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THE EFFECTS OF GOVERNMENT EXPENDITURE ON THE OUTPUT: A REAL BUSINESS CYCLE ANALYSIS FOR THE ROMANIAN ECONOMY

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Abstract: One of the most researched topics in macroeconomics is the development and implementation of Real Business Cycle models. This article presents a small Real Business Cycle model, which is built for the Romanian economy, with data from the 2nd quarter of 1995 through the 3rd quarter of 2022. The main aim of this analysis is to assess the historical influence of exogenous and government spending shocks on economic growth. In order to obtain accurate results, we implemented a Bayesian estimation technique for calculating the parameters of the model. The main findings indicate the significant exogenous shocks effect on the Romanian economy, and the way in which government spending had a positive effect on increasing economic growth for the period between the 1st quarter 2000 and the 3rd quarter of 2022.

JEL classification: E32, E60

Keywords: economic growth, real business cycle model, Romanian economy

1. Introduction

An interesting topic in economic research is the way in which shocks have an effect on the principal macroeconomic variables. The study of this topic has been a staple of scientific research in the last decades, with highly influential papers (such as Hansen et al., 1985, and Evans, 1989) dealing among other topics with the effect of shocks on the economic growth. However, in the present time, economists are still debating the effect and the particular way in which shocks affect an economy.

In the last decades, the study of the effect of shocks on macroeconomic variables for the countries in Central and Eastern Europe has seen an increased interest from the scientific community (Copaciu et al., 2015; Vasilev, 2018 and Sueppel, 2003). Generally, the literature agrees that shocks determine in a significant manner the evolution of the economy. A specific shock, which we consider of great interest is the government spending shock. This shock has been studied extensively

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in the scientific literature (for example in Ravn et al., 2007 and in Gali et al., 2007), due to its implications on the development of economic growth and its relation to the Keynesian economic theory[1].

The real business cycle (RBC) methodology (developed in papers such as Kydland and Prescott, 1982) provides an interesting way to analyse the relation between the government spending and economic growth. This methodology allows for the historic decomposition of the output by using the economic shocks, in this way we are able to observe the evolution of the economy and the relation of the government spending shock to economic growth. In the development of other models presented in the scientific literature (Copaciu et al., 2015) a historic decomposition of the output was included, and the effect of a government spending shock was positive on increasing economic growth for the first five quarters in the case of the Romanian economy. While offering numerous examples for the study of the relation between government spending and economic growth, the research literature presents conflicting views regarding their relation. The stated Keynesian approach is in direct conflict with the neo-classical view that government spending generates a decrease of the resources in the market, and can have negative effects on the output for a medium and long period of time (Carboni and Medda, 2011). This research gap is even more significant in the case of the Romanian economy, where except for a few number of papers (such as Copaciu et al., 2015 and Caraiani, 2007) the real business cycle methodology has not been extensively studied. In order to address the knowledge gap stated before, we aim to answer the following research question: What is the relation between government expenditure and economic growth in the case of the Romanian economy?

To answer this research question, we present the following research hypothesis from which we have started: A government spending shock promotes economic growth in the case of the Romanian economy.

This hypothesis was shaped by previous studies on the Romanian economy (Copaciu et al., 2015 and Caraiani, 2007) which have found a significant positive influence on the economy of government spending shocks. Our research makes several noteworthy contributions regarding the application of the RBC methodology for the Romanian economy and the study of the relation between economic growth and government spending. Firstly, we develop an RBC model with variable capacity utilization that contains a government spending shock. This model is implemented for the case of the Romanian economy and is Bayesian estimated using real time series. It should be noted that the present article is one of the few examples of the application of the RBC methodology for the Romanian economy.

Secondly, our analysis indicates the way in which the government spending shock has had an influence on economic growth for the Romanian economy for the period between the 1st quarter of 2000 and the 3rd quarter of 2022. We find that there is a strong positive historic effect of the government spending shocks on promoting economic growth for the case of the Romanian economy. These findings underscore the significant role that economic policy through government spending has on the economic growth and the subsequent development of a country.

[1] Acording to Keynes (1936), a government spending shock can boost economic growth by promoting employment.

Thirdly, the Bayesian estimation of the economic parameters for the Romanian economy leads to a better fit of the model on the real economic data. This is an interesting development due to the implications it has for future models that analyse the Romanian economy (it allows for comparing results and assessing the state of the economy). The results of the model indicate that for the period between the 1st quarter 2000 and the 3rd quarter of 2022. In line with the existing research literature, the present article provides an interesting view on the dynamics of economic growth and could be used as an analysis tool for decision makers and researchers. The following part of the paper is grouped in five sections: Literature review, Methodology, Results and discussions, Conclusion and References.

Literature review

In the present section we will present the most relevant ideas of the scientific literature regarding the role of government spending and the way to implement RBC models in order to quantify the influence of the government spending shock.

The effect of government spending on economic growth has been a topic of interest in economics since the work of Keynes (1936), which argued that the increase of government spending can promote economic growth by reducing the rate of unemployment and increasing the aggregate demand in the economy. In order to better test this hypothesis in the context of the Romanian economy, we decided to use a simplified RBC methodology. The framework of the RBC models has been developed in the paper written by Kydland and Prescott (1982) which created the first real business cycle model as a response to what is now known as the Lucas critique (Lucas, 1976) to traditional macroeconomic modelling (the critique is mainly related to the lack of a microeconomic basis in economic modelling).

