The Transmission of Foreign Shocks to South Eastern European Economies

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Abstract

This paper investigates the transmission of foreign shocks to economic activity and macroeconomic policies in the South Eastern European (SEE) economies with fixed exchange rate regimes: Croatia, Macedonia and Bulgaria. Specifically, we provide empirical evidence on the influence of the EMU policy and non-policy shocks (the output gap, the money market rate and the inflation rate in the euro-zone) on monetary and fiscal policies and economic activity in the analysed countries.The main motivation behind our empirical investigation is the fact that all of these economies are small open economies with rigid exchange rate regimes, with different degree of integration within the EU. As for the methodological issues, we employ recursive Vector Auto regressions to identify the exogenous shocks in the euro-area. Generally, the estimated results imply that euro-zone economic activity has significant and relatively strong influence on SEE economies and these external shocks are transmitted relatively quickly. Moreover, the results also suggest that the effects of exogenous shocks are more persistent if the domestic economy is more integrated with the EU. An additional finding is that shocks in the foreign reference rate are relatively quickly transmitted to domestic money market rates. We can explain these effects by several factors, such as: the fixed exchange rates, the relatively high integration of SEE financial markets to EMU financial markets as well as the dependence of banks on foreign financing. Finally, euro-zone inflation does not have a significant influence on domestic inflation, which might indicate that inflation in SEE economies is mostly driven by idiosyncratic shocks.

Key words: Monetary Policy, Vector Autoregression, Exogenous shocks.

JEL codes: C3, E52, E58, E61

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1. Introduction

Since the very beginning of the transformation process, the former communist countries have declared their aspiration towards joining the European Union (EU). In this respect, they have engaged in massive institutional and economic reforms which have helped them to converge gradually to the "old" EU members. As a result, first Bulgaria and Romania and later on Croatia succeeded in achieving the goal of EU accession, while Macedonia has been given the candidate status. Looking forward, SEE countries are faced with another challange related to the EU accession process, namely, that of adopting the single currency.

Therefore, exploring the transmission of EU economic and policy shocks represents a relevant research issue for the former transition economies from SEE, such as: Croatia, Macedonia, and Bulgaria. Our paper aims to examine the following issues: What is the reaction of fiscal and monetary policy in SEE countries to a shock in the economic activity within the EU? What is the reaction of fiscal and monetary policy in SEE countries to a shock in the EU inflation rate? Do monetary policies in SEE countries follow the monetary policy implemented by the European Central Bank? In addition, we seek to find out whether there are any significant differences in the impacts of foreign shocks on domestic macroeconomic variables depending on the level of EU integration. Hence, the paper provides empirical evidence on the effects of several euro-zone macroeconomic and policy shocks (output gap, inflation, and interest rates) on several macroeconomic and policy variables in the SEE countries (output, inflation, interest rates and budget surpluses) based on the impulse response functions estimated with recursive VARs. In this way, we are able to assess how the exogenous factors affect macroeconomic performances and policy variables in SEE economies.

Generally, the estimated results imply that euro-zone economic activity has significant and relatively strong influence on SEE economies and these external shocks are transmitted relatively quickly. Moreover, the results also suggest that if the domestic economy is more integrated with the EU, then these exogenous shocks are more persistent. An additional finding is that shocks in the foreign reference rate are relatively quickly transmitted to domestic money market rates. We can explain these effects by several factors,

such as: the fixed exchange rates, the relatively high integration of SEE financial markets to EU financial markets as well as the dependence of banks on foreign financing. Surprisingly, euro-zone inflation does not have a significant influence on domestic inflation, which might indicate that inflation in SEE economies is mostly driven by idiosyncratic shocks.

The rest of the paper is organized as follows: Section 2 provides a short overview of the empirical literature on the transmission of foreign shocks and the response of domestic policies. 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.

2. An overview of the empirical literature on the transmission of foreign shocks

The effects of foreign real and monetary shocks and the response of domestic economic policies have been discussed extensively in the open economy macroeconomics literature (For instance, see Prachowny, 1984; Krugman, 1988; Shone, 1989; Karakitsos, 1992; Jha, 1994; Agénor and Montiel, 1996; Hossain and Chowdhury, 1996; Obstfeld and Rogoff, 1996).

The empirical literature focusing on the effects of foreign shocks on former transition economies has emerged only recently, reflecting the accession process towards the EU and the prospective membership in the euro area. For instance, Christoffersen and Wescott (1999) show that foreign price shocks have significant effects on inflation in Poland. Petrevski et al. (2012) obtain the same results for a panel of 17 CEE economies during 1990-2009. Similarly, Horváth and Rusnák (2009) find that inflation dynamics in Slovakia is predominantly influenced by foreign factors. Also, they show that euro area interest-rate shocks have strong effects on domestic money market interest rates and inflation, but not on the other macroeconomic variables. Petrevski and Bogoev (2012) find a cointegrating relationship between Euribor and Bulgarian money market and lending rates, but not in Croatia and Macedonia. On the other hand, Minea and Rault (2011) show that Bulgarian interest rates are not linked with ECB's interest rates in the short-run.

Crespo-Cuaresma et al. (2011) study the transmission of foreign fiscal shocks to five CEE countries during 1995-2009 and show that German fiscal expansion is followed by an increase in government spending, and a decline in net-taxes, output and inflation in most of

these countries. Jiménez-Rodriguez et al. (2010) analyze the effects of foreign shocks on macroeconomic variables in ten CEE countries from the early 1990s to 2009. They provide evidence that the effects of foreign price shocks depend on the economic structure and the credibility of the monetary policy. Also, foreign production shocks have strong effects on these economies' output, especially in the countries that are members of the euro area. Korhonen (2003), too, examines the effects of the euro area industrial production on the production in nine CEE countries. He provides evidence that for some countries, business cycles are highly correlated with the euro area business cycles. Benčík (2011) shows that the degree of bysiness cycle synchronization in CEE countries was low in the 1990s, but it had increased since 2001.

Fidrmuc and Korhonen (2003) investigate the correlation between supply and demand shocks between euro area and CEE economies in the 1990s. They find that some countries have high degree of correlation, but for most of them the shocks are idiosyncratic. Similar results are obtained in Eickmeier and Breitung (2006) and in Frenkel and Nickel (2005). Employing a meta-regression analysis, Fidrmuc and Korhonen (2006) provide support for the high degree of business cycle correlation between the euro area and some CEE economies. Unevska Donevska and Petkovska (2011) study the transmission mechanism of foreign prices and foreign demand on Macedonian output and find that only the latter has significant (though low) effects. Velickovski (2010, 2012) analyses the level of synchronisation of supply and demand shocks in Macedonia and other transition countries vis-à-vis the euro-area. The main results of these studies point to a low level of synchronisation of supply and demand shocks in the Western Balkan countries vis-à-vis the euro-area as well as a slow or absent convergence of the shocks. On a sample of four SEE economies, Petrovska (2012) shows that the synchronization with the euro area business cycle depends on the degree of integration with the EU.

