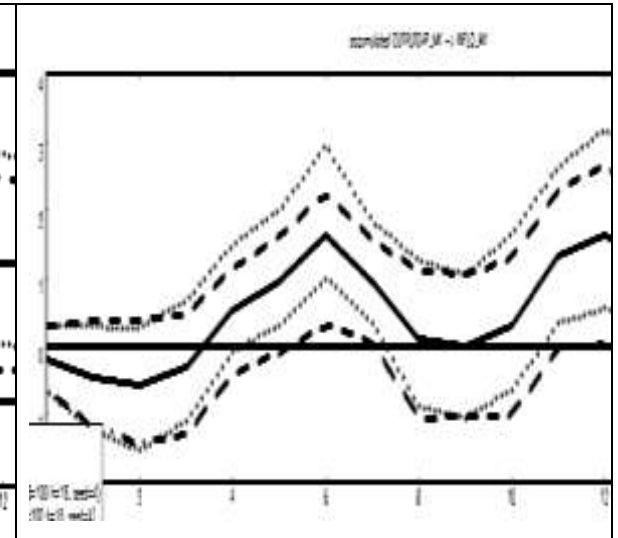| Bulgaria | Croatia | Macedonia |
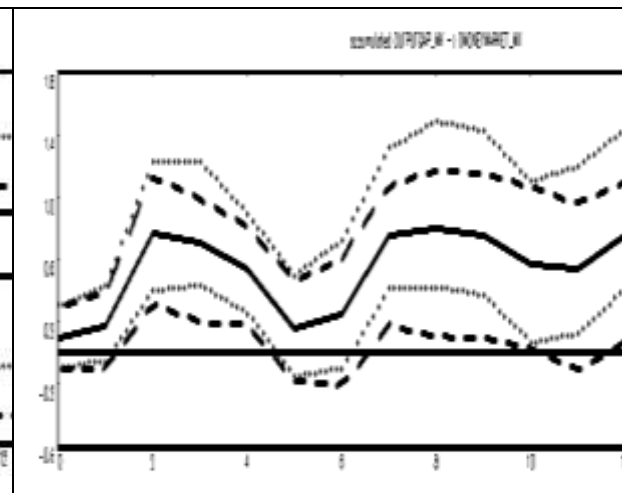
Impulse responses of inflation:
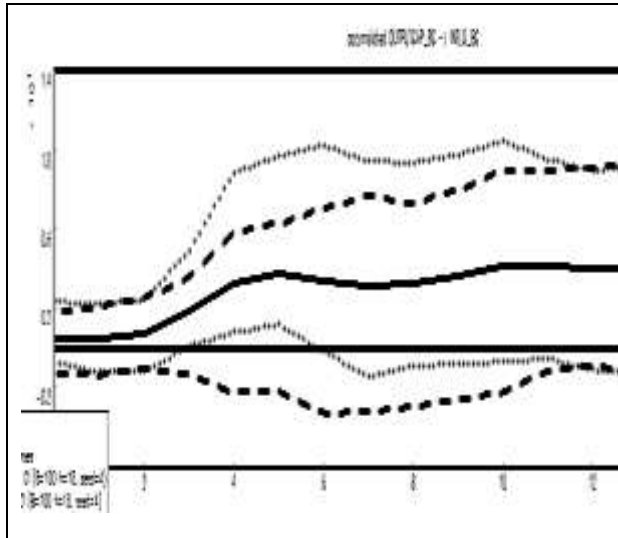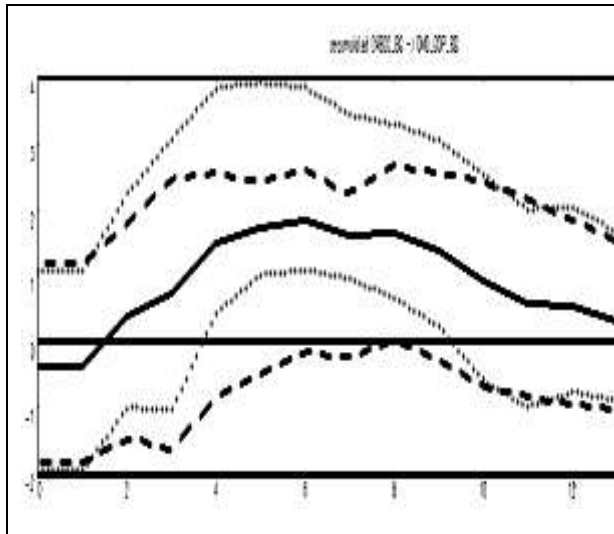
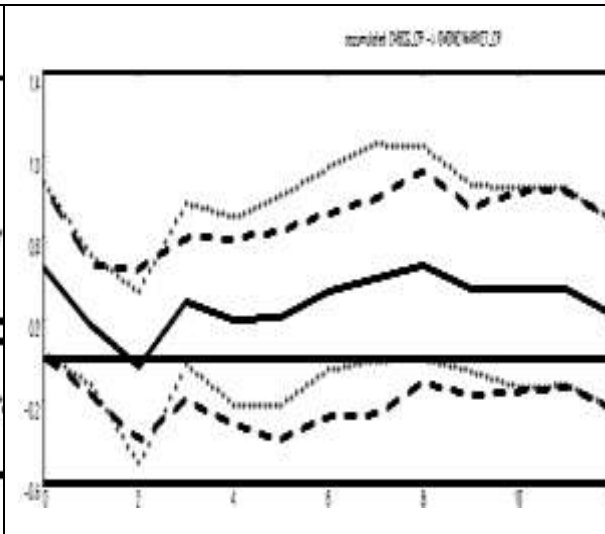Bulgaria   Croatia   Macedonia