The use of RBC models has seen a continued interest ever since the paper written by Kydland and Prescott (1982). In the article the authors made the use of a microeconomic basis for developing a macroeconomic model, this development being considered a step in the right direction for developing a better understanding of macroeconomics through econometric models. The model developed by Kydland and Prescott (1982) and other similar ones (i.e., Long and Plosser, 1983) explained the business cycles as being generated by exogenous shocks sustained by the production function. These approaches indicate that investment is influenced by the change in the Gross Domestic Product of the economy. This approach is however in conflict with the view proposed by Keynes (1936) according to which the marginal efficiency of investment is responsible for generating an increase in the output of the economy. An interesting development of the real business cycle framework is the adding of the capacity utilization for the capital by Greenwood et al (1988). By adding the possibility of measuring the utilization rate of the capital, the model describes with a larger accuracy the business cycle phenomenon. Due to the way in which it provides a channel for investment shocks and the mechanism through which they can have an effect on labour productivity allows for the creation of the Keynesian type of equilibrium (model equilibrium with less than full employment). The paper written by Greenwood et al (1988) proposes a model which matches a majority of the business cycle facts of the US economy for the period between 1948 and 1985.

In more recent studies, the idea of capital utilisation has been most notably treated in Duarte et al. (2019), Vasilev (2018), and Garlappi and Song (2017). Duarte et al. (2019) argue that capital utilisation and the short-term debt of the economy are

cyclical with the output of the economy. In this paper, the authors implement a Dynamic Stochastic General Equilibrium (DSGE) model that when accounting for capital utilisation and subjected to positive and financial shocks will determine the companies to increase their dependence on short term debt. The authors conclude that at company level the implications of a model without the use of capital utilisation can lead to the lack of understanding regarding the short-term debt of companies and their attitude to undertaking leverage.

Vasilev (2018) uses a standard RBC model in which it introduces an endogenous capital utilisation rate that is considered cyclical. The data for the model is from 1999 and 2016 by taking into account the period after the inauguration of the currency board. The author also includes the possibility of an energy shock which is implemented as a negative technological shock. The model performance for Bulgaria is improved by the presence of the features mentioned previously and helps to make a better framework for prediction than the standard real business cycle model.

Another interesting study is the one developed by Garlappi and Song (2017). The authors develop a general equilibrium model with two sectors in order to study the impact of capital utilisation and the evolution of the market on asset prices. The two sectors of the economy in which companies operate are the investment sector and the consumption sector. The results indicate that the consumption in the economy decreases when subjected to a positive investment shock, this being explained by the workers switching from the consumption sector to the investment sector of the economy.

The papers described have been of great influence in deciding to implement a real business cycle model to study the dynamics of economic growth in the Romanian economy. In order to answer the research question, we decided to implement a model similar to the one described by Greenwood et al (1988) but to which we added the government and for which we approximated parameters using a Bayesian estimation. The main difference between the model developed in this paper and the developments described above sits in the approach and the research question which is related to the effect of government spending on the economic growth.

The use of models for the Romanian economy has been a developing research topic in the last years. Some noteworthy approaches regarding the use of the real business cycle and dynamic stochastic general equilibrium models have been by Caraiani (2007) and Copaciu et al. (2015).

In the paper written by Caraiani (2007), the authors implement an RBC model for the Romanian economy for the period between 1991 and 2002 using quarterly data. The results obtained are of interest due to the fact that the author states that the real business cycle model developed in the paper can be a viable and useful starting point for the simulation of the complex dynamics in the Romanian economy. The implemented model can be used to calculate good predictions of the output and of the interest rate. Also, the results of the model indicate a failure in replicating specific business facts of the Romanian economy such as the fact that the capital is cyclical in a moderate manner and that the level of consumption is more volatile than the Gross Domestic Product for the analysed period. These failures can be since in part the consumption is financed by increasing the debt through the increase of imports for the analysed period, and the model being less complex cannot estimate these influences. Nevertheless, we consider the contribution made by Caraiani (2007) noteworthy and of interest in the history of the development of real business cycle models for the Romanian economy.

The model implemented by Copaciu et al. (2015) is a more complex model which is part of the Dynamic Stochastic General Equilibrium (DSGE) class of models. This class of models is developed from the real business class (RBC) of models but includes the non-neutrality of money on the short term. This change is interesting since in the standard RBC model (such as the one implemented in this paper) money are neutral and the monetary policy does not play a significant role, this however is not the case in DSGE models. The DSGE model presented by Copaciu et al. (2015) is based on the work of Christiano et al. (2011) and models the Romanian economy as a small open economy with a partial euroization present in the financial sector. The model estimates using Bayesian methods the parameters to better fit the data. Also, the model stands out by the depiction of the way in which a shock in the Euro area has a direct impact on the Romanian economy due to the credits denominated in foreign currency when compared to the effects of a similar shock in the US economy on the Romanian economy.

When compared to the models from the articles presented in the previous paragraphs the model that we constructed in this paper is based on the methodology of Greenwood et al. (1988) and employs a more simplified methodology then Copaciu et al. (2015). This is due to the scope of the present scientific research, as stated in the research question we aim to observe the interesting relation between government spending and economic growth. Also, this approach allows for a more focused view regarding the research gap (the conflict between the Keynesian and neo-classical views regarding the effect of government spending). In this way our model does not use the external market or the monetary policy in the way that the model employed by Copaciu et al. (2015) does, or the interest rate as in Caraiani (2007). Instead, our model employs a variable utilisation capacity in order to analyse the dynamics of the economy and is tailored to answer the research question stated in the introduction of this paper.

