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MEASURING THE IMPACT OF FISCAL POLICY SHOCKS IN ROMANIA

Abstract. *The aim of this paper is assessing the current state of public finances as well as the impact of the shocks in the economy. For this we determinate the size of spending and revenue using fiscal multipliers, that we computed by means of several methods, using a VAR framework. After analyzing the results, we can conclude that the efficiency of the transmission towards the real economy has diminished the implemented policies effect, during the 2013-2020 years, meaning that structural changes, of raising the efficiency of the public spending structure, are required.*

Keywords*: Fiscal Multipliers, Fiscal Policy shocks, Romanian Economy.*

JEL Classification : E52, E58, E62, E63, E17

1. Introduction

Eurozone fiscal policies are a national precondition, a matter of the common Stability and Growth Pact. This infers that the country-specific dimension

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is predominantly significant, as fiscal policy choices can be very diverse across countries.

The same idea can be found in Romania, as in many other member countries, namely that the most obvious visible consequence of the procyclical fiscal policy, adopted during the economic expansion prior to 2008, was in fact a strong overheating of the functioning of the economy, element that favored and became a catalyst for the massive destabilization of budget balances. Another negative effect of pro-cyclical fiscal policies, policies adopted by governments and other decision-makers, was the cancellation of the role and effect of the automated fiscal stabilizing element intended to naturally maintain the economic balance (Voinescu, 2018).

The main research question of this paper is the impact of fiscal policies on the real economy. The aim of this paper is to estimate the impact of fiscal policy shocks using Vector Autoregressive (VAR, SVAR and BVAR) models on Romanian economy. So, the objective was to estimate fiscal multipliers attained by simulating Impulse Response Functions (IRFs) to the shock of government spending and to the shock of government revenue (specifically tax shock). The VAR model covers the subsequent variables: government spending, GDP, the GDP deflator, taxes, and the interest rate. We must specify that GDP, government spending and taxes are included in the VAR model in terms of real per capita and taken in log level. First, we seasonally adjusted the GDP and fiscal variables using the E-views X-13 set from E-views 11 (Voinescu, 2018).

For carrying out the analysis we used the E-views 11 software and the Bayesian Estimation, Analysis and Regression (BEAR) toolbox from Dieppe, Legrand and van Roye (2016) coded on Matlab. We used quarterly data, starting from Q_1 in 2000 and ending with Q_4 in 2020.

2. Literature Review

Determining and highlighting major shocks results in a multitude of papers and articles using various methodologies targeting model specifications. An overwhelming majority of the literature uses these economic models to determine the effects of monetary policy on the economy. In this article, however, we focus on the effects of fiscal policy, following the changes induced by them in the economic sphere.

The size and sometimes even the sign assigned to the tax multipliers is one of the issues strongly disputed in the literature and even more so in everyday economic practice. In this idea, left-wing economists, supporters of the Keynesian or neo-Keynesian current have attributed higher values to fiscal multipliers, which leads to the conclusion that fiscal policy has a major impact on GDP growth. Lindé and Trabandt (2017) determine the size of the government consumption multiplier for an original, Keynesian model.

On the contrary, classical, and so-called neoclassical economists hold a diametrically opposite view, according to which fiscal policy is relatively inefficient in economic growth. As a result, these multipliers in their scientific vision and estimation have low and sometimes even negative values.

Auerbach and Gorodnichenko (2012) using the VAR mode switching model described by Blanchard and Perotti (2002) eventually came to generate specific, state-dependent multipliers. In conclusion, these expenditure multipliers are significantly higher in periods of recession compared to periods of economic expansion.

The implemented model uses the same data set, as in the studies conducted by Perotti (2005) or Caldara and Kamps (2008). It should be noted that the choice of definition is very important, having a strong impact on the results obtained, see Endemann et al. (2007).

In addition, the estimates made by us for the specific case of Romania, the size of the multipliers confirm a very small value for multipliers, sometimes being statistically practically insignificant (in the estimates made, a single multiplier, namely the one of expenses having a statistical relevance relative). The study leads to the idea that all the results of the investigation remain consistent with most of the other conclusions regarding various studies in CEE countries (Cuaresma et al. 20110), (Muir and Weber 2013), (Ilzetzky et al. 2011). They appear to be largely in line with the implications of the standard model described by Mundell and Fleming, concluding that fiscal policy is irrelevant in small and open economies, with an adaptable, highly flexible exchange rate.

