Effects of Fiscal Policy Shocks in the European Transition Economies

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Abstract:

 EU member countries are currently exposed to negative implications of the economic and financial crisis. In connection with this problem arises the question of an anti-cyclic role of an economic policy or more precisely the (regulatory) role of the government in the economy that seems to be the centre of discussions in the academic as well as economic policy sphere. The problem of a permanent deficiency of the general government budget stresses many "old" as well as "new" EU member countries. It significantly reduces an expansionary potential of the national fiscal policies. Because the economic crisis seems to be a very difficult problem due to its specific and complex features, it is necessary for the EU member countries to coordinate the process of the national stimulatory actions approving that would help the countries to avoid an undesired reallocation of resources outside the EU single market as well as the negative common competitive effects.

 In the paper we analyze the effects of fiscal policy shocks in the Czech republic, Hungary, Poland, the Slovak republic, Bulgaria and Romania in the period 2000-2008. Our objective is to estimate the effects of discretionary changes in fiscal policy (associated with an increase in government expenditures) as well as the role of automatic stabilizers (associated with an increase in tax revenues). To meet the objective we estimate vector autoregression (VAR) model. To check the robustness of the results we implement an identification scheme based on two approaches. The first, recursive approach, is based on the Cholesky decomposition of innovations that allows us to identify structural shocks hitting the model. The second approach, structural VAR approach, is based on applying long-run restrictions to the reduced-form VAR model. From both identified true models we compute impulse-response functions to estimate the responses of real output, inflation and short term interest rates to the government expenditure and tax revenue shocks.

Keywords: fiscal policy, government expenditure, tax revenue, unrestricted VAR, Cholesky decomposition, SVAR, structural shocks, impulse-response function

JEL Classification: C32, E62

1. Introduction

 European Union member countries are currently exposed to negative implications of the economic and financial crisis. In connection with this problem arises the question of an anti-cyclic role of an economic policy or more precisely the (regulatory) role of the government in an economy that seems to be the centre of discussions in the academic as well as economic policy sphere. At the same time the economic crisis seems to be a very difficult problem due to its specific and complex features that we may conclude as follow:

- European Union countries don't seem to be affected by the economic crisis with the same intensity. There are also differences in the size of casualties the economic crisis causes in the individual branches and sectors of the national economies.
- Economic crisis affects both supply and demand sides of the aggregate markets. At the same time it quickly spreads among countries of the single European Union market using different transmission channels.
- Efficiency of national stimulatory actions seems to be reduced due to high economic interconnections among individual European Union countries.
- Selective stabilisation and stimulation actions (with a national as well as international radius) produce market distortions in an individual country or even the whole European Union market. As the result we might expect that the more protectionist are the actions the governments take in fighting the economic crisis the more they reduce the overall allocation and stimulation functions of the markets.

 Considering a complexity of the economic crisis it seems to be crucial to emphasize not only direct effects of the stabilizing actions but also their indirect and side effects. Because the economic crisis doesn't affect the supply and demand side of the individual markets of the European Union member

countries with the same intensity, it seems to be rather difficult to precisely estimate the potential inflationary effects of the economic crisis that the countries are going to experience during the process of economic recovery (despite of the disinflationary pressures that we might currently observe). Nevertheless the economic crisis that followed the financial crisis originated in the U.S. subprime mortgage crisis, the potential (dis)inflationary or even deflationary pressures in the European Union member countries can't be considered as a purely monetary phenomenon. Downward pressures to the interbank money market interest rates followed by the European central bank's monetary policy softening may stamp on the precautious lending policy of commercial banks. As the result the overall supply of new loans to the private sector wouldn't necessarily increase. In a situation when the agents face a higher uncertainty on the international financial markets it would also lead to an increased volatility in the short-term capital and its inconvenient reallocation outside the single market of the European Monetary Union. The capabilities of monetary authorities to eliminate the negative effects of the economic crisis seem to be rather limited. Moreover the overall effects of the lower retail interest rates wouldn't necessarily be beneficial in the same manner in all Euro-area countries especially due to differing exposure of the countries to the crisis effects.

Economic crisis has spread across the single market of the European Union in the period of the continuous monetary integration. The loss of the monetary sovereignty of the Euro-area member countries focuses an attention of politicians and economists again to the discussion about an importance of coordination and cooperation in the selected areas of fiscal policy. We assume it is one of the greatest challenges the European Union and individual member countries representatives currently face.

It is also necessary to emphasize that the common Euro-area monetary policy performed by the European central bank had typical stabilization and anti-cyclic features of let's say the common economic policy of the European Monetary Union since the beginning (1999). On the other hand national fiscal policies significantly miss this feature. It is especially caused by permanent deficits in many European Union countries during the period 2000-2008 that have markedly reduced the overall flexibility of national fiscal policies as well as their anti-cyclic potential if we also consider that a main operational framework for these countries is shaped by the Growth and Stability Pact. Quite similar trend we might observe in the group of six countries (Czech republic, Hungary, Poland, Slovak republic, Bulgaria and Romania) that were in the centre of our research. In the Euro-area candidate countries fiscal policy framework is strengthened by the Maastricht nominal convergence criteria.

The problem of say about a permanent deficiency of the general government budget stresses many "old" (Austria, France, Greece, Germany, Great Britain, Italy, Portugal) as well as "new" (Cyprus, Czech republic, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovak republic, Slovenia) European Union member countries (of course we consider the period before the economic crisis put a stress on revenue and expenditures sides of national fiscal budgets). It significantly reduces an expansionary potential of the national fiscal policies. At the same time both the European Union as well as the European Monetary Union records permanent fiscal deficits as a whole since 2000. As traditional examples of a positive fiscal development we can mention Scandinavian countries (Denmark, Finland, Iceland, Ireland, Norway and Sweden) and Luxemburg. From the group of the new European Union member countries we can mention Bulgaria (but only till 2004) and Estonia.