2. Methodology

In order to model the Romanian economy, we implemented the following equations, based on the work of Greenwood et al. (1988). The model has three main sections: the consumer, the firm and the government. In the following paragraphs we will present the equation block for the consumer in the economy. The optimisation problem for the consumer is summed up by the following equation:

$$\max_{C_t, H_t} U_t = \log C_t + \beta \mathrm{E}_t[U_{t+1}] + \psi \log (1 - H_t)$$

where U_t is the maximum utility of the consumer obtained by the substitution between consumption (C_t) at this moment and leisure time, calculated by the following part: $\log (1 - H_t)$ where H_t is the number of hours worked. Also in the utility equation we have the expected utility of consumption at a later date ($\mathrm{E}_t[U_{t+1}]$). The equation of optimisation of the consumer is subject to the following mathematical restriction:

$$C_t + T_t = \Pi_t + H_t W_t(\lambda_t^c)$$

Which presents the idea that the sum of the consumption (C_t) and taxes (T_t) at moment t are equal to the sum of the profit generated by the companies (Π_t) and the product between the hours worked and the wages paid in the economy ($H_t W_t$). The first order condition for the existence of the utility of the consumer, the consumption and the hours worked in the economy are the following:

$$\beta - \lambda_t^{\mathrm{U}} = 0(U_t)$$
$$-\lambda_t^{\mathrm{c}} + {C_t}^{-1} = 0(C_t)$$
$$\lambda_t^{\mathrm{c}} W_t - \psi(1 - H_t)^{-1} = 0(H_t)$$

In order to portray the behaviour of the companies in the market, we implemented the following equation block, in which the problem of optimisation for the companies is modelled by the next equation:

$$\max_{K_t, H_t^{\mathrm{d}}, Y_t, I_t, \Pi_t, CapUt_t} V_t = \Pi_t + \lambda_t^{\mathrm{c}-1} \mathrm{E}_t[\lambda_{t+1}^{\mathrm{U}} \lambda_{t+1}^{\mathrm{c}} V_{t+1}]$$

The management of the company wants to maximize its value (V_t) by making taking into account the current profit (Π_t) and the expected future value of the company ($\mathrm{E}_t[\lambda_{t+1}^{\mathrm{U}} \lambda_{t+1}^{\mathrm{c}} V_{t+1}]$). This equation is subject to the following restrictions.

$$Y_t = {H_t^{\mathrm{d}}}^{1-\alpha} (e^{Z_t})^{1-\alpha} (K_{t-1} CapUt_t)^{\alpha} (\lambda_t^{\mathrm{FIRM}^1})$$
$$K_t = I_t + K_{t-1}(1 - \delta {CapUt_t}^{\omega})(\lambda_t^{\mathrm{FIRM}^2})$$
$$\Pi_t = -I_t - H_t^{\mathrm{d}} W_t + P_t Y_t (\lambda_t^{\mathrm{FIRM}^3})$$

Also, the utilized capital (K_t^{ut}) at moment t is calculated using the following formula:

$$K_t^{\mathrm{ut}} = K_{t-1} CapUt_t$$

The first order conditions for the equation of the company are the following:

$$-\lambda_t^{\mathrm{FIRM}^{\mathrm{V}}} + {\lambda_{t-1}^{\mathrm{c}}}^{-1} \lambda_t^{\mathrm{U}} \lambda_t^{\mathrm{c}} = 0(V_t)$$
$$-\lambda_t^{\mathrm{FIRM}^2} + \mathrm{E}_t[\lambda_{t+1}^{\mathrm{FIRM}^{\mathrm{V}}} (\lambda_{t+1}^{\mathrm{FIRM}^2} (1 - \delta {CapUt_{t+1}}^{\omega})$$
$$+\alpha \lambda_{t+1}^{\mathrm{FIRM}^1} CapUt_{t+1} {H_{t+1}^{\mathrm{d}}}^{1-\alpha} (e^{Z_{t+1}})^{1-\alpha} (K_t CapUt_{t+1})^{-1+\alpha})] = 0(K_t)$$
$$-\lambda_t^{\mathrm{FIRM}^3} W_t + \lambda_t^{\mathrm{FIRM}^1} (1 - \alpha) {H_t^{\mathrm{d}}}^{-\alpha} (e^{Z_t})^{1-\alpha} (K_{t-1} CapUt_t)^{\alpha} = 0(H_t^{\mathrm{d}})$$
$$-\lambda_t^{\mathrm{FIRM}^1} + \lambda_t^{\mathrm{FIRM}^3} P_t = 0(Y_t)$$
$$\lambda_t^{\mathrm{FIRM}^2} - \lambda_t^{\mathrm{FIRM}^3} = 0(I_t)$$
$$1 - \lambda_t^{\mathrm{FIRM}^3} = 0(\Pi_t)$$
$$-\delta \omega K_{t-1} \lambda_t^{\mathrm{FIRM}^2} {CapUt_t}^{-1+\omega} + \alpha K_{t-1} \lambda_t^{\mathrm{FIRM}^1} {H_t^{\mathrm{d}}}^{1-\alpha} (e^{Z_t})^{1-\alpha} (K_{t-1} CapUt_t)^{-1+\alpha} = 0(CapUt_t)$$