3. Data and Methodology and Estimation results

We researched the impulse response function for several macroeconomic variables. Starting from this observation, we determined by calculation the main fiscal multipliers present in the domestic economy. used the Perotti processing methodologies from 2005 and Caldara- Kamps from 2008 respectively:

1. ly – the logarithm of the real GDP per capita indicator per quarter
2. lg – the logarithm of effective (real) public spending per quarter per capita
3. lr – the logarithm of the effective (real) net public income per quarter per capita
4. i – average per quarter of the banking indicator ROBOR 3 M, corresponding to the interest rate
5. hcpi – inflation rate (Voinescu, 2018)

In a first phase of this partially empirical study, we approached a series of estimates using the E-viwes econometric program and the BP methodological strategy. VAR with specific identification algorithms, such as Cholesky decomposition and triangular decomposition. We also used several priorities of the BVAR model, the most significant being Normal Wishart and Litterman. the calculation typology first discussed by Caldara-Kamps in 2008.

The calculation was performed taking as a point of origin the simplified form of the structural model VAR- with variable endogenous vector Yt, the polynomial matrix C (L) and the error vector Ut

$$\boldsymbol{Y_t = \mu_0 + \mu_1 t + A_1 Y_{t-1} + \ldots + A_p Y_{t-p} + C X_t + u_t}$$

The reduced-form VAR model is expressed as:

$$\boldsymbol{Y_t = \mu_0 + \mu_1 t + A(L) Y_{t-1} + C X_t + u_t}$$

3.1. The Cholesky decomposition

The identification method used involves the reduction of the matrix B as an identity matrix of dimension "k". Instead, the matrix A0 has as a defining element the fact that the elements of the main diagonal are unitary and those above it are zero. As a result of the observed economic phenomena and the interdependencies between the input variables, we opted for an orderly setting of them: 1. Expenditures; 2. GDP; 3. Inflation; 4. Income; 5. Interest rate that. The calculation model is stable, because all tests of polynomial roots belong to the domain (0-1) Under these conditions the relation between the error vectors "ut-et" is:

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ -a_{y,g} & 1 & 0 & 0 & 0 \\ -a_{hicp,g} & -a_{hicp,y} & 1 & 0 & 0 \\ -a_{r,g} & -a_{r,y} & -a_{r,hicp} & 1 & 0 \\ -a_{i,g} & -a_{i,y} & -a_{i,hicp} & -a_{i,r} & 1 \end{bmatrix} \begin{bmatrix} u_t^g \\ u_t^y \\ u_t^{hicp} \\ u_t^r \\ u_t^i \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} e_t^g \\ e_t^y \\ e_t^{hicp} \\ e_t^r \\ e_t^i \end{bmatrix}$$

Logical choices involve satirical placement of "expenses" in the first place, because the translation of this variable does not include a strong cyclical component, compared to the example with "income", which is why they are not so exposed to economic shocks in the private sector. GDP and Inflation can be placed before revenues. The justification is that shocks severely affect the tax base, which is why these two variables have a direct cyclical component compared to revenues. immediate decisions based on the existing macroeconomic situation while net private income is not significantly influenced by the interest rate.

The case study used the classic methodology presented by Blanchard and Perrotti in 1999. In principle, this method uses an autoregressive structural vector, which takes institutional information from the tax system. On the other hand, the transfer system is used. aiming at the periodic collection of taxes, to identify the size and sign of tax multipliers. Of course, all this in the conditions in which the exogenous fiscal shocks, on the one hand, and the delays in the implementation of the fiscal programs, lead to big gaps between the moment of application of the measures and respectively the appearance of the corresponding effects in the economy.

Identifying the system in this case involved using the VAR estimate in the Eviews program. At the same time, in the case of this econometric approach, we were interested in presenting the variation decomposition. Annex 1 presents the responses to the expenditure and revenue impulses, presented, and displayed in accordance with the identification model described by the Cholesky method.

It is very interesting to note that the cumulative multipliers determined by this method are almost insignificant; for example, the cumulative multiplier of revenues and expenditures shows a relatively small decrease over a large period totaling 20 quarters, not being significant as an economic indicator, which is nevertheless intuitive and easy to anticipate for the economic peculiarities specific to the Romanian state.

3.2. Triangular decomposition

The identification method in the model used is very close to the classic Cholesky decomposition. The noticeable difference is that the matrix B in this situation is no longer the identity matrix of ordinl k, because of which the standard deviation for structural errors no longer has value 1. Separated from the mathematical constraints imposed in the classical Cholesky decomposition, here is added the separate unitary response of a contemporary variable to its own shock generated by it. The developed model is stable because the test of the roots of the polynomial gives values that fall in the range (0,1).

3.3. Blanchard Perotti

The exposed identification method is based on the studies carried out by the scientists Blanchard and Perotti in 2002 and then, the extension developed later exclusively by Perotti in 2005. The first studies from 2002 use the methodology with only 3 specific endogenous variables, unlike the solution proposed by Perotti that expands the number of these variables to 5, exactly as presented in this article. This identification scheme devised by Blanchard and Perotti is also based on multiple other institutional information related to the tax system used and especially to the time allocated to tax collection, precisely in order to notice and precisely identify the automatic response of incomes and respectively of expenses reported to the economic activity carried out (Voinescu, year 2018).

