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Emerging Markets Queries in Finance and Business

The effects of fiscal policy shocks in Romania. A SVAR Approach.

Ioana Boiciuc[a,*]

[a]*The Bucharest University of Economic Studies, 5-7, Mihail Moxa Street, Romania*

Abstract

There has always been an interest in analyzing the effects of fiscal policy on the main macroeconomic variables such as GDP, inflation, interest rate, employment, but compared with the empirical literature on the effects of monetary policy on economic activity, fiscal policy has received less attention. With the recent economic recession fiscal policy was regarded with more interest since it was expected to be effective in economic recovery. An approach commonly used to estimate the effects of fiscal policy shocks on economic activity is based on vector autoregressive (VAR) models with different scheme of identification of the shocks. This paper analyzes the effects of a government expenditure shock and tax revenue shock on economic activity by applying a VAR methodology to Romanian data. For identification of fiscal policy shocks I first used a recursive approach (Cholesky decomposition) and second I apply the methodology proposed by Perotti (2002), based on Blanchard and Perotti (1999). The results obtained are consistent with other studies on emergent economies. The impact of fiscal shocks on macroeconomic variable is reduced and the fiscal multipliers are very small.

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Keywords: fiscal policy; fiscal shocks; SVAR model; impulse response function.

1. Introduction

There has always been an interest in analyzing the effects of fiscal policy on the main macroeconomic variables such as GDP, inflation, interest rate, employment, but compared with the empirical literature on the

* Corresponding author. Tel.: +40-0741-576-680.
E-mail address: ioana_boiciuc@yahoo.com.

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effects of monetary policy on economic activity, fiscal policy has received less attention. With the recent economic recession fiscal policy was regarded with more interest since it was expected to be effective in the economic recovery. Given the limited scope of monetary policy to provide additional stimulus, fiscal policy has became the most important tool for stabilizing business cycles. The developed economies implemented fiscal stimulus packages as a measure for the economic recovery while the emergent economies adopted consolidation fiscal measures imposed as a consequence of a pro-cyclical policy adopted before the economic crises. The empirical studies have not reached a consensus about the effects of fiscal policy (or their magnitude) on macroeconomic variables. Regarding the effects of fiscal policy shocks there are two main views in the economic literature: New Keynesian theory and neoclassical theory. In the New Keynesian model a positive fiscal policy shock determine a rise in aggregate demand and labour demand so that both consumption and wages will rise. In the neoclassical model a positive fiscal policy shock is regarded as a negative wealth shock because either now or in the futures, the increase in government spending will need to be financed by higher taxes. According to this assumption, households will reduce their consumption and increase labour supply. Both theories predict a rise in output but through different channel. Different studies have different result and there is still a lack of consensus in the empirical literature regarding the effects of fiscal policy and the fiscal multipliers. An approach commonly used to estimate the effects of fiscal policy shocks on economic activity is based on vector autoregressive (VAR) models. The empirical studies with VAR approach have different scheme of identification of the shocks the main ones being: the recursive approach introduced by Sims (1980), the event-study approach introduced by Ramey and Shapiro (1998), the structural vector autoregressive (SVAR) approach proposed by Blanchard and Perotti (1999) and the sign-restrictions approach proposed by Uhlig (2005). Another method to determine the impact on economic activity of a fiscal policy intervention is to estimate a VAR with Bayesian technique. Recently there have been developed more complex studies -DSGE models, to quantify the effects of fiscal policy. Other approaches investigate the impact of fiscal policy taking into account periods of recession and economic expansion and find that the impact of fiscal shocks is different, more pronounced in recession. In recession fiscal multipliers are larger. Among these studies mention here: Auerbach and Gorodnitchenko (2010), Batini et. al (2012). This study seeks to analyze the effects of a government expenditure shock and tax revenue shock on economic activity by applying a VAR methodology to Romanian data. I used quarterly data for five variables: real output, inflation, interest rate, government expenditure and tax revenues. For identification of fiscal policy shocks I first used a recursive approach (Cholesky decomposition) and second I apply the methodology proposed by Perotti (2002) based on Blanchard and Perotti (1999). The results are consistent with the economic theory but the responses are less persistent and the fiscal multipliers are very small. The remainder paper is organized as follows: Section 2 presents the literature review. Section 3 includes a description of the methodology in use and section 4 includes the data. The effects of fiscal policy on macroeconomic variables are discussed in section 5. Section 6 concludes.