After reduction these conditions can be written as follows:

$$-\lambda_t^{\mathrm{FIRM}^{\mathrm{V}}} + {\lambda_{t-1}^{\mathrm{c}}}^{-1} \lambda_t^{\mathrm{U}} \lambda_t^{\mathrm{c}} = 0(V_t)$$
$$-1 + \mathrm{E}_t[\lambda_{t+1}^{\mathrm{FIRM}^{\mathrm{V}}} (1 - \delta {CapUt_{t+1}}^{\omega} + \alpha \lambda_{t+1}^{\mathrm{FIRM}^1} CapUt_{t+1} {H_{t+1}^{\mathrm{d}}}^{1-\alpha} (e^{Z_{t+1}})^{1-\alpha} (K_t CapUt_{t+1})^{-1+\alpha})] = 0(K_t)$$
$$-W_t + \lambda_t^{\mathrm{FIRM}^1} (1 - \alpha) {H_t^{\mathrm{d}}}^{-\alpha} (e^{Z_t})^{1-\alpha} (K_{t-1} CapUt_t)^{\alpha} = 0(H_t^{\mathrm{d}})$$
$$-\lambda_t^{\mathrm{FIRM}^1} + P_t = 0(Y_t)$$
$$-\delta \omega K_{t-1} {CapUt_t}^{-1+\omega} + \alpha K_{t-1} \lambda_t^{\mathrm{FIRM}^1} {H_t^{\mathrm{d}}}^{1-\alpha} (e^{Z_t})^{1-\alpha} (K_{t-1} CapUt_t)^{-1+\alpha} = 0(CapUt_t)$$

At equilibrium the values of the prices (P_t) in the economy and those of the hours worked (H_t). Are the following:

$$P_t = 1$$
$$H_t = H_t^{\mathrm{d}}$$

Where H_t^{d} measures the hours demanded to be worked by the company in order to attain its goals.

For the government the model has the following identities:

$$T_t = G_t$$
$$G_t = \epsilon_t^{\mathrm{G}} + \phi^{\mathrm{G}} G_{t-1}$$

The exogenous shock, which is represented by external factors that are not accounted in the model is calculated using the following model:

$$Z_t = \epsilon_t^{\mathrm{Z}} + \phi^{\mathrm{Z}} Z_{t-1}$$

At equilibrium the mathematical relations described become as follows:

$$-1 + \beta C_t \mathrm{E}_t[{C_{t+1}}^{-1}(1 - \delta {CapUt_{t+1}}^{\omega} + \alpha CapUt_{t+1} {H_{t+1}}^{1-\alpha}(e^{Z_{t+1}})^{1-\alpha}(K_t CapUt_{t+1})^{-1+\alpha})] = 0$$
$$-K_t^{\mathrm{ut}} + K_{t-1} CapUt_t = 0$$
$$-W_t + (1-\alpha){H_t}^{-\alpha}(e^{Z_t})^{1-\alpha}(K_{t-1} CapUt_t)^{\alpha} = 0$$
$$-Y_t + {H_t}^{1-\alpha}(e^{Z_t})^{1-\alpha}(K_{t-1} CapUt_t)^{\alpha} = 0$$
$${C_t}^{-1} W_t - \psi(1 - H_t)^{-1} = 0$$
$$-\delta\omega K_{t-1} {CapUt_t}^{-1+\omega} + \alpha K_{t-1} {H_t}^{1-\alpha}(e^{Z_t})^{1-\alpha}(K_{t-1} CapUt_t)^{-1+\alpha} = 0$$
$$\epsilon_t^{\mathrm{Z}} - Z_t + \phi^{\mathrm{Z}} Z_{t-1} = 0$$
$$\epsilon_t^{\mathrm{G}} - G_t + \phi^{\mathrm{G}} G_{t-1} = 0$$
$$I_t - K_t + K_{t-1}(1 - \delta {CapUt_t}^{\omega}) = 0$$
$$U_t - \log C_t - \beta \mathrm{E}_t[U_{t+1}] - \psi \log(1 - H_t) = 0$$
$$-C_t - G_t + SPI_t + H_t W_t - \beta C_t \mathrm{E}_t[{C_{t+1}}^{-1} SPI_{t+1}] = 0$$
$$-I_t - SPI_t + Y_t - H_t W_t + \beta C_t \mathrm{E}_t[{C_{t+1}}^{-1} SPI_{t+1}] = 0$$

The RBC model presented in this article is implemented with the use of the gecon.estimation package for R, and the model is based on the DSGE estimation of the package.

3. Results and discussions

By using time series for the Gross Domestic Product of the Romanian economy and the government expenditure for the period between the 2nd quarter of 1995 and the 3rd quarter of 2022, we estimated the following values for the parameters of the model. The estimation was done using Bayesian econometrics, this method of estimation allows for a better fit of the model by taking into account prior information regarding the variables. The values for the model's parameters are the following:

$$\alpha = 0.33$$
$$\beta = 0.99$$
$$\delta = 0.0265$$
$$\omega = 1.6058486$$
$$\phi^{G} = 0.7024123$$
$$\phi^{Z} = 0.83515855$$
$$\psi = 1.75$$

Where α is the share of the capital in total output of the companies in the economy, β is the discount factor, δ is the rate of depreciation for the capital, the capital utilization parameter notated with ω, which has been set using Bayesian econometrics and ψ the labour disutility parameter. The parameters for the shocks of the model ϕ^{G} (the shock of government spending) and ϕ^{Z} (the exogenous shock) were calibrated using Bayesian econometrics and the time series for the Gross Domestic Product and the government expenditure.

In Table 1 we present the steady state values of the variables in the model.