The identification in this case has several characteristic specifications, as follows: GDP is unresponsive to the shocks generated by inflation and the interest rate, being in turn affected by both the shocks generated by the respective revenues and expenditures.

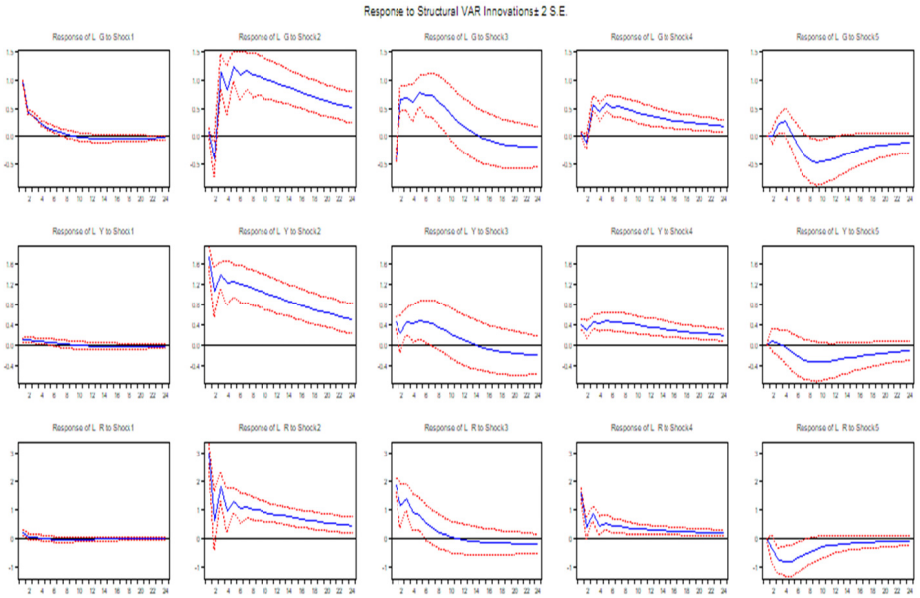
Another hypothesis is that the inflation rate reacts simultaneously to all other shocks generated by expenditures, revenues, and GDP, but does not show variations in the interest rate shock. Instead, the interest rate is supposed to be directly affected by all other system shocks. It is interesting to note that Perotti (2005) set a distinct parameter, denoted βg, r = 0, based on the assumption that the

government decision, in relation to expenditure, is a priority over revenue, placed in a secondary position, in the sense that only later can the decision be made about them.

For a correct calibration of the data, the parameters identical to those initially assumed by Perotti (2005) are used, namely an aggregate value for the production elasticity of government revenue elasticity, denoted (αry) = 1.85 and another aggregate value of revenue elasticity. relative to the value of inflation, (αrπ) = 1.25.

Given that these government expenditures are influenced by transfers, being therefore acyclic, Perotti (2005) determines the elasticity of production and government expenditures, respectively, zero, denoted (αgy) = 0.

Perotti also sets a measure that characterizes the inflationary elasticity of government spending (αgπ) = (- 0.5), considering that the salaries of government employees, which are a significant part of government consumption, do not have a simultaneous, instantaneous reaction to changes in inflation. Thus, the government's payroll is reduced in real terms by a considerable, but not total, share when unpredictable inflation rises (Caldara, et. al, 2008).



Source: authors own computations

Figure 1. Response to shocks using Blanchard Perotti approach

3.4. The sign and impact restriction approach

Based on the stability considerations made by Caldara and Camps in the 2008 paper: "What Are the Effects of Fiscal Policy Shocks? A VAR-Based Comparative Analysis" can be stated that the number of shocks is not necessarily equal to the number of variables, in some cases may be less than the number of variables considered (Caldara, et. al, 2008). Another notable advantage of the existence of sign restrictions is that we do not have to make assumptions about variable interactions, which were not valid in the other two previous methods are presented. We do not need to use the shock generated by monetary policy, because it does not significantly influence the calculation estimate, this shock being effectively ignored in the mentioned paper: Caldara and Kamps (2008).

