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# TESTING THE IMPACT OF THE FISCAL POLICY WITH THE SVAR MODEL IN SEVEN CEE ECONOMIES

**Abstract.** *In this study, we aimed to estimate the fiscal shocks from seven economies belonging to Central and Eastern Europe (Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovakia and Slovenia) with the Blanchard-Perotti methodology for testing the effectiveness of fiscal policy, between 1999 to 2012 years. This scientific approach is particularly useful since in times of economic crisis, the fiscal policy management is extremely important in order to achieve an optimal compromise between stimulating economic recovery and fiscal consolidation. The results obtained by the SVAR modeling are consistent with those identified in the literature. Thus, the expansionary fiscal policy has rather non-Keynesian effects characteristic of emerging economies, which have a high degree of economic openness and a flexible exchange rate (less Bulgaria, respectively Slovakia, Slovenia, after adopting the euro).*

**Key words**: *fiscal shocks; SVAR model; Blanchard-Perotti methodology; fiscal policy efficiency; non-Keynesian effects.*

**JEL Classification: C54, E62, H3**

The current economic and financial crisis has emphasized the significance of the fiscal policy's anti-cyclical feature, under the terms in which the monetary policy transmission in the real economy is very limited (despite the fact that the interest rate has decreased). However, the margins for fiscal maneuver are quite low, as the budget deficits (which get automatically increased during the recession periods) extended even in the expansion years, thus increasing the public debt's stock in the GDP. The fiscal policy's effectiveness in order to stabilize the economy may be analyzed by means of several macroeconomic approaches. The differences between them are generated by the asymmetries in consumption/savings behaviors of the economic

agents, by the economic openness degree, by the exchange rate type or by the flexibility of the production costs and prices.

**1. Literature review on the effects of the fiscal policy**

Beside the influence of the factors conditioning the transmission of the fiscal impulses into the real economy, the results obtained are dependent on the estimation methodology. Generally, the literature uses two types of models – some of them which are more recent, of DSGE type and the others based on the classical VAR model and on that with restrictions (the SVAR type). Typically, the multipliers estimated with vector autoregressive models are superior to those resulting from the DSGE models or to those based on the real business cycle, particularly as a result of the private consumption's evolution. If in the DSGE models an expansionary fiscal shock leads to a decrease of the population's welfare and of its consumption, in the VAR models the fiscal impulse generates an increase of the consumer expenditures. Moreover, the VAR models do not take into account the Ricardian behavior of the economic agents, which may lead to a higher multiplier.

The first VAR models of the fiscal policy have been estimated for the US economy, the results being influenced by the type of the method used. Thus, Blanchard and Perotti (2002) estimated a cumulative government spending multiplier of 0.5 in the first three years since the shock occurred, while Galí et al (2007) identified a multiplier which exceeds one. Mountford and Uhlig (2009) found a multiplier of 0.5 after the first year since the fiscal shock, which even became negative in time. Ramey (2011) used a narrative method to estimate the impact of the public spending and obtained fiscal multipliers ranging between 0.6 and 1.2. The results obtained in the case of other economies were also different. For example, Baum and Koester (2011) estimated for Germany a cumulative multiplier of 0.7 after the first year, its level being higher during the recession periods and lower during the inflationary gap periods. Biau and Girard (2005) applied the methodology of Blanchard-Perotti and they estimated that the government spending multiplier is close to 2 in the case of France, after a year since the fiscal shock and it may go below 1.5 after three years since the impulse. Using the same estimation method, Burriel and others (2010) obtained a multiplier of 0.87 for the Euro area economy after 1 year and, respectively of 0.85 after two years since the fiscal impulse.

Surprisingly, not all the government spending multipliers are positive, as some authors obtained negative values for them, as a result of the action of non-Keynesian effects of the expansionary fiscal stimulus. For example Perotti (2002) estimated a multiplier of -0.27 after 1 year and -0.6 after 3 years for the Great Britain (19980-2001), Benassy-Quere and Cimadomo (2006) obtained a multiplier of -0.3 after two years for Great Britain, too, and of -0.23 for Germany, respectively. Similarly, not every increase of the net taxes has generated a production decrease, as it is stated in the economic theory. In a study made by the European Commission (2012) for the period 1980-2010, the impact of the higher government spending upon the GDP was examined for Germany, Italy, Spain and the entire Euro area. In all economies, the increase of spending generated an increase of the production for at least two years, after which it decreases for at least 6 quarters. The efficiency of the fiscal policy has increased as a result of the economic crisis in Spain and in the Euro area and got significantly decreased in the case of Germany. One explanation refers to the proportion of the people with budgetary constrains, which increased significantly in Spain, due to higher unemployment and reduced in Germany, as a result of the measures that have generated new jobs. The non-linearity of the fiscal policy's impact is generated both by the period in which it is promoted (crisis, recessionary gap and inflationary gap) and also by the objectives aimed by the authorities, which may be those aiming to economic recovery or, on the contrary, those aiming to fiscal consolidation.

**2. Data series**

According to the results from the economic literature, we anticipate a reduced efficiency of the expansionary fiscal shocks upon the economic activity in the CEE economies, given that these are emerging economies which are characterized by a high degree of openness and by a flexible exchange rate (except Bulgaria, respectively Slovakia, Slovenia, after adopting the euro). In this study, we aimed to estimate the fiscal shocks from seven economies belonging to the Central and Eastern Europe (Bulgaria, the Czech Republic, Hungary, Poland, Romania, the Slovak Republic and Slovenia). The data series used were the gross domestic product, the net taxes, the

government spending, the inflation rate and the interest rate. The analyzed period was 1999:1-2012:2, the total quarterly number of observations being 54. The fiscal policy affects not only the gross domestic product but also other variables such as the interest rate and the inflation rate, thus justifying the inclusion of these two sets of data in a study on the efficiency of the fiscal policy.

The gross domestic product (Y) was expressed as an index with constant prices (2005=100). Due to quarterly seasonality we used the seasonal adjustment method Tramo-Seats, the resulting series being expressed in logarithm. The fiscal variables used to capture the tax revenues and government spending were expressed in millions of Euro, constant prices, using general price index (euros) with 2005 year as basis. The fiscal variables used in this analysis were derived based on the recommendations provided in the economic literature. Thus, we identified the government spending data series (G) by eliminating those elements that are not part of GDP, especially social transfers from the total expenditure. Consequently, the resulting data series includes only those budget elements through which the state influences the demand in the economy - purchases of goods and services, public investments, public sector wages and government subsidies. The data series that captures the government revenues was calculated as the difference between the total budgetary revenues and the social transfers, being called *net taxes* (T). The inflation rate (INF) was deducted from the logarithm of the harmonized index of consumer prices calculated with 2005 as the base year, and the interest rate (IR) is the 3-month interbank rate. In the cases of Slovenia and Slovakia this indicator included the domestic interest rates until 2007 and 2009, after which the interbank interest rate in the Euro area was used.