Table 1. Steady state values of the variables[2]

	Steady-state value	Std. dev.	Variance
C	0.7723	0.0025	0
G	0	0.0114	0.0001
I	0.1997	0.1107	0.0123
K	11.9805	0.0045	0
W	2.0027	0.0083	0.0001
Y	0.972	0.0219	0.0005

In order to promote economic growth the taxes (T_t) at steady state are 0 (in order to promote economic growth). As we can observe due to the fact that the taxes are equal to the government spending ($T_t = G_t$) government expenditure is also 0 at steady state. This helps the model describe in a more accurate way the evolution of the economy for the analyzed period as we will see in figures 5 and 6.

In Table 2, we can observe the correlation matrix of the variables in the model. The relation between private consumption and government expenditure is inverse proportional (as consumption increases the rate of government expenditure decreases), this is due to the consumption reducing the available resources in the economy. Also we can observe a positive correlation between the Gross Domestic Product (Y) and all the variables in the economy: consumption (C), government expenditure (G), investment (I), capital (K) and the hourly wages paid in the economy (W).

[2] Where C is consumption, G is government expenditure, I is investment, K represents capital, W is the hourly wages paid in the economy and Y is the Gross Domestic Product

Table 2. Correlation matrix[3]

	C	G	I	K	W	Y
C	1	-0.372	0.716	0.815	0.748	0.635
G		1	-0.424	-0.124	-0.024	0.06
I			1	0.181	0.898	0.877
K				1	0.334	0.196
W					1	0.988
Y						1

In Table 3, we present the autocorrelations of the variables in the model. In the case of the capital we can see the largest autocorrelation with past values, this can be explained by the nature of the capital stock. We also consider of significant interest the fact that the consumption has also a positive and significant autocorrelation. Consumption has the 1st lag determining with a degree of 0.787 the value of the current consumption. This meaning that in theory, the consumption of the last quarter influences in a significant and positive way (almost 79%) the value of consumption in the present.

Table 3. The autocorrelations of the variables[3]

	Lag 1	Lag 2	Lag 3	Lag 4	Lag 5
C	0.787	0.582	0.393	0.226	0
G	0.551	0.248	0.048	-0.077	-0.151
I	0.632	0.352	0.145	-0.004	-0.107
K	0.941	0.81	0.638	0.451	0.265
W	0.661	0.393	0.186	0.03	-0.083
Y	0.651	0.378	0.169	0.014	-0.096

The variance decomposition of the shocks used in the model is presented in Table 4. With the help of the variance decomposition we can see the way in which the two shocks (exogenous shock and government expenditure shock) have an influence on the macroeconomic variables in the model. As we can see the evolution of the variance of consumption is explained in a greater measure by the exogenous shock then by the government spending shock. Also the variance decomposition of the level of investment in the economy is explained by the exogenous shock in proportion of 0.819 and the government spending shock in proportion of 0.181. In the case of the variance of the capital for the Romanian economy, the exogenous shock explains 0.788 of the government spending shock explains 0.212. For the variance of the hourly wages rate, the exogenous shock explains 0.997 and the government spending shock has an influence of 0.003.

[3] Where C is consumption, G is government expenditure, I is investment, K represents capital, W is the hourly wages paid in the economy and Y is the Gross Domestic Product

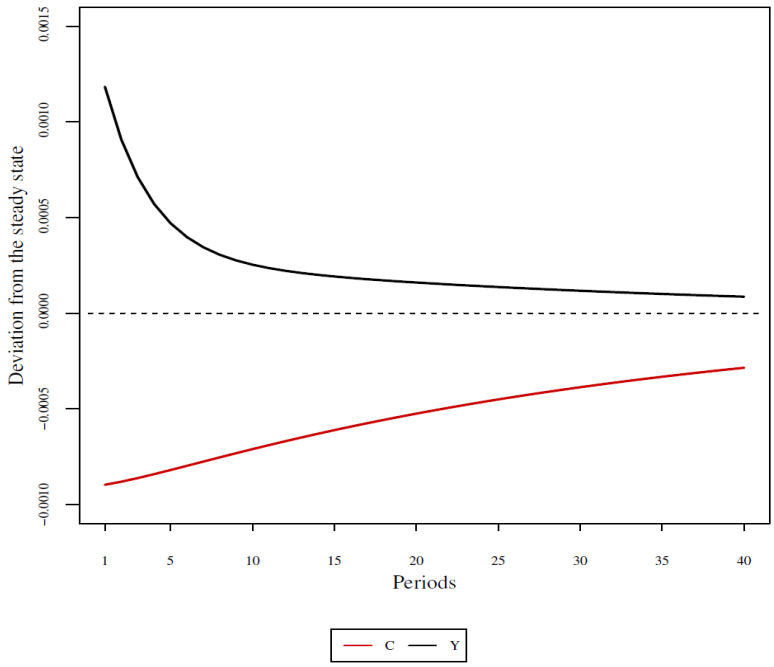
The variance decomposition for the analyzed variables shows that the government spending shock is the most explicative for the case of consumption, followed by the capital for both explaining over 20% of the variance.

Table 4. Variance decomposition[3]

	Exogenous shock	Government spending shock
C	0.775	0.225
G	0	1
I	0.819	0.181
K	0.788	0.212
W	0.997	0.003
Y	0.996	0.004

In the following we will present the impulse response functions for the shocks of the model. In Figure 1 we can observe the impulse and response function in the case of a shock of government spending for the consumption and the output.