Figure 1 shows a development of main fiscal policy parameters in our group of six transition economies in the period 2000-2008. In all countries (except Hungary) the share of government expenditures and government revenues was around 40 percent during the whole period. Except the Slovak republic and partially Poland (since 2007) we didn't experience any significant reduction in the government's involvement in the national income redistribution. All countries (except Bulgaria, excluding period 2004-2007) record a permanent fiscal deficit during the whole period. Despite a negative trend in the government deficit development, the overall public debt has moderately increased only in Hungary. The Slovak republic, Bulgaria and Romania were even able to continuously reduce its share of the total output.
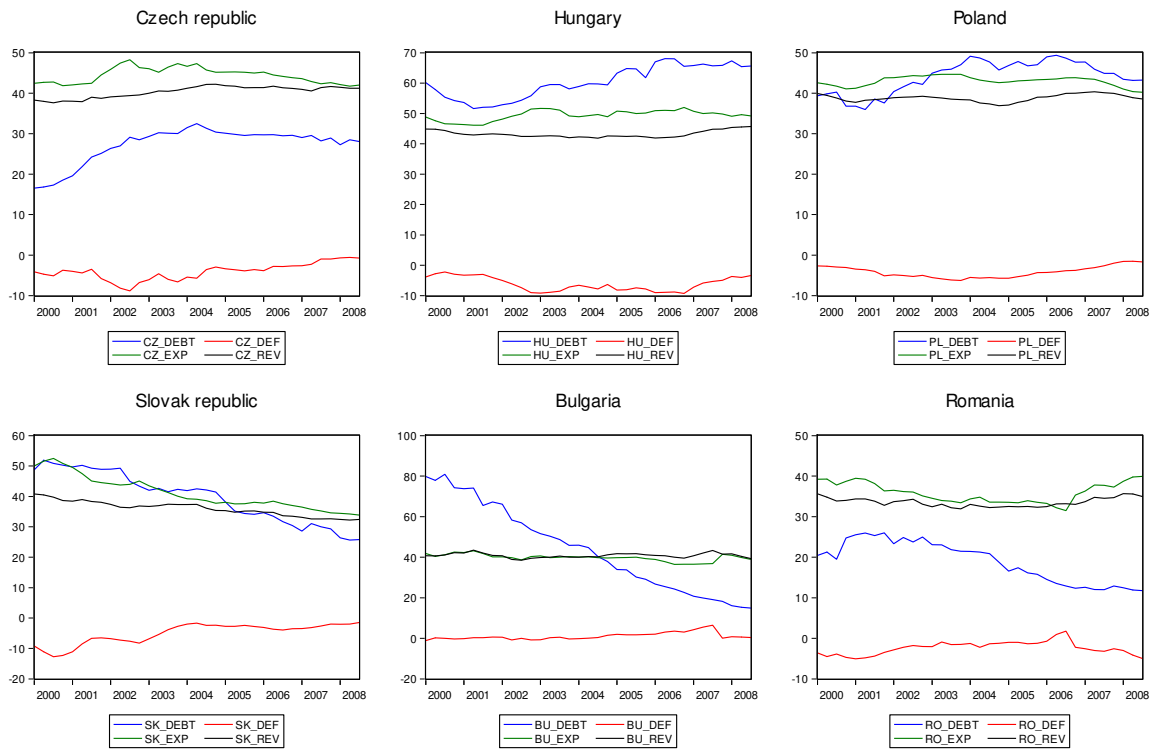
Figure 1. Fiscal policy parameters

Note: All fiscal indicators are expressed as a percentage share on the national output.

The overall effects of the economic crisis on the general government budgets of the European Union member countries can be demonstrated in two areas. (1) Slow down of a real economic growth as well as an increase of unemployment due to a strong negative demand (domestic as well as foreign) shock put negative pressures on the revenue side (a decrease in tax and other fiscal contributions) as well as the expenditure side (an increase in social transfers related to a rise of an unemployment) of national fiscal budgets. Consequently an economy recession forces countries (especially those with permanent fiscal deficits) to break a limit for fiscal deficit specified in the Stability and Growth Pact. An individual country can avoid a sanction procedure if an excessive fiscal deficit is the result of a negative real gross domestic product development trend. On the other hand if a recession does less damage to the real output, the country cannot avoid sanctions in case the European Commission doesn't soften conditions in the Stability and Growth Pact. (2) As the second channel of transmitting the negative impulses from the economic crisis to national fiscal budgets we consider the packages of recovery actions that national governments approves in order to eliminate the negative impacts of the crisis to national economies. We assume these recovery actions burden especially expenditure side of national fiscal budgets. If we put these actions under a critical revision, we can only accept stimulatory actions with wide area effects that should help to eliminate undesired structural deformations leading to decreased allocation effectiveness of the domestic markets. Governments should also avoid to approve too selective actions focused on the small target groups or areas of national economies. Much higher accent should be given to the systematic actions with significant multiplicative effects.

Even though we expect governments presumably avoid to approve stimulatory actions affecting revenue sides of fiscal budgets, reduction of tax burden seems to be great challenge especially for some old European Union member countries (France, Germany, Italy, Great Britain). Another challenging task is to coordinate the process of the national stimulatory actions approving that would help the countries to avoid an undesired reallocation of resources outside the European Union single market as well as the negative common competitive effects.

In the paper we analyze the effects of fiscal policy shocks in the Czech republic, Hungary, Poland, the Slovak republic, Bulgaria and Romania in the period 2000-2008. Our objective is to estimate the

effects of discretionary changes in fiscal policy (associated with an increase in government expenditures) as well as the role of automatic stabilizers (associated with an increase in tax revenues). To meet the objective we estimate vector autoregression (VAR) model. To check the robustness of the results we implement an identification scheme based on two approaches. The first, recursive approach, is based on the Cholesky decomposition of innovations that allows us to identify structural shocks hitting the model. The second approach, structural VAR approach, is based on applying long-run restrictions to the reduced-form VAR model. From both identified true models we compute impulse-response functions to estimate the responses of real output, inflation and short term interest rates to the government expenditure and tax revenue shocks.

2. Overview of the literature

Effects of fiscal policy shocks are well documented especially on a sample of developed countries. Blanchard and Perotti (Blanchard and Perotti, 1999) used mixed structural VAR/event study approach to identify the automatic responses of taxes and government spending to economic activity. They also argued that positive government spending shocks have a positive effect on output, and positive tax shocks have a negative effect, while the multipliers for both spending and tax shocks are typically small.

Perotti (Perotti, 2002) implemented SVAR approach in order to analyze the effect of fiscal policy on GDP, prices and interest rates in five OECD countries. The results we may conclude as follows: 1) The effects of fiscal policy on GDP and its components have become substantially weaker in the last 20 years; 2) The tax multipliers tend to be negative but small; 3) Once plausible values of the price elasticity of governments spending are imposed, the negative effects of government spending on prices that have been frequently estimated become positive, although usually small and not always significant; 4) Government spending shocks have significant effects on the real short interest rate, but uncertain signs; 5) Net tax shocks have very small effects on prices; 6) The U.S. is an outlier in many dimensions; U.S. responses to fiscal shocks are often not representative of the average OECD country included in this sample.

Giuliodori and Beetsma (Giuliodori and Beetsma, 2004) also implemented few identifications schemes using VAR methodology to analyze the (spill-over) effects of fiscal policy shocks in European economies. Their analysis is focused on the indirect channel of transmitting the fiscal policy shocks that affect an import of the country. They also emphasized a necessity of enhanced fiscal coordination at the macroeconomic level.

Romer and Romer (Romer and Romer, 2007) analyze the causes and consequences in the levl of taxation in the postwar U.S. Their results indicate that tax changes have very large effects on output. At the same time output effects are very persistent. Authors argue it is due to the strong response of investments to the tax burden decrease.

