Fiscal multipliers and macroeconomic performance in the case of Slovakia and Hungary

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Abstract: The aim of the paper is to estimate and assess the impact of fiscal policy shocks on gross domestic product (GDP) in Slovakia and Hungary as the EU and V4 members and to compare the results of how fiscal policy affects the economy with euro compared with the economy with its own currency. The paper is based on the vector autoregressive (VAR) model to compare the impacts of fiscal shocks in government expenditure and government revenues on real Slovak and Hungarian economy and identify possible differences. Government expenditure shock has a short-term positive effect on Slovak and Hungarian GDP, too. Also, the response of GDP to a single shock in government revenues has an immediate negative impact in Hungary in contrast to Slovakia with the positive response at the beginning. Moreover, the findings support that government expenditure has more significant impact on GDP than in the case of government revenues.

Keywords: fiscal policy; fiscal multipliers; VAR; vector autoregressive; GDP; gross domestic product; government expenditure; government revenues; single shock; EU; V4; Slovakia; Hungary.


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INTRODUCTION

Global economic crisis and European sovereign debt crisis have drawn the attention to fiscal policies of the EU countries. The situation could be considered as a shift from the primary interest in monetary policy to fiscal policy. EU members started to introduce different proposals of effective fiscal procedures to mitigate negative impacts of crises on economic growth in economies. Therefore, discussions about the impact of fiscal policies on countries’ macroeconomic performance are very controversial topic nowadays.

Generally, it is widely believed that application of a fiscal policy is more complex and controversial than in the case of monetary policy, especially in a monetary union (Leeper, 2010; Philippopoulos et al., 2015). Moreover, as far as economic theory goes, before the 2008-episode, fiscal policy was considered “… as playing a secondary cyclical role, with political constraints sharply limiting its de facto usefulness …” (Blanchard et al., 2010, p.200). Also from an empirical perspective it was well established that fiscal institutions significantly affect fiscal policy outcomes (Badinger and Reuter, 2015; Debrun and Kumar, 2007; Persson and Tabellini, 1997; Persson et al., 2004) and the opinion was prevailed that the monetary policy itself is capable of maintaining a stable output gap, that domestic bond market in emerging economies is incipient, limiting the use of fiscal countercyclical policy, and that a mixture of short recessions and lags in the implementation of fiscal policy can increase the risk that possible countercyclical measures will arrive too late. After consideration of policy advice and application regarding fiscal policy, however, it remains true that even before the 2008-episode “… in practice … the rhetoric was stronger than the reality …” (Blanchard et al., 2010, p.202), and that even before the 2008-episode, the fiscal policy usually played a more important role in an economy than monetary policy. Particularly, fiscal sustainability was proved to be necessary to strengthen actions taken by monetary authorities, and the link between fiscal and monetary policy was established as well.
Therefore, it is evident that the discussion of the role of fiscal policy in the economy stabilisation has changed since the outbreak of the financial crisis in the autumn of 2008. It has shifted from the primary interest in the monetary policy to fiscal policy, respectively discretionary fiscal stimulus. The impulse for the change was, in particular, that “… the financial nature of the crisis weakens the traditional monetary transmission …” (Spilimbergo et al., 2008, p.3). Moreover, it negatively affects the effectiveness of measures realised to stabilise inflation and economic activity (da Silva and Viera, 2016).

For that reason, discussions of the impact of fiscal policies on macroeconomic performance and the analyses of the role of fiscal multipliers in the economy stabilisation stand for a very controversial topic nowadays, mainly in the EU and the Eurozone. Recent macroeconomic development in the Eurozone characterised by persisting deflationary pressures, e.g., induces fundamentally various background for the framework of economic policy and related institutions experimenting with a favourable policy mix to provide incentives to growth and enhance growth perspectives in the Eurozone, and limits the ability to conduct standard monetary policy in the Eurozone members. Moreover, due to some evident failures of Euro project design and the fact that the Eurozone members have leveraged only over their fiscal policies, the importance of fiscal policy as an efficient tool to restore aggregate demand and fight unemployment in the EU and the Eurozone increases (Dosi et al., 2015; Krugman and Eggertsson, 2011).