B: Impulses generated from a fiscal policy shock
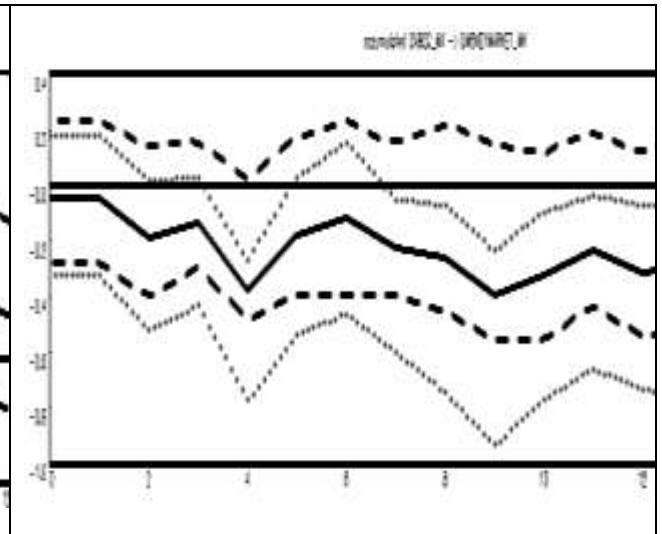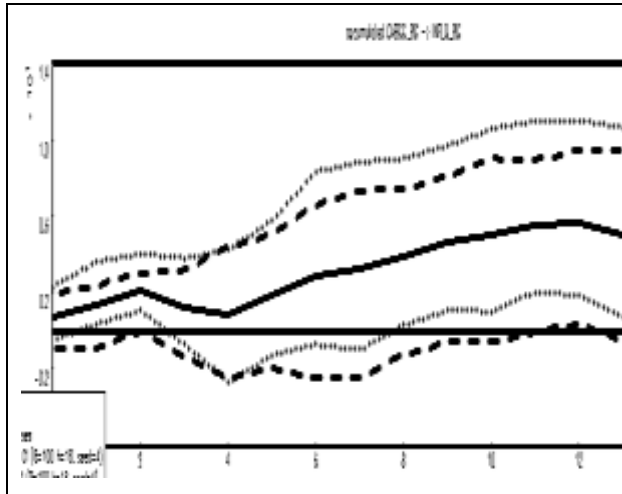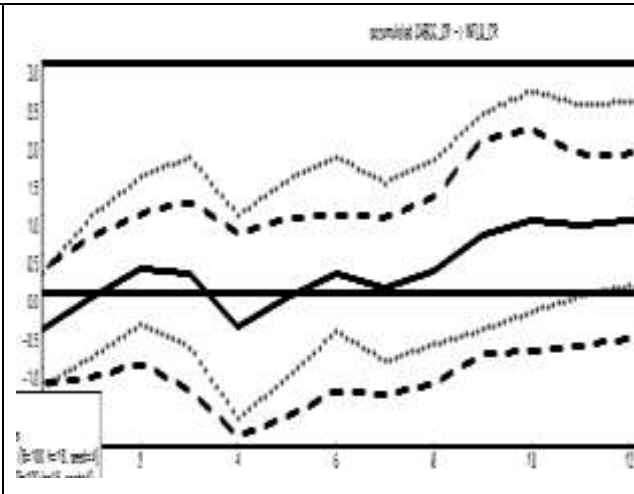
Impulse responses of the monetary policy indicator:

