The Role of the Monetary Policy in the Context of the Macroeconomic Policies Mix –A Fiscal and Monetary Policy Case Study for Romania

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Abstract: The main object of the research is to analyze and identify an optimal monetary and fiscal policy model that responds to the economic problems of the countries from Central and East Europe and, mainly, of Romania. Given the vulnerabilities of the Central and Eastern Europe region at the beginning and during the recent global economic and financial crisis, there is an increased interest to identify the models that can explain the main features of the Central and Eastern Europe macroeconomic data: GDP, inflation rate, the nominal interest rate, the weight of governmental expenses and public debt in GDP. Moreover, due to the importance of the uncertainty in modelling the monetary policy and to the increasing attention that central banks should pay to the anticipation of the future macroeconomic conditions, another objecive of the research is to identify the significant shocks that influence the macroeconomic environment, such as: productivity (technology) shock, world output shock, mark-up shock, interest rate shock, tax shock and spending shock.

Keywords: monetary; fiscal; policy; shocks; Bayesian

JEL Classification: C01; D50; B22; C4

1. Introduction

Given the vulnerabilities of the countries from Central and East Europe at the beginning and during the recent economic and financial global crisis, there is an increasing interest to identify models that explain the most significant characteristics of the macroeconomic variables, such as: GDP (gross domestic product), inflation rate (GDP deflator), nominal interest rate, public debts and governmental expenses.

As a result, the main object of the research is to analyze and identify an optimal monetary and fiscal policy model that complies with the macroeconomic context and responds to financial and economic problems of the countries from Central and East Europe and, mainly, of Romania.

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Generally, central banks put an eye on the importance of uncertainty in shaping monetary policy (e.g., as in Greenspan A. (2004)), uncertainty that can take many forms. The central bank must act in anticipation of future macroeconomic conditions, which are affected by shocks that are currently unknown.

Given the importance of the uncertainty in modelling the monetary policy in terms of future shocks, another objective of the research is to identify which are the significant shocks that influence the macroeconomic environment.

As a result, I have proposed during the current thesis to consider how monetary and fiscal policy should be conducted in the face of multiple sources of uncertainty, including model and parameter uncertainty as well as uncertainty about future shocks.

In this purpose the analyzed model proposes the interdependent analysis of the monetary and fiscal policy, through the analysis of the impulse response function of the variables from the model.

For the analysis we have taken into consideration 5 observed variables: GDP, inflation rate (measured based on the GDP deflator), the nominal interest rate, the weight of governmental expenses and public debt in GDP and also 6 exogenous shocks: productivity (technology) shock, world output shock, mark-up shock, interest rate shock, tax shock and spending shock.

The thesis is organized as follows: section 1-Introduction, section 2 contains the description of the model, section 3 describes the econometric estimation methodology, description of the parameters calibration and data set and also the results of the parameters estimates, section 4 is the section of conclusions, followed by References section.

2. The Model

The model proposed as in Cem, C. (2011) supposes a standard small-scale open economy New Keynesian model, in accordance with the model proposed by Lubik and Schorfheide (2007), modified in order to include the effects of fiscal policy. Moreover, the model can also be considered a modified version of that proposed by Gali and Monacelli (2005) that includes also fiscal policy, as in Fragetta and Kirsanova (2010).

The agents involved by the model are the following ones: the private sector represented by households, the producers, the monetary and fiscal policy authorities.

Another hypothesis of the model is the fact that there is a continuum of identical monopolistically competitive firms in the economy that produce domestic goods. The same situation is in case of firms that produce imported goods.

2.1. Private Sector

This sector is formed by infinite lived households who try to maximize the expected present discounted value of the lifetime utility, as follows:

$$E_0 \sum_{t=0}^{\infty} \beta^t \left(\frac{C_t^{1-\sigma}}{1-\sigma} + \chi \frac{G_t^{1-\sigma}}{1-\sigma} - \frac{N_t^{1+\varphi}}{1+\varphi}\right) \quad (1), \text{ where:}$$

$\beta \in (0,1)$ represents the discount factor of the households;

σ is the inverse intertemporal elasticity of substitution in consumption;

φ is the inverse labour supply elasticity with respect to real wage and

χ is the relative weight on consumption of public goods.

The variables C_t, G_t and N_t represents the private consumption, the governmentt spending and, respectively, the labour supplied (measured in terms of number of hours of work).