According to quarterly real GDP, the seven economies have experienced a trend of income convergence with European Union until the economic and financial crisis. Among the analyzed economies, only Poland and Slovakia recorded a production level which is superior to that previous of the economic crises, while Bulgaria and the Czech Republic are characterized by similar values of the output. In Hungary and Slovenia, the trend of economic recovery started in 2010 was stopped due to the adoption of certain budget austerity measures. Romanian economy is characterized by a persistent gap in quarterly GDP relative to that from 2008.

The seven economies have recorded a downward trend of inflation and of the interest rate until 2006-2007. This trend was interrupted by the two factors. The first

one was the emphasis of the inflationary pressures generated by the overheating tendency of the most economies analyzed, as the monetary policy is used as a countercyclical tool. Thus, the interest rate increased more in Romania, Bulgaria and Hungary. The second factor was observed at the beginning of the economic crisis, consisting in the leaving of the foreign capitals and in some pressure on the exchange rates depreciation. The interbank interest rates at 3 months increased the most in Romania and Hungary, their level coming back to the natural trend of a recessionary gap since the 3rd quarter of 2009. In the context of the CEE economies facing a demand deficit since 2008, the inflationary pressures were reduced, except in Romania and Hungary, whose average rate was about 5.3%, and 4.5%. The explanation of this contradictory evolution is the response of these economies to the shocks specific to supply and those governments' decisions to increase VAT and certain administered prices.

## 2.1. Stationarity analysis

The five variables were tested in terms of stationarity with *ADF* (*Augmented Dickey-Fuller*) and *PP* (*Phillips-Perron*) unit root tests, in order to achieve the valid structural VAR models. A VAR model composed from non-stationary variables should capture the links between variables, but it does not allow accurate estimation of the parameters. In the table below, we included the probabilities associated to stationarity tests, to the H0 hypothesis and to the significance threshold. The null hypothesis states that there is a unit root at the first level of a data series, so that the variable is not stationary. If the probability associated to the *ADF* and *PP* tests is lower than the chosen threshold of 1%, then this hypothesis is not accepted, and the respectively variable becomes stationary. Most of the variables are not stationary at the level, but they become stationary, as a result of the first difference. Exceptions regarding stationarity at the level are Bulgaria (PP test), the Czech Republic, in the case of the government spending, the Czech Republic, Hungary and Slovakia in the case of the net taxes, the Czech Republic (PP test) and Romania and Slovenia for interbank interest rate. The stationarity of the fiscal variables can be interpreted according to the fiscal consolidation measures, started along with the economic crisis. Generally, the probability associated to the ADF test leads to the same conclusion regarding the

stationarity such as the probability of the PP test. In the case of the exceptions noted in the table below, we have chosen the integration level suggested by the PP test.

**Table 1. Stationarity of the variables included in the SVAR models**

| | | Budgetary spending (G) | | Net taxes (T) | | Inflation rate (INF) | | Interest rate (IR) | | GDP (Y) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **Level** | **First diff.** | **Level** | **First diff.** | **Level** | **First diff.** | **Level** | **First diff.** | **Level** | **First diff.** |
| **BG** | Prob (ADF) | 0.8247 | 0.0000 | 0.2562 | 0.0000 | 0.5289 | 0.0000 | 0.2986 | 0.0000 | 0.4458 | 0.0231<br>0.0063** |
| | Prob (PP) | 0.0019 | - | 0.1849 | 0.0000 | 0.6498 | 0.0000 | 0.2977 | 0.0000 | 0.2415 | 0.0002 |
| **CZ** | Prob (ADF) | 0.0000 | - | 0.0012 | - | 0.4277 | 0.0053 | 0.0421 | 0.0000 | 0.4607 | 0.0002 |
| | Prob (PP) | 0.0000 | - | 0.0005 | - | 0.3443 | 0.0053 | 0.0028 | - | 0.4507 | 0.0001 |
| **HU** | Prob (ADF) | 0.1436 | 0.0000 | 0.0000 | - | 0.1835 | 0.0000 | 0.0303 | 0.0000 | 0.1626 | 0.0019 |
| | Prob (PP) | 0.1439 | 0.0000 | 0.0000 | - | 0.0155 | 0.0000 | 0.0625 | 0.0000 | 0.0500 | 0.0021 |
| **PL** | Prob (ADF) | 0.3296 | 0.0000 | 0.1461 | 0.0728<br>0.0000** | 0.2030 | 0.0000 | 0.1839 | 0.0000 | 0.3959 | 0.0243<br>0.0017** |
| | Prob (PP) | 0.5005 | 0.0000 | 0.5059 | 0.0000 | 0.2984 | 0.0000 | 0.1509 | 0.0000 | 0.7192 | 0.0002 |
| **RO** | Prob (ADF) | 0.0404 | 0.0000 | 0.0881 | 0.0000 | 0.7858 | 0.0000 | 0.0000 | - | 0.6135 | 0.0000 |
| | Prob (PP) | 0.8958 | 0.0000 | 0.0890 | 0.0000 | 0.7858 | 0.0000 | 0.0001 | - | 0.2216 | 0.0001 |
| **SK** | Prob (ADF) | 0.0419 | 0.0000 | 0.0093 | - | 0.6868 | 0.0226<br>0.0000** | 0.0038 | - | 0.8016 | 0.0156<br>0.0000** |
| | Prob (PP) | 0.0419 | 0.0000 | 0.0067 | - | 0.2110 | 0.0000 | 0.0000 | - | 0.9096 | 0.0001 |
| **SI** | Prob (ADF) | 0.4111 | 0.0000 | 0.6201 | 0.0000 | 0.8049 | 0.0000 | 0.1504 | 0.0000 | 0.8414 | 0.0142<br>0.0000** |
| | Prob (PP) | 0.3868 | 0.0000 | 0.6268 | 0.0000 | 0.8800 | 0.0000 | 0.3048 | 0.0000 | 0.2470 | 0.0081 |

Note: **) Stationarity with second difference (diff)
Source of data: Eurostat, own calculations

Following the transformation of non-stationary variables at the 1% threshold in stationary series, we conducted a VAR model for each of the seven economies included in the analysis. The validity of a VAR model is conditioned by the following:

- an appropriate representation by choosing the optimal number of lags;
- the stability of the model, achieved when the VAR root module is less than 1;

- the lack of autocorrelation errors, the normalization and homoskedasticity of the VAR residual.