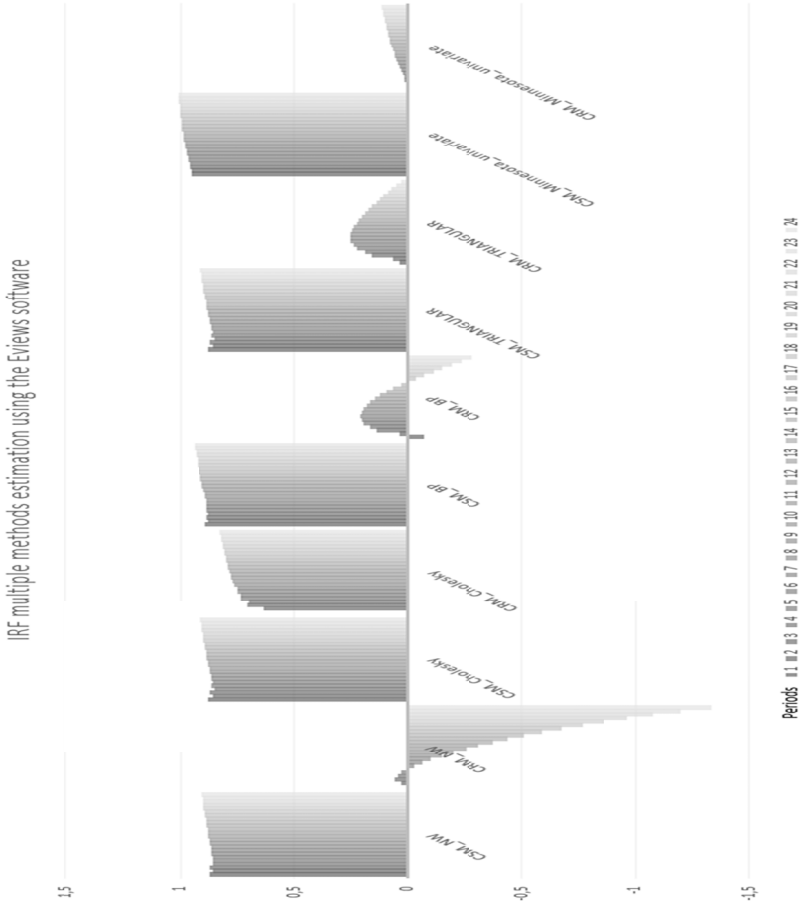


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Figure 2 IRF estimations

It is important to note that the sign and impact constraints specific to the economic cycle shock appear identified by the previous stability of positive responses for the first 4 quarters of GDP and revenue. Thus, the revenue shock arises because of the need to generate a positive impulse response for revenues resulting from the first shock in the quarterly periods.

4. Bayesian Vector Autoreggression methods

4.1. Gibbs sampling for VAR

Estimates of objects of interest, such as impulse response functions and forecasts can become imprecise in large scale models. Using the incorporation of existing prior information in the development of the mathematical estimation process, the approximate results obtained by Bayesian methods usually prove to be more accurate, compared to the estimation results obtained by the standard classical method. Additionally, Bayesian simulation methods, such as Gibbs sampling, lead to a complex and precise strategy not only for the purpose of obtaining point estimates of values, but even much more than that, in the sense of ensuring the possibility of sensing and characterizing with sufficient clarity , the degree of uncertainty in the area of the respective point estimates. A more general treatment of Bayesian VARs can be found in Canova (2007), among others.

4.2. The Minnesota prior

Most of the Bayesian VAR type applications carried out were based on the previous structure described by Litterman (1986) characteristic of the so-called Minnesota. Which implies that, for some VAR model having n endogenous variables, and respectively m exogenous variables and a specific p lags, the previous average of the VAR coefficients constitutes a defined vector q× 1 = n (np + m) × 1 β0. At the same time, the previous covariance matrix is defined as: q × 1 = n (np + m) × 1 vector β0. q Thus the matrix Ω0 having variance terms on the main diagonal and no entries off this diagonal (ie with zero entries) shows the absence of any prior covariance between the coefficients. Dieppe, A., R. Legrand, and B. van Roye, 2016).

4.3 Independent Normal Wishart prior

The Wishart-type normal prior, although it is more flexible than the Minnesota-type prior (because the symbol/value Σ does not assume to be known, it still has its own limitations. Thus the obtained structure generates, for each equation, a specific dependence between the variance of the residual (term residual) and the variance of the VAR coefficients. This dependence could be an unwanted assumption, which can generate difficulties in calculating and

interpreting the result obtained - according to the observations in the bibliographic reference: Dieppe, A., R. Legrand and B. van Roye, 2016.

4.4. TVP-BVAR:

The model used is Time Varying Parameters Vector Autoregression with stochastic volatility (TVP-VAR). TVP-VAR is a generalization of the traditional VAR method, the parameters being

TVP-VAR allows making estimates at any point in time, compared to the traditional VAR that makes a single estimate, on average, on every sample.