Also, Blanchard et al. (2010) propose that macroeconomic policy should be rethought to put fiscal policy back to the centre of discussion as an important policy tool, if the monetary policy, including credit and quantitative easing, has reached its limits. The authors add that when a recession is expected to last long, fiscal policy could be beneficial, despite its implementation lags (Badinger and Reuter, 2015; da Silva and Viera, 2016). For that reason, the primary aim of the paper is to estimate and assess the impact of fiscal policy shocks on gross domestic product (GDP) in Slovakia and Hungary as the EU members and members of the V4. Also, our aim is to clarify the role of the country membership in the Eurozone and beyond with regard to its economy stabilisation. The analysis allows us to compare the situation in two small open economies where Slovakia is the Eurozone member and Hungary has its own currency and independent monetary policy. The way of the fiscal consolidation in Slovakia and Hungary is also an important motivation for the analysis. According to Alesina et al. (2015) “… the effects of consolidation (namely) depend on their design.” and as stated by Ramey (2011), distinguishing between announced and unanticipated shifts in fiscal variables is crucial for evaluating the effectiveness of fiscal multipliers (Alesina et al., 2015, p.19.). Moreover, both authors argue that fiscal adjustments based on spending cuts are much less costly, regarding output loses, than tax-based ones and have especially low output costs due to involving permanent rather than stop-and-go changes in taxes and spending. Additionally, the fact that Slovakia and Hungary are still subject to the convergence process towards the advanced European economies plays a major role in the evaluation of results presented in the paper as well. This process mainly forms preconditions for the presence of shocks both from supply and demand side and for a reliance on a contribution of foreign demand to economic growth. The depth of financial markets does also trace behind their more advanced peers, so the process of financial deepening is still taking its place. As a result, the interest rate plays a less prominent role in conducting monetary policy. On the contrary, the exchange rate has frequently been used to anchor the inflation development. A high weight of exchange rate in a real economy is a natural result of being very open to trade. We can consider it from the other
perspective – accumulated problems in the real economy may lead to abrupt changes in the exchange rate. This realignment of the exchange rate eliminates disequilibria being caused. However, it may result in bouts of inflation and/or recession due to a decreased domestic demand. The role of fiscal policy in these countries is comparatively significant, although it is diminishing in the convergence process (Benčík, 2009).

Based on the previous consideration, there are different approaches to estimating tax and spending multipliers. However, two most common approaches employ structural macro econometric models or vector autoregressive (VAR) models. Among these two methods, the VAR models play a more prominent role in the recent literature. For that reason, the paper is based on the VAR model that is used to compare the impacts of fiscal shocks in government expenditure and government revenues on real Slovak and Hungarian economy and identify possible differences in presented effects. The choice of the 3-variable VAR similarly as in the study of Blanchard and Perotti (2002) is motivated by the fact that limited data lead to robust estimates compared to the 5-variable model represented in the paper of Perotti (2002). Our results have important implications for the identification of an optimal fiscal policy mix for Slovakia and Hungary, respectively the Eurozone and the EU as well. The government expenditure shock has a short-term positive effect on Slovak and Hungarian GDP, too. Also, the response of GDP to a single shock in government revenues has an immediate negative impact in Hungary in contrast to Slovakia with the positive response at the beginning. Moreover, the findings support that government expenditure has more significant impact on GDP than in the case of government revenues. One of the problems of our research is a small number of observations and numerous structural breaks in the Slovak and Hungarian economy during the analysed period.

The structure of the paper is organised as follows. Section 1 provides the overview of major studies examining the impact of fiscal policy shocks on macroeconomic variables in an economy based on the concept of fiscal multipliers. Section 2 describes data and methodology applied in the paper. Section 3 discusses the results. Consequently, the final section of the paper summarises and presents conclusions.