Bulgaria	Croatia	Macedonia

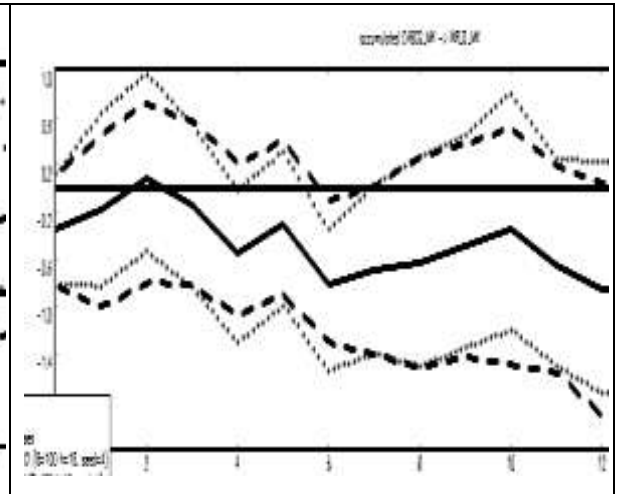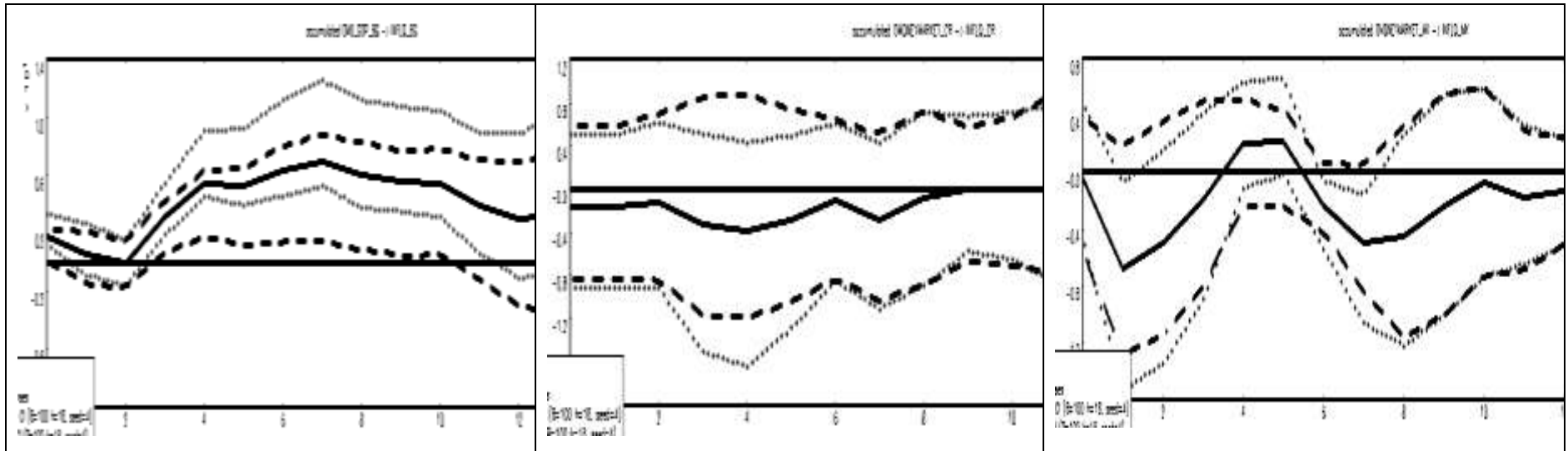Impulse responses of inflation:

Bulgaria	Croatia	Macedonia

C: Impulses generated from a monetary policy shock

Impulse responses of inflation:

| Bulgaria | Croatia | Macedonia |

where:

▬ Zero Line
▬ SVAR Impulse Responses
▬ 95% Efron Percentile CI (B=100 h=10)
····· 95% Hall Percentile CI (B=100 h=10)

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