2. Literature review

The seminal paper for fiscal policy SVAR approaches is Blanchard and Perotti (2002). Their study analyze the effects of fiscal policy on economic activity in the US using data for three variables- government expenditure, net taxes and GDP. Their results show that positive government spending shocks have a positive effect on output and positive tax shocks have a negative effect, but the multipliers for both spending and tax shocks are small. The identification of fiscal policy shocks is achieved by exploiting decision lags in fiscal policy and institutional information about the elasticity of fiscal variables to economic activity. This approach is used in many other studies to identify the impulse response functions. Among these studies: Perotti (2002) examines 5 OECD countries including the US using a five-variable VAR (GDP, the GDP deflator, government direct expenditure, net revenue and the interest rate), Gali et al. (2003) studies the effects of fiscal policy on the

US economy using a four-variable VAR, (GDP, government direct expenditure, employment and the real interest rate), Biau and Girard (2005) use the same method to assess the effects of fiscal policy in France, Raffaela Giordano et al. (2005) apply Blanchard-Perotii methodology for Italy and Fernandez (2006) for Spain. Effects of fiscal policy shocks are well documented especially for developed countries. Fiscal policy shocks have a reduced effect on the economic activity in emerging market. Mirdala (2009) evaluate the fiscal policy dynamic for six emerging economies: Czech Republic, Hungary, Poland, the Slovak Republic, Bulgaria and Romania in the period 2000-2008 and find fiscal multipliers positive but small, while Cuaresma et.al (2011) also find fiscal multipliers small with different sign for Czech Republic, Hungary, Poland, the Slovak Republic.

The next section will briefly explain the SVAR approaches used in this paper.

3. Methodological issues

To assess the effects of fiscal policy the SVAR methodology is used. The structural representation of a VAR model is:

$$A_0 x_t = A(L)x_{t-1} + B\varepsilon_t \quad (1)$$

where A_0 is the matrix of contemporaneous influence between the variables, x_t is a (n x 1) vector of the endogenous macroeconomic variables (government expenditures (g), real output (y), inflation (π), tax revenues (t) and short-term interest rates (r)), $A(L)$ is a (n x n) matrix of lag-length L, representing impulse-response functions of the shocks to the elements of x_t, B is a (n x n) matrix that captures the linear relations between structural shocks and those in the reduced form, ε_t is a (n x 1) vector of structural shocks. The structural shocks are uncorrelated and identically normally distributed.

To estimate the SVAR model, the reduced form is determined by multiplying equation (1) by an inverse matrixA_0^{-1}.

$$x_t = C(L)x_{t-1} + u_t \quad (2)$$

where: $C(L) = A_0^{-1}A(L)$ and $u_t = A_0^{-1}B\varepsilon_t$. u_t is a (n x 1) vector of shocks in reduced form that are uncorrelated and normally distributed but contemporaneously correlated with each other. The relation between structural shocks and reduced form shocks is:

$$A_0 u_t = B\varepsilon_t \quad (3)$$

The identification scheme first use to identify the structural shocks (the government expenditure shock ε_g and the tax shock ε_t) is Cholesky decomposition of variance-covariance matrix of VAR residuals. To identify the third relation it is necessary to impose restrictions assuming that some structural shocks have no contemporaneous effects on some endogenous variables. According to Cholesky decomposition the matrix A_0 is identify as a lower triangular matrix and matrix B as n-dimensional identity matrix. A main disadvantage of this method is that is necessary to take into account the ordering of the variables. The ordering presented below is according to previous studies that investigated the fiscal policy shocks. The variables are ordered as it follows: government expenditure, real output, inflation, taxes and interest rate, assuming that:

- government spending is not contemporaneously affected by any of the shocks;

- real output is contemporaneously affected only by the government expenditure shock;
- inflation respond contemporaneously to government expenditure and the real output shocks, and it is not contemporaneously affected by the tax revenues and interest rates shocks;
- taxes are contemporaneously influenced by all the shocks of the model except the interest rates shock;
- interest rate is contemporaneously influenced by the shocks from all the variables of the model.