2 Literature review

Traditionally, most of academics and scientists were focusing on monetary policy and its impact on macroeconomic performance, e.g., Bernanke and Mihov (1998). However, due to fiscal consolidations over Europe in the 1980s, contrary to Keynesian wisdom, there was a substantial growth in output in the short-run as well as in the long-run. Therefore, economists and policymakers drew their attention to the investigation of established theories regarding fiscal policy. Recent studies, including Alesina et al. (2002) and Arin et al. (2015), argue that this so-called puzzling result is explained by the fact that some fiscal shocks, e.g., shocks to government wages and salaries can show non-Keynesian effects. In that case, shocks to government wages and salaries cause an increase in economic activity in the short-run and long-run as well. The previous is caused by decreasing labour demand and wages thus increasing business profits and investment. Also, the debate over the application of fiscal policy has been intensified since 2009 when most European governments embarked on the difficult task of reducing their public debts in time of stagnant or negative growth and of finding the best policy reaction to economic conditions within a new environment (Philippopoulos et al., 2015).
Recently, due to global economic crisis and massive adverse effects of the European sovereign debt crisis, the attention has turned to fiscal policy as many empirical studies have proved that the primary causes of the crisis were large and persistent trade and fiscal deficits and that they were systemic. However, the empirical analyses of the impact of fiscal policy are still widespread worldwide, and the consensus has not been reached yet. Most empirical studies have focused on the investigation of fiscal policy in the US, e.g., Blanchard and Perotti (2002), Caldara and Kamps (2008), Fragetta and Melina (2011) or Mountford and Uhlig (2005). On the other hand, empirical studies of the investigation of fiscal policy shocks with the application to Europe are significantly limited, e.g., Burriel et al. (2010), Cuaresma et al. (2011), de Castro Fernández and Hernández de Cos (2006), Mirdala (2009) or Tenhofen et al. (2010) among others. As for Slovakia and Hungary, there are only a few studies focusing on this issue, e.g., Benečík (2009), Stanova (2015), Pécsyová (2013). All authors mentioned, however, state that fiscal policy is much more balanced in Slovakia than in Hungary. Hungarian economy has several backwards that have slowed its economic growth, e.g., low level of productivity growth, high unemployment rate, and a weak fiscal framework. Moreover, high level of debt, both private and public, and a significant percentage of foreign currency loans have made the economy vulnerable. The above mentioned facts also determine the results of the analysis presented below.

The study of Blanchard and Perotti (2002) belongs to one of the first studies examining the fiscal policy shocks in an economy. Their findings support the fact that increases in spending cause increases in output and when taxes increase output decreases. Another result is more surprising than previous: spending shocks lead to increases in private consumption while private investment is significantly crowded out. Moreover, the authors highlighted the positive features of the structural VAR approach that could be more suitable for fiscal policy than in previous studies examining the impact of monetary policy. The first reason is the presence of exogenous fiscal shocks and the second one is a negligible or no discretionary reaction of fiscal policy to surprising actions in activity if there is a high enough frequency. The authors argue that if they were capable of identifying the shocks they could trace their dynamic impacts on GDP. The significant study of Perotti (2002) analyses the effects of fiscal policy on GDP and other variables, e.g., prices and interest rates in five OECD countries, i.e., the US, West Germany, Canada, the UK and Australia, based on a structural VAR approach. The significant finding is that the impact of fiscal policy on GDP and its components was significantly weak in the last 20 years. He also argues that the tax multipliers tend to be negative but small. The result mentioned is interpreted in the way that fiscal policy has become more ineffective in the last years. The most likely cause is the increased labour and capital mobility. Finally, VAR or SVAR methodology is also used in Barro and Redlick (2011), Baunsgaard et al. (2012), Cloyne (2013), Jones et al. (2015) or Romer and Romer (2010). Also, we analyse the impact of fiscal policy on GDP in the case of Slovakia and Hungary through the fiscal multipliers based on VAR approach.

Our paper is based on the definitions of fiscal multipliers formulated by Spilimberto et al. (2009). The authors argue that “the fiscal multiplier is the ratio of a change in output \((\Delta Y)\) to an exogenous change in the fiscal deficit \((\Delta G)\) concerning their respective baselines” (Spilimberto et al., 2009, p.2). In other way, fiscal multipliers indicate the amount by which GDP is growing if the government raises government expenditure for one unit. Fiscal multipliers measure the effectiveness of fiscal policy in stimulating economic activity. Empirical evidence suggests that government
consumption and tax cuts have a positive impact on output. Also, it is true that depending on the time frame considered; different multipliers are used. Fiscal multipliers employed in the paper are thus, consistent with definition of Spilimbergo et al. (2009), defined as follows:

\[
\begin{align*}
\frac{\Delta Y(t)}{\Delta G(t)} &= \sum_{j=0}^{\infty} \frac{\Delta Y(t+j)}{\Delta G(t+j)} \\
Y_t &= N_j N_j Y_t G_t 
\end{align*}
\] (1)

The impact multiplier is defined as the change in output over the change in fiscal expenditure (1), and the cumulative multiplier is defined as “… the cumulative change in output over the cumulative change in fiscal expenditure at some horizon N” (Spilimbergo et al., 2009, p.2).