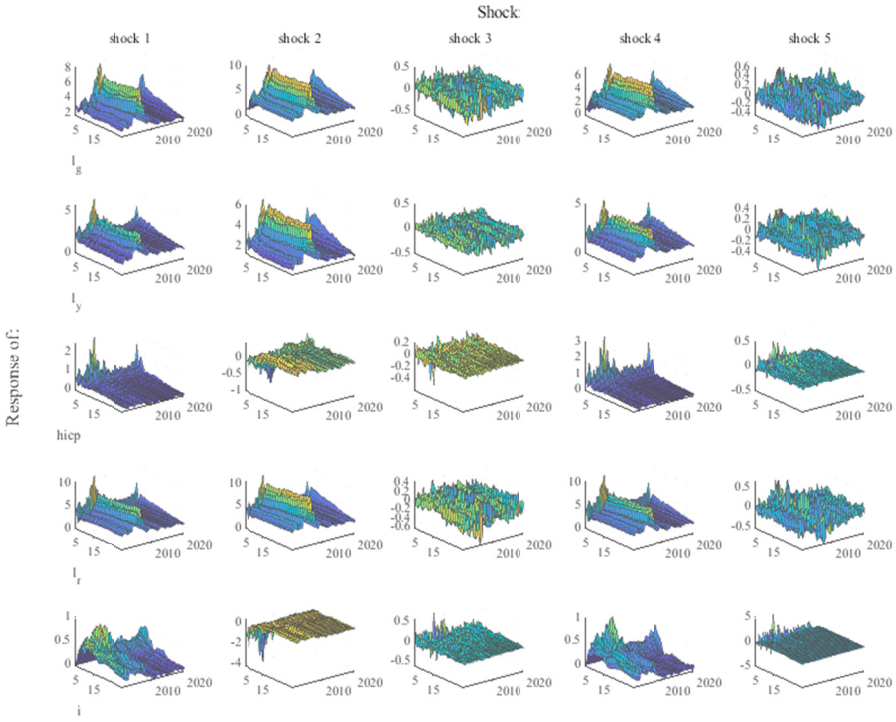
$$y_t = A_{1,t}\, y_{t-1} + A_{2,t}\, y_{t-2} + \ldots + A_{p,t}\, y_{t-p} + CX_t + \varepsilon_t$$

Y_t – parameters vector at "t" moment

$A_{p,t}$ - coefficient matrix at "t" moment

X_t – exogenous variables vector at "t" moment, with coefficient matrix "C"

ε_t – residues.



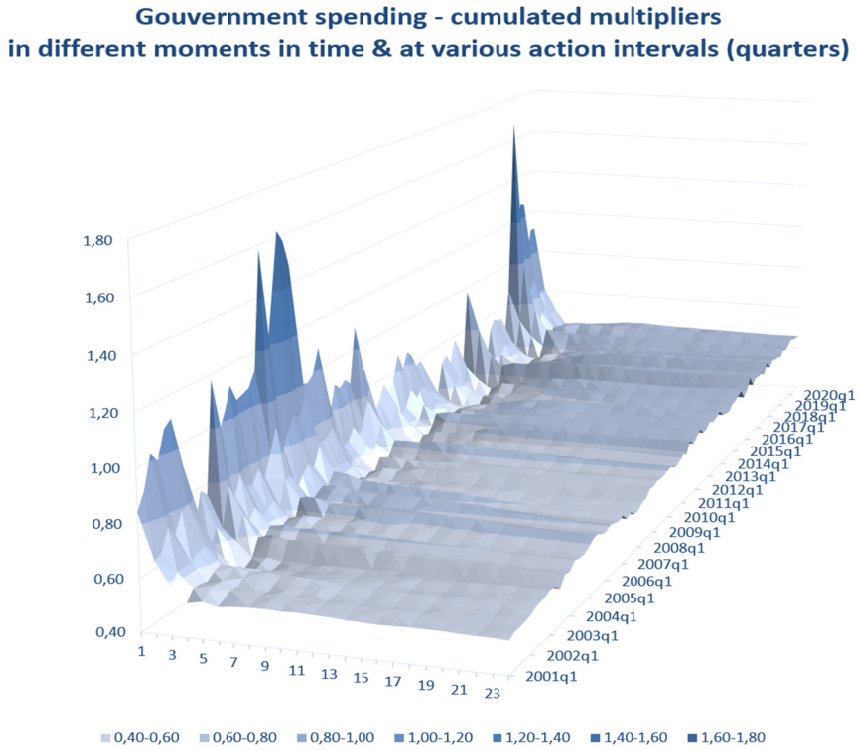
Note*: shock 1 = shock / momentum in government spending, shock 2 = shock / momentum in the business cycle; shock 3 = shock / impulse in inflation; shock 4 = shock / boost in budget revenues; shock 5 = shock / momentum at the level of monetary policy.
Source: authors own computations

Figure 3: The impulse response functions of the variables

Next, we analyzed the impact of the cumulative fiscal multipliers, because according to the literature they reflect best the impact of fiscal policies.

Auerbach and Gorodnichenko (2012) argue that for the US, the multipliers (spending) depend on the phase of the economic cycle, they are being higher in recessions (intervals with deficit demand in the economy). We can also observe this phenomenon, in the below graph, in the great recession years 2008Q1-Q2 and the following years 2010Q1, as well as in the pandemic years, starting with 2019Q2 till 2020Q4, when the cumulated spending multiplier surpasses 1,6 in 2008 and 2020.