Caldara and Camps (Caldara and Camps, 2008) provide an empirical evidence on the response of key macroeconomic variables to government spending and tax revenue shocks for the U.S. over the period 1955-2006. Authors implemented four approaches (the recursive approach, the Blanchard-Perotti approach, the sign-restrictions approach and the event-study approach) to identify their system based on the VAR methodology. While there is the empirical evidence that the positive responses of private consumption and the real wage are very persistent, authors argued that the most current-generation DSGE models consistent with an increase in these variables predict that the responses turn negative already about one year after the government spending shock occurs. They also find strongly diverging results as regards the effects of tax shocks depending on the identification approach used, with the estimated effects of unanticipated tax increases ranging from non-distortionary to strongly distortionary.

3. Econometric model

An approach we use in our analysis to estimate the effects of fiscal policy shocks (government expenditure shock, tax revenue shock) is based on the vector autoregressive (VAR) methodology. In order to recover the structural shocks that affect the endogenous variables of the model we implement two identification approaches. First approach is based on the recursive Cholesky decomposition of the variance-covariance matrix of the model residuals. The recursive identification approach also

considers the causal ordering of the variables. Second approach is based on the identification scheme that imposes long-run restrictions on the variance-covariance matrix of the model residuals. Nevertheless both approaches uses different scheme to recover structural shocks we expect they both provide comparable results of the effects of the fiscal policy shocks in the selected group of transition economies.

True model is represented by the following infinite vector moving average representation:

$$A_0 Y_t = A(L)Y_{t-1} + B\varepsilon_t \tag{1}$$

where Y_t is a N x 1 vector of the endogenous macroeconomic variables, $A(L)$ is a polynomial variance-covariance matrix (represents impulse-response functions of the shocks to the elements of Y) of lag-length l, L is lag operator and ε_t is a (k x 1) vector of identically normally distributed, serially uncorrelated and mutually orthogonal white noise disturbances (vector of true structural shocks in elements of Y):

$$E(\varepsilon_t) = 0, \quad E(\varepsilon_t \varepsilon_t') = \Sigma_\varepsilon = I, \quad E(\varepsilon_t \varepsilon_s') = [0] \quad \forall t \neq s \tag{2}$$

The vector Y_t of the endogenous variables of the model consists of the following five elements: government expenditures (g), real output (y_r), inflation (p), tax revenues (t) and short-term interest rates (i). In our five-variate model we assume five exogenous shocks that determine endogenous variables - government expenditures shock (ε_g), demand shock (ε_y), inflation shock (ε_p), tax revenues shock (ε_t) and monetary policy shock (ε_i).

By multiplying equation (1) by an inverse matrix A_0^{-1} we obtain the reduced-form of the VAR model (this adjustment is necessary because the model represented by the equation (1) is not directly observable and structural shocks cannot by correctly identified):

$$Y_t = A_0^{-1}A(L)Y_{t-1} + A_0^{-1}B\varepsilon_t = C(L)Y_{t-1} + u_t \tag{3}$$

where $C(L)$ is again a matrix representing the relationship among variables on the lagged values and u_t is a N x 1 vector of normally distributed shocks (shocks in reduced form) that are serially uncorrelated but can be contemporaneously correlated with each other:

$$E(u_t) = 0, \quad E(u_t u_t') = \Sigma_u = \begin{pmatrix} \sigma^2_1 & \sigma_{12} & \sigma_{13} \\ \sigma_{12} & \sigma^2_1 & \sigma_{23} \\ \sigma_{13} & \sigma_{23} & \sigma^2_1 \end{pmatrix}, \quad E(u_t u_s') = [0] \quad \forall t \neq s \tag{4}$$

Equation (3) reveals the relationship between reduced-form VAR disturbances u_t and structural disturbances ε_t, that is given by

$$u_t = A_0^{-1}B\varepsilon_t \text{ or } A_0 u_t = B\varepsilon_t \tag{5}$$

As we have already mentioned we implement an identification scheme based on two approaches. The first, recursive approach, is based on the Cholesky decomposition of innovations that allows us to identify structural shocks hitting the model. Cholesky decomposition of variance-covariance matrix of VAR residuals defines the matrix A_0 as a lower triangular matrix and matrix B as k-dimensional identity matrix.

The lower triangularity of A_0 implies a recursive scheme among variables that has clear economic implications and has to be empirically tested as any other relationship. Identification scheme of the matrix A_0 implies that some structural shocks have no contemporaneous effects on some endogenous variables given the ordering of the endogenous variables.

At the same time the off-diagonal elements of *B* are all zero, implying that we do not allow for the structural shocks to be mutually correlated. This assumption is consistent with empirical results - the correlation between government spending and tax revenue shocks is not statistically different from zero.

The equation (5) we can now rewrite to the following form:

$$
\begin{bmatrix}
1 & 0 & 0 & 0 & 0 \\
a_{21} & 1 & 0 & 0 & 0 \\
a_{31} & a_{32} & 1 & 0 & 0 \\
a_{41} & a_{42} & a_{43} & 1 & 0 \\
a_{51} & a_{52} & a_{53} & a_{54} & 1
\end{bmatrix}
\begin{bmatrix}
u_{g,t} \\
u_{y,t} \\
u_{p,t} \\
u_{t,t} \\
u_{i,t}
\end{bmatrix}
=
\begin{bmatrix}
1 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 1
\end{bmatrix}
\begin{bmatrix}
\varepsilon_{g,t} \\
\varepsilon_{y,t} \\
\varepsilon_{p,t} \\
\varepsilon_{t,t} \\
\varepsilon_{i,t}
\end{bmatrix}
\tag{6}
$$

The ordering of the variables reveals following relations among them:

- Government expenditures don't respond contemporaneously to the shock from any other endogenous variable of the model.
- Real output doesn't respond contemporaneously to inflation, tax revenues and interest rates shocks, while it is contemporaneously affected only by the government expenditure shock.
- Inflation doesn't respond contemporaneously to the tax revenues and interest rates shocks, while it is contemporaneously affected by the government expenditure and the real output shocks.
- Tax revenues don't respond contemporaneously to the interest rates shock, while it is contemporaneously affected by the government expenditure, the real output and tax revenues shocks.
- Interest rates are contemporaneously affected by the shocks from all of the endogenous variables of the model.

It is also necessary to emphasize that after the initial period the endogenous variables of the model can interact freely without any restrictions.