These assumptions define the relationships between reduced shocks only in the first period, while later every shock can be affected by any other shock. According to Cholesky decomposition the third equation becomes:

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ -a_{yg} & 1 & 0 & 0 & 0 \\ -a_{\pi g} & -a_{\pi y} & 1 & 0 & 0 \\ -a_{tg} & -a_{ty} & -a_{t\pi} & 1 & 0 \\ -arg & -a_{ry} & -a_{r\pi} & -a_{rt} & 1 \end{bmatrix} \begin{bmatrix} u_{gt} \\ u_{yt} \\ u_{\pi t} \\ u_{tt} \\ u_{it} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \varepsilon_{gt} \\ \varepsilon_{yt} \\ \varepsilon_{\pi t} \\ \varepsilon_{tt} \\ \varepsilon_{rt} \end{bmatrix} \quad (4)$$

After the estimation of the VAR model the impulse-response functions are obtained. This identification scheme is applied to Romanian data and the results are presented in the next section.

The second scheme used to obtain structural innovations from the reduced innovations is based on the methodology used by Perotti (2002). According to this approach, the reduced form of innovations of government spending (u_{gt}) and tax revenues (u_{tt}) are considered to be a linear combination of three components:

- the automatic responses of government spending and tax revenues to output (u_{yt}), inflation ($u_{\pi t}$) and interest rates (u_{rt}) innovations;
- the systematic discretionary response of fiscal policy to variables shocks;
- the random, discretionary fiscal policy shocks, which are the structural forms of innovations of government spending (ε_{gt}) and tax revenues (ε_{tt}) to be identified.

The identification assumptions† are the following:

$$u_{gt} = a_{gy}\, u_{yt} + a_{g\pi} u_{\pi t} + a_{gr} u_{rt} + b_{gt}\varepsilon_{tt} + b_{gg}\varepsilon_{gt} \quad (5)$$

$$u_{tt} = a_{ty}\, u_{yt} + a_{t\pi} u_{\pi t} + a_{tr} u_{rt} + b_{tg}\varepsilon_{gt} + b_{tt}\varepsilon_{tt} \quad (6)$$

$$u_{yt} = a_{yg}\, u_{gt} + a_{yt} u_{tt} + b_{yy}\varepsilon_{yt} \quad (7)$$

$$u_{\pi t} = a_{\pi g}\, u_{gt} + a_{\pi y} u_{yt} + a_{\pi t} u_{tt} + b_{\pi\pi}\varepsilon_{\pi t} \quad (8)$$

$$u_{rt} = a_{rg}\, u_{gt} + a_{ry} u_{yt} + a_{r\pi} u_{\pi t} + a_{rt} u_{tt} + b_{rr}\varepsilon_{rt} \quad (9)$$

The first two relations are the reduced form of fiscal policy shocks. According to Perotti (2002) the reduced form of innovations in government spending and tax revenue (5) and (6) can be displayed as cyclically

† Perotti (2002) imposes from the beginning restrictions on the diagonal of matrix B.

adjusted reduced form:

$$u_{gt}^{CA} = u_{gt} - (a_{gy}\, u_{yt} + a_{g\pi} u_{\pi t} + a_{gr} u_{rt}) = b_{gt}\varepsilon_{tt} + b_{gg}\varepsilon_{gt} \quad (10)$$

$$u_{tt}^{CA} = u_{tt} - (a_{ty}\, u_{yt} + a_{t\pi} u_{\pi t} + a_{tr} u_{rt}) = b_{tg}\varepsilon_{gt} + b_{tt}\varepsilon_{tt} \quad (11)$$

The next step to identify the model is to assume the ordering of the fiscal shocks. If the government make first decisions related to government spending, then $b_{gt} = 0$ and if the decisions related to tax revenues come first, then $b_{tg} = 0$. Perotti (2002) argues that neither of the alternatives has any theoretical or empirical basis (the results are not sensitive to the ordering of fiscal shocks).

According to this identification scheme the third relation becomes:

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ -a_{yg} & 1 & 0 & -a_{yt} & 0 \\ -a_{\pi g} & -a_{\pi y} & 1 & -a_{\pi t} & 0 \\ 0 & \boldsymbol{-a_{ty}} & \boldsymbol{-a_{t\pi}} & 1 & 0 \\ -a_{rg} & -a_{ry} & -a_{r\pi} & -a_{rt} & 1 \end{bmatrix} \begin{bmatrix} u_{gt} \\ u_{yt} \\ u_{\pi t} \\ u_{tt} \\ u_{it} \end{bmatrix} = \begin{bmatrix} b_{gg} & 0 & 0 & b_{gt} & 0 \\ 0 & b_{yy} & 0 & 0 & 0 \\ 0 & 0 & b_{\pi\pi} & 0 & 0 \\ 0 & 0 & 0 & b_{tt} & 0 \\ 0 & 0 & 0 & 0 & b_{rr} \end{bmatrix} \begin{bmatrix} \varepsilon_{gt} \\ \varepsilon_{yt} \\ \varepsilon_{\pi t} \\ \varepsilon_{tt} \\ \varepsilon_{rt} \end{bmatrix} \quad (12)$$