The inter-temporal budget constraint of households is the following:

$$P_t C_t + E_t\{Q_{t,t+1} D_{t+1}\} + T \leq D_t + (1-\Psi_t) W_t N_t \quad (2), \text{ where:}$$

$Q_{t,t+1} = (1/1+r_t)$ represents the stochastic discount factor for one-period ahead;

r_t is the nominal interest rate;

T represents the constant lump-sum taxes;

Ψ_t represents the income tax rate;

W_t is the nominal wage;

D_t is nominal portfolio;

P_t is consumer price index (CPI) and

C_t is composite consumption index which that contains an index of domestically produced goods ($C_{H,t}$) and of imported goods, ($C_{F,t}$).

Through the forward looking open economy IS curve proposed by Gali & Monacelli (2005) a log-linearized IS curve in terms of deviations from steady state can be expressed as follows:

$$\hat{y}_t = E_t\{\hat{y}_{t+1}\} - E_t\{\Delta\hat{g}_{t+1}\} + \alpha(\varpi - 1)(\rho_{c^*} - 1)\hat{c}_t^{\,*} - \frac{1}{\sigma_\alpha}(\hat{r}_t - E_t\{\hat{\pi}_{H,t+1}\}),\ (3)$$

Where: $\sigma_\alpha \equiv \dfrac{\alpha}{(1-\alpha)+\alpha\varpi}$ and $\varpi \equiv \sigma\gamma + (1-\alpha)(\sigma\eta - 1)$.

η >0 is the elasticity of substitution between domestic and foreign goods;

α is the share of domestic consumption allocated to imported goods (degree of openness)

γ is the elasticity of substitution between the goods produced in different foreign countries.

The obtained forward looking open economy IS curve obtained through processing in the gap form is as follows:

$\tilde{y}_t = E_t\{\tilde{y}_{t+1}\} - E_t\{\Delta\tilde{g}_{t+1}\} - \dfrac{1}{\sigma_\alpha}(\tilde{r}_t - E_t\{\tilde{\pi}_{H,t+1}\})$, (4), where:

$\tilde{y}_t = \hat{y}_t - \hat{y}_t^{\,n}$, $\tilde{r}_t = \hat{r}_t - \hat{r}_t^{\,n}$.

$\tilde{g}_{t+1} = \hat{g}_{t+1}$ and $\tilde{\pi}_{H,t+1} = \hat{\pi}_{H,t+1}$, since $\hat{g}^n{}_{t+1} = \hat{\pi}^n{}_{H,t+1} = 0$.

$\hat{y}_t^{\,n}$ and $\hat{r}_t^{\,n}$ represent the natural level of output and of nominal interest rate, respectively.

The equilibrium level of output and interest rates for the model without nominal rigidities are:

$$\hat{y}_t^{\,n} = \frac{(1+\varphi)}{(\sigma_\alpha + \varphi)}\hat{a}_t - \frac{(\sigma - \sigma_\alpha)}{(\sigma_\alpha + \varphi)}\hat{c}_t^{\,*}\ (5),$$

$$\hat{r}_t^{\,n} = \sigma_\alpha(E_t\{\hat{y}^n{}_{t+1}\} - \hat{y}_t^{\,n}) + \sigma_\alpha\alpha(\varpi - 1)(\rho_{c^*} - 1)\hat{c}_t^{\,*}\ (6),$$

Where a_t is log of technology process, A_t.

2.2. Firms Behaviour and Price Setting

The model supposes that each firm produces a differentiated good using linear technology, so a firm's production function is described as follows: $Y_t = A_t N_t(j)$ (7).

Similar with the hypothesis proposed by Calvo (1983), the model assumes that a fraction of $1-\theta$ of the firms can set a new price in each period, while the remaining θ of the firms keep the price unchanged. As a result, the fraction 1/($1-\theta$) represents the average duration of fixed prices.

The price, $p_{H,t}{}^{b}$, chosen by rule of thumb price setters, is written as in Gali and Gertler (1999):

$p_{H,t}{}^{b} = P_{H,t-1}{}^{*} \dfrac{P_{H,t-1}}{P_{H,t-2}}$, (8) where $P_{H,t-1}{}^{*} = (P^{b}_{H,t-1})^{\zeta}$ is the aggregate price chosen in the period t-1 by both optimizing (forward looking, $P^{f}_{H,t-1}$) and rule of thumb (backward looking, $P^{b}_{H,t-1}$) price setters.

The log-linearized open economy hybrid Philips curve in terms of deviation from steady state is as follows:

$\hat{\pi}_{H,t} = \lambda^{b}\hat{\pi}_{H,t-1} + \lambda^{f} E_t\{\hat{\pi}_{H,t+1}\} + \kappa \hat{mc}_t + \varepsilon_t^{\pi}$ (9)

$\hat{mc}_t = (\sigma_\alpha + \varphi)(\hat{y}_t - \hat{y}_t{}^{n}) - \sigma_\alpha \hat{g}_t + \hat{\tau}_t$ (10), where $\lambda^{b} = \dfrac{\zeta}{\theta + \zeta(1-\theta(1-\beta))}$, $\lambda^{f} = \dfrac{\beta\theta}{\theta + \zeta(1-\theta(1-\beta))}$ and $\kappa = \dfrac{(1-\beta\theta)(1-\theta)(1-\zeta)}{\theta + \zeta(1-\theta(1-\beta))}$.