The second approach, structural VAR (SVAR) approach, is based on decomposing a series into its permanent and temporary components. It imposes long-run restrictions to the reduced-form VAR model. Identification scheme in the SVAR models reflects a long-run neutrality assumption so that we expect the cumulative effect of a certain shock on the certain endogenous variable development is zero. The equation (5) we can now rewrite to the following form:

$$
\begin{bmatrix}
1 & 0 & 0 & 0 & 0 \\
a_{21} & 1 & 0 & a_{24} & 0 \\
a_{31} & 0 & 1 & a_{34} & 0 \\
0 & a_{42} & a_{43} & 1 & 0 \\
a_{51} & a_{52} & a_{53} & a_{54} & 1
\end{bmatrix}
\begin{bmatrix}
u_{g,t} \\
u_{y,t} \\
u_{p,t} \\
u_{t,t} \\
u_{i,t}
\end{bmatrix}
=
\begin{bmatrix}
1 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 1
\end{bmatrix}
\begin{bmatrix}
\varepsilon_{g,t} \\
\varepsilon_{y,t} \\
\varepsilon_{p,t} \\
\varepsilon_{t,t} \\
\varepsilon_{i,t}
\end{bmatrix}
\tag{7}
$$

In order to correctly identify the model we impose following long-run restrictions:

- Government expenditures do not have a permanent effect on tax revenues.
- Real output does not have a permanent effect on government expenditures and inflation.
- Inflation does not have a permanent effect on government expenditures and real output.
- Tax revenues do not have a permanent effect on government expenditures.
- Interest rates do not have a permanent effect on any other endogenous variable of the model.

Both systems are now just-identified and can be estimated using vector autoregression. From both identified true models we compute impulse-response functions to estimate the responses of real output, inflation and short term interest rates to the government expenditure and tax revenues shocks.

3. Data and results

In order to estimate our model represented by five endogenous variables for each country from the group (the Czech republic, Hungary, Poland, the Slovak republic, Bulgaria and Romania) we used the quarterly data ranging from 2000Q1 to 2008Q4 (32 observations) for the government expenditures, real gross domestic product, inflation, tax revenues and short term interest rates (figure 2). Time series for the main fiscal parameters were drawn from Eurostat's Government Finance Statistics. Data for core inflation, nominal and real gross domestic product were taken from OECD's Frequently Requested Statistics Database. Finally, short-term money market interest rates were drawn from the national central bank's websites.

Time series for the quarterly government expenditures, real gross domestic product and tax revenues were seasonally adjusted. Time series for the nominal government expenditures and tax revenues were deflated using gross domestic product deflator. As an inflation indicator we used core inflation without food and energy. As a short-term interest rates indicator we used national interbank offered rates for the deposits with 3 months maturity.
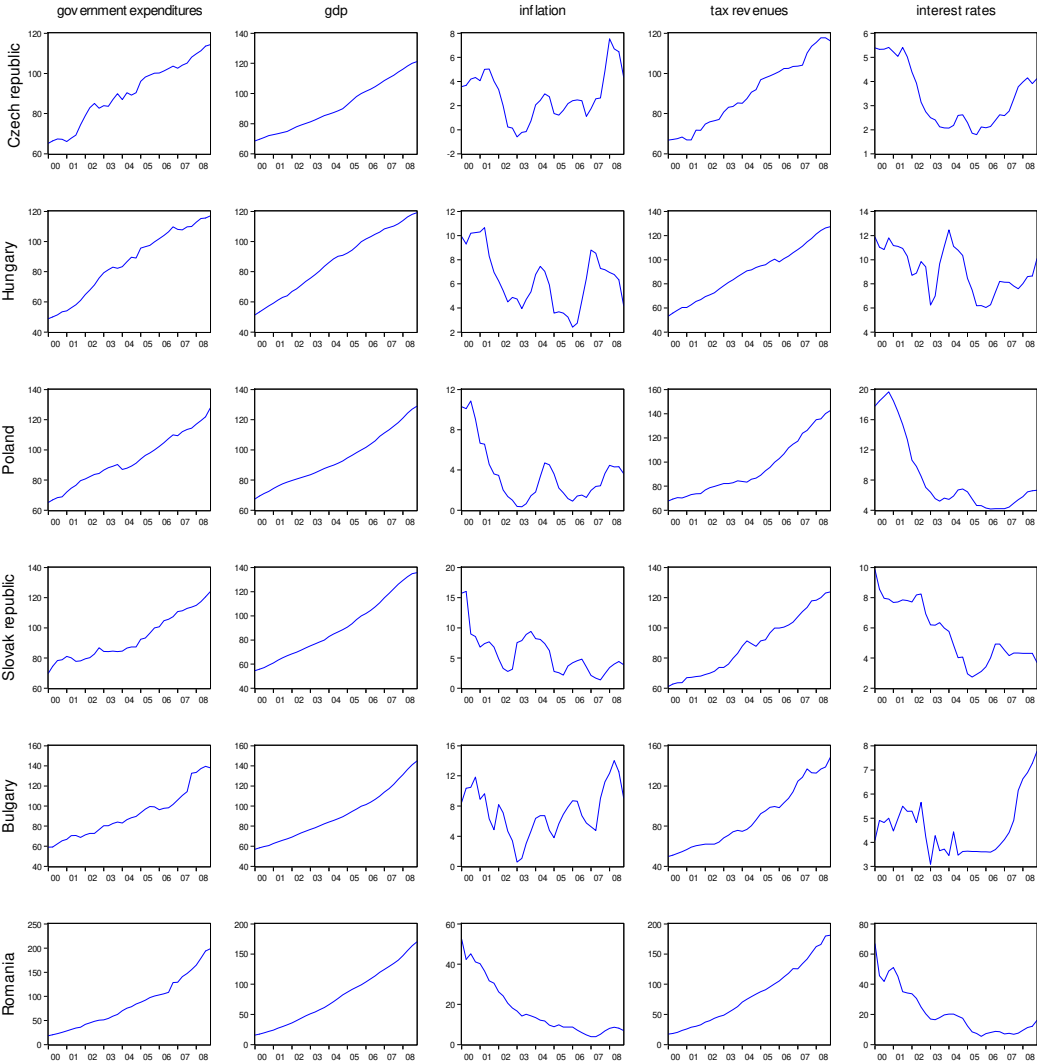

Figure 2. Variables (2000-2008)

Note: Inflation and interest rates are expressed in percentage, government expenditures, real gross domestic product and tax revenues are expressed as an index (2005 = 100).

Before we estimate the model it is necessary to test the time series for stationarity and cointegration. The augmented Dickey-Fuller (ADF) and the Phillips-Perron (PP) tests were computed to test the endogenous variables for the existence of unit roots. Both ADF and PP tests indicate that all variables are non-stationary on the values so that the null hypothesis of a unit root cannot be rejected for any of the series. Testing variables on the first differences indicates the time series are stationary so that we conclude that the variables are I(1).