3. Data description

For the empirical investigation 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 occured 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. In addition, the output gap in EMU is included as an indicator of foreign economic activity; euro-zone money market rate (the 3-month Euribor) is included as a foreign reference interest rate and euro-zone inflation as a foreign inflation. We have done a seasonall 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 the CPI data. The output gap is calculated as a percentage difference between the actual and potential GDP. In estimating potential GDP andoutput gap we use one of the most commonly used statistical methods in the empirical literature, i.e. the Hodrick-Prescott (HP) filter method with the default lambda of 1600 (λ=1600).

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]. After performing the same unit-root tests on the first differences of these variables we obtain stationarity. Consequently, we conclude that the 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.

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

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 room for autonomous monetary policy in these two countries due to the followingreasons: *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 ratioas 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 as well as for the euro-zone.

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

Country:	Variable:	Observations	Mean	Median	Minimum	Maximum	Std. Dev.
Foreign variables - Euro-zone:	Outputgap_EMU	52	0.05	-0.02	-2.83	3.08	1.40
	Euribor3m_EMU	52	2.85	2.69	0.66	5.02	1.30
	Infl_EMU	51	2.10	2.15	-1.33	4.86	1.17
Domestic variables - 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
Domestic variables - 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
Domestic variables - 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

The estimation method applied in this research is based on recursive Vector Autoregression (VAR) models, which have become the main econometric tool for assessment of the effects of monetary and fiscal policy shocks (Stock and Watson, 2001; Lutkepohl and Kratzig, 2004; Enders, 2010). We apply the recursive VAR for modelling the external environment (the euro-zone), domestic economic activity in the three economies 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 s follows: *First,* these models are seen as most appropriate choices 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 allow for the inclusion of various restrictions about the contemporaneous impact of the variables in the model.

The general specification of the recursive VAR model 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 structural form orthogonal errors, t is a time operator. A is a lower triangular matrix ($A=I_k$) that specifies instantaneous relations between the variables in the model and B is a KxK is an identity matrix.

In order for model (1) to be estimated, we first 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 the foreign variables, while the variables 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. We estimate the VARs separately for the three economies.

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

$$\begin{vmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ \alpha_{21} & 1 & 0 & 0 & 0 & 0 & 0 \\ \alpha_{31} & \alpha_{32} & 1 & 0 & 0 & 0 & 0 \\ \alpha_{41} & \alpha_{42} & \alpha_{43} & 1 & 0 & 0 & 0 \\ \alpha_{51} & \alpha_{52} & \alpha_{53} & \alpha_{54} & 1 & 0 & 0 \\ \alpha_{61} & \alpha_{62} & \alpha_{63} & \alpha_{64} & \alpha_{65} & 1 & 0 \\ \alpha_{71} & \alpha_{72} & \alpha_{73} & \alpha_{74} & \alpha_{75} & \alpha_{76} & 1 \end{vmatrix} \begin{vmatrix} u_t^{yf} \\ u_t^{if} \\ u_t^{\pi f} \\ u_t^{yd} \\ u_t^{Fd} \\ u_t^{id} \\ u_t^{\pi d} \end{vmatrix} = \begin{vmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{vmatrix} \begin{vmatrix} \varepsilon_t^{yf} \\ \varepsilon_t^{if} \\ \varepsilon_t^{\pi f} \\ \varepsilon_t^{yd} \\ \varepsilon_t^{Fd} \\ \varepsilon_t^{id} \\ \varepsilon_t^{\pi d} \end{vmatrix} \qquad (4)$$

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 the economic activity variable and the 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.

We build our model on the assumption that the euro-area affects exogenously the sample economies for the following reasons: *first*, all the three economies are relatively small as measured by their GDP and GDP per capita as well as their share in the euro-zone trade; *second*, they are quite open in the sense that exports plus imports combine more than 100% of their respective GDP (for instance, see Petrevski et al., 2012); *third*, their foreign trade is highly integrated with the euro-area since more than 40% of their trade is with the euro-zone member countries; *fourth*, their banking sectors are also highly connected with the euro-zone banking system because majority of the foreign owned bank capital originates from the EMU economies. As a result, the banks in these countries are dependent on foreign financing from the EMU financial markets (Bogoev, 2011); *fifth*, these economies import many products for final consumption from the EMU countries that may have direct impact on their inflation, while the percentage share of their exports in the total imports of the EMU economies is almost negligible. In contrast, we assume that these economies cannot influence economic developments and economic policy in the euro-zone.

Following the approach of Cushman and Zha (1997) and Aysegul (2004), the block-exogeneity is imposed in the model such that in the baseline unrestricted VAR specification, 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. In a matrix notation, in a simplified form (by omitting the constant and other deterministic regressors), this can be presented as follows:

$$Y(t) = \begin{vmatrix} Y_t^{yf} \\ Y_t^{if} \\ Y_t^{\pi f} \\ Y_t^{yd} \\ Y_t^{Fd} \\ Y_t^{id} \\ Y_t^{\pi d} \end{vmatrix}, \quad A(L) = \begin{vmatrix} A_{11}(L) & A_{12}(L) & A_{13}(L) & 0 & 0 & 0 & 0 \\ A_{21}(L) & A_{22}(L) & A_{23}(L) & 0 & 0 & 0 & 0 \\ A_{31}(L) & A_{32}(L) & A_{33}(L) & 0 & 0 & 0 & 0 \\ A_{41}(L) & A_{42}(L) & A_{43}(L) & A_{44}(L) & A_{45}(L) & A_{46}(L) & A_{47}(L) \\ A_{51}(L) & A_{52}(L) & A_{53}(L) & A_{54}(L) & A_{55}(L) & A_{56}(L) & A_{57}(L) \\ A_{61}(L) & A_{62}(L) & A_{63}(L) & A_{64}(L) & A_{65}(L) & A_{66}(L) & A_{67}(L) \\ A_{71}(L) & A_{72}(L) & A_{73}(L) & A_{74}(L) & A_{75}(L) & A_{76}(L) & A_{77}(L) \end{vmatrix}, \quad \varepsilon(t) = \begin{vmatrix} \varepsilon_t^{yf} \\ \varepsilon_t^{if} \\ \varepsilon_t^{\pi f} \\ \varepsilon_t^{yd} \\ \varepsilon_t^{Fd} \\ \varepsilon_t^{id} \\ \varepsilon_t^{\pi d} \end{vmatrix}$$

(6)

where $Y(t)$ is a Kx1 vector of observations, $A(L)$ is an KxK matrix polynomal in the lag operator L with non-negative powers and $\varepsilon(t)$ is an Kx1 vector of structural disturbances. The dimension of $A_{11}(L)$ is K_1xK_1, $A_{12}(L)$ is K_1xK_2, $A_{13}(L)$ is K_1xK_3 and so on. The dimension of ε_t^{yf} is K1x1, of ε_t^{if} is K2x1 and so on. The restrictions:

$$A_{14}(L) = A_{15}(L) = A_{16}(L) = A_{17}(L) = A_{24}(L) = A_{25}(L) = A_{26}(L) = A_{27}(L) = A_{34}(L) = A_{35}(L) = A_{36}(L) = A_{37}(L) = 0 \qquad (7)$$

imply that the first block of foreign three variables (euro-zone output gap, money market rate and inflation) are exogenous to the model whereas the lags of the domestic variables do not enter in their equations (they are restricted to zero).