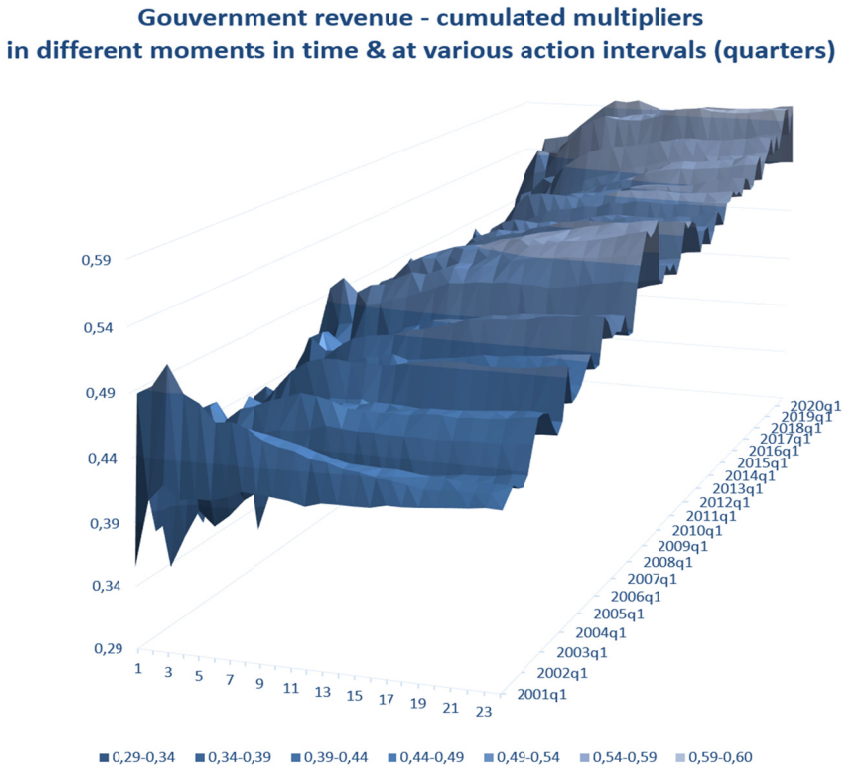
If we have a look at the cumulated revenue multiplier, we can observe one of the years, in which it was higher, was 2009, due to the VAT decrease, from 24% to 19%, which lead to an increase in consumption.



Source: authors own computations

Figure 4. Government spending

In the below graph it can be observed the cumulated expenditure and revenues multipliers estimated with different priors, and for different periods 1 – 24, with the BEAR toolbox.