$\hat{mc}_t$ is the real marginal cost and $\tau_t = -\ln(1-\psi_t / Y_t)$ is a log-linearized tax rate.

ε_t^{π} is a cost push (mark-up) shock which is included in the Philips curve according with Smets and Wouters (2003, 2007).

2.3. Monetary Policy

The model supposes a simple Taylor interest rate rule, based on inflation and output gap, as described below:

$\hat{r}_t = \rho_r(\hat{r}_{t-1} - \hat{r}_{t-1}{}^{n}) + (1-\rho_r)[r_\pi \hat{\pi}_{H,t} + r_y(\hat{y}_t - \hat{y}_t{}^{n})] + \hat{r}_t^{n} + \varepsilon_t^{r}$ (11), where:

$\hat{r}_t^n$ represents the natural level of nominal interest rate;

ρ_r ($0 \leq \rho_r \leq 1$) represents the interest rate smoothing coefficient;

ε_t^r represents an i.i.d (independent and identically distributed) interest rate shock.

The explanation of the monetary policy rule is that Central Banks changes the nominal interest rates in response to deviation of the inflation and output from the steady state value and, respectively, from the natural level of output.

Moreover, as proposed by the monetary policy rule, Central Banks also take into account the past values of the nominal interest rate (where $\rho_r \neq 0$) in setting the current nominal interest rate.

2.4. Fiscal Policy

The fiscal policy rule takes into consideration the lagged responses of fiscal policy to economic activity, as follows:

$$\hat{g}_t \equiv \rho_g \hat{g}_{t-1} + (1-\rho_g)[g_y(\hat{y}_{t-1} - \hat{y}^n{}_{t-1}) + g_b \hat{b}_t] + \varepsilon_t^g \quad (12)$$

$$\hat{\tau}_t = \rho_\tau \hat{\tau}_{t-1} + (1-\rho_\tau)[\tau_y(\hat{y}_{t-1} - \hat{y}^n{}_{t-1}) + \tau_b \hat{b}_t] + \varepsilon_t^\tau \quad (13)$$

Parameters ρ_g and ρ_τ indicate the degree of fiscal smoothing, while parameters g_y and τ_y represent the sensitivities of government spending and tax to past value of output gap.

Parameters g_b and τ_b are the feedback coefficients on unobservable debt stock and

ε_t^g and ε_t^τ are independent and identical distributed government spending and tax shocks, which represent the non-systematic component of discretionary fiscal policy or discretionary exogenous deviations from the fiscal rules.

To conclude, the fiscal policy has two objectives: output stabilization and debt stabilization.

2.5. Government Solvency Constraint

A log-linearized government solvency constraint (fiscal constraint) is expressed as follows:

$$\hat{b}_{t+1} = \hat{r}_t + \frac{1}{\beta}[\hat{b}_t - \hat{\pi}_{H,t} + (1-\beta)(\hat{\tau}_t - \hat{y}_t) + \frac{\overline{C}}{\overline{B}}(\hat{g}_t - \hat{\tau}_t)], \quad (14)$$ where:

$b_t = \ln(B_{t/}P_{H,t-1})$, B_t is the nominal debt stock, $\overline{B}$ is the steady state debt to GDP ratio and $\overline{C}$ is the steady state consumption to GDP ratio.

In conclusion, the analyzed model consists of the following: a forward looking IS curve, a hybrid Philips curve, monetary and fiscal policy rules and government solvency constraint.

The observed variables are: output, inflation, nominal interest rate, tax to GDP ratio and spending to GDP ratio, while the un-observed variables are: debt stock, natural level of output and of nominal interest rates.

The model suppose that the stochastic behaviour of the system is driven by te following six exogenous disturbances: productivity (technology) shock, world outphut shock, mark-up shock, interest rate shock, tax shock and spending shock.

3. Econometric Estimation Methodology

3.1. Econometric Methodology

For the analysis of the interaction between the fiscal and monetary policy and of their role in the macroeconomic stabilization I will use the Bayesian approach, using Matlab program and Dynare tool.

Based On this approach I will obtain estimations using the a-priori distributions proposed of the parameters and the observed variables of the model (extracted with Kalman filter, through the maximization of the likelihood function).