On the size and use of fiscal multipliers, Spilimbergo et al. (2009) also notice that the cumulative multipliers are often the most appropriate measure and are typically larger than the impact multipliers. Despite this fact, they are rarely reported. Moreover, Brinca, et al. (2015) add that multiplier for government spending should be theoretically larger than for taxes. However, the empirical literature based on VAR-identified shocks suggests that tax multipliers are greater than spending multipliers. Also, multipliers are found to be larger during recessions (Auerbach and Gorodnichenko, 2012; Giavazzi and McMahon, 2013), although Ramey (2013) raised some doubts on this evidence. The multiplier appears to be viewed as a function of country characteristics and a state of an economy, in addition to the type of fiscal instrument used, e.g., Brinca, et al. (2015) and Ilzetzki et al. (2013). Furthermore, according to Spilimbergo et al. (2009), fiscal multipliers are low in small open economies, i.e., around 0.5 in the case of the government spending multiplier and 0.25 in the case of tax multipliers. Ilzetzki et al. (2013) argue that multipliers are larger in developing countries than developed countries, larger under fixed exchange rates but negligible otherwise, and larger in closed economies than in open economies. The results in Auerbach and Gorodnichenko (2012) indicate that the response of output is significant in recessions but insignificant during normal times.

3 Data and methodology

To assess the effects of fiscal policy on an economy, we employ a SVAR approach based on the identification scheme in the study of Blanchard and Perotti (2002). A reduced-form VAR model is defined as follows:

\[
Y_t = \mu_0 + C(L)Y_{t-1} + u_t, \tag{3}
\]

where \(Y_t = (T_t, G_t, GDP)_t\) presents the vector of endogenous variables, i.e., government revenues, government spending and real GDP, \(\mu_0\) is the constant, \(C(L)\) is the autoregressive lag polynomial and the vector \(u_t\) includes the reduced form residuals with \(E[u_t] = 0, E[u_t u_s'] = \sum_{s} E[u_s u_s'] = 0\) for \(s \neq t\). Estimated reduced form residuals
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are, in general, contemporaneously correlated, and thus the variance-covariance matrix \( \Sigma_u \) is not diagonal. Therefore, a shock in one variable affects contemporaneously another variable. We apply the identification methodology introduced by Blanchard and Perotti (2002), where the reduced-form residuals are considered to be a linear combination of tax, government spending, and GDP tax shocks as follows:

\[
\begin{align*}
    u_t^r &= a_t u_t^{\text{GDP}} + a_2 u_t^{G} + \varepsilon_t^r \\
    u_t^{G} &= b_1 u_t^{\text{GDP}} + b_2 \varepsilon_t^r + \varepsilon_t^{G} \\
    u_t^{\text{GDP}} &= c_1 u_t^r + c_2 u_t^{G} + \varepsilon_t^{\text{GDP}}. \\
\end{align*}
\]

The system of equations mentioned can be written in matrix notation as

\[ Au_t = B\varepsilon_t, \]