The first condition requires the identification of the number of lags for each economy included in the analysis, in order to capture the dynamics of the variables without losing too many degrees of freedom in the VAR models. As it can be seen in Table 2, choosing the lags number of the VAR was based on the results synthesis of five tests, the Likelihood Ratio (LR), the criterion of minimizing the final prediction error (FPE), Akaike (AIC), Schwartz (SC) and Hannan-Quinn (HQ). Given the limited number of observations, the models with maximum 4 lags were considered. Given that these criteria did not suggest the choice of a single lag for the VAR model, we used the Lag Exclusion Wald Test, of which H0 hypothesis is the poor representation of the lag chosen by the previous tests. The null hypothesis is rejected if a probability is less than 1%, so that chosen lag is the right one for the VAR model. In the table below we have included the results of the five tests and the probability associated to the chosen lag. According to them, the VAR model has a number of 4 lags in Bulgaria, 3 lags Czech Republic and Romania, and one lag for Hungary and Slovenia.

**Table 2. Identification of the optimal number of lags**

| | VAR MODEL (G; Y; INF; T; IR) | | | | | | |
|---|---|---|---|---|---|---|---|
| | LR | FPE | AIC | SC | HQ | Lag exclusion test (Probability) | Optimal lag |
| Bulgaria | 4 | 4 | 4 | 1 | 1 | 0.0000 | 4 |
| Czech Republic | 3 | 3 | 4 | 3 | 1 | 0.0000 | 3 |
| Hungary | 1 | 1 | 1 | 1 | 1 | 0.0000 | 1 |
| Poland | 4 | 2 | 4 | 2 | 2 | 0.0000 | 2 |
| Romania | 3 | 3 | 4 | 1 | 1 | 0.0000 | 3 |
| Slovakia | 2 | 2 | 2 | 1 | 2 | 0.0000 | 2 |
| Slovenia | 1 | 1 | 1 | 1 | 1 | 0.0000 | 1 |

Source of data: Eurostat, own calculations

The seven VAR models meet the stability condition, because the modulus of the unit roots is less than one. Another set of conditions that must be satisfied by a VAR model refer to the econometric validity of the residual, based on the normal distribution, on the presence of homeoskedasticity and on the lack of errors autocorrelation. In the table 3 we presented the probabilities associated to residuals of

the VAR models. As the probabilities are higher than the significance threshold of 5%, then the H0 hypotheses associated to the three tests are accepted, which maintains the correct representation of the VAR models.

**Table 3. Validity tests of the VAR models**

| Countries | LM autocorrelation tests | Normalization test (Structural factorization) | Heteroskedasticity test |
|---|---|---|---|
| | H0 There is no error autocorrelation for the chosen lag | H0 The VAR residual has a normal distribution | H0 Lack of heteroskedasticity |
| Bulgaria | 0.5028 | 0.6468 | 0.5034 |
| Czech Republic | 0.8269 | 0.7572 | 0.5299 |
| Hungary | 0.9853 | 0.0976 | 0.8697 |
| Poland | 0.5320 | 0.2200 | 0.3193 |
| Romania | 0.3547 | 0.1002 | 0.1983 |
| Slovakia | 0.4534 | 0.3583 | 0.1586 |
| Slovenia | 0.8766 | 0.7722 | 0.3025 |

Source of data: Eurostat, own calculations with Eviews 7

## 3. Blanchard-Perotti methodology

The VAR models focus on the analysis of *shocks* upon the studied variables. The *Shocks* or *innovations* are the part of a variable that can not be explained by its lagged values or by other variables from the system. Thus, an innovation appears as an error term (residual) in the stochastic equation of the system. The macroeconomic phenomena manifest as complex dynamic systems with feedback and mutual causality. The SVAR type models use restrictions imposed by the economic theory or by the results from certain empirical estimates to identify the structural shocks in the reduced form of the residuals. The identification of the structural shocks can only be made if certain conditions are met regarding the number of parameters in the system.

*The Blanchard – Perotti methodology* was proposed by these economists in 2002 for the US economy in order to show the dynamic effects of the shocks related to the government spending and to the taxes upon the economic activity during the postwar period. To identify the influence of the fiscal shocks, the study followed a structural VAR analysis which was based on institutional information both on the tax and transfer systems, and also on the duration of the budgetary revenues collection.

The authors considered that the structural VAR modeling is suitable for the study of fiscal policy because the budget variables change for various reasons, out of which the production stabilization being rarely predominant, in other words, there are exogenous fiscal shocks (regarding the output). The model used by the two authors was composed of three variables: the government spending, the tax revenues and the production level. While the tax revenues and the output influence each other, there is no feedback between the economic activity and the government spending.

The starting point of the structural VAR model analysis is the following equation, which is a structural model of the economy:

$$AY_t = A(L)Y_{t-1} + Be_t \quad (1)$$

where,

*A* and *B* are *k x k* matrices of the structural parameters, matrix *A* describes the contemporary structural relationships between the model's endogenous variables;

$Y_t$ is the *k x 1* vector of the endogenous macroeconomic variables;

A(L) is a matrix of polynomials with *lags*

$e_t$ is the *k x 1* vector of the uncorrelated structural shocks with zero mean and a diagonal matrix of the covariance (time invariant)

In order to obtain the reduced form of the SVAR model the equation (1) is multiplied by the inverse $A^{-1}$ matrix. This operation is necessary because the model represented by equation (1) is not directly observable and the structural shocks cannot be properly identified.

$$Y_t = A^{-1}A(L)Y_{t-1} + A^{-1}Be_t \quad (2)$$

or

$$u_t = A^{-1}Be_t = A_1e_t \quad (3)$$

The reduced form of the residuals $u_t$ represents linear combinations of the structural shocks $e_t$. Identifying the matrices *A* and *B*, it results that the structural residuals $u_t$ can be interpreted as structural shocks upon the individual endogenous variables. The identification of the structural shocks can only be made if certain conditions are met regarding the number of the parameters in the system. Blanchard-Perotti methodology uses additional restrictions for both matrices *A* and *B*, which are

derived from previous estimates about the intensity of the relations between certain economic variables. For a correctly identified SVAR model, $k^2$ restrictions will be required (for the *A* matrix) and $k \cdot (k-1)$ restrictions corresponding to *B* matrix, so that we restrict $k^2+k\cdot(k-1)/2$ parameters of the system of equation (3).

In this study we used the methodology of Blanchard-Perotti for a SVAR model with the form *AB* ($Au_t = Be_t$), the number of the variables (k) included in the model being 5. Thus, $u_t$ is the residuals vector of the reduced form of the VAR model (1x5) and $e_t$ is the vector of the structural shocks (1x5). *A* and *B* are square matrices with the form (5x5). The reduced form of the VAR model has 5 variables, two of them being tax variables (G, and T), a monetary one (IR), the other two being the GDP (Y) and the inflation rate (INF). The $u_t$ vector is composed of the VAR residuals and each of its components may contain information on the remaining residuals. Matrix *A* contains the contemporary coefficients (elasticities) of the five variables from the model. As a result of the multiplication of matrix coefficients *A* and $u_t$, the structural shocks included in the vector $e_t$ will be uncorrelated with the remaining shocks, and they may be identified in the *AB* model. The general form of the *AB* type model is:

(4)

In order to identify the *AB* model, 35 restrictions are required to the elements of the two matrices *A* and *B*, as we have established earlier. The elements on the diagonal of matrix *A* are considered to be equal with 1, allowing to express the residuals of the 5 variables according to the residuals of the others variables and to the structural shocks. To identify the impact of fiscal shocks which are not correlated with the shocks of the other equations, we considered that all the elements of *B* matrix are equal to 0 except the diagonal and the coefficients highlighting the correlation between the net taxes (T) and the government spending (G). Based on these restrictions, the

reduced forms of the tax residuals ($u_t^G$ and $u_t^T$) are considered to be a linear combination of three components:

- the automatic reaction of the government spending and of the budget revenues according to the output, inflation rate and interest rate residuals;
- the discretionary response of the fiscal policy to the shocks on the GDP, on the inflation rate and on the interest rate;
- the random discretionary shocks, i.e. the structural forms of government spending shocks ($e_t^G$) and of the net taxes ($e_t^T$). These shocks can be interpreted as an increase in spending, and net taxes by 1 standard deviation (or by one unit) relative to the average of the analyzed period.