Moreover, using the Bayesian approach I can take into account in the analysis also the shocks proposed by the model in order to estimate the standard deviations, with a role in interpreting the impulse response functions.

The obtained results will be interpreted from the perspective of the decomposition of the istorical variance of the analyzed variables, of the MCMC (Makov Chain Monte Carlo) convergence graphs, obtained though the optimization using the Metropolis-Hastings algorithm, the a-priori and, respectively, a-posteriori distributions, the stabilization of the system (through the verification of Blanchard-Kahn condition), of the graphic interpretation of the impulse response functions and of the shocks.

3.2. Calibration and A-Priori Distributions of the Parameters

In terms of the parameters of DSGE model, I will use in the research the Bayesian estimation method, using the likelihood function and the a-priori distributions of the model's parameters, in order to obtain the a-posteriori functions. This a-posteriori function is afterwards optimized through the mothod of Markov-Chain-Monte-Carlo simulation, using 350,000 iterations.

In order to compute the likelihood function for the observed data series, I use Kalman filter, similarly to the proposal of Sargent T.J. (1989) and, afterwards, through the combination of the likelihood function with the a-priori distribution of the parameters, it will be obtained the a-posteriori distribution of parameters.

It should be also taken into consideration the fact that it is necessary to set fixed values for a part of the parameters during the estimation. Most of those parameters are in a direct connection with the steady-state values of the state variables and can be estimated starting from the average of the observed variables (or the linear combination of them).

The parameters fixed through calibration are: the discount factor (β =0.998) calculated based on the medium interest rate ROBOR 3M as 1/(1+ROBOR 3M/4), taking into consideration the quarterly frequency of the observed variables of the model, τ representing the income tax rate and is calibrated to 16%, α represents the average degree of openness of the economy (the average weight of imports in GDP) being calibrated at 0.38 , η represents the elasticity of substitution between the external and internal consumption and is calibrated at 1, and the average weight of the consumption in GDP, at the steady-state point, θ, is calibrated to 0.7 (as described in the table 1 below).

Moreover, in order to establish the a-priori distributions, I took into consideration the nature of the series, establishing invers gamma distributions with two degrees of freedom for the standard deviations of the estimated exogenous shocks, normal distributions for the parameters with the average 0 and beta distributions for the parameters in the range (0,1), as described in figure 1 below.

Regarding the establishment of the a-priori distributions (as illustrated in figures 1, 2 and 3 below), I assumed that the standard deviations of the structural shocks have inverse gamma distributions (given the sign restriction), while parameters with compact support are assumed to follow beta distributions and the remaining parameters follow normal and gamma distributions.

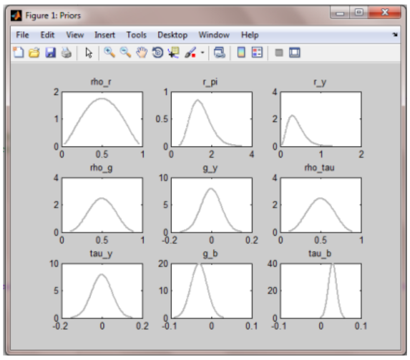

Figure 1. A-priori distributions

Source: Econometric application Matlab

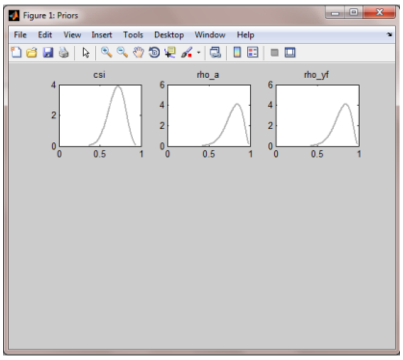

Figure 2. A-priori distributions

Source: Econometric application Matlab

Figure 3. A-priori distributions

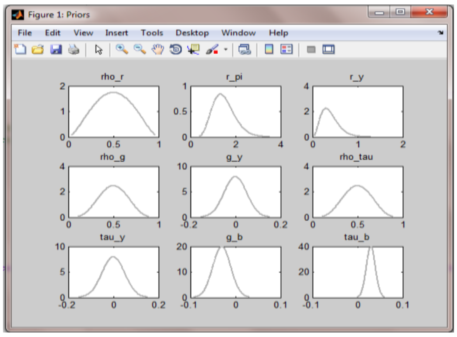

Table 1. Fixed parameters through calibration

Parameter	**Value**
β	0.998
τ	16%
α	0.38
η	1
θ	0.7

Source: Econometric application Matlab

3.3. Parameters Estimation

In addition to the a-priori distribution, it is important also the estimation of the parameters' a-posteri distribution and of the standard deviation of the shocks, with or without optimization, using the Metropolis-Hastings algorithm (see table 2 and table 3 below).