where \( \varepsilon_t \) is the vector of uncorrelated structural shocks. Also, we partially apply the Blanchard and Perotti (2002) technique to determine the coefficients of the system. Coefficient \( a_t \) represents the elasticity of government revenues to GDP and \( b_t \) the elasticity of government spending to GDP. According to Blanchard and Perotti (2002), if the observables are on a quarterly basis, coefficients \( a_t \) and \( b_t \) only capture the automatic effect of GDP on fiscal variables. This is associated with the fact that democratic institutions are not able to react to GDP fluctuations with appropriate fiscal policy measure within one quarter. Hence the second effect is not included in \( a_t \) or \( b_t \). Unlike Blanchard and Perotti (2002), we calibrate the parameter \( a_t \). We use the values estimated in Eller (2009), i.e., 0.88 for Slovakia and 1.02 for Hungary. As the government spending does not include transfers (see below), we assume there is no response to changes in GDP. Hence, we set \( b_t = 0 \). Subsequently, the coefficients \( a_2 \) and \( b_2 \) are used to calculate cyclically adjusted tax residuals \( u_t^{\text{CT}} = u_t^r - a_t u_t^{\text{GDP}} \) and cyclically adjusted government spending residuals \( u_t^{\text{CG}} = u_t^{G} - b_t u_t^{\text{GDP}} = u_t^{\text{G}} \). As Blanchard and Perotti (2002) noted, cyclically adjusted residuals are not correlated with \( \varepsilon_t^{\text{ct}} \), and thus they can be used as instruments within estimation of \( c_1 \) and \( c_2 \). The remaining parameters \( a_2 \) and \( b_2 \) are determined as follows. We set \( a_2 = 0 \) and estimate \( b_2 \) by using the cyclically adjusted residuals \( u_t^{\text{CT}} \) and \( u_t^{\text{CG}} \) with the application of the OLS. It follows the fact that a decision in government revenues precedes a decision in government spending. As it is not clear what kind of order should be used (whether \( a_2 = 0, \ b_2 \neq 0 \) or \( a_2 \neq 0, \ b_2 = 0 \)), the literature recommends assessing estimated coefficients and IRFs with both types of orders. As it seems, calculated IRFs are not dependent on the kind of order.

According to the identification scheme described, the model can be rewritten into the structural form as follows:

\[ AY_t = \delta_0 + D(L)Y_{t-1} + B\varepsilon_t, \]

where \( \delta_0 = A^{-1}\mu_0, \ D(L) = A^{-1}C(L) \) and \( u_t = A^{-1}B\varepsilon_t \). The identification scheme above is also known as the AB model (Lütkepohl, 2005), where \( \Sigma_u = A^{-1}BB^T A^{-T} \) and \( E[\varepsilon_t \varepsilon_t^T] = I_1 \). Specifically, \( A \) is the matrix of contemporaneous effects.

We use quarterly data of Slovakia and Hungary in a range of 1999Q1 to 2015Q3. Time series data used are based on ESA 2010. Fiscal data, GDP and GDP deflator are drawn from the Eurostat. The composition of particular variables is similar to those in related literature (e.g., Borg, 2014). Government spending \( G \) includes government
consumption expenditure, and government gross fixed capital formation. Government revenues (next only ‘net taxes’) are calculated as total revenues less transfers, subsidies and interest payments. The GDP deflator was used to deflate all variables and the X-13 ARIMA-SEATS filter to adjust the variables. Finally, the logarithm was applied. However, it appears that time series in log-levels are non-stationary, therefore, we use variables in the first differences. The previous is in contrast to a vast number of studies employing fiscal VAR model, where the common practice is to use time series in levels or log-levels.

4 Results

Our primary interest is to assess the responses of the endogenous variables to a positive expenditure shock and responses to an increase in net taxes. We apply 3-variable VAR model with variables of government spending ($G$), net taxes as government revenues ($T$) and GDP. In our analysis, differentiated data was used since the initial time series are non-stationary. Regarding stationarity tests, as there are more testing alternatives of ADF, we use the SIC criteria to assign the number of augmentation lags. We set the aim similarly to the one in the study of Blanchard and Perotti (2002), i.e., we analyse the impact of fiscal policy on GDP through fiscal multipliers (see Table 3).

In the next subsection, we present results of the analysis on fiscal multipliers in the case of Hungary and Slovakia. Firstly, descriptive statistics was conducted to obtain some of the most important characteristics of time series data in Hungary and Slovakia (see Table 1). Furthermore, we consider three information criteria for the optimal lag length. Specifically, they are Akaike information criterion (AIC), Hannan-Quinn information criterion and Schwarz information criterion. Also, a maximum of 10 lags is considered in choosing the optimal model. All of them suggest employment of one lag.

Subsequently, we apply stationarity tests as we transformed data to differentiated data. We introduced the ADF test for testing unit root while involving lag augmentation for specific time series in the equation. We obtain the lags mentioned by using the information criteria, too. Table 2 presents the results of ADF test. As can be seen, $t$-values have smaller values than critical values. Therefore, we reject the $H_0$ hypothesis on 1% and 5% confidence level and accept the alternative hypothesis that the data is stationary.