Figure 1. Impulse response function to a government spending shock for C, Y[4]

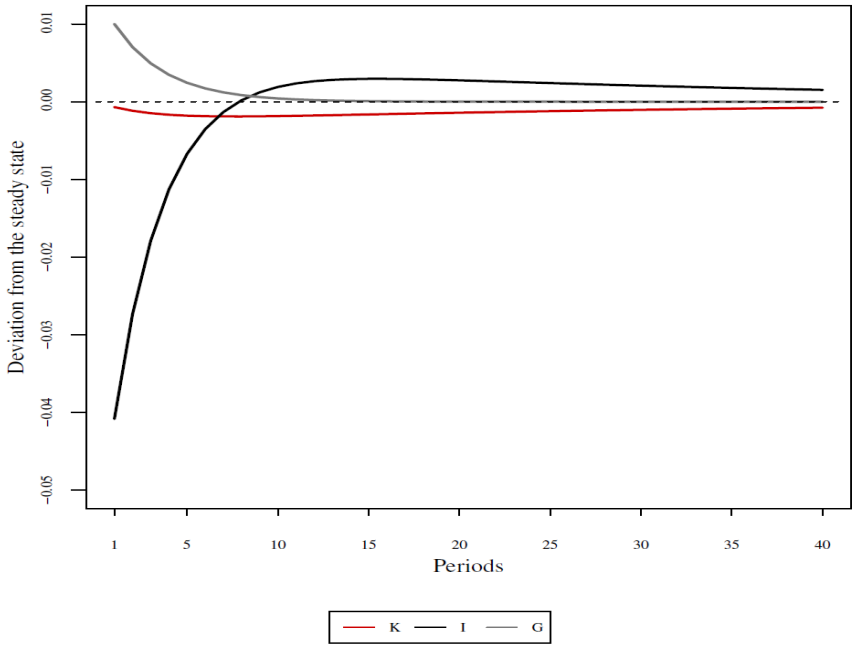


[4] Where C is consumption and Y is the Gross Domestic Product

As we can observe from Figure 1, an increase in government spending leads to a marginal increase in the output due to the inherent effect on the economic activity, but it also leads to a decrease in consumption. This effect is explainable, through the idea that consumption is discouraged by the decrease in resources generated by the increase in government spending. These results are in line with observations made in Copaciu et al. (2015) for the Romanian economy, according to which consumption decreases and the GDP increases when the economy faces a government expenditure shock.

In Figure 2, we present the impulse response function for the capital, the investments and government spending when the economy is subjected to government spending shocks.

Figure 2. Impulse response function to a government spending shock for K, I, G[5]



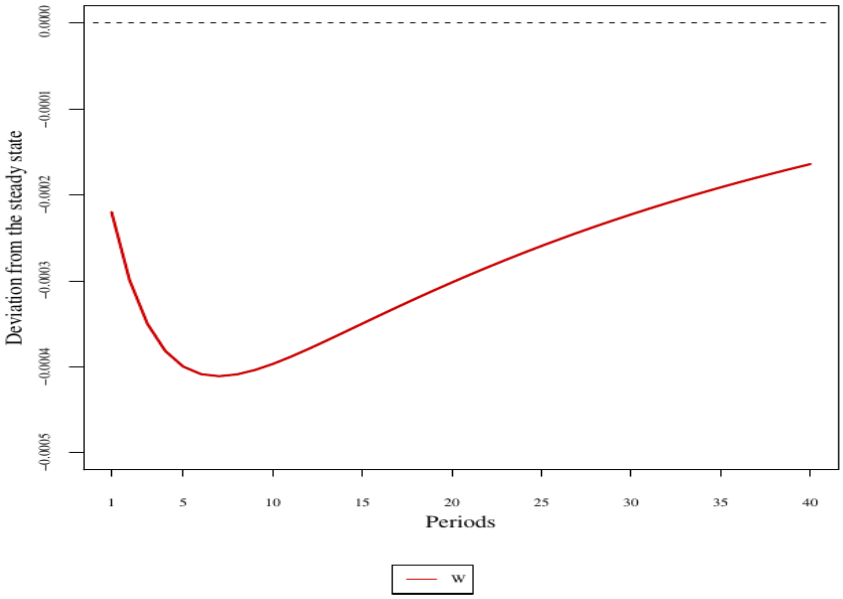
From Figure 2, we can observe the negative effect of government spending on investment and capital for the Romanian economy. A similar result has been obtained in Copaciu et al. (2015) regarding the effect of the government expenditure on investments. The economic reason behind the mechanism that discourages the investment rate during the government spending shock, is that the government consumes more of the available resources. This effect is connected with the money markets and the banking system. By increasing spending, the government increases the rate of borrowing from the money markets and the banks, this leads to less

[5] Where K is capital, I is investment and G is the government expenditure

resources available on the market for investments. An observation can be made regarding the persistence of the effects of the shock, for the investments the effect is observable and negative for the approximatively 10 quarters, after that the effect of the government spending shock is slightly positive.

In Figure 3 we can observe the response of the hourly wages in the economy to a shock of the government spending shock. The effect is small but significant; a government expenditure shock can lead to a decrease in the hourly wages of the workers.