Because all endogenous variables have a unit root on the values it is necessary to the test the time series for cointegration using the Johansen cointegration test. The test for the cointegration was computed using two lags as recommended by the AIC (Akaike Information Criterion) and SIC (Schwarz Information Criterion). The results of the Johansen cointegration tests confirmed the results of the unit root tests. Both trace statistics and maximum eigenvalue statistics (both at 0.05 level) indicate that there is no cointegration among the endogenous variables of the model. The results of unit root and cointegration tests are not reported here to save space. Like any other results, they are available upon request from the author.

To test the stability of the VAR model we also applied a number of diagnostic tests. We found no evidence of serial correlation, heteroskedasticity and autoregressive conditional heteroskedasticity effect in the disturbances. The model also passes the Jarque-Bera normality test, so that errors seem to be normally distributed. The VAR models seem to be stable also because the inverted roots of the model for each country lie inside the unit circle (figure 3).
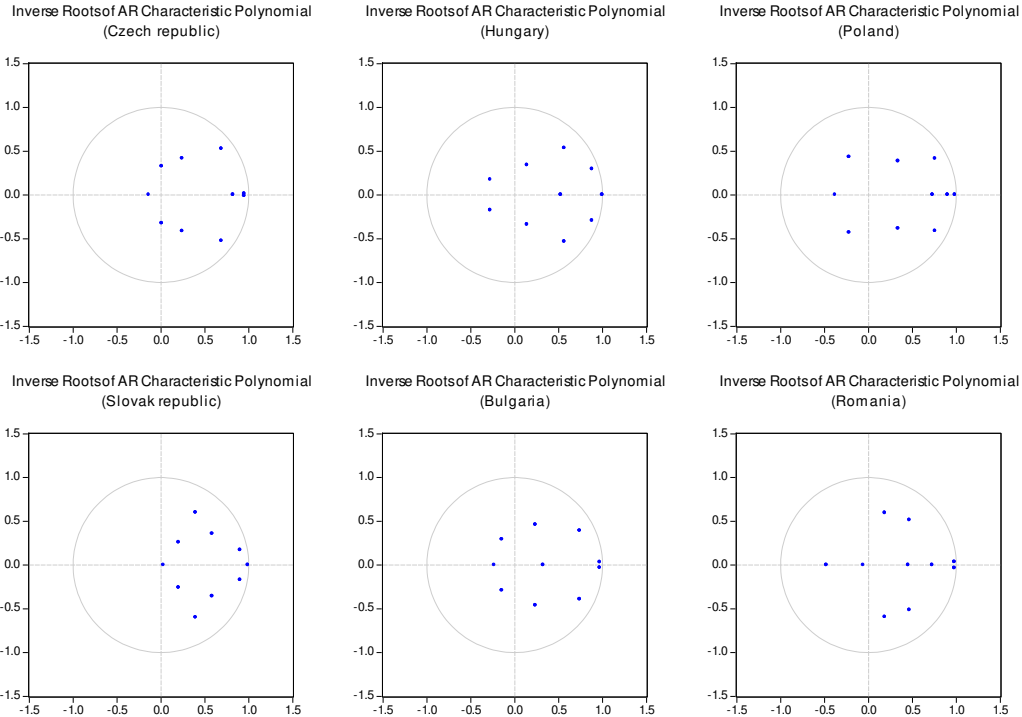

Figure 3. VAR stability condition check

Source: Author's calculations.

Following the results of the stationarity and cointegration tests we estimate the model using the variables in the first differences so that we can calculate impulse-response functions of endogenous variables of the model (responses of endogenous variables to one standard deviation government expenditures and tax revenues shocks) for each country from the selected group. In figures 4 (recursive approach) and 6 (SVAR approach) we summarize the responses of endogenous variables to the government expenditure shock. In figures 5 (recursive approach) and 7 (SVAR approach) we summarize the responses of endogenous variables to the tax revenues shock.

The impulse-response functions that show the responses of the endogenous variables to the government expenditure shock (Cholesky identification scheme) are shown in the figure 4. Under the

above Cholesky identification structure, the real government spending is not contemporaneously (within the same quarter) affected by the changes in the real economic activity. That is the reason why we consider government expenditure shock as a discretionary change in fiscal policy represented here by the deliberate change in the government expenditures. In this regard we assume that there is no institutional setting to believe that any spending component reacts automatically to real activity changes.
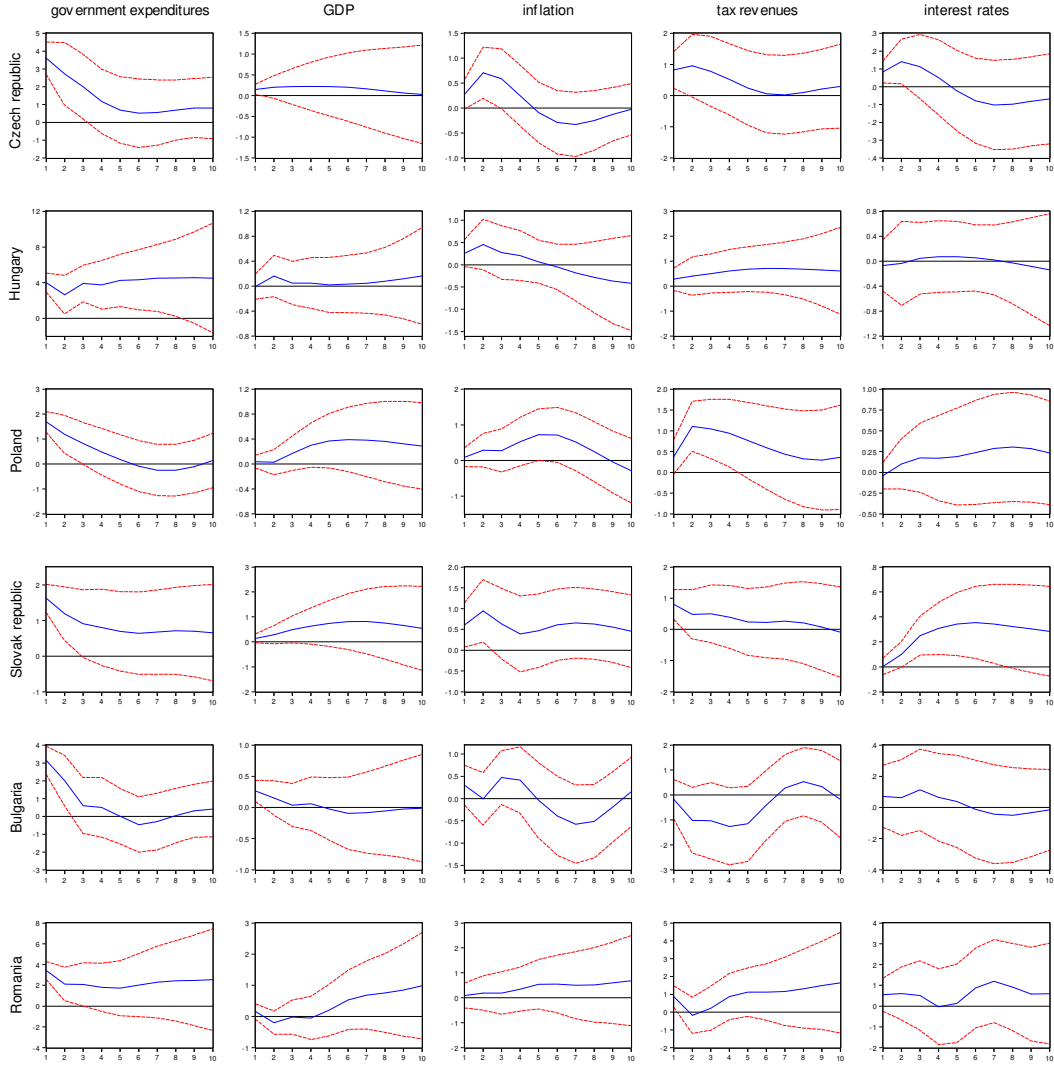