Before estimation, two more restrictions regarding the coefficients a_{ty} and $a_{t\pi}$ are included in the model. This elasticity's are calibrated to 1.7 and 0.9. In order to calculate elasticity tax to output I added the following categories‡ of tax elasticity: income taxes, profit taxes, social contributions, and indirect taxes, weighted by the weight of type tax in the sum of taxes. A disadvantage of using this calibration is that initial elasticity's are determine for a shorter period of time and it is necessary to make the assumption of constant elasticity. The model is just-identify being imposed 35 constraints on the two matrices.

4. Data

The data used for estimation are quarterly data ranging from 2000:1 to 2012:4. The set of macroeconomic variables used for the study of the dynamic effects of fiscal policy changes consist of the following: government expenditure, real output, GDP deflator for inflation variable, taxes and short-term interbank interest rate (6-month money market rate) for interest rate variable. Time series for the fiscal data, GDP and GDP deflator were drawn from Eurostat and data for the short-term money market interest rates were drawn from the national central bank websites. All the variables except for interest rate are seasonally adjusted. Government expenditure, taxes and output are expressed in real terms, deflated by GDP deflator. All variables except interest rate are used in logarithm. The data were tested for the existence of unit roots. The Augmented Dickey-Fuller test indicate that there is a unit root in the level of variables but the null hypothesis of a unit root can be rejected for the series in first difference. Given that the series are non-stationary, the SVAR approach it is used and the model is estimated in levels of first differences. According to selection criteria (Akaike Information Criterion and Schwarz Information Criterion) a 2 lag vector autoregressive model is estimated.

‡ Altar et.al (2010) Estimating the cyclically adjusted budget balance for Romanian Economy. A Robust Approach, Romanian Journal of Economic Forecasting.

5. Empirical results

In the first figure it is summarize the response of endogenous variables to the government expenditure shock according to the recursive approach and in figure 2 it is summarize the response of endogenous variables to the tax revenues shock.

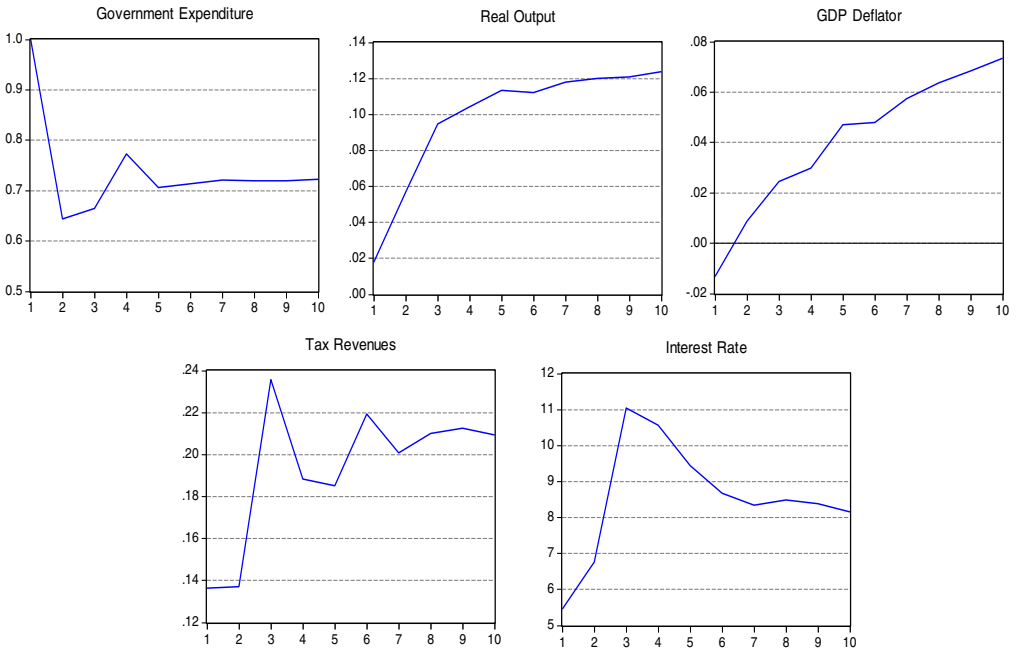

Fig.1. Accumulated response of endogenous variables to the government expenditure shock (recursive Cholesky approach)