Thus, the reduced forms of the fiscal residuals can be written as follows:

(5)

The coefficients $\alpha$ reflect the automatic contemporary response of the fiscal variables' residuals to the residuals of the output, inflation rate and interest rate, while the $\beta$ coefficients show the current effect of the structural shocks upon the tax residuals. Therefore, the residuals of the fiscal variables will be written as a sum of cyclical components (the automatic stabilizers) and structural components (the discretionary nature of the fiscal policy), such in analysis made by Talpoş et al. (2009). Thus, $\alpha_{G/Y}$ represents the elasticity of the government spending relative to GDP change, $\alpha_{T/Y}$ refers to the elasticity of net taxes relative to the GDP, and the other coefficients $\alpha$ can be interpreted as elasticities of G, and T relative to the inflation rate and the interest rate.

The first two elasticities were calculated by the European Commission (2008) in the table below. These elasticities are designed to capture the impact of automatic stabilizers upon the budget balance, which will reduce the budget deficit in the years with inflationary gap and will increase the budget deficit in the years with recessionary gap. The most significant budget sensitivities to the changes in the economic activity are recorded by Slovenia and Hungary, the total effect on the budget being 0.47, respectively 0.46% of the GDP. These levels are higher than the EU27 average (0.43), than the average of the ten economies that joined the EU in 2004 (0.3) and close to the

euro area average (0.48). Romania and Slovakia record the lowest elasticities of the budget balance to the changes in domestic production, so that a further increase of 1% leads to an increase of the budget balance by about 0.28-0.29% of the GDP.

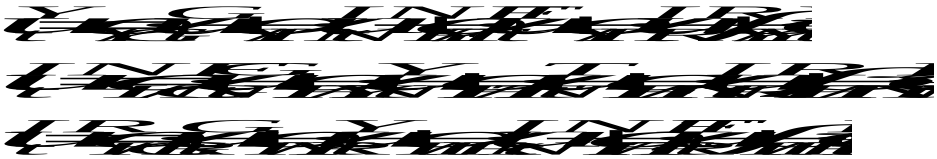
**Table 4. Elasticity of the fiscal variables relative to the GDP**

| | Elasticity of the net taxes according to Y $\alpha_{T/Y}$ | Elasticity of the government spending according to Y $\alpha_{G/Y}$ |
|---|---|---|
| Bulgaria | 0.35 | -0.01 |
| Czech Republic | 0.36 | -0.01 |
| Hungary | 0.45 | -0.01 |
| Poland | 0.33 | -0.06 |
| Romania | 0.28 | -0.02 |
| Slovakia | 0.27 | -0.02 |
| Slovenia | 0.42 | -0.05 |

Source: European Commission (2008)

The next step is to identify the order of the fiscal variables in the SVAR model. If we assume that the decision on the government spending is taken prior to the decisions on the government revenues, then $\beta_{G/T}=0$, and otherwise $\beta_{T/G}=0$. In fact, as Perotti (2002) also argued, the decisions on the budgetary spending influence the decisions on the budget revenues so that $\beta_{T/G}$ is not 0.

The other equations for the residuals of the VAR reduced form have the following form:



The complete identification of the *AB* model in the Blanchard-Perotti version involves additional restrictions in matrix *A*, according to certain economic assumptions. These assumptions can also be interpreted according to the order of the variables in the SVAR model. Thus, the models estimated for the seven CEE economies will include five endogenous variables, ordered as follows: government spending (G), real GDP (Y), inflation rate (INF), net taxes (T) and the interest rate

(IR). The particularity of the Blanchard-Perotti decomposition results from the comparison with the recursive Cholesky method.

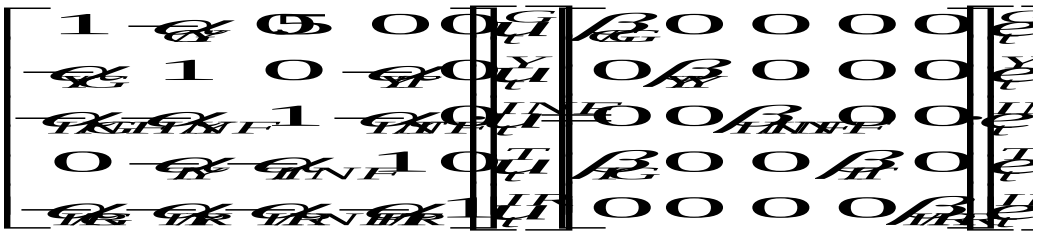
- **Government spending** have been ranked first in the model because there is a significant lag between the decision to allocate the budget resources and their actual spending. Thus, the evolution of the economy in a particular quarter may influence the adoption of certain decisions on government spending, but the use of the financial resources for the established purpose will be take place with a particular time lag. Therefore, the government spending does not react contemporarily (i.e. in the same quarter) to the shocks of the other variables, such in the recursive decomposition. The only exception is related to the sensitivity of the government spending (G) to the inflation rate. The inflation rate increase is not immediately balanced by the indexing of the spending with budgetary wages, causing a reduction in real terms of these spending by around 0.5%, for every 1% increase in inflation, according to Perotti (2002).
- **The real GDP** does not contemporarily react to the shocks of the inflation rate, of the net taxes and of the interest rate, but it is affected by the change in the government spending (Cholesky interpretation). Contrary to previous assumptions, the Blanchard-Perotti decomposition supposes that elasticity of GDP relative to the net taxes is different from zero. Therefore, this methodology also analyzes the discretionary stance of taxation on the GDP, which completes the discretionary response of the GDP relative to the government spending.
- **The inflation rate** is not contemporarily influenced by the net taxes and by the interest rate shocks, but it is sensitive to changes of the government spending and of the GDP (Cholesky decomposition). The transmission gap of the interest rate on the inflation rate can be understood according to the transmission mechanism of the monetary policy through the interest rate channel, the duration of which is at least 1 quarter. Blanchard-Perotti methodology involves the sensitivity of inflation to shocks specific to the net taxes as a result of their contemporary effect on the aggregate demand, on the GDP and on the final goods prices.