Figure 3. Response of W to a government spending shock[6]



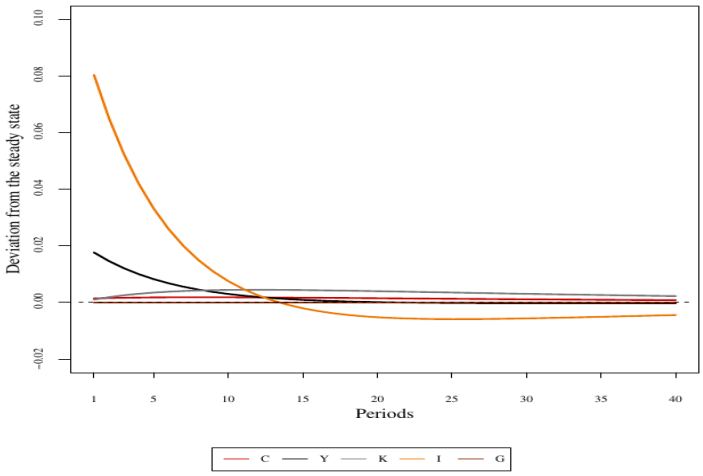
The decrease in wages as an effect to a government expenditure shock is also observed for the Romanian economy in the paper written by Copaciu et al. (2015). This effect leads to the conclusion that an increase in government spending can lead to a decrease in wages. The effect on wages seems to be constant and persistent for the next 40 quarters (when not taking into account counter measures).

The effect of the government spending shock on the principal macroeconomic variables present in the model, indicates the idea that by increasing government spending the policy makers may discourage investment, consumption and reduce the wages in the economy. These implications lead to the conclusion that government spending may not be the best economic growth driver when taking into account long term development goals.

[6] Where W represents the hourly wages paid in the economy

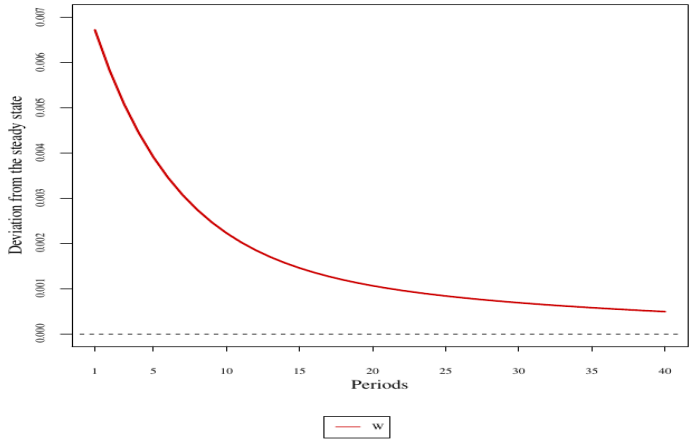
In Figure 4, we present the response of the main macroeconomic variables to an exogenous shock. The exogenous shock is represented by the shocks not taken into account in the model. As we can see the shock is significant and has important effects on investments and the Gross Domestic Product.

Figure 4. Impulse response function to an exogenous shock for C, Y, K, I, G[7]



By analyzing Figure 4 we can conclude that the exogenous shock represents an overall positive influence on the economy, when taking into account the analyzed variables. In Figure 5 we depicted the response of the hourly wages paid in the economy to an exogenous shock.

Figure 5. Response of W to an exogenous shock[8]



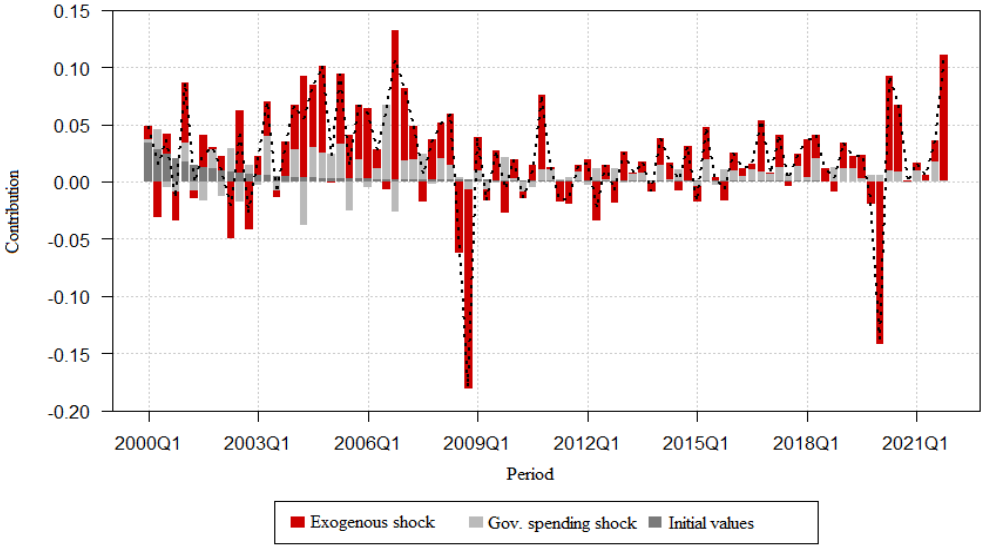
[7] Where C is consumption, G is government expenditure, I is investment, K represents capital, W is the hourly wages paid in the economy and Y is the Gross Domestic Product

[8] Where W represents the hourly wages paid in the economy

As we can observe the exogenous shock has a positive impact on the wages level of wages in the Romanian economy, for the analyzed period. This observed positive impact of the exogenous shocks seems to underline the fact that government spending has not been the most relevant driver of economic development for the Romanian economy (taking into account data for the period between the 2nd quarter of 1995 through the 3rd quarter of 2022).