The results obtained using Dynare tool, in Matlab program, are structured in two sets of results regarding the estimation of the parameters.

As a result, the first set of results contains the a-posteriori values obtained through the maximization of the logarithm of the a-posteriori distributions based on the most frequent values of the parameters (mode) and the standard errors approximated based on Hessian matrix. The second set of information includes the results of the a-posteriori distribution of the parameters, obtained through the Metropolis- Hastings algorithm, for a number of 350,000 iterations. Bsed on this information, taking into account the value associated to the test t-statistic I could verify that the parameters are significantly different from zero.

Table 2. Estimated parameters

prior	**mean**	**mode**	**s.d.**	**prior**	**pstdev**
θ	0.5	0.2004	0.0518	beta	0.1
φ	2	2.6688	0.3905	norm	0.5
σ	3	1.3113	0.0137	norm	0.75
ρ_r	0.5	0.613	0.0716	beta	0.2
r_π	1.5	2.2553	0.1766	gamm	0.5
r_y	0.4	0.2348	0.064	gamm	0.2
ρ_g	0.5	0.8938	0.0431	beta	0.15
g_y	0	0.0444	0.0483	norm	0.05
ρ_τ	0.5	0.967	0.0087	beta	0.15
τ_y	0	0.0322	0.0491	norm	0.05
g_b	-0.03	0.0085	0.0025	norm	0.02
τ_b	0.03	0.0238	0.01	norm	0.01
ξ	0.7	0.2604	0.0636	beta	0.1
ρ_a	0.8	0.9757	0.0139	beta	0.1
ρ_{yf}	0.8	0.9974	0	beta	0.1

Source: Econometric application Matlab

Table 3. Standard deviation of shocks

Param.	**Medie**	**Mode**	**Std. dev.**	**Distrib. a-priori**	**Pstdev**
ε_a	1	0.1224	0.0114	Invg	4
ε_{pi}	0.6	0.1349	0.022	Invg	4
ε_{yf}	5	4.5421	0.7439	Invg	4
ε_r	0.4	0.0714	0.0105	Invg	4
ε_g	2	0.2579	0	Invg	4
ε_τ	1	0.1422	0.0134	Invg	4

Source: Econometric application Matlab

3.4. Data Set

Once the macroeconomic observed variables that will be used for the estimation of the model and the time period of analysis are established, it is necessary the seasonal adjustment of the variables and the test of stationarity, using the Philips-Perron (PP) or Augmented Dickey Fuller (ADF) test.

Once the observed variables are seasonally adjusted and tested for stationarity in Eviews, these are imported in Matlab for a further processing using Dynare 4.4.0 tool.

For the set of observed variables, the output of Dynare used for the analysis consists of the following:

- A-priori distributions graphs analysis;
- The results of a-posteriori optimization (including the maximum likelihood function);
- The graphs of the shocks, of the historical variables and of the observation errors;
- The impulse response functions of the shocks;
- Historical variance decomposition;
- The MCMC convergence graphs (Markov Chain Monte Carlo);
- Results of studying the stability of the system (Blanchard-Kahn conditions).

The observed variables used in the model are represented by the following 5 series of macroeconomic indicators: GDP, GDP deflator, the nominal interest rate, the weight of the governmental expenses in PIB and the weight of the public debt in GDP, with a quarterly frequence.

As a result, the data set will be collected from Eurostat Database and European Central Bank (ECB), National Bank of Romania (NBR) for the period: 2000 first quarter 1 – 2014 quarter 4.

The GDP data was collected from Eurostat database, being expressed in RON millions and seasonally adjusted.

The GDP data was deflated with the GDP deflator, in order to obtain the real variable and is expressed in percentage variation of the GDP, compared with the previous quarter, in order to obtain an evidence of the real evolution rates (more precisely, it is expressed as a difference of the natural logarithm of GDP at the moment t, compared with the previous period, t-1).

In case of GDP deflator, the index is computed based on the percentage evolution, compared with the previous period (GDP in current prices).

In terms of monetary policy, given the high volatility of the Overnight interest rate (ON), I have used the quarterly interest rates computed based on the daily ROBOR 3M interest rate for the period 2000q1- 2014 q4. So, I have computed an average interest rate for the 60 periods (quarters) from the period 2000 quarter 1 – 2014 quarter 4.

The series of governmental expense expressed as weight in GDP and, respectively, public debt expressed as weight in GDP are collected from the Eurostat site (**gov_q_ggnfa** and **gov_q_ggdebt** -ESA 95 for the period before 2014 and **gov_10q_ggnfa**, **gov_10q_ggdebt**-ESA 2010 for data in the period 2014q1 -2014 q4).