- **The net taxes** do not react in the same quarter to the interest rate shocks, but are sensitive to the shocks of the other three endogenous variables from the model (Cholesky recursive method). Ordering of the output and of the inflation before net taxes can be justified by the fact that the shocks on these two variables have an immediate impact on the tax base, thus generating a contemporary effect on tax revenues. Blanchard-Perotti methodology supposes that budgetary revenues (net taxes) do not contemporarily react to the government spending, the relationship between these variables being captured in *B* matrix through the coefficient $\beta_{T/G}$.
- **The interest rate** is influenced in the same quarter by the shocks of all the other endogenous variables of the two matrices, according both to the recursive approach and also to the Blanchard-Perotti's**.** This way of ordering the interest rate can be justified based on the reaction function of the central bank, as the interest rate is determined by the output gap and by inflation. Moreover, the government revenues and spending are not sensitive to the interest rate changes.

**In summary, the methodology adopted by Blanchard-Perotti supposes the following:**

- the government spending do not have a permanent impact on the tax revenues (net taxes);
- the real GDP has no permanent effect on the government spending (G);
- the inflation rate has a permanent impact on the real GDP;
- the net taxes have no impact on a long-term upon the spending (G);
- the interest rate does not have permanent effects on the other four variables included in the model.

According to previous assumptions, the general form of the model AB in the Blanchard-Perotti approach is the following:



**4. The results**

Applying the Blanchard-Perotti restrictions in the SVAR models explained in the previous section we identified the matrices *A* and *B*, respectively the elasticity coefficients included in particular in matrix *A*. These coefficients only partially have the signs established according to the theoretical macroeconomic correlations (*Annex 1*). According to the obtained results, the real GDP responds relatively low due to increased government spending, the elasticity is positive, but less significant in six of the seven CEE economies studied (Table 5). The exception is Slovakia, its quarterly GDP change being not dependent on the change in the government spending. The lack of significant or negative reaction of GDP can be explained by the non-Keynesian effects of the fiscal policy, such as the crowding-out effect on investment and on the net exports. The hypothesis of the occurrence of this type of effect is only valid for Bulgaria and Slovenia, as in their case, the increase of the government spending cause an increase of the interest rate, this relationship being specific to the IS-LM model. The governmental shock has the anticipated influence on inflation in most of the analyzed economies, Romania being characterized by the highest inflationary pressure exerted by the increase of G. Thus, the 1% increase of the government spending leads to the increase of the inflation rate by 0.51 percentage points. Unlike the other CEE economies, Romania is characterized by a significant response of the aggregate demand to the changes in public spending, and the effects on the aggregate supply in the economy are quite lower. In Slovenia and Bulgaria, the aggregate supply reacts more quickly to the governmental shock, if compared to the influence upon demand, thus neutralizing the impact upon inflation.

The shock corresponding to the government revenues (net taxes) has, at first glance, an influence on the GDP which is different from that anticipated by the economic theory. Thus, the net tax increase by 1% leads to a quarterly increase of the GDP by 0.08% in Poland and Romania, respectively 0.07% in Slovenia, while in the cases of Hungary and Bulgaria, the domestic production does not react to that shock. But, the net tax increase may be the result both of the reduction of the social transfers which improve the incentives in the economy and decrease the natural rate of unemployment, and also of the tax base increase, both factors exerting a positive influence upon production. Regarding the relationship between the net taxes on the one hand, and the inflation rate and the interest rate, on the other hand, most of the elasticity coefficients have a negative sign, corresponding to the Keynesian macroeconomic correlations between these variables. Romania is characterized by the most significant response of the inflation rate and of the interest rate to the increase of the net taxes, while in the other CEE economies the interest rate does not significantly react to the fiscal shock. Regarding the elasticity coefficient of the budget revenues according to the government spending, identified in the matrix B, there is a less insignificant relationship between the two variables, so that the current budgetary shocks do not significantly influence the fiscal decisions of the governments.

**Table 5. The coefficients of the SVAR model (type AB)**

| | $\alpha_{Y/G}$ | $\alpha_{INF/G}$ | $\alpha_{IR/G}$ | $\alpha_{Y/T}$ | $\alpha_{INF/T}$ | $\alpha_{IR/T}$ | $\beta_{T/G}$ |
|---|---|---|---|---|---|---|---|
| Bulgaria | 0.01 | 0.01 | 0.02 | 0.00 | -0.04 | 0.00 | -0.01 |
| Czech Republic | 0.01 | 0.04 | 0.00 | 0.03 | -0.02 | 0.02 | -0.05 |
| Hungary | 0.06 | 0.04 | 0.00 | 0.00 | -0.04 | 0.00 | 0.03 |
| Poland | 0.05 | 0.03 | -0.03 | 0.08 | -0.02 | -0.02 | 0.03 |
| Romania | 0.02 | 0.51 | 0.00 | 0.08 | -0.22 | -0.25 | 0.00 |
| Slovakia | 0.00 | 0.07 | -0.02 | 0.02 | -0.03 | 0.00 | -0.02 |
| Slovenia | 0.06 | -0.06 | 0.02 | 0.07 | -0.02 | 0.00 | 0.00 |

Source: Eurostat, own calculations

### 4.1. Impulse-response functions to the fiscal shocks

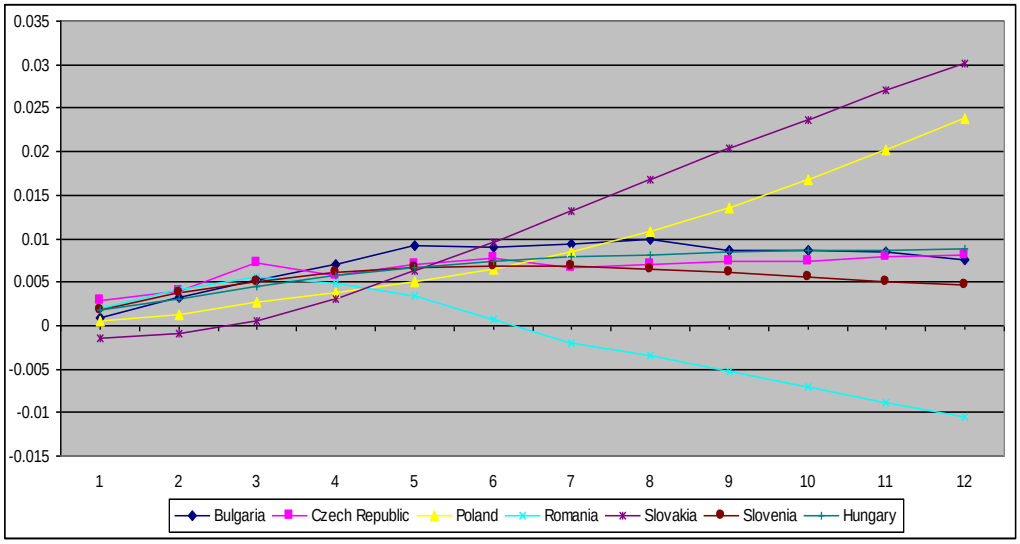
The reaction of the variables included in the model to the fiscal shocks can be captured using the impulse-response function, of which hypothesis is that of a shock equal to one standard deviation. The shock response function describes the effect of an

*innovation* on the same variable and on the other variables from the model, which is useful to identify the sign of reaction and their persistence. Thus, we found the cumulative reaction of SVAR model's variables for 12 quarters from the occurrence of the fiscal shock.