Figure 4. Response of endogenous variables to the government expenditure shock (recursive Cholesky approach)

Source: Author's calculations.

After a positive government expenditure shock the real output responded in a rather different way in the selected group of countries. Real output increased markedly immediately after the shock only in Bulgaria followed by the Czech republic. Moderate but slightly gradual increase of the real output we observed in Hungary and the Slovak republic. In Poland and Romania the positive impact of the government expenditure shock on the real output development appeared with a lag. When we focus on an intensity in which the government expenditure shock affected the real output we also investigate rather differing results among countries. In Hungary and Bulgaria the government expenditure shock affected the real output only for a short period (three respectively four quarters) and then died. In the Czech republic and the Slovak republic the immediate positive effect of the government expenditure shock accelerated the real output in about three respectively four years until it died. Despite the initial one quarter lag the real output in Poland responded to the government expenditure shock quite similar

to the scenario in the Slovak republic even thought the overall effect of the shock died about one year later. While in Romania the real output responded to the government expenditure shock with a significant lag of one year its intensity was the strongest in comparison with other countries. Additionally its positive effect died after rather long period (7 years).

After the initial government expenditure shock the inflation increased in all countries (here again with rather differing intensity). An upward inflation pressure is the most clearly visible in the Slovak republic as the inflation decreased (after an initial increase) only very slowly. In the Czech republic, Hungary and Bulgaria the overall effect of the government expenditure shock on the inflation is more like destabilizing than strictly increasing. In Poland inflationary pressure of the government expenditure shock died after two years. In Romania an inflation increase seems to be persisting even in the short run and died only in the long period.

In the Czech republic, Hungary, Poland, the Slovak republic and with three quarters lag in Romania the positive government expenditure shock forced an increase in the tax revenues. We observed that only in Bulgaria the increased government expenditures produced typical deficit-financed expansionary effect.

Finally, the positive government expenditure shock increased the short-term interest rates (with differing intensity and durability) in all countries except Hungary because the interest rates seem to be rather neutral to this shock.
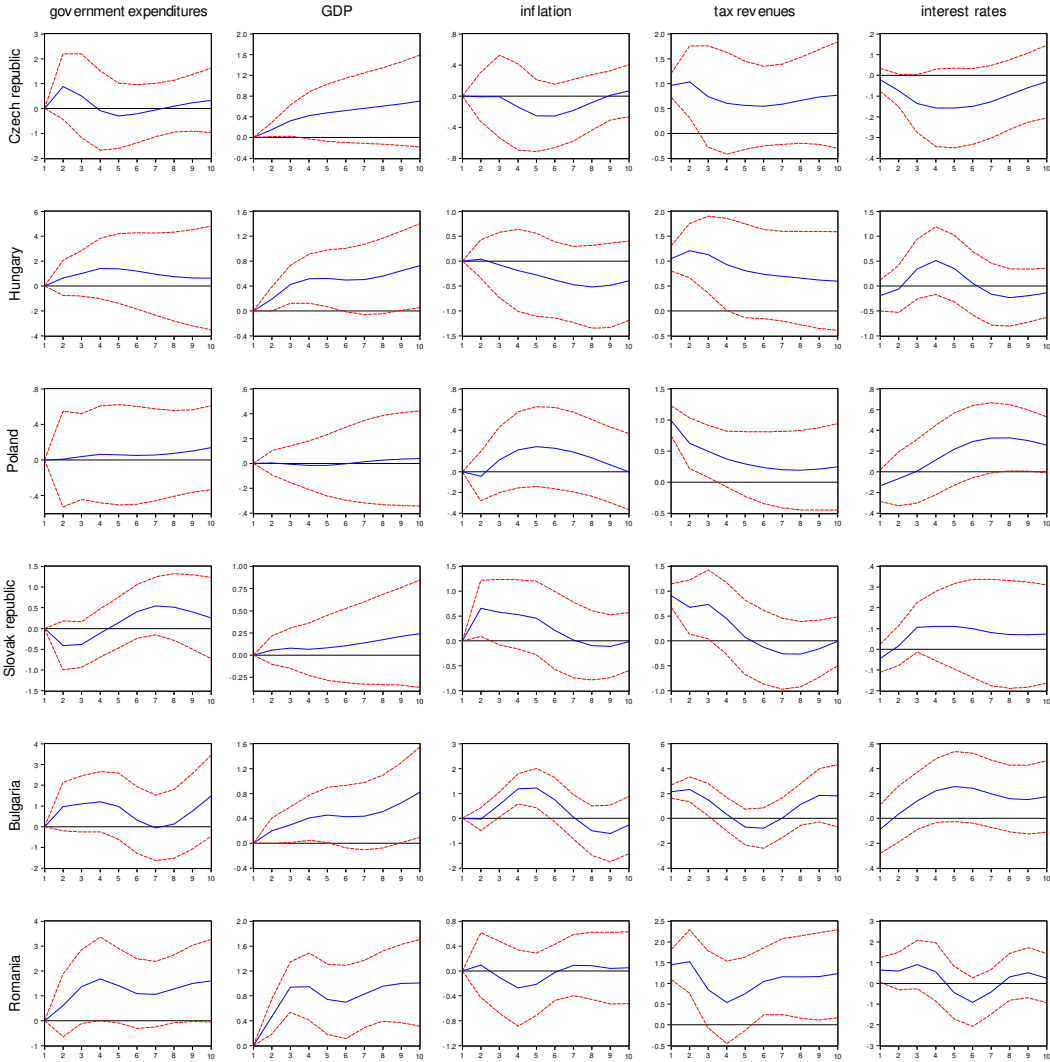

Figure 5. Response of endogenous variables to the tax revenues shock (recursive Cholesky approach)

Source: Author's calculations.