The data series used in Dynare tool for these observed variables are represented by the natural logarithm of the weights in GDP, seasonally adjusted.

The seasonally adjusted and tested for stationarity series are imported in Matlab, for further processing using Dynare 4.4.0 tool.

3.5. Results

As a summary of the model, it is formed by the following: 8 variables (out of which 8 state variables and 0 static variables), 6 stochastic shocks, and 3 forward looking variables (jumpers).

From the analysis of the shocks and endogenous variables results that shocks realizations are around the value of 0 (being considered “white noises”).

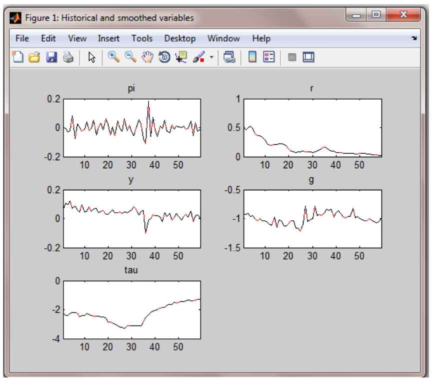

Figure 4. Smoothed variables

Source: Econometric application Matlab

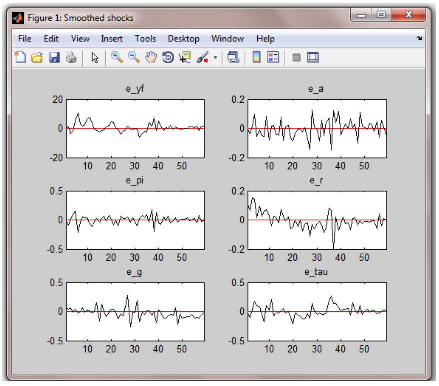

Figure 5. Smoothed shocks

Source: Econometric application Matlab

The Analysis of the Impulse Response Functions

The figures below illustrate the results of the impulse response functions analysis of the 5 observed variables and of the un-observed variable public debts, for a confidence range of 90%.

As results from the figure 6, the shock of the world output (that can be a shock of shock of preferences or a demand shock) leads to the decrease of GDP and of the nominal interest rate, compared with the steady-state point. The decrease of the nominal interest rate leads to the decrease of of the public debt and, as a result, the fiscal authority increases the governmental expenses and reduces taxes. As a result, the inflation rate decreases and the Central Bank will maintain the interest rate to a decreased level, in order to diminish the deflationary pressure.

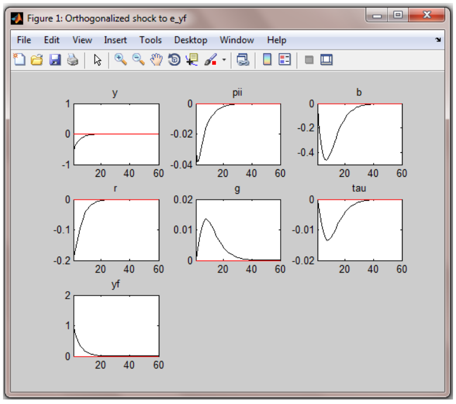

Figure 6. Impulse response function- ε_{yf}

Source: Econometric application Matlab

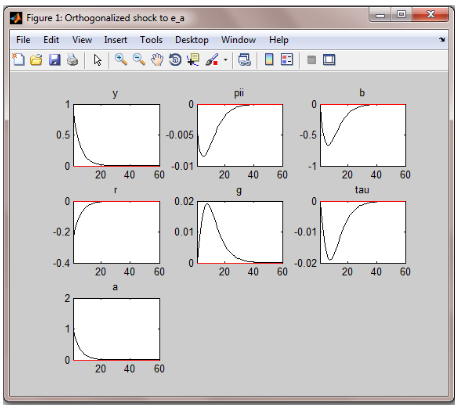

Figure 7. Impulse response function- ε_{a}

Source: Econometric application Matlab

As results from the figure 8, at a prices shock, the nominal interest rate increases for the stabilization of the inflation. Even though the nominal interest rate increases, the public debt decreases as a result of inflation effect. In order to bring the GDP and public debt back to the steady-state level, the government implements an expansionist fiscal policy, through the decrease of the tax level and the increase of governmental expenses.

A positive shock of the nominal interest rate leads to the decrease of inflation and GDP (figure 9). The high level of interest rate leads also to the increase of public debt. As a result, for the stabilization of the debt, the fiscal authority intervenes through the decrease of governmental expense and the increase of taxes. The decrease of governmental expenses and the increase of taxes will lead also to the stabilization of inflation.