The main interest is to analyze the impact of a government expenditure shock to endogenous variable, especially on real output. As it is shown in similar studies, the impact of a government expenditure shock for emergent economies is small. After positive government expenditure shock the real output rise but its intensity is reduced. The fiscal (spending) multiplier is about 0.1 after four quarters and about 0.12 after eight periods, less than 1 if it were to compare with fiscal multipliers obtained for developed economies that are according to Keynesian theory. After the initial government expenditure the dynamic of the endogenous variables is consistent with the economic theory: inflation, tax revenues and interest rate increase in short-term.

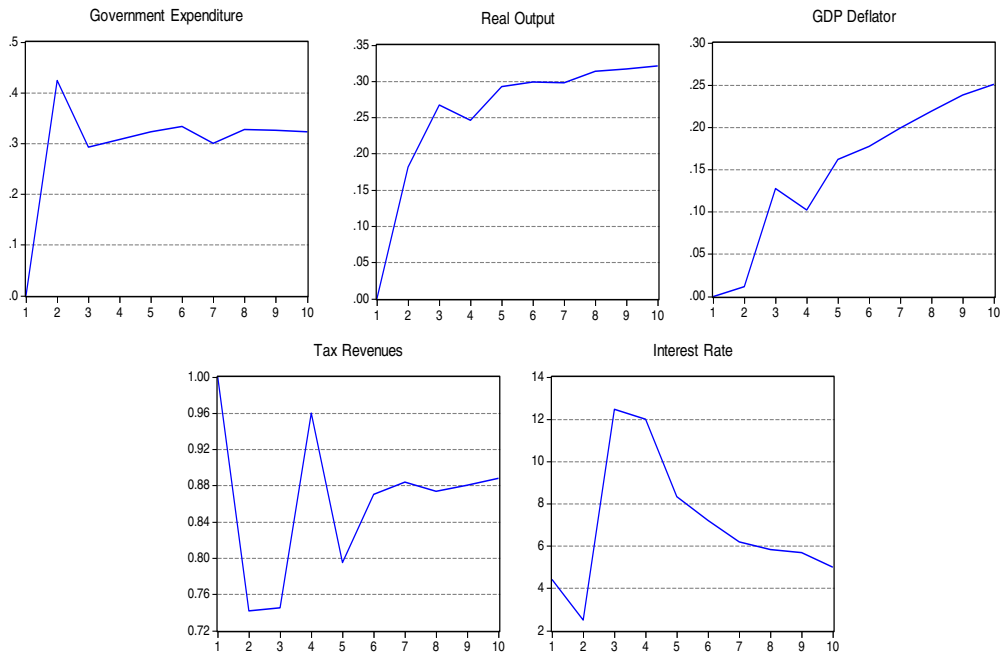

Fig.2. Accumulated response of endogenous variables to the tax revenues shock (recursive Cholesky approach)

The endogenous variables respond to a tax revenues shock as in the case of government expenditure shock but with greater intensity. The tax multiplier is 0.3 after four quarters and 0.32 after 8 periods. I estimated also the model using restrictions in long term. The restrictions imposed on the model are contained by the matrix A from relation (12). Even though it is used a different approach to identify the fiscal shocks it doesn't have any significant influence on the estimated impulse-response functions. The Figure 3 and 4 displays the response impulse function of the endogenous variables to government expenditure shock and to tax revenues shock according to Perotti's approach. The dynamic of variables is not very different compared to the first approach but the intensity of the shock is much more reduced than in previous estimation.