The impulse-response functions that show the responses of the endogenous variables to the tax revenue shock (Cholesky identification scheme) are shown in the figure 5.

Under the above Cholesky identification structure (due to an integrated recursive principle the causal ordering of the variables is considered), the real tax revenues are contemporaneously (within the same quarter) affected by changes in the government expenditures, the real economic activity as well as the inflation. That is the reason why we consider the tax revenues shock as an automatic stabilizer in the fiscal policy represented here by the automatic adjustment in the tax revenues. In this regard we assume that there is a logical institutional setting to believe that the tax revenues react automatically to the real economic activity changes. After the initial real output shock the tax revenues increased in all six countries (the impulse-response functions of the real output is not presented here, like any other results, they are available upon request from the author).

Considering the internal logic of the recursive approach we assume that the government expenditures, the real output and the inflation doesn't respond to the tax revenue shock within the initial period while these variables can interact freely without any restrictions after the initial period.

Since the second quarter the government expenditures increases after the tax revenues shock. Despite the differences in the intensity as well as durability of the tax revenue shock we can conclude that this shock doesn't generate the sufficient condition to improve the fiscal budget balance in all countries.

After the initial tax revenues shock the real output responded since the second quarter differently in all countries. The response of the real output in all transition economies (except Poland) seems to be rather interesting an in general contrary in comparison with other research studies focusing on the western developed countries. In the Czech republic, Hungary, the Slovak republic, Bulgaria and Romania the real output increased after the tax revenue shock (with differing intensity and durability). Because we considered the tax revenues as the automatic stabilizer we expected that the real output should decrease in response to the positive tax revenue shock. On the other hand as the increase in the tax revenues must not necessarily be associated with increased tax rates we assume that higher tax revenues shouldn't inevitably slow down the economy. Higher real national income can thus increase the tax revenues without subsequent harming effect on the economic growth. At the same time the real output in Poland seems to be neutral to the tax revenues shock.

In Poland, the Slovak republic and Bulgaria the positive tax revenues shock increased the rate of inflation (with differing intensity and durability). On the other hand in the Czech republic, Hungary and Romania the positive tax revenues shock decreased the rate of inflation (with differing intensity and durability). Rather inconsistence results we address to the assumption of an uncertain wealth effect (it definitely affects the consumption preferences as well as the core inflation shifts) that is associated with the tax revenues increase.

Tax revenues shock increased the short-term interest rates in all countries (except the Czech republic) with differing intensity and durability. As we have already mentioned the tax revenues must not necessarily be associated with an increased tax burden. At the same time we revealed that the tax revenues don't prove well as the automatic stabilizer in the fiscal policy. An increase in the short-term interest rates simply confirms this suggestion.
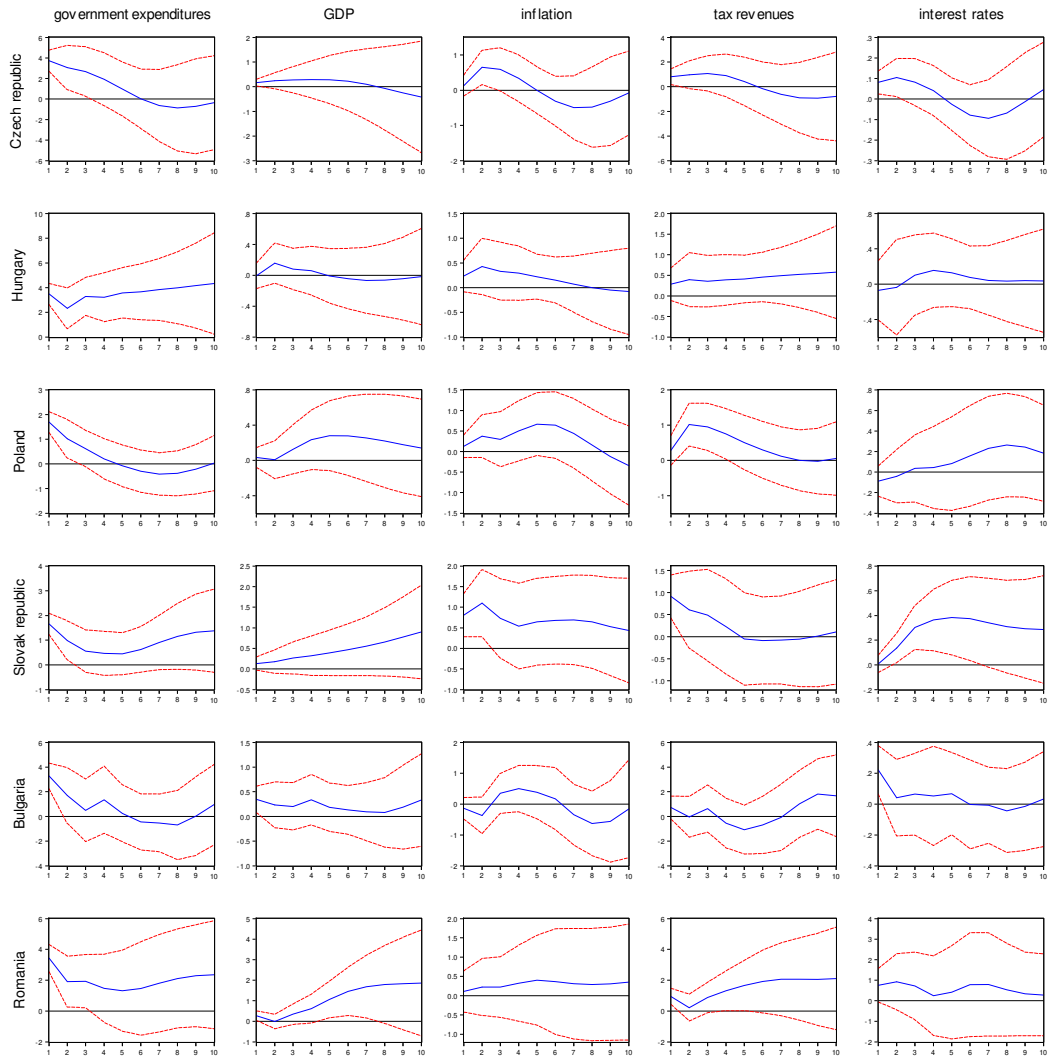
Figure 6. Response of endogenous variables to the government expenditure shock (SVAR approach)

Source: Author's calculations.

The impulse-response functions that show the responses of the endogenous variables to the government expenditure shock (SVAR identification scheme) are shown in the figure 6.