Generally, the seven economies included in the analysis are small open economies in which a significant part of the fiscal policy's expansionary effects are directed towards imports. Moreover, Romania, Poland, Hungary and the Czech Republic had a flexible exchange rate during the entire period, which reduces the expansionary impact of the fiscal policy, due to the external crowding-out effect. According to the estimates made by Castro and de Cos (2006), the positive shock of the government spending causes an initial increase in the quarterly real GDP, which tends to neutralize after about 6-8 quarters. According to the cumulative quarterly GDP values included in Figure 1, it results that the increase by 1 standard deviation point of the government spending has the highest influence after 3 years in Slovakia and Poland, despite the fact that the reaction after 1 year is the lowest in those economies. Consequently, the government spending has spillover effects in the economy, as an evidence of the influence upon the potential output. However, Romania has a negative reaction of the quarterly GDP to the increase of the government spending, especially due to the crowding-out effect.

Moreover, Romania is characterized by the highest response of the interest rate to the government spending among the CEE economies. Thus, increasing of the government spending led to a higher demand for funds from the financial market, so that the interbank interest rate will deviate from the trend by about 0.04 points. In addition, a higher interest rate may be the result of the central bank's strategy which will thus neutralize the inflationary effects of an expansionary fiscal policy. In the other four CEE countries (Bulgaria, the Czech Republic, Slovenia and Hungary) the influence of fiscal policy is reduced starting from the second year and is stabilized at about 0.006 standard deviation points. The results obtained are similar as intensity to those of Cuaresma et al (2011), but higher with reference to effects of the government spending increase. These authors estimated that real GDP will decrease in the Czech Republic, Hungary and Slovenia by at least 0.01 standard deviation units, while

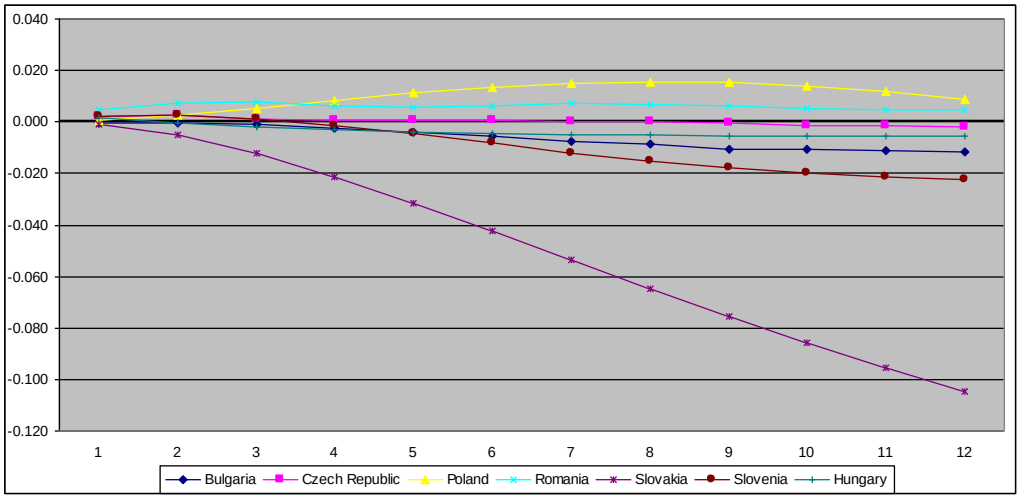
Slovakia was the only economy in which the quarterly real GDP grew by about 0.01 units after ten quarters from the shock action.




Source of data: Eurostat, own calculations with Eviews 7

**Figure 1. Quarterly GDP change to a government spending shock (one standard deviation point)**

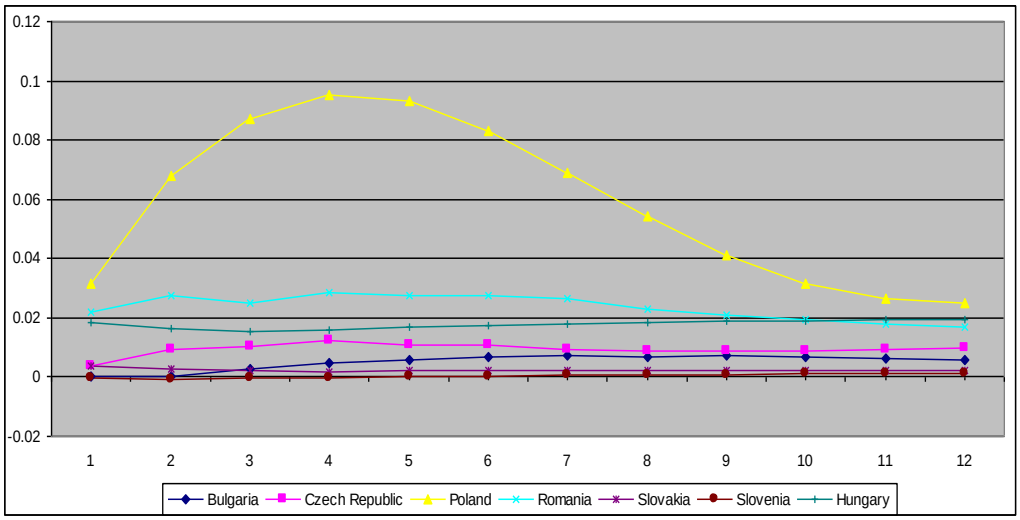
Regarding the influence of a unit standard deviation shock of the net taxes, the GDP change is very low in the first year because they indirectly influence the domestic production (through consumption and supply). The inverse relationship between the net taxes and the GDP is invalidated in Poland, Romania and the Czech Republic, the results obtained being consistent with those of Heppke-Falk et al (2006) and Lozano and Rodriguez (2008). This reaction could be justified by the fact that the tax revenues are simultaneously affected (in the same quarter) by the changes in the real output and by the positive effects of the social transfers reduction (Figure 2). Slovakia records the highest specific Keynesian response to the increased net taxes, and the real GDP contracts by about 0.1% after 3 years, in accordance with the results obtained by Cuaresma et al (2011).