As a result, a tightening monetary policy is followed by a tightening fiscal policy, on the basis of the decrease of the governmental expenses and the increase of the tax level.

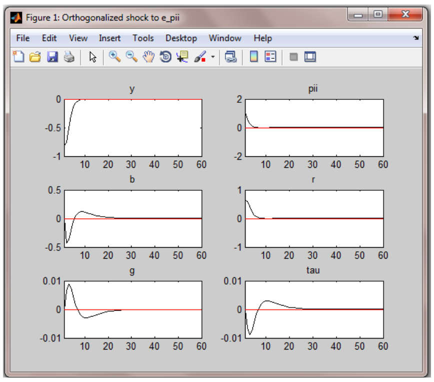

Figure 8. Impulse response function- ε_{pi}

Source: Econometric application Matlab

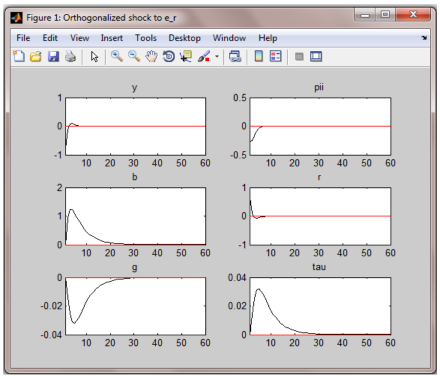

Figure 9. Impulse response function- ε_{r}

Source: Econometric application Matlab

A positive shock of the governmental expenses (figure 10) leads to the increase of GDP and of the inflation rate. As a result, the Central Bank, as the authority responsible with the monetary policy, will take the decision to increase the interest rate. The increase of governmental expenses, followed by the increase of the nominal interest rate will lead to the increase of the public debt. In order to achieve the stabilization of the public debt, the fiscal authorities decide the increase of taxes. As a result, an expansionist fiscal policy through the increase of governmental expenses is followed by a tightening monetary policy and subsequently, by a tightening fiscal policy, through the increase of taxes.

A shock of taxes (as illustrated by figure 11) leads to the increase of the marginal cost and, as a result, an increase of the inflation rate. As a result of the increasing inflation, the nominal interest rate increases too, at the incentive of the Central Bank. To conclude, the increase of taxes and inflation rate leads to the decrease of the public debt, having a stronger effect than the increase of the interest rate. As a result, a tightening fiscal policy through the increase of taxes leads to the adoption by the Central Bank of a tightening monetary policy (the increase of the nominal interest rate).

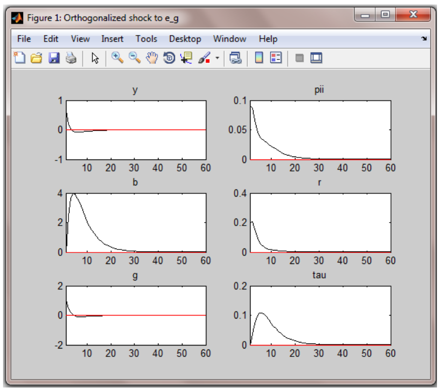

Figure 10. Impulse response function- ε_g

Source: Econometric application Matlab

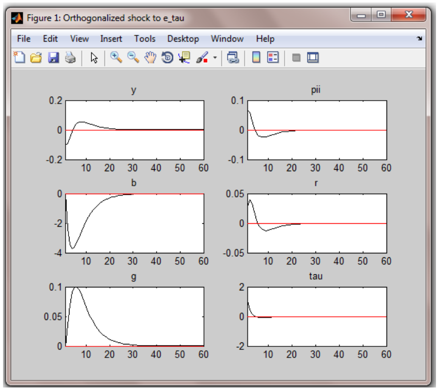

Figure 11. Impulse response function- ε_τ

Source: Econometric application Matlab

Variance Decomposition

As results from the historical variance decomposition graph (figure 12), the stochastic behaviour that influences the variation of GDP from the steady state is determined in the highest proportion by the technologic factor shock, by the initial values of the observed variables, by the governmental expenses shock, followed by the tax shock, world output shock, prices shock and interest rate shock.

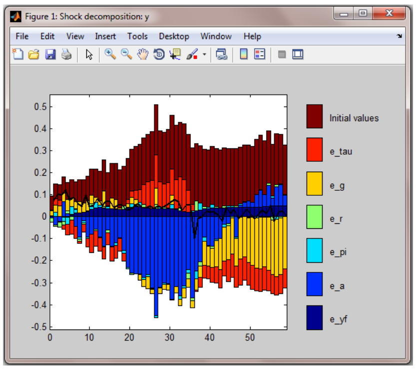

Figure 12. Variance decomposition

Source: Econometric application Matlab

Stability of the System

In terms of system's stability, the system is stable according with the analysis of the eigenvalues of the system. In order to meet the Blanchard-Kahn condition, there must be as many roots larger than one in modulus (the number of non-predetermined variables) as there are forward-looking variables in the model.