Comparing figures 4 and 6 we may conclude that different approach to identify the variance covariance matrix of reduced form residuals doesn't have any significant influence on the estimated impulse-response functions of the government expenditure shock. Indeed there are minor differences in the intensity as well as durability of the government expenditure shock but in general the direction in which endogenous variables respond to the shock is identical. Such an investigation reflects a high accuracy of our results.
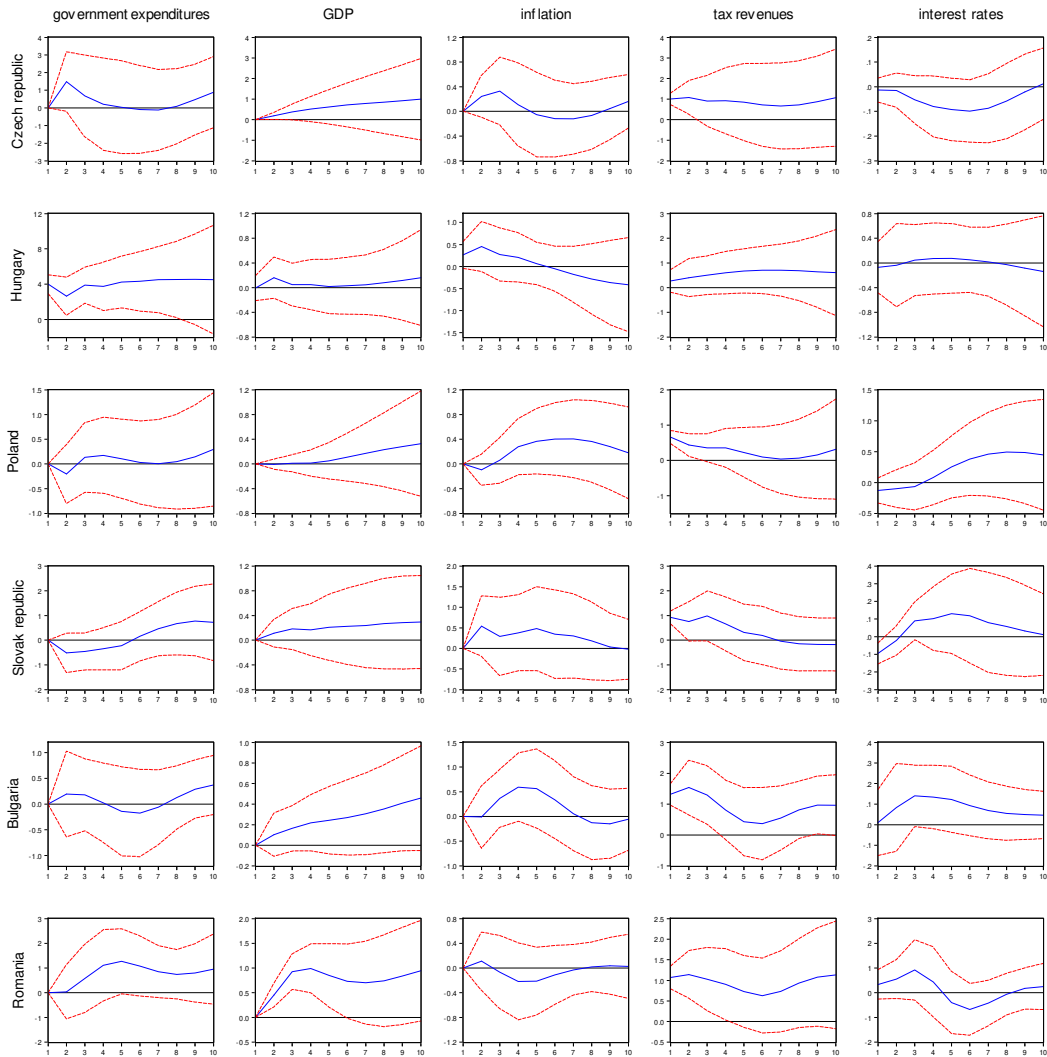
Figure 7. Response of endogenous variables to tax revenues shock (SVAR approach)

Source: Author's calculations.

The impulse-response functions that show the responses of the endogenous variables to the tax revenue shock (SVAR identification scheme) are shown in the figure 7.

Comparing figures 5 and 7 we may conclude that different approach to identify the variance covariance matrix of reduced form residuals doesn't have any significant influence on the estimated impulse-response functions of the tax revenue shock. Indeed there are minor differences in the intensity as well as durability of the tax revenues shock but in general the direction in which endogenous variables respond to the shock is identical. Such an investigation reflects a high accuracy of our results.

4. Conclusion

In the paper we have estimated VAR model for the six countries in order to analyze the effects of fiscal policy shocks in the Czech republic, Hungary, Poland, the Slovak republic, Bulgaria and Romania in the period 2000-2008. Our objective was to estimate the effects of discretionary changes in fiscal policy (associated with an increase in government expenditures) as well as the role of automatic stabilizers (associated with an increase in tax revenues). We implemented an identification scheme based on two approaches. The first, recursive approach, is based on the Cholesky decomposition of innovations that allows us to identify structural shocks hitting the model. The second approach, structural VAR (SVAR) approach, is based on applying the long-run restrictions to the

reduced-form VAR model. From both identified true models we compute impulse-response functions to estimate the responses the real output, inflation and short term interest rates to the government expenditure and tax revenue shocks.

After the government expenditure shock the real output increased markedly only in Bulgaria followed by the Czech republic. Moderate but slightly gradual increase of the real output we observed in Hungary and the Slovak republic. In Poland and Romania the positive impact of the government expenditure shock on the real output development appeared with a lag. When we focus on an intensity in which the government expenditure shock affected the real output we also investigate rather differing results among countries. In Hungary and Bulgaria the government expenditure shock affected the real output only for a short period (three respectively four quarters) and then died. In the Czech republic and the Slovak republic the immediate positive effect of the government expenditure shock accelerated the real output in about three respectively four years until it died. Despite the initial one quarter lag the real output in Poland responded to the government expenditure shock quite similar to the scenario in the Slovak republic even thought the overall effect of the shock died about one year later. While in Romania the real output responded to the government expenditure shock with a significant lag of one year its intensity was the strongest in comparison with other countries. Additionally its positive effect died after rather long period (7 years).

After the initial tax revenues shock the real output responded since the second quarter differently in all countries. The response of the real output in all transition economies (except Poland) seems to be rather interesting an in general contrary in comparison with other research studies focusing on the western developed countries. In the Czech republic, Hungary, the Slovak republic, Bulgaria and Romania the real output increased after the tax revenue shock (with differing intensity and durability). Because we considered the tax revenues as the automatic stabilizer we expected that the real output should decrease in response to the positive tax revenue shock. On the other hand as the increase in the tax revenues must not necessarily be associated with increased tax rates we assume that higher tax revenues shouldn't inevitably slow down the economy. Higher real national income can thus increase the tax revenues without subsequent harming effect on the economic growth. At the same time the real output in Poland seems to be neutral to the tax revenues shock.

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