Source of data: Eurostat, own calculations with Eviews 7

**Figure 2. Quarterly GDP change to a net taxes shock (one standard deviation point)**

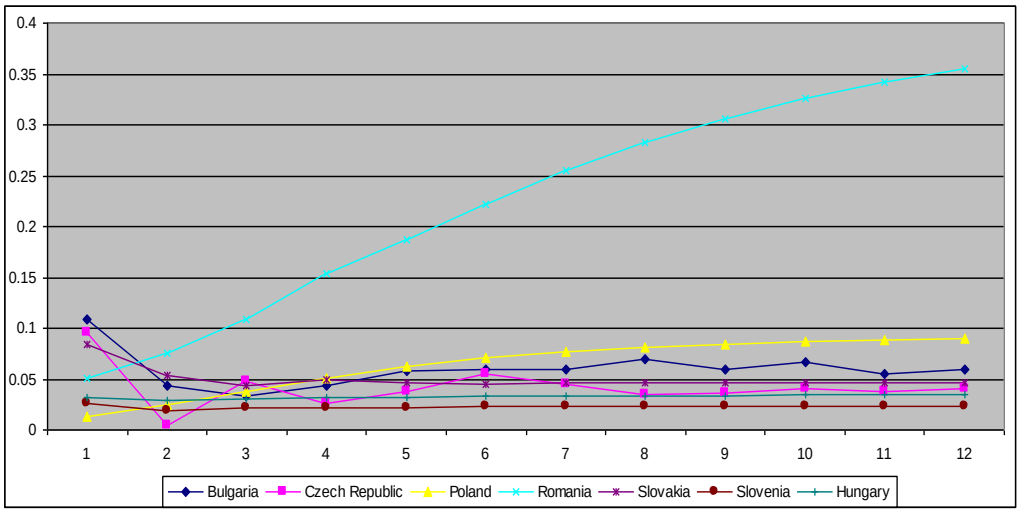
According to the SVAR models estimated for the CEE economies, the expansionary fiscal shocks should generate an increase of the inflation rate by means of aggregate demand, and of the interest rate, through the funds demand in the financial market. If the influence of the government spending on the inflation rate is confirmed in all the seven CEE economies, the intensity of the reaction is different. However the impact of the G on the interest rates is invalidated in Hungary, Slovakia and Poland. Generally, the sensitivity of inflation is higher in the short term and tends to decrease on a long term as a result of the positive effects upon the aggregate supply. This hypothesis is validated especially in Poland, which is characterized by an inflation rate of about 0.02 standard deviation units, despite a change of about 0.1 units after the first year from the government spending increase. In the other economies, inflation rate responds less to the fiscal shock, but it is relatively more persistent if compared to Poland (Figure 3).




Source of data: Eurostat, own calculations with Eviews 7

**Figure 3. Inflation rate change to a government spending shock (one standard deviation point)**

The net taxes shock has a very small impact on both the inflation rate and the interest rate. Therefore, the increase of the net tax had a rather negative influence on the aggregate demand, decreasing consumption and the demand for financial resources, which generate lower interest rate. The most important interest rate cuts were recorded in Romania and Slovenia, as the deviation from the average is approximately 0.035 points after 3 years from the increase of the net taxes. Generally both the government spending and the net taxes are characterized by a high degree of persistence caused by an own shock. The government spending have an obvious discretionary component being less influenced by the evolution of the economic activity through the automatic stabilizers. As shown in Figure 4, the shock of the government spending leads to further increase by maximum 0.1 standard deviation units after 3 years in six CEE economies. Specifically, certain investments, government acquisition made in a quarter are followed by other spending until the investment projects or certain contracts are completed.




Source of data: Eurostat, own calculations with Eviews 7

**Figure 4. Government spending change to a own shock (one standard deviation point)**

Regarding the net taxes, we have caught their reaction to the own shocks and to those of the economic activity, the latter corresponding to the action of the automatic stabilizers. Typically, the initial shock of the net taxes caused by increasing of the tax base or of the tax level generates positive effects on budgetary revenues in the following quarters. Moreover, the revenues from taxes on consumption and on income have a positive reaction due to the favorable evolution of the economy. Based on the results listed in the table below, it results a high dependence of the tax revenues according to the discretionary change of the net taxes in Hungary, while Slovakia is characterized by the most important influence of the economic activity on the budgetary revenues. The results obtained can be useful to interpret the efficiency of the fiscal consolidation process in the context in which it is done by means of discretionary measures and not by the action of automatic stabilizers. From a theoretical perspective, the increase of the net taxes leads to higher budgetary revenues, but also leads to decrease of the economic activity that will reduce revenues

and could adversely affect the fiscal consolidation process. In Hungary and Slovenia, the fiscal consolidation can be achieved without too much risk because the automatic stabilizers' sensitivity is relatively lower, while in the other economies the consolidation should be achieved in the absence of the negative shocks upon the GDP.

**Table 6. Net taxes reaction to the own shock and to the real GDP shock (based on the impulse-response function) – in standard deviation units**

| | Year I | | Year II | | Year III | |
|---|---|---|---|---|---|---|
| | Shock T | Shock Y | Shock T | Shock Y | Shock T | Shock Y |
| Bulgaria | 0.048 | 0.058 | 0.015 | 0.021 | 0.017 | 0.018 |
| Czech Republic | 0.013 | 0.030 | 0.017 | 0.018 | 0.019 | 0.021 |
| Hungary | 0.202 | 0.029 | 0.216 | 0.048 | 0.220 | 0.053 |
| Poland | 0.050 | 0.038 | 0.074 | 0.071 | 0.074 | 0.080 |
| Romania | 0.035 | 0.026 | 0.035 | 0.026 | 0.031 | 0.031 |
| Slovakia | 0.099 | 0.060 | 0.075 | 0.118 | 0.060 | 0.119 |
| Slovenia | 0.105 | 0.043 | 0.143 | 0.090 | 0.161 | 0.090 |

Source of data: Eurostat, own calculations with Eviews 7

## Conclusions

The objective of this study was to analyze a topic of great interest given that financial and economic crisis has emphasized the importance of the fiscal policy both for economic recovery and for ensuring a sustainable consolidation of public finances. In addition, the stabilization function of the fiscal policy becomes more important for the states which are part of the euro area (Slovenia and Slovakia) but for other economies targeting monetary integration (Bulgaria, Czech Republic, Hungary, Poland and Romania). The novelty of this study involved adapting Blanchard-Perotti methodology to test the effectiveness of fiscal policy in seven economies in Central and Eastern Europe. The results suggest the presence of non-Keynesian effects of an expansionary fiscal policy in Romania, while in the rest of the economies (except Poland and Slovakia), fiscal policy has limited effects on domestic output. Therefore, in these countries should be promoted a series of complementary measures, such as those that increase of the business environment attractiveness, in order to generate some spillover effects and support from the private sector.