In Figure 6, we present the historical shock decomposition of the Gross Domestic Product by taking into account the government expenditure shock and the exogenous shocks in the economy, for the period between the 1st quarter 2000 and the 3rd quarter of 2022. As we can observe, the government expenditure shocks have been a significant and positive influence on the economic growth. Promoting economic growth through government spending has been more significant in the period before the 2009 economic crisis and in the period between 2015 and 2019. Also the historical decomposition shows the strong effect of exogenous shocks in the generation of the 2009 crisis and the 2020 COVID-19 pandemic crisis.

Figure 6. Gross Domestic Product historical shock decomposition



We consider the results in Figure 6 of interest in their relation with the previous findings regarding the effect of the government spending shock on the main macroeconomic variables in the model. Summing up the results, the model indicates a significant positive and historic relation between government spending and economic growth and a significant negative relation between the government spending and consumption, investments and wages. In the scientific literature similar results regarding the effect of government spending on the economic growth have been seen in Ravn et al. (2007) with the exception that in the case of the data used

for a panel of countries (USA, UK, Canada and Australia), the government spending shock was positively correlated with consumption. This result could indicate that the analyzed period in Ravn et al. (2007) (between 1975 and 2005) includes a series of measures that increased government spending for welfare purposes. Another study that deals with the relation between government spending and consumption is the one written by Gali et al. (2007) which concludes that for the US economy consumption is positively correlated with the government spending. The difference in the results of the Romanian economy could be from the fact that the government spending that has been seen in the first period of the interval was caused by the subsidizing of the industry during the transition towards the market economy.

4. Conclusion

In conclusion we can observe the fact that government expenditure has a significant role in promoting economic growth. This fact is in line with the assumptions stated by Keynes (1936), that the increase in government spending leads to the increase in economic growth. Even if this is the case the model indicates a negative relation between government spending and consumption, investment and wages, these relations have been also observed in Copaciu et al. (2015). This can lead to the idea that, even though government spending promotes economic growth, it might hinder economic development on the long term by discouraging investments and consumption (which are two of the main drivers of economic development). An interesting feature of our model is the existence of a government In other papers that implement variable capital utilization for companies (Greenwood et al., 1988 and Duarte et al., 2019) the government is not introduced in the model. We consider the presence of the government to be of interest and that its inclusion can lead to a better depiction of the analyzed economy.

The results of the current paper confirm the research hypothesis stated in the introduction, but they also lead to the idea stated before, that encouraging economic growth only through government spending may lead to negative effects on the medium and long term. In order to offer an answer to the research question we can state that for the Romanian economy an increase in the government spending will lead to an increase in the economic growth, but policy makers should take into account the implications that such an increase has on the level of investment and consumption.

An interesting finding is that of the way in which the government spending influences the investment and the capital. By increasing the spending the government leads to a decrease in investment and in the evolution of the stock of capital in the Romanian economy. But the government spending is slightly positively correlated with the output, and historically has determined a positive deviation from the steady state for the Gross Domestic Product. This leads to the conclusion that the influence of government expenditure on the output even though marginally positive has a negative influence in the long run by discouraging investment, the growth of the stock of capital and consumption.

These results are interesting and seem to offer a synthesis of both the Keynesian and the neo-classical point of view. Government spending can be a historically positive influence and can also hinder potential development through discouraging the evolution of other main macroeconomic variables (such as

consumption, investment and capital). For future research, an interesting study could be the investigation regarding the effect of government spending on consumption in other countries that have seen a transition from a centralized to a market economy.

We conclude by stating that the increase in government spending seemed to have a significant positive effect on the economy, but its prolonged use could lead to a decrease in output due to negative effects on investment, capital and consumption.

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Appendix

Steady state relations for the model

$$-1+\beta(1-\delta CapUt_{ss}{}^{\omega}+\alpha CapUt_{ss}H_{ss}{}^{1-\alpha}(e^{Z_{ss}})^{1-\alpha}(CapUt_{ss}K_{ss})^{-1+\alpha})=0$$
$$-K_{ss}^{ut}+CapUt_{ss}K_{ss}=0$$
$$-W_{ss}+(1-\alpha)H_{ss}{}^{-\alpha}(e^{Z_{ss}})^{1-\alpha}(CapUt_{ss}K_{ss})^{\alpha}=0$$
$$-Y_{ss}+H_{ss}{}^{1-\alpha}(e^{Z_{ss}})^{1-\alpha}(CapUt_{ss}K_{ss})^{\alpha}=0$$
$$C_{ss}{}^{-1}W_{ss}-\psi(1-H_{ss})^{-1}=0$$
$$-\delta\omega K_{ss}CapUt_{ss}{}^{-1+\omega}+\alpha K_{ss}H_{ss}{}^{1-\alpha}(e^{Z_{ss}})^{1-\alpha}(CapUt_{ss}K_{ss})^{-1+\alpha}=0$$
$$-Z_{ss}+\phi^{Z}Z_{ss}=0$$
$$-G_{ss}+\phi^{G}G_{ss}=0$$
$$I_{ss}-K_{ss}+K_{ss}(1-\delta CapUt_{ss}{}^{\omega})=0$$
$$U_{ss}-\log C_{ss}-\beta U_{ss}-\psi\log(1-H_{ss})=0$$
$$-C_{ss}-G_{ss}+SPI_{ss}-\beta SPI_{ss}+H_{ss}W_{ss}=0$$
$$-I_{ss}-SPI_{ss}+Y_{ss}+\beta SPI_{ss}-H_{ss}W_{ss}=0$$