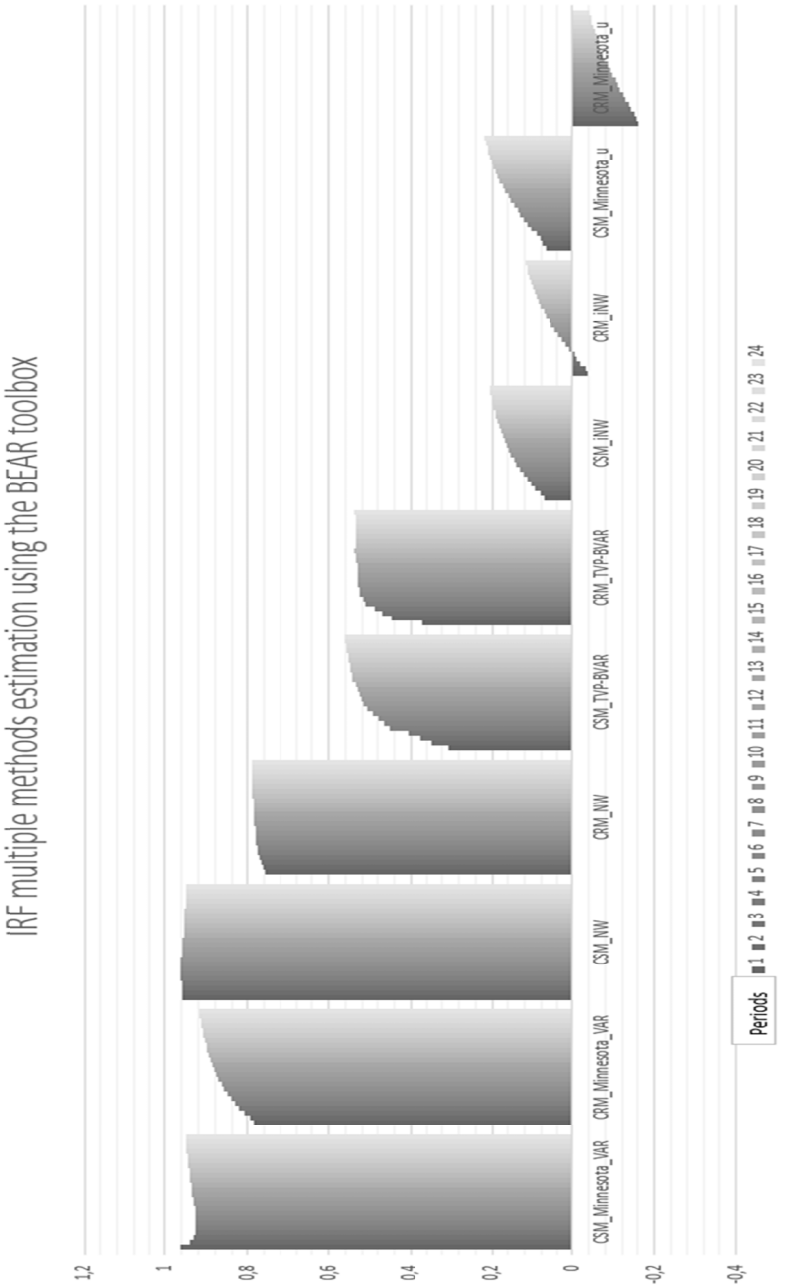
Source: authors own computation

Figure 5. Government revenue

5. Conclusions

For the Normal Wishart univariate methodology, as well as for the Minnesota univariate approach, the same prior specification was used in both Eviews and BEAR software, meaning 0.8 AR (1) coefficient prior, with an overall tightness of 0.1 lambda, as residual prior.

Although same prior type and specification was used in both econometric systems, it can be observed that the discrepancy in terms of medium cumulated multipliers is quite high, especially for the revenue multiplier in the Normal Wishart BEAR approach versus the Eviews approach, difference which can be seen also in the Minnesota estimation, as a parallel between the two software, especially in the cumulated spending multiplier.



Source: authors own computation

Figure 6. IFR estimation

The fact that the cumulated revenue multipliers are statistically insignificant, in most estimation results, meaning less than 0.5 and with the wrong sign, we can argue that the redistribution function of fiscal policy doesn't work, statement described also by Georgescu et al. (2020).

The value of the cumulated revenue multipliers throughout the prior estimations in the Eviews software are situated between – 1.33 and 0.82, during the whole estimated periods, whereas in the BEAR toolbox valuation they are between – 0.15 and 0.91.

Considering these values and comparing them with the results from Caldara and Kamps (2008), we can see that most revenue multipliers have the wrong sign and are statistically insignificant. This leads us to believe that the supplementary resources which were offered to the entrepreneurs, in the period 2013 - 2019, like stated by Georgescu et al. (2020), demonstrates the fact that these resources were not used in the sense of potential growth of the Romanian economy.

The small value of the cumulated spending multipliers situated between 0.06 and 0.96 according to the prior estimations from the BEAR toolbox state that because of mostly the pro-cyclical fiscal policy, this has brought with itself, during the great recession and the pandemic years, a 9% structural budgetary deficit, meaning an unsustainable economic raise.

It can be observed that in the TVP-BVAR estimation, after the first 3 quarters the effects of the fiscal impulses are diminishing, suggesting that on the long run the structural issues of the economy will diminish the impact of the fiscal policy towards the economic development.

The spending multipliers in absolute terms are statistically relevant and the budgetary expenditures are an efficient instrument, thus, the fiscal consolidation should be attained on the revenues; considering that the small value of the revenue multipliers implies small or even negative effects on the GDP side, having very little influence. According to the estimation results the spending needs to be stimulated.

Given the fact that fiscal multipliers are sub-unitary, for all estimations, as an effect over time it is shown that, in general, stimulating the economy through fiscal policy, regardless of the instrument, is not effective.

Implicitly, for an improvement in the transmission of fiscal policies to the real economy (not generating additional imbalances) it is necessary for a fiscal consolidation - preferably on the revenue side - and achieve a sustainable (accountable) and anti-cyclical position of the economy.

A possible policy to stimulate the economy out of the pandemic crisis, could be achieved by increasing spending with a high multiplier effect, given the higher values of spending multipliers than those of income multipliers.

Automatic stabilisers and Covid-19 related fiscal measures will also have a significant impact on government budgets in 202. The public deficits in nearly all of the EU member states are expected to exceed the 3% public deficit ceiling in the Maastricht Treaty. In Greece, Spain, Romania and the UK, the public deficit is

expected to be around 8%. Most countries are expected to have public deficits ranging between 4% and 7%. The fiscal stimulus in Slovakia (2%), Romania (2%), Portugal (2%) and Denmark (3%) had the smallest impact on the budget in 2020.

For 2021, the costs of Covid-related income support measures are expected to be lower than in 2020.