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 unrestricted VAR model in order to determine the optimum number of lags of the variables. 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 below).
2. After specifying the maximum number of lags, 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 generalised 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, Jarque-Bera Normality test, and 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 seveal 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 and SVARs 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) 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) for the case of Croatia indicated one lag whereas in the case of Bulgaria and Macedonia did not indicate any specific number of lags. 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. For a cross-check, we also conducted the same residual-based diagnostic tests for Croatia in order to see if the model is properly specified. Accordingly, for all the three countries, the null-hypothesis for all the employed residual-based tests pointed to non-rejection at least at 5% level of significance. The residual-based tests pointed to two lags for the case of Bulgaria and one lag for the case of Macedonia whereas in the case of Croatia they confirmed the selection of one lag by the lag length selection criteria.

As mentioned before, 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. 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 cumulative impulse responses from the recursive VARs (See Appendix 1). In assessing the IRFs we calculate the 95% confidence bands of Efton (Efton and Tibshirani, 1993) and Hall (1992), estimated with bootstrap method of 100 replications. In what follows, we discuss the impulse responses generated by the shocks in foreign variables (the output gap, Euribor and inflation in the euro-zone, respectively). In contrast to many empirical studies, which do not adress the statistical significance of the obtained impulse responses and discuss the policy implications even in the case of insignificant impulse responses, we only pay attention to those where there is a statistically significant response by the two 95% confidence bands.

As can be seen in Appendix 1A, a positive shock to the euro-area output gap with a magnitude of one standard deviation signifcantly and positively affects the domestic economic activity in the three sample economies. The cummulative transmission of a shock in the euro-zone output gap to the domestic output gaps of the sample economies ranges between 1.6 and 2 percentage points. The peak of the response to the shock occurs from the sixthtothe eightquarter. The strongest, most persistent and most immediate reaction of the domestic economic activity can be traced in Croatia. On the other side, the lowest reaction can be noticed in Macedonia, which has not yet started the negotiation process for joining the EU. These findings can be interpreted as evidence for some degree of synchronization of business cycles between the euro-area and SEE economies. In this respect, it seems that the synchronization of business cycles depends on the level of integration of SEE economies with the EU (Jiménez-Rodriguez et al., 2010; Petrovska, 2012; Velickovski, 2010, and 2012).

The IRFs for fiscal policy behavior to a shock in the output gap in the euro-zone imply that there is a significant reaction in Croatia and Macedonia where a positive shock in the euro-area output gap leads to improved fiscal policy stance. This might reflect the attempts of Croatian and Macedonia policymakers to offset the spillover effects from the EU-wide expansion (positive aggregate demand shocks) by tight fiscal policy, i.e. using the favourable external environment to improve the cyclically adjusted fiscal balance. This result is in line with the models that suggest the use of countercyclical discretionary fiscal policy behaviour at individual country level within the EU (Bryson, 1993; Galí and Monacelli, 2008; Beetsma and Jensen, 2002). Finally, it can be seen that the shock in the output gap in the euro-zone is transmitted to these economies very quickly, but the reaction of fiscal authorities is relatively short-lived, i.e. the cuclically adjusted primary balance reverts to the trend in three to four quarters.

Changes in the euro-zone economic activity have positive effects on domestic inflation in the three economies. More precisely, the euro-area expansion spurres economic activity in the three economies, which puts an upward pressure on domestic inflation through the higher domestic demand (demand side pressure). This results in a higher inflation. The size of the reaction of domestic inflation to the euro-zone output shock ranges from three to five percentage points. The magnitude of the reaction of inflation is greater in Bulgaria and

Croatia compared to Macedonia, which once again may be explained by the closer integration of these economies with the EU. The response of domestic inflation to foreign output shocks is immediate on Croatia and also very quick in Bulgaria and Macedonia. In all three countries the impulses peak from three to four quarters. The statistical significance of the impulses disappears relatively quickly (after the fifth or sixth quarter), which implies that the inflationary effects caused by foreign output shocks are short-lived

When assessing the IRFs to a shock in the foreign reference rate (the 3-month Euribor, see Appendix 1B), we can notice that it exerts negative effects on domestic economic activity in Bulgaria and Croatia, but not in Macedonia. In the former countries, a positive shock in the Euribor affects negatively the economic activity with a magnitude of 1.5 – 2 percentage points. The transmission of the foreign shock to domestic economic activity is quicker in Croatia with a delay of one quarter and the effects last up to six quarters, while in Bulgaria there is a greater time lag in the transmission of the shock (five quarters) and the impulses become statistically insignificant after the eight quarter horizon. This result of statistically negative reaction of domestic output gap in Bulgaria and Croatia can be associated with the higher level of EU integration compared to Macedonia. The channel through which the foreign money market rate affects domestic economic activity in these two SEE economies can be explained by the higher costs of external financing of the private sector (banks and firms for example) from the euro-zone through loans from financial institutions, intercompany loans etc. More precisely, when the foreign reference rate increases, then the companies' costs for financing their investment activities increase as well. This, in turn, reduces their rate of return of new investments that may alter their decisions to reduce investment expenditures with a negative impact on dometic economic activity. Morever, another channel may be the banking sector, which is predominantly foreign-owned in these countries.Namely, the higher foreign reference rate increases the costs of borrowing from abroad of domestic banks, which may also reduce their profitability. As a result, the banks may reduce lending, which may negatively affect domestic economic activity (for more details see Bogoev, 2011).

The IRFs of our special interest are the ones of the domestic monetary policy indicators. Here, a positive shock to the foreign reference rate triggers a significant increase

in domestic money market rates only in Macedonia with a magnitude of 0.8 percentage points. In Croatia, the initial response of domestic market rate is quite oscilating, i.e. a positive shock to the Euriborhas a negative impact on the domestic money market rate only in the firstand in the fourth quarter. The results for Croatia are very puzzling since they contradict the conventional wisdom that rigid exchange rate regimes impose severe constraints on the possibility for conducting autonomous monetary policy. This finding can be interpreted as evidence that the Croatian central bank, which throughout the sample period has implemented a series of non-interest rate measures (see Kraft, 2003; and Lang and Krznar, 2004), may have preserved some autonomy in the conduct of monetary policy. In the case of Bulgaria, the shock in the Euribor has a negative effect on the M0-to-GDP ratio, which is in line with the prior expectations that, under a currency board, foreign monetary contraction is transmitted into domestic conomy. However, the impulses are measured quite imprecisely, i.e. they are not statistically significant, which supports the results by Minea and Rault (2011) who find that Bulgarian interest rates and money supply are not linked with ECB's interest rates in the short-run.