Following our results, the VAR model is created with three variables, the number of lags 1 and a constant variable in every equation. The model is estimated by OLS.

The analysed model for Hungary was the subject of diagnostic tests. The results of Jarque-Bera normality test confirm that time series of $T$ and $G$ follow a normal distribution. However, in the case of GDP, a sample does not follow a normal distribution mainly due to the financial crisis that caused significant fluctuations in observations. The presence of serial correlation is being tested based on the Portmanteau autocorrelation test. Based on the findings, we do not reject the $H_0$ hypothesis that there is no serial correlation regardless the number of lags. Subsequently, we test an autoregressive conditional heteroscedasticity based on the ARCH test. The results confirm that there is no autoregressive conditional heteroscedasticity in our model. Moreover, we conduct a cointegration test as we use the first differences of non-stationary data. According to the
Johansen cointegration test (trace statistics and maximum eigenvalue statistics), we conclude that there is no cointegration among the variables.

Table 1  The results of conducted descriptive statistics in Hungary and Slovakia

<table>
<thead>
<tr>
<th></th>
<th>Hungary</th>
<th>Slovakia</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Max</td>
<td>Min</td>
</tr>
<tr>
<td>$T$</td>
<td>0.1071</td>
<td>−0.0842</td>
</tr>
<tr>
<td>$G$</td>
<td>0.1242</td>
<td>−0.1110</td>
</tr>
<tr>
<td>GDP</td>
<td>0.0203</td>
<td>−0.0407</td>
</tr>
<tr>
<td>$T$</td>
<td>0.4174</td>
<td>−0.5233</td>
</tr>
<tr>
<td>$G$</td>
<td>0.0905</td>
<td>−0.0828</td>
</tr>
<tr>
<td>GDP</td>
<td>0.0617</td>
<td>−0.0933</td>
</tr>
</tbody>
</table>

Table 2  Results of the ADF test for testing unit root in Hungary and Slovakia

<table>
<thead>
<tr>
<th></th>
<th>Hungary</th>
<th>Slovakia</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>t-statistics</td>
<td>p-value</td>
</tr>
<tr>
<td>$T$</td>
<td>−4.6375</td>
<td>0.0003</td>
</tr>
<tr>
<td>$G$</td>
<td>−10.9864</td>
<td>0.0000</td>
</tr>
<tr>
<td>GDP</td>
<td>−3.9791</td>
<td>0.0027</td>
</tr>
<tr>
<td>$T$</td>
<td>−10.1472</td>
<td>0.0000</td>
</tr>
<tr>
<td>$G$</td>
<td>−3.5384</td>
<td>0.0104</td>
</tr>
<tr>
<td>GDP</td>
<td>−8.8165</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

Table 3  The computation of fiscal multipliers in Hungary and Slovakia

<table>
<thead>
<tr>
<th></th>
<th>Hungary</th>
<th>Slovakia</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IM</td>
<td>CM after 4 quarters</td>
</tr>
<tr>
<td>Government spending shock</td>
<td>0.00</td>
<td>0.13</td>
</tr>
<tr>
<td>Revenue shock</td>
<td>0.04</td>
<td>0.08</td>
</tr>
<tr>
<td>Government spending shock</td>
<td>0.15</td>
<td>0.27</td>
</tr>
<tr>
<td>Revenue shock</td>
<td>−0.03</td>
<td>−0.01</td>
</tr>
</tbody>
</table>

Diagnostic tests were also conducted for Slovakia. Based on the results of Jarque-Bera normality tests, we can conclude that samples of $T$ and $G$ follow a normal distribution. However, the sample of GDP, similarly as in Hungary, does not follow normal distribution mainly due to the presence of financial crisis, too. Also, the Portmanteau autocorrelation test points to no serial correlation in the VAR model up to 10 lags. Based on the results of the ARCH test, there is no autoregressive conditional heteroscedasticity in the model. Moreover, we tested the model for its stability. Figure 1 confirms that the roots lie inside the unit circle which concludes that the model is stable in both cases. The results of the Johansen cointegration test indicate that there is no cointegration among the variables.
A reduced form of VAR model has a problem with the residual correlation in equations. Blanchard and Perotti (2002) solve the problem by introducing the identification scheme with the calibration of a value of one parameter (next only ‘BP approach’). Specifically, it is an elasticity that speaks for the range of changes in government revenues on 1% change in GDP in selected country. As presented above, the value of the parameter in Hungary is 1.02.