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## Annex 1. Matrices A and B of the SVAR models

### BULGARIA

| Estimated A matrix: | | | | |
|---|---|---|---|---|
| 1.000000 | 0.010000 | 0.500000 | 0.000000 | 0.000000 |
| -0.008314 | 1.000000 | 0.000000 | -0.000982 | 0.000000 |
| -0.011425 | 0.377445 | 1.000000 | 0.046227 | 0.000000 |
| 0.000000 | -0.350000 | -0.900000 | 1.000000 | 0.000000 |
| -0.014518 | -0.229156 | -0.041388 | -0.000110 | 1.000000 |
| Estimated B matrix: | | | | |
| 0.108524 | 0.000000 | 0.000000 | 0.000000 | 0.000000 |
| 0.000000 | 0.006793 | 0.000000 | 0.000000 | 0.000000 |
| 0.000000 | 0.000000 | 0.009381 | 0.000000 | 0.000000 |
| 0.013874 | 0.000000 | 0.000000 | 0.059083 | 0.000000 |
| 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.004160 |

### CZECH REPUBLIC

| Estimated A matrix: | | | | |
|---|---|---|---|---|
| 1.000000 | 0.010000 | 0.500000 | 0.000000 | 0.000000 |
| -0.012248 | 1.000000 | 0.000000 | -0.028117 | 0.000000 |
| -0.044330 | -0.125032 | 1.000000 | 0.016586 | 0.000000 |
| 0.000000 | -0.360000 | -0.900000 | 1.000000 | 0.000000 |
| 0.009443 | 0.079418 | -0.021190 | -0.018794 | 1.000000 |
| Estimated B matrix: | | | | |
| 0.097997 | 0.000000 | 0.000000 | 0.000000 | 0.000000 |
| 0.000000 | 0.008847 | 0.000000 | 0.000000 | 0.000000 |
| 0.000000 | 0.000000 | 0.011699 | 0.000000 | 0.000000 |
| 0.054766 | 0.000000 | 0.000000 | 0.086130 | 0.000000 |
| 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.002110 |

### POLAND

| Estimated A matrix: | | | | |
|---|---|---|---|---|
| 1.000000 | 0.060000 | 0.500000 | 0.000000 | 0.000000 |
| -0.052412 | 1.000000 | 0.000000 | -0.086297 | 0.000000 |
| -0.037610 | 0.050676 | 1.000000 | 0.178787 | 0.000000 |
| 0.000000 | -0.330000 | -0.900000 | 1.000000 | 0.000000 |
| 0.029714 | -0.053796 | -0.001850 | 0.013401 | 1.000000 |
| Estimated B matrix: | | | | |
| 0.027542 | 0.000000 | 0.000000 | 0.000000 | 0.000000 |
| 0.000000 | 0.004142 | 0.000000 | 0.000000 | 0.000000 |
| 0.000000 | 0.000000 | 0.084735 | 0.000000 | 0.000000 |
| -0.031006 | 0.000000 | 0.000000 | 0.028762 | 0.000000 |
| 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.003862 |

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**ROMANIA**

| Estimated A matrix: | | | | |
|---|---|---|---|---|
| 1.000000 | 0.020000 | 0.500000 | 0.000000 | 0.000000 |
| -0.019029 | 1.000000 | 0.000000 | -0.078143 | 0.000000 |
| -0.513978 | 0.571314 | 1.000000 | 0.212892 | 0.000000 |
| 0.000000 | -0.280000 | -0.800000 | 1.000000 | 0.000000 |
| 0.007372 | -0.417642 | 0.093583 | 0.240997 | 1.000000 |
| Estimated B matrix: | | | | |
| 0.061927 | 0.000000 | 0.000000 | 0.000000 | 0.000000 |
| 0.000000 | 0.014647 | 0.000000 | 0.000000 | 0.000000 |
| 0.000000 | 0.000000 | 0.040420 | 0.000000 | 0.000000 |
| -0.005095 | 0.000000 | 0.000000 | 0.064057 | 0.000000 |
| 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.024499 |

**SLOVAKIA**

| Estimated A matrix: | | | | |
|---|---|---|---|---|
| 1.000000 | 0.020000 | 0.500000 | 0.000000 | 0.000000 |
| -0.003085 | 1.000000 | 0.000000 | -0.021339 | 0.000000 |
| -0.071659 | -0.076615 | 1.000000 | 0.025441 | 0.000000 |
| 0.000000 | -0.270000 | -0.900000 | 1.000000 | 0.000000 |
| 0.019371 | -0.048616 | 0.038605 | -0.003154 | 1.000000 |
| Estimated B matrix: | | | | |
| 0.087369 | 0.000000 | 0.000000 | 0.000000 | 0.000000 |
| 0.000000 | 0.012744 | 0.000000 | 0.000000 | 0.000000 |
| 0.000000 | 0.000000 | 0.012623 | 0.000000 | 0.000000 |
| 0.019973 | 0.000000 | 0.000000 | 0.072567 | 0.000000 |
| 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.005448 |

**SLOVENIA**

| Estimated A matrix: | | | | |
|---|---|---|---|---|
| 1.000000 | 0.050000 | 0.500000 | 0.000000 | 0.000000 |
| -0.063997 | 1.000000 | 0.000000 | -0.069461 | 0.000000 |
| 0.010188 | -0.017163 | 1.000000 | 0.021860 | 0.000000 |
| 0.000000 | -0.420000 | -0.900000 | 1.000000 | 0.000000 |
| -0.024149 | 0.061232 | 0.069523 | 0.009805 | 1.000000 |
| Estimated B matrix: | | | | |
| 0.025701 | 0.000000 | 0.000000 | 0.000000 | 0.000000 |
| 0.000000 | 0.009046 | 0.000000 | 0.000000 | 0.000000 |
| 0.000000 | 0.000000 | 0.006897 | 0.000000 | 0.000000 |
| 0.001209 | 0.000000 | 0.000000 | 0.033634 | 0.000000 |
| 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.005489 |

**HUNGARY**

| Estimated A matrix: | | | | |
|---|---|---|---|---|
| 1.000000 | 0.010000 | 0.500000 | 0.000000 | 0.000000 |
| -0.059908 | 1.000000 | 0.000000 | -0.009179 | 0.000000 |
| -0.461941 | -1.854888 | 1.000000 | 0.043316 | 0.000000 |
| 0.000000 | -0.450000 | -0.900000 | 1.000000 | 0.000000 |
| -0.002037 | -0.056480 | 0.109327 | -0.008581 | 1.000000 |
| Estimated B matrix: | | | | |
| 0.041155 | 0.000000 | 0.000000 | 0.000000 | 0.000000 |
| 0.000000 | 0.008114 | 0.000000 | 0.000000 | 0.000000 |
| 0.000000 | 0.000000 | 0.034880 | 0.000000 | 0.000000 |
| -0.024508 | 0.000000 | 0.000000 | 0.167007 | 0.000000 |
| 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.009093 |

Testing the Impact of the Fiscal Policy with the SVAR Model in seven CEE Economies