As for the IRFs to a shock in foreign inflation (see Appendix 1C) we can observe that there is only a statistically significant reaction by the monetary policy indicator, while the impulse responses of domestic economic activity and fiscal policy are statistically insignificant. In these regards, a positive shock in foreign inflation leads to an increase in domestic money market rates in Macedonia and a decline in the M0-toGDP ratio in Bulgaria. The magnitude of the reaction of domestic money market rate in Macedonia is around 0.8 percentage points, while in Bulgaria, a shock in foreign inflation induces decline of M0-to-GDP ratio of 2 percentage points. On the other hand, the money market rate in Croatia declines in response to higher euro-area inflation. The positive reaction of domestic money market rate in Macedonia to a shock of foreign inflation can be explained with the relatedness of domestic and foreign money market rates, i.e. the results are consistent with the IRFs for domestic money market rate (as explained above). Hence, it seems that when the inflation in the euro-area intensifies, the ECB reacts by increasing the key policy rate, which affects the euro-area money market rate. In turn, the rise in the Euribor is transmitted on the Macedonian money market rate with a certain delay. In addition, rising foreign inflation may also induce

an increase in the domestic money market rate due to the greater risk premium reflecting the expectations that higher foreign inflation may be transmitted into the domestic economy (see the paragraph below regarding the IRFs for domestic inflation following a shock in the euro-area inflation). In Bulgaria, the decline in the M0-to-GDP ratio can be explained within the standard money demand theory, i.e. if higher foreign inflation increases the risk of rising domestic inflation, economic agents reduce their cash balances. Finally, the decline in the money market rate in Croatia in a response to higher euro-area inflation is in line with the reaction of money market rate to a shock in the Euribor. These two results can be seen as evidence that the Croatian money market rate does not follow the Euribor, which might be a consequence of the massive use of various non-interest rate measures by the Croatian central bank.

Finally, Appendix 1C shows the IRFs of domestic inflation to a shock in foreign inflation. As can be seen, the results for all the three countries are as expected, i.e. there is apositive and statistically significant reaction of domestic inflation. The reaction of domestic inflation to a shock in the euro-zone inflation is immediate though short-lived, because the impulses become quickly insignificant. The size of the reaction of domestic inflation is greater in Bulgaria, which is estimated around 5 percentage points and a bit lower in Croatia and Macedonia estimated around 2 percentage points. This finding implies that domestic inflation in the SEE economies is closely linked with the euro-zone inflation, which is quite expected for small economies with fixed exchange rates, high level of trade openness and heavy import dependence from the euro-zone economy.

6. Conclusions

This study examines the effects of foreign shocks on SEE economies with fixed exchange rate regimes, such as: Bulgaria, Croatia and Macedonia. Specifically, we have conducted empirical investigation in the response of several macroeconomic and policy variables (output, inflation, interest rates and budget surpluses) in SEE countries to various euro-zone shocks (output, interest rates and inflation), based on the impulse response functions

estimated with recursive VARs. In this way, we are able to assess how the exogenous factors affect macroeconomic performances and policy variables in SEE economies.

Generally, the estimated results imply that euro-zone economic activity has significant and relatively strong influence on SEE economies and these external shocks are transmitted relatively quickly. Moreover, the results also suggest that the more domestic economy is integrated with the EU, the more persistent are the effects of exogenous shocks. Also, the research provides evidence that shocks in the foreign reference rate are transmitted to domestic money market rates in Macedonia and to some extent in Croatia. An additional important finding of this analysis is that euro-zone inflation is instantly and to great extent transmitted to domestic inflation, which indicates that inflation in SEE economies is mostly driven by foreign (euro-zone) inflation.

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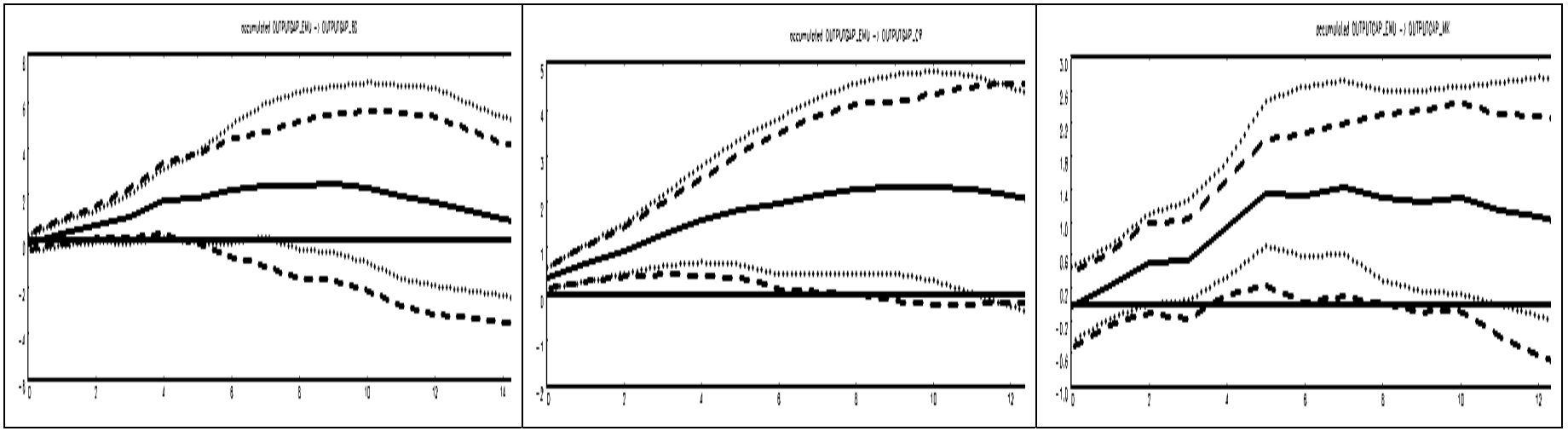
Appendix: IRFs of recursive VAR with 95% confidence intervals of Efton and Hall, respectively.

A: Impulses generated from the output gap in the euro-zone

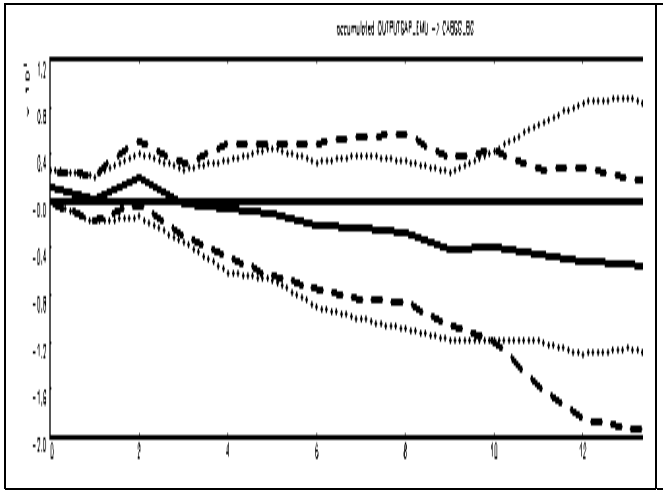
Impulse responses of domestic output gap:

Bulgaria | Croatia | Macedonia

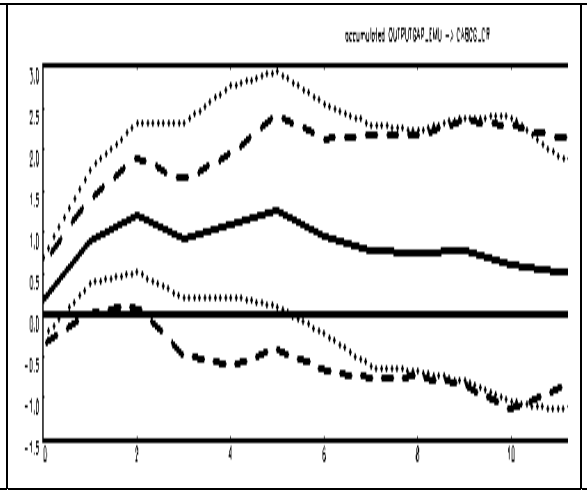


Impulse responses of fiscal policy:

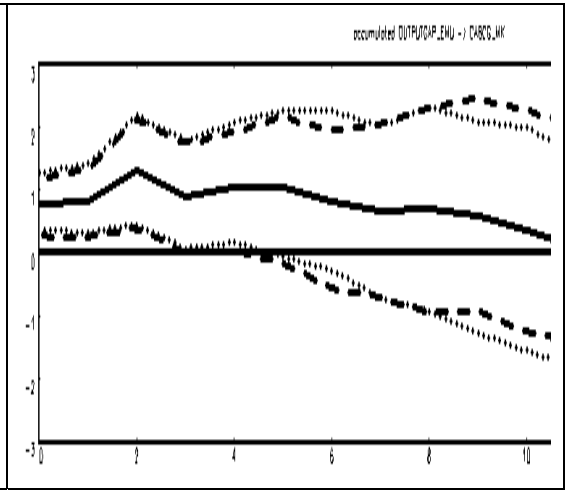
Bulgaria



Croatia

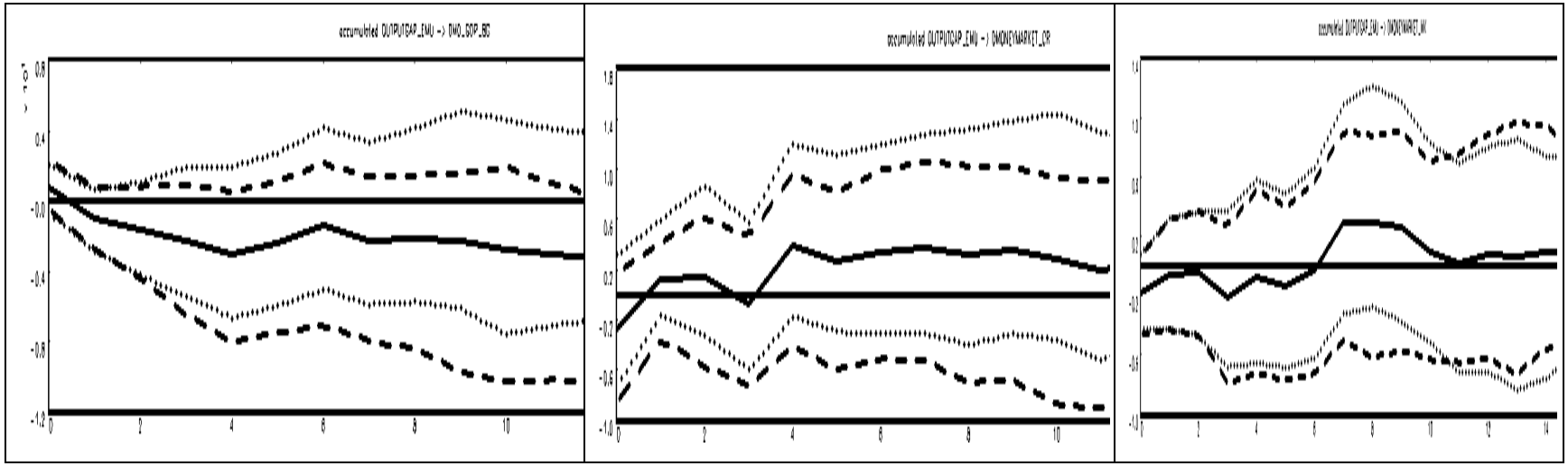


Macedonia



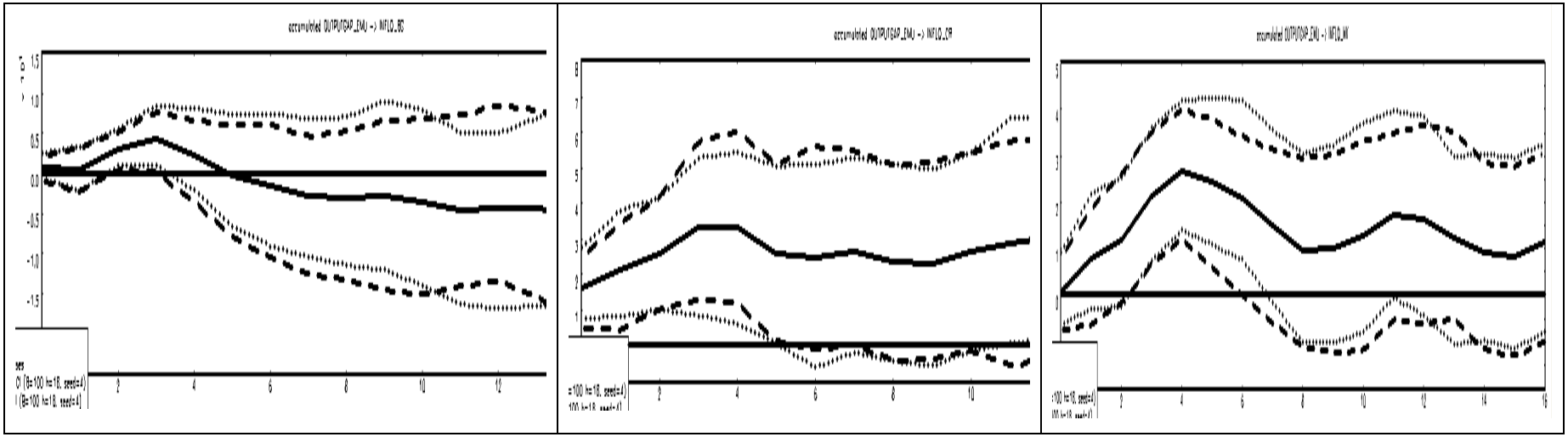
Impulse responses of domestic monetary policy indicator:

Bulgaria | Croatia | Macedonia



Impulse response of domestic inflation:

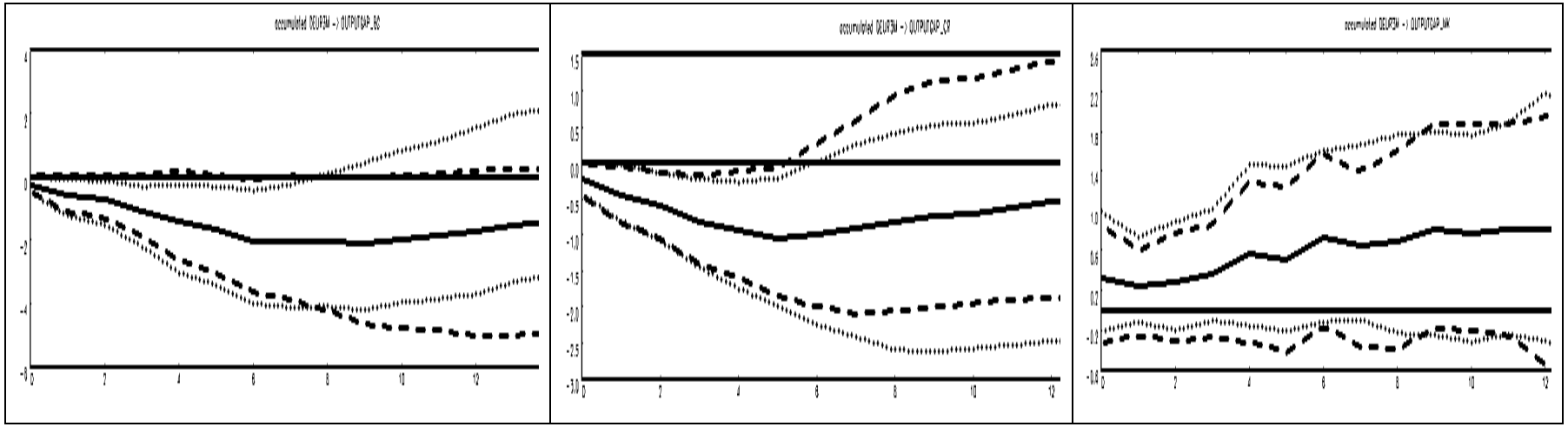
Bulgaria | Croatia | Macedonia



B: Impulses generated from the 3-month Euribor

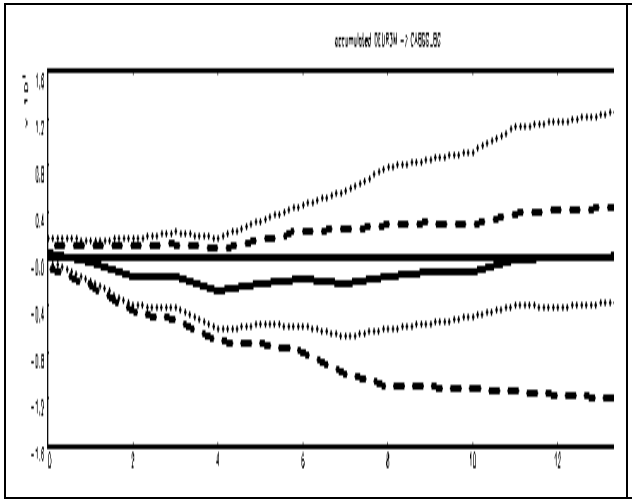
Impulse responses of domestic output gap:

Bulgaria | Croatia | Macedonia

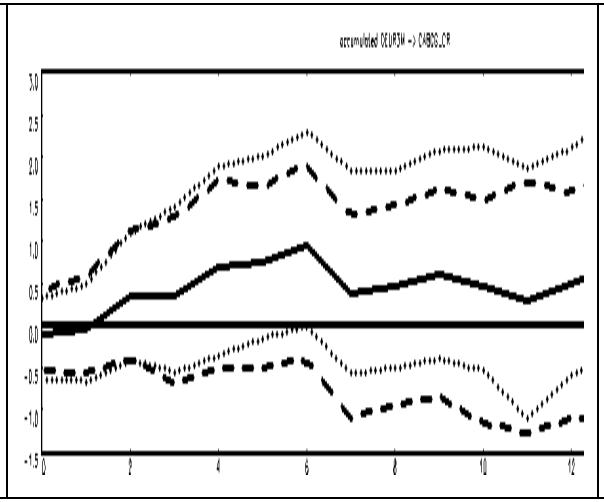


Impulse responses of fiscal policy:

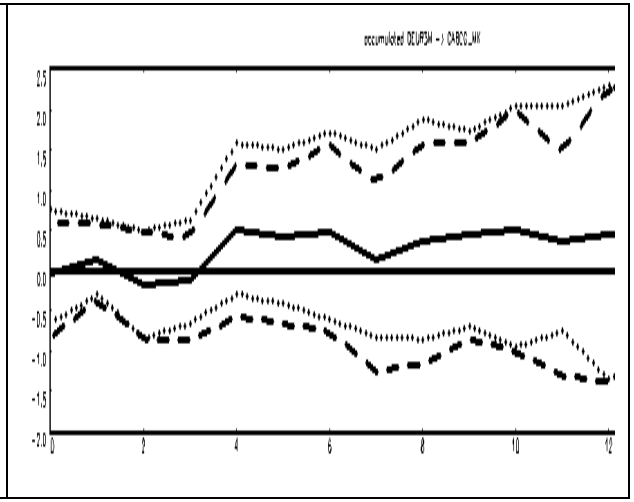
Bulgaria



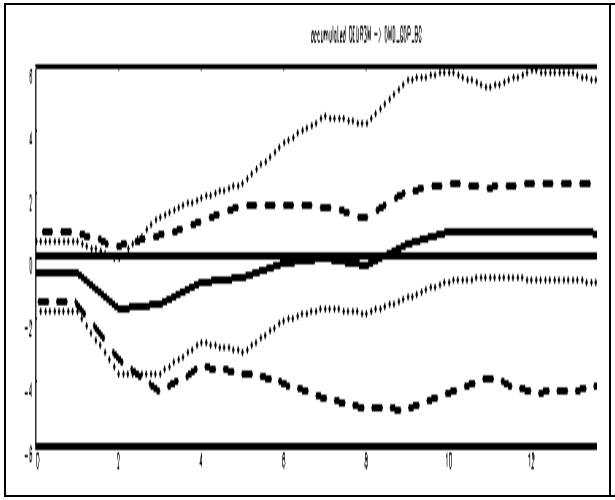
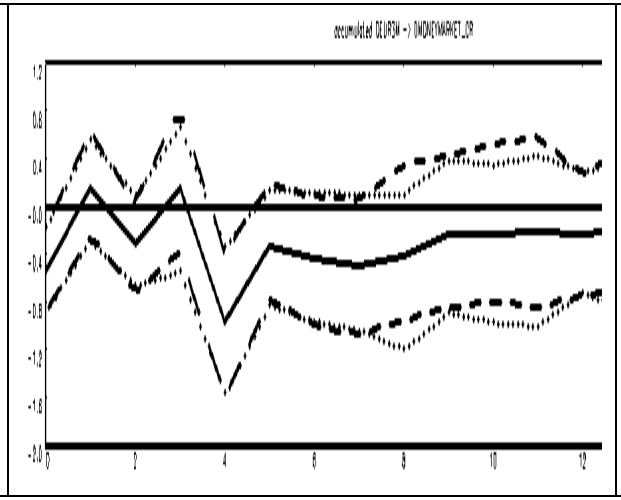
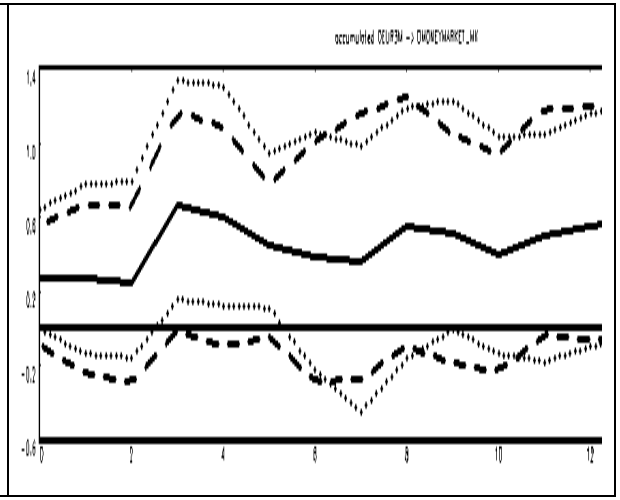
Croatia