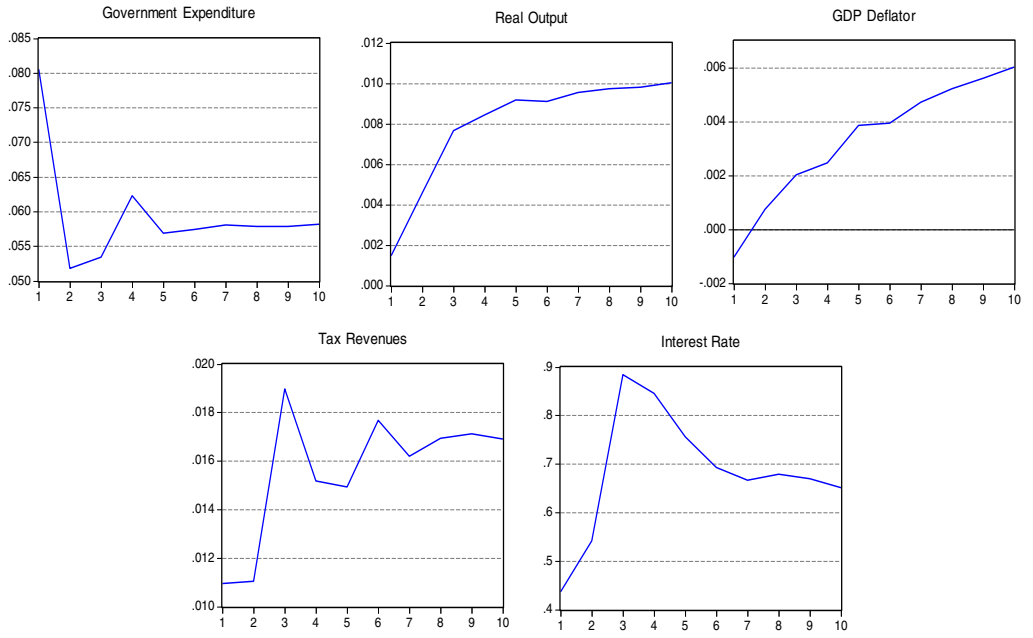

Fig.3. Accumulated response of endogenous variables to the government expenditure shock (Perotti approach)

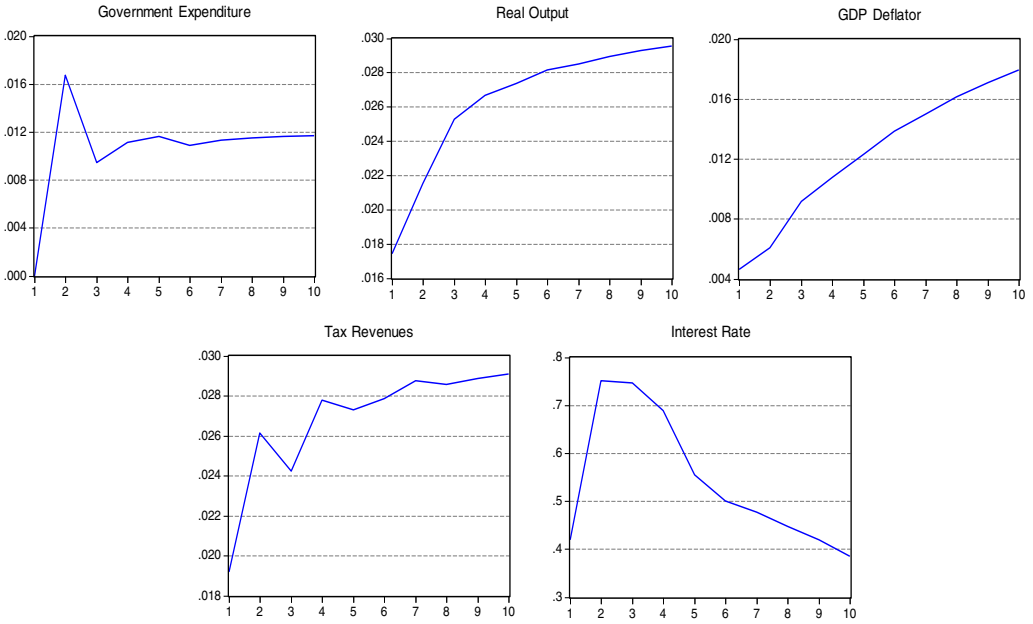

Fig. 4. Accumulated response of endogenous variables to the tax revenues shock (Perotti approach)

6. Conclusion

This paper estimate the fiscal policy shocks based on two different approaches for the identification of the structural shocks: the recursive Cholesky approach and Blanchard and Perotti approach. According to the impulse response functions I can mention the following: the dynamic of variables is similar in both approaches but the impact of the shocks is greater in the first estimation, the real output shows a weaker response to fiscal shocks, the fiscal multipliers are positive and small meaning the economic activity is not significantly influence by fiscal policy in an emergent country. Also, the results should be regarded with certain restraint because of the assumption made about the tax elasticity's and the relative short sample used in estimation. Even though the results are consistent with the economic literature and empirical studies related to emergent countries, the analysis should be continued by investigating the following: other SVAR method of shock identification, fiscal policy effects on GDP components, models that includes more economic information.

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