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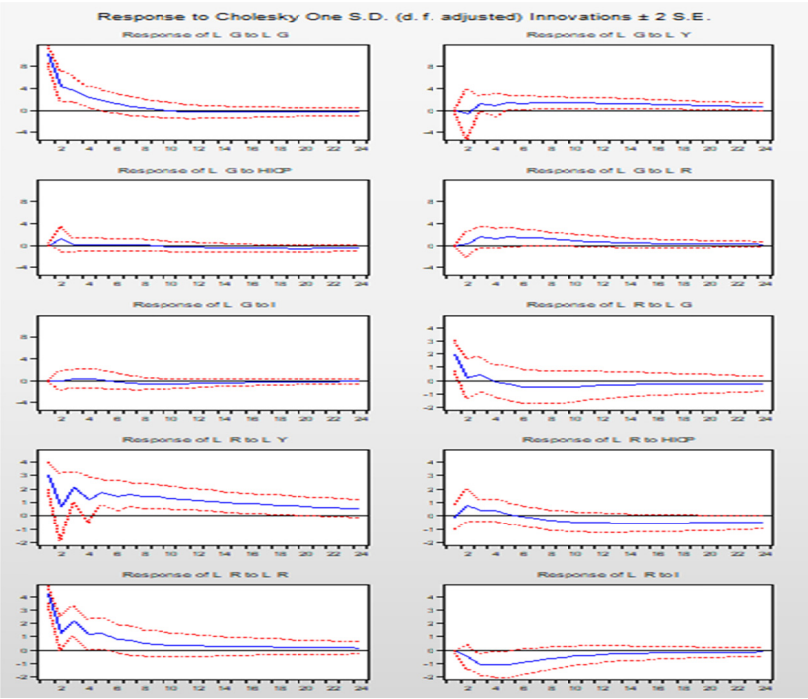
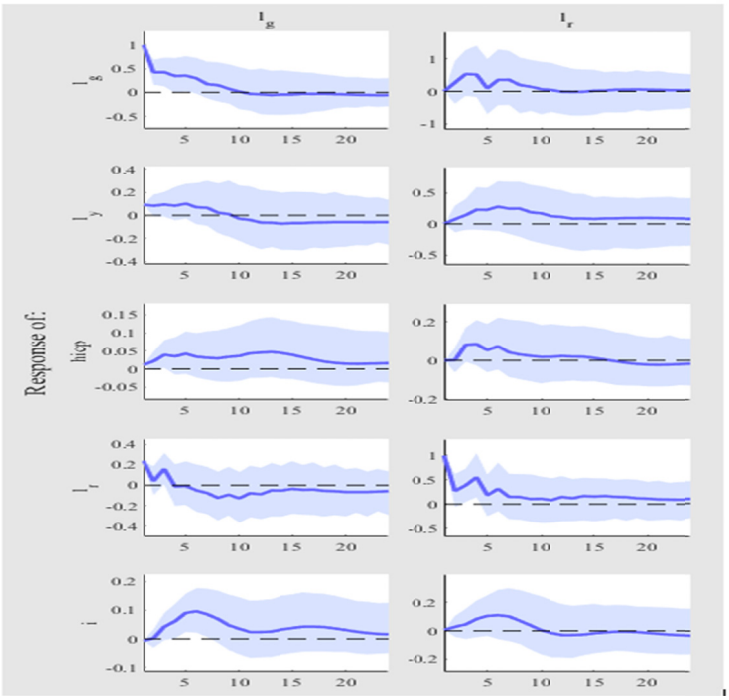
Annex 1



Annex 2



Annex 3: Used Notations

Eviews Software	BEAR Toolbox
CSM_NW = Cumulated expenditure multiplier using Normal Wishart univariate AR, as prior distribution	CSM_TVP-BVAR = cumulated expenditure multiplier using Time varying parameter Bayesian VAR
CRM_NW = Cumulated income multiplier using Normal Wishart univariate AR, as prior distribution	CRM_TVP-BVAR = cumulated income multiplier using Time varying parameter Bayesian VAR
CSM_Cholesky = Cumulated expenditure multiplier Cholesky	CSM_iNW = cumulated expenditure multiplier using Bayesian VAR with independent Normal-Wishart (S_0 as univariate AR) as prior distribution
CRM_Cholesky = Cumulated income multiplier Cholesky	CRM_iNW = cumulated income multiplier using Bayesian VAR with independent Normal-Wishart (S_0 as univariate AR) as prior distribution
CSM_BP = Cumulated expenditure multiplier Blanchart Perotti	CSM_Minnesota_u = cumulated expenditure multiplier using Bayesian VAR with Minnesota (univariate AR) as prior distribution
CRM_BP = Cumulated income multiplier Blanchart Perotti	CRM_Minnesota_u = cumulated income multiplier using Bayesian VAR with Minnesota (univariate AR) as prior distribution