In the next subsection, we present and discuss our estimated results based on the impulse response functions (IRF). Figure 2 presents the findings of IRF on a single shock in government expenditure, government revenues and cumulative response in the case of Hungary.

Figure 2 IRF on a single shock in G and T in Hungary – BP approach (see online version for colours)

\( G \) represents government expenditure, \( T \) represents taxes, and GDP is the gross domestic product.

The findings point out to a weak immediate reaction of GDP to \( G \). However, the reaction is positive at 90% defined confidence intervals with the impact of spending multiplier equal to 0. Moreover, a single shock in government expenditure results in the immediate negative change in government revenues, i.e., \( T \). Also, the findings prove the weak immediate reaction of GDP to \( T \) as well. Also, the response of GDP to the shock in \( T \) is
negative at 90% defined confidence intervals with the impact of revenue multiplier equal to 0.04. Moreover, the immediate reaction of $G$ to $T$ is negative. Additionally, cumulative responses of GDP to $G$ point to the positive long-term reaction compared with cumulative negative responses of GDP to $T$.

Moreover, we conduct the robustness analysis applying another method to examine the changes in GDP, i.e., the Cholesky approach. The aim is to find out whether our findings are robust, i.e., whether there is a change in fiscal multipliers if we change an identification scheme. Following our results based on the Cholesky approach (see Figure 3), we may argue that the results are identical in all cases considered, except a slight difference in the response of GDP to $T$. The previous might be due to the order of variables in the equation as the order was $T$, $G$, GDP.

As mentioned before, we follow a similar procedure in the case of Slovakia, too. The value of in Slovakia is set to 0.88. Figure 4 presents the IRF of variables in the model of a positive shock in government expenditure and government revenues in Slovakia at 90% defined confidence intervals. The main findings support a positive reaction of GDP to a single shock, although only from the beginning. However, after a few observations, we can observe decreasing, i.e., slightly negative response to a shock in government expenditure. On the contrary, the reaction of GDP to a single shock in $T$ had a different development as it decreased shortly at the beginning, moved to negative values and oscillated around zero during the rest of observations. Also, cumulative responses of GDP to fiscal multipliers of expenditure and revenues have been showing the positive development in both cases. The difference can be seen in the initial observations. Cumulative response of GDP to $G$ is greater and gradually increasing compared with cumulative response of GDP to $T$. Another difference is visible at increase in cumulative response of GDP to $G$ and stabilising on the equal level in comparison to cumulative response of GDP to $T$ as the response is decreasing and stabilising at the lower level than in the case of $G$.

**Figure 3** IRF on single shock in $G$ and $T$ in Hungary – Cholesky approach (see online version for colours)

$G$ represents government expenditure, $T$ represents taxes, and GDP is the gross domestic product.

Similarly, based on the Cholesky approach in the case of Slovakia (see Figure 5), we may argue that our results are robust as the responses of GDP are identical to the ones according to the BP approach. Also, we consider the same order of variables as in Hungary.
Furthermore, we performed additional robustness checks to assess the sensitivity of the results, besides the alternative identification scheme. Firstly, we focused on the composition of government spending. Alternatively, we replaced the government final consumption expenditure as reported in ESA 2010 by intermediate consumption and compensation of employees. Along with a gross fixed capital formation, they present $G$. Computed IRFs indicate slightly lower spending multiplier compared to baseline model for Slovakia. Subsequently, we estimated fiscal multipliers in the pre-crisis period (1999Q1–2007Q4) in both countries. The omission of data observed during and after the crisis resulted in rejection impossible of the null hypothesis of normality in multivariate JB test. The development of cumulative revenue multiplier in Slovakia remained broadly unchanged; however the spending multiplier considerably increased. Regarding Hungary, the cumulative spending multiplier decreased and became slightly negative. However, cumulative revenue multiplier increased to 0.12. The results show that the post-crisis development has weakened the response of GDP to tax shocks. On the other hand, it seems that the response of GDP to spending shocks is more significant for the whole period than just the period before the crisis. We also re-estimated baseline models with various values of the coefficient $a_1$. According to Pecsyová (2013), the elasticity of net taxes to GDP is 0.76 for Slovakia. It seems that the IRFs based on the re-estimated model for Slovakia with the only slightly lower value of $a_1$ did not significantly influence fiscal multipliers. Therefore, we decided to calibrate $a_1$ to values between 0.5 and 1.5 for both countries. Different values of the coefficient $a_1$ do not significantly influence the fiscal multipliers. In the case of Hungary, the cumulative spending multiplier within the fourth and eighth quarter was only slightly higher for the lower value of the coefficient compared to the baseline model. Higher values of resulted in higher cumulative revenue multiplier. Also, various values of $a_1$ did not affect the fiscal multipliers in the case of Slovakia.