According with the output of Dynare tool, from Matlab, in the model there are 3 eigenvalue(s) larger than 1 in modulus for 3 forward-looking variable(s), the rank condition being verified, which means that the Blanchard-Kahn condition is met.

4. Conclusions

To conclude, based on the analysis of the results obtained I have studied the interactions of the fiscal and monetary policy and their role in the stabilization of the economy, putting accent on the analysis of the fiscal policy tools (such as: governmental expenses, income tax rate) and also monetary policy instruments (monetary policy interest rate, characterized through a Taylor rule, based on inflation and output gap target).

The Central Bank modifies the interest rate as a response to the deviation of inflation rate and output from their steady-state point and, respectively, from the natural level of output, taking into consideration also the historical values of the nominal interest rate.

Concomitantly, the fiscal policy initiated by the fiscal authority has two objectives: output and public debt stabilization.

The interdependent analysis of the fiscal and monetary policy is even more important, as a higher level of the public debt is of the nature to block the Central Bank to hold an independent monetary policy, given the fact that an increase of the interest rate would lead to the increase of the public debt.

The current research represents a stage in the analysis of the optimal monetary and fiscal policy mix, for the economy of Romania, given the importance granted by Central Bank to price stability as a target of the optimal monetary policy, target that can only be analyzed as a part of the interactions between the different macroeconomic policies.

To conclude, as a result, an expansionist fiscal policy through the increase of governmental expenses leads to a tightening monetary policy, through the increase of the interest rate and subsequently, to a tightening fiscal policy, through the increase of taxes. A tightening fiscal policy through the increase of taxes leads to the adoption by the Central Bank of a tightening monetary policy (through the increase of the nominal interest rate). Moreover, a tightening monetary policy (through the increase of nominal interest rate) leads to a tightening fiscal policy, on the basis of the decrease of the governmental expenses and the increase of the tax level.

In terms of variance decomposition, the stochastic behaviour that influences the variation of GDP from the steady state is determined in the highest proportion by the technologic factor shock, by the initial values of the observed variables, by the governmental expenses shock, followed by the tax shock, world output shock, prices shock and interest rate shock. As a further direction for future analysis, I proposed to analyze how the model proposed by the authors Zoltan M. Jakab and Balazs Vilagi (2009) in the article *An estimated DSGE model of the Hungarian economy* responses to the need of Romania's economy, as this is an open-economy extension of the DSGE model presented in Smets & Wouters (2003).

In addition to the model proposed by Smets & Wouters (2003) in terms of openness of the economy, the model assumes that beyond labor and capital an additional imported input is needed for domestic production. On the other hand, another assumption is that part of domestic production is exported. A further complication in this model, missing from that of Smets & Wouters (2003), is the presence of non-Ricardian rule-of-thumb consumers, as in Galí et al. (2007), in order to replicate the empirical co-movement of private and government consumption. Moreover, according with the model there are two types of rule-of-thumb consumers: those who spend her entire labor income for consumption and the second type of rule-of-thumb consumers, pensioners, whose income is independent of labor-hour movements, which decreases consumption volatility. Another interesting subject seems to me the study of macro-prudential policy, as proposed by Dominic Quint and Pau Rabanal (2013), in the article *Monetary and Macroprudential Policy in an Estimated DSGE Model of the Euro Area*, taking into account role of macro-prudential policies included in several studies of the Bank for International Settlements.

The authors proposed the analysis of the optimal mix of monetary and macro-prudential policies in an estimated two-country model of the euro area. They have also have also suggested that the use of macroprudential tools could improve welfare by providing instruments that target large fluctuations in credit markets. The model includes real, nominal and financial frictions, so, both monetary and macro-prudential policy can play a role. The authors have found that the introduction of the macro-prudential rule would help in reducing macroeconomic volatility, improve welfare, and partially substitute for the lack of national monetary policies. The model includes: two countries (a core and a periphery) which share the same currency and monetary policy, two sectors (non-durables and durables, which can be thought of as housing) and two types of agents (savers and borrowers) such that there is a credit market in each country and across countries in the monetary union. The model also includes a financial accelerator mechanism on the household side, such that changes in the balance sheet of borrowers due to house price fluctuations affect the spread between lending and deposit rates. In addition, risk shocks in the housing sector affect conditions in the credit markets and in the broader macro-economy.

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