Macedonia

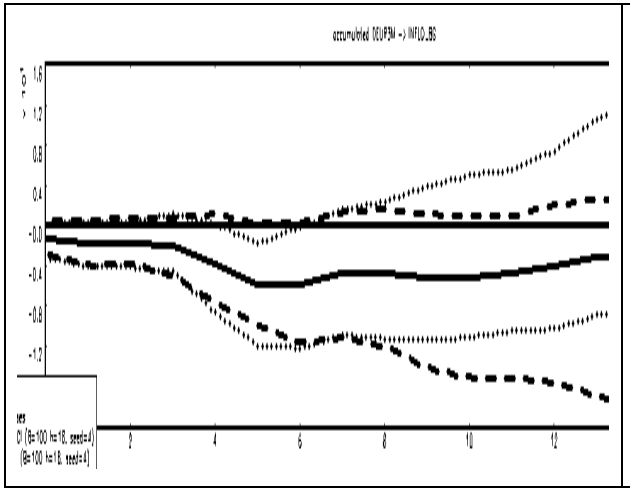


Impulse responses of domestic monetary policy indicator:

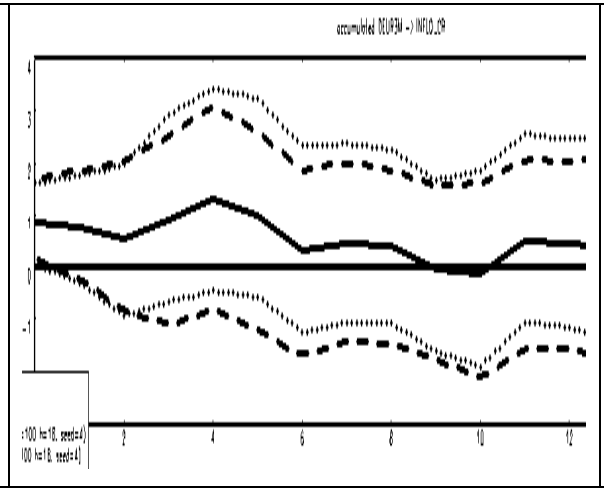
Bulgaria	Croatia	Macedonia
		

Impulse responses of domestic inflation:

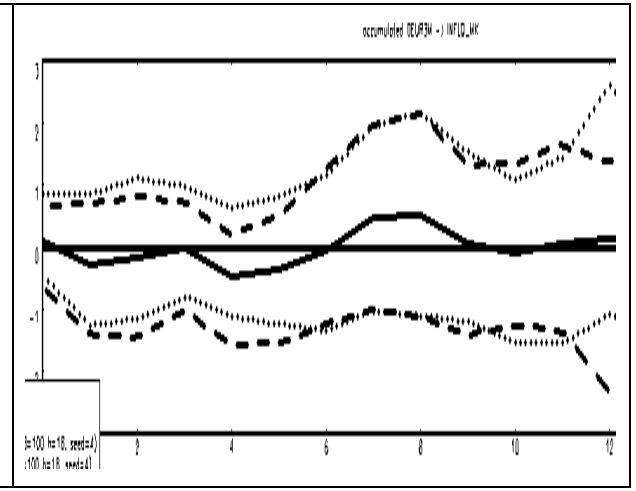
Bulgaria



Croatia



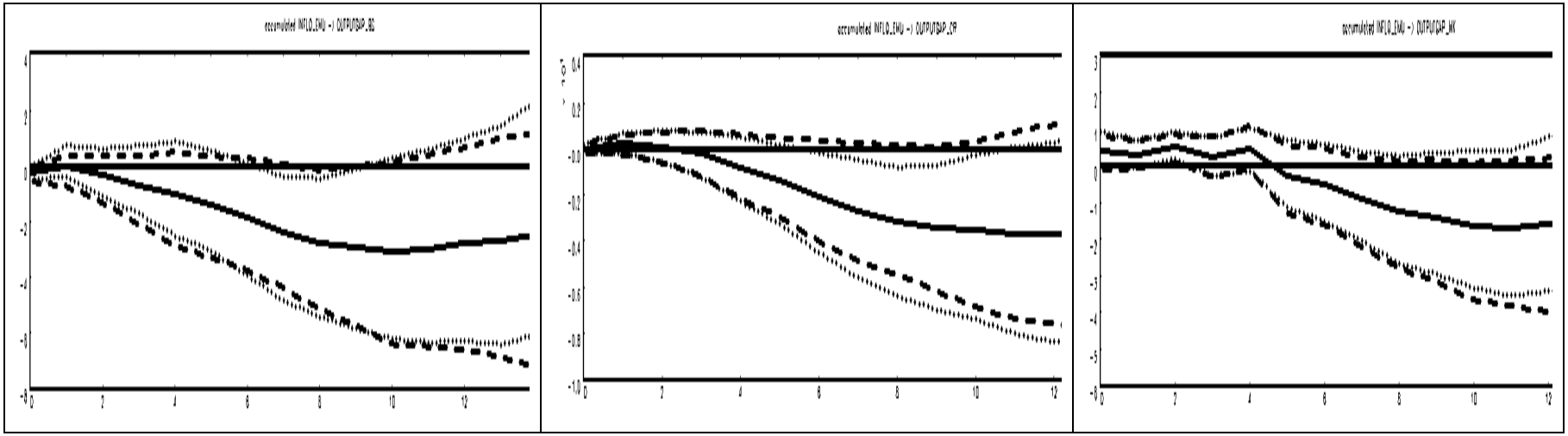
Macedonia



C: Impulses generated from the euro-zone inflation

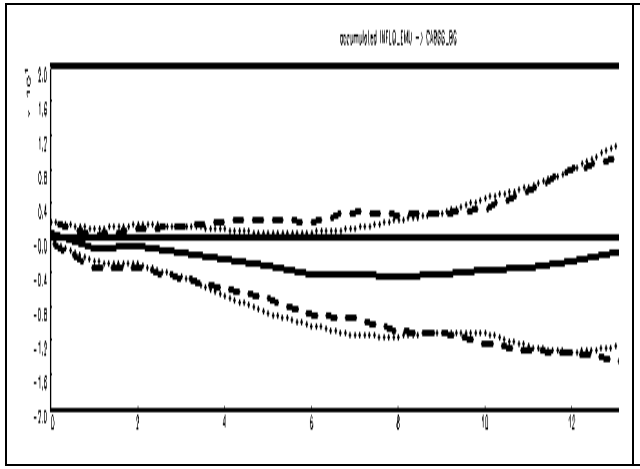
Impulse responses of domestic output gap:

Bulgaria | Croatia | Macedonia

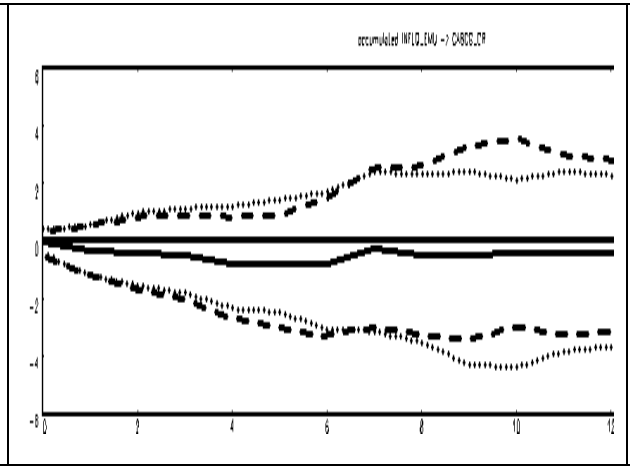


Impulse responses of fiscal policy:

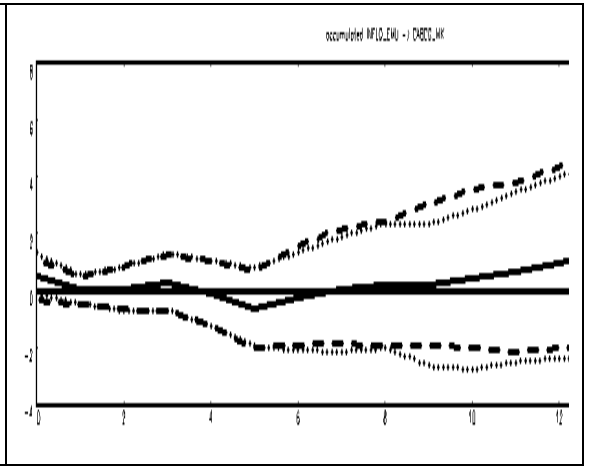
Bulgaria



Croatia

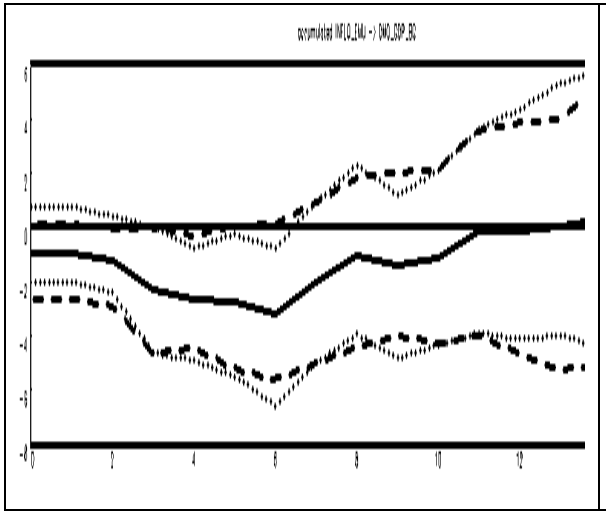


Macedonia

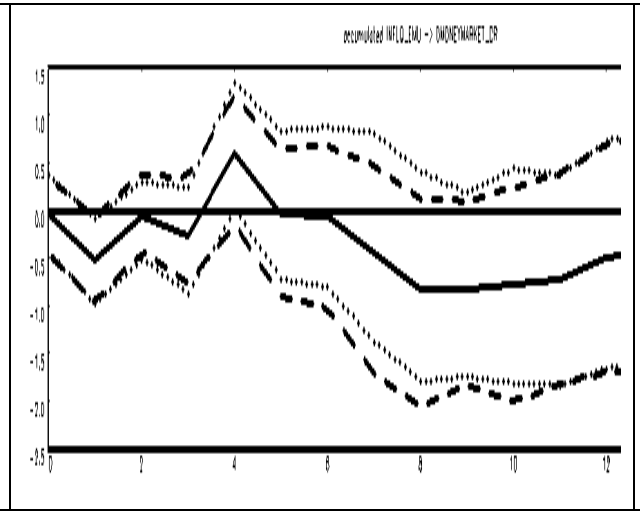


Impulse responses of domestic monetary policy indicator:

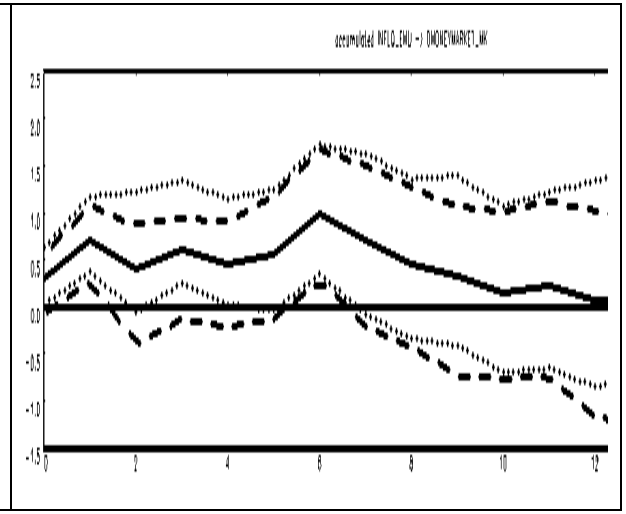
Bulgaria



Croatia

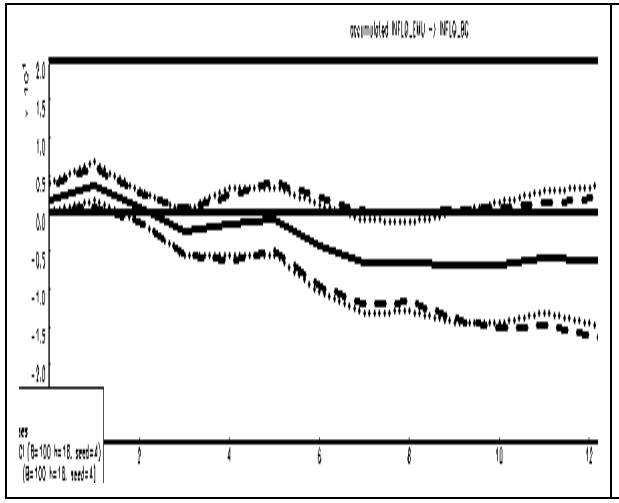


Macedonia

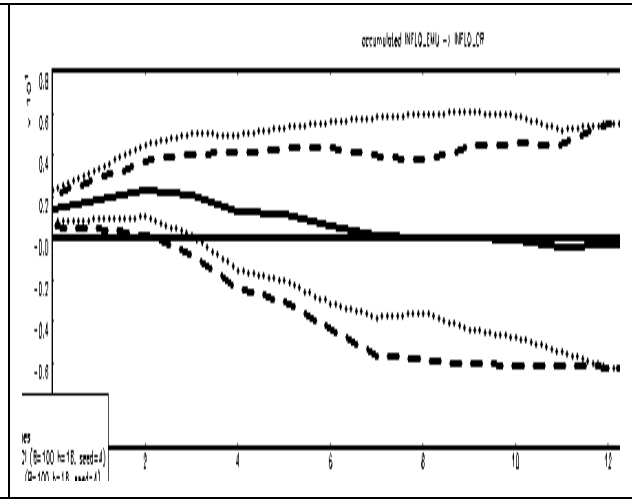


Impulse responses of domestic inflation:

Bulgaria



Croatia



Macedonia