Moreover, we included a dummy variable for the crisis period as it is a common practice in the literature related to fiscal VAR. Cumulative spending multiplier in the case of Hungary decreased to 0.04, but revenue multiplier was not affected by the modification. Cumulative spending multiplier only slightly increased and revenue multiplier remained unchanged regarding Slovakia.
We may conclude that some of our findings are similar to the ones in related literature. For example, Pécsyová (2013) estimated that spending multiplier and revenue multiplier on impact is equal to 0.14 or 0 respectively in 5-variable SVAR model for Slovakia. Cumulative spending multiplier is equal to 0.39 after four quarters which is in line with our estimates on the pre-crisis dataset. Similarly, low fiscal multipliers were estimated in the study of Eller et al. (2011).

Figure 5  IRF on single shock in $G$ and $T$ in Slovakia – Cholesky approach (see online version for colours)

$G$ represents government expenditure, $T$ represents taxes, and GDP is the gross domestic product.

5 Conclusion

The effectiveness of fiscal policy to stimulation of output has continued to be a widely debated issue in the academic literature. The 2008–2009 global economic and financial crises and its aftermaths have kept forcing policymakers to rethink the consequences of macroeconomic policy and demonstrated its limits. The euro area crisis forced economists to rethink the performance of currency unions, the role of fiscal policy, and the issue of fiscal policy coordination in the Eurozone and possible unreasonable effects of fiscal rules imposed by the Stability and Growth Pact.

According to asymmetric results for Slovakia and Hungary, the policy implications from our results are not clear. The government expenditure shock has a short-term positive effect on Slovak and Hungarian GDP, but the response of GDP to a single shock in government revenues has the immediate negative impact in Hungary in contrast to Slovakia with the positive response at the beginning. Nevertheless, our findings support that government expenditure has more significant impact on GDP than government revenues. Similarly to Spilimbergo et al. (2009), we also confirm that fiscal multipliers in small open economies are low. Based on the Cholesky robustness analysis, we confirm that our results are robust and identical, except Hungary (the reaction of GDP to $T$).

Despite the fact mentioned above, we state that a fiscal stimulus is important for the EU countries from the long-run perspective. For that reason, we agree with Spilimbergo et al. (2008) who argue that
“… a fiscal stimulus should be timely (as there is an urgent need for action), large (because the drop in demand is large), lasting (as the recession will likely last some time), diversified (as there is uncertainty regarding which measures will be most effective), contingent (to indicate that further action will be taken, if needed), collective (all countries that have the fiscal space should use it given the severity and global nature of the downturn), and sustainable (to avoid debt explosion in the long run and adverse effects in the short run).” (Spilimbergo et al., 2008, p.3)

Therefore, we are in favour of public spending measures, direct support of spending by consumers and firms rather than tax cuts and transfers, mainly because of the risk of a prolonged recession. Also, the potential of macro prudential tools can be seen.

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References


**Notes**

1 Estimated coefficients are insignificant and it seems that calculated fiscal multipliers are not affected by the type of ordering but the response of government spending to shock to net taxes and response of net taxes to government spending slightly changes.

2 $T$ is calculated as: indirect taxes + direct taxes + capital taxes + social contributions + capital transfers receivable + other current transfers receivable – social benefits – other current transfers payable – capital transfers payable – subsidies.

3 At least in the case of Slovakia.