The Implications for Fiscal Policy Considering Rule-of-Thumb Consumers in the New Keynesian Model for Romania

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Abstract	*In this paper it was analyzed the effects of fiscal spending shocks on the Romanian economy. The study of the literature has suggested that the standard real business cycle and New Keynesian models have difficulties in predicting the effects of fiscal policy on the economy, particularly in predicting the response of private consumption. One possible reason of this problem is that they ignore the fact that a significant fraction of households does not behave in a forward-looking manner. In this respect we use a New Keynesian model, where rule-of-thumb households, which consume their current income, coexist with the standard optimizing households. The main conclusion is that the response of Ricardian households, due to a negative wealth effect of governmental consumption, which is caused by a higher tax burden in the future, these households, decreases their consumption and increases their labour supply.*
Key words	Fiscal policy, fiscal multipliers, rule-of thumb consumers

1. Introduction

In this paper it was analyzed the effects of fiscal spending shocks on the Romanian economy. The study of the literature has suggested that the standard real business cycle and New Keynesian models have difficulties in predicting the effects of fiscal policy on the economy, particularly in predicting the response of private consumption. One possible reason of this problem is that they ignore the fact that a significant fraction of households does not behave in a forward-looking manner. In this respect we use a New Keynesian model, where rule-of-thumb households, which consume their current income, coexist with the standard optimizing households.

In the literature of the fiscal policy effects during the time the rule-of-thumb households have been included into models. Galí et al. (2007) extend their model in (Galí et al., 2004) by an introduction of simple fiscal policy rules (the former model focused on implications of the presence of non-Ricardian households on the monetary policy). Lump sum taxes are attached on both types of consumers, so the non-Ricardian households consume their after-tax income, while optimizing households smooth their consumption in the way predicted by other macroeconomic models. The modification of the level of taxes from its steady state responds to the deviation of the debt and government consumption from their steady state levels. The level of government expenditures is determined by a highly persistent exogenous shock. This model will be described in detail in the theoretical part. The existence of rule-of-thumb households leads a higher sensitivity to current income, which offsets negative wealth effect and the decrease of consumption of optimizing households after a government spending shock. Therefore, the model can be seen as a synthesis of the Keynesian approach (predicting the sensitivity of consumption to disposable income) and the real business cycle approach (the forward-looking behaviour of the other part of households).

A similar approach to model the effects of fiscal policies was considered by Coenen and Straub (2004). They developed the DSGE model by Smets and Wouters (2002), which provides acceptable results except for

the dedine in consumption following a government spending shock, which is not observed in reality. The authors incorporate three features into the model - fiscal policy rule of the government, distortionary and lump sum taxes and finally non-Ricardian households. Parameters of the model are estimated using Bayesian inference and the results are not as higher as the results in the model by Galí et al. (2007). Although, consumption is higher on the impact after a fiscal shock, compared to the baseline model with no rule of thumb households but the response of consumption is still negative. One explanation for this might be a low share of non-Ricardian households, as the authors claim. The second reason is a high persistence of government spending shock, which causes a negative wealth effect. Due to the persistence of a shock, the households expect a larger rise of taxes in the future and thus they save more instead of consuming.

2. Theoretical background

The households are assumed to be of two types, one type, Ricardian or intertemporally optimizing households, are maximizing its lifetime utility subject to an intertemporal budget constraint. These households have an unlimited access to capital markets, so they can save funds or borrow without any limits. The second type, rule-of-thumb households, cannot access capital markets and they consume their entire current labour. It is assumed that a proportion of λ of households belong to the second group, while the rest of households belong to the Ricardian group. Consumption in period t by Ricardian households and the labour supply will be defined as C_t^0 respectively N_t^0.

The dynamic programming problem is given by the following three expressions:

$$\max_{\{c_t^0 N_t^0\}_{t=0}^{\infty}} E_0 \sum_{t=0}^{\infty} \beta^t U(C_t^0 N_t^0), \quad s.t \tag{1}$$

$$P_t(C_t^0 + I_t^0) + R_t^{-1} B_{t+1}^0 = W_t N_t^0 + R_t^k K_t^0 + B_t^0 + D_t^0 - P_t T_t \tag{2}$$

$$K_{t+1}^0 = (1 - \delta)K_t^0 + \phi\left(\frac{I_t^0}{K_t^0}\right)K_t^0 \tag{3}$$

The second equation is the budget constraint:
- P_t is the price level
- W_t is the nominal wage
- R_t^k is the nominal rental costs of capital
- B_t^0 amount of bonds with face value equal to one unit of consumption good in period t purchased in period t-1
- B_{t+1}^0 represents bonds with maturity in period t+1
- R_t is the gross nominal return on bonds purchased in period t
- D_t^0 are the dividends to the company owners
- T_t denotes the taxes in real terms
- C_t^0 is the consumption in real terms
- I_t^0 are the investments in real terms

The last equation is the law motion of capital where the adjustment of the capital level is captured by the term $\phi\left(\frac{I_t^0}{K_t^0}\right)K_t^0$. The function $\phi(\cdot)$ is assumed to be increasing and concave. The instantaneous utility function is of the form:

$$U(C_t^0, N_t^0) \equiv \log C_t^0 - \frac{(N_t^0)^{1+\varphi}}{1+\varphi}, \varphi \geq 0 \tag{4}$$

where φ is the inverse Frisch labour supply elasticity.

In order to obtain the first order conditions we use the Bellman equation approach. Rewriting the capital motion law and extracting the amount of investment we obtain:

$$I_t^0 = \phi^{-1}\left(\frac{K_{t+1}^0 - (1-\delta)K_t^0}{K_t^0}\right)K_t^0 \tag{5}$$

The Bellman equation associated is defined:

$$V(K_t^0 B_t^0) = \max_{K_{t+1}^0, N_t^0 B_{t+1}^0} \{U(C_t^0 N_t^0) + \beta E_t V(K_{t+1}^0, B_{t+1}^0)\} \tag{6}$$

Where the investment is written as in [5] and consumption is written as:

$$C_t^0 = \frac{W_t}{P_t}N_t^0 + \frac{R_t}{P_t}K_t^0 + \frac{B_t^0}{P_t} + \frac{D_t^0}{P_t} - T_t^0 - I_t^0 - \frac{R_t^{-1}}{P_t}B_{t+1}^0 \tag{7}$$

The following three equations are derived from the first order conditions:

$$P_t Q_t = E_t\left\{\Lambda_{t,t+1}\left[R_{t+1}^k + P_{t+1}Q_{t+1}\left((1-\delta) + \phi_{t+1} - \left(\frac{I_{t+1}^0}{K_{t+1}^0}\right)\phi'_{t+1}\right)\right]\right\} \tag{8}$$

$$\frac{W_t}{P_t} = N_t^\varphi C_t \tag{9}$$

$$1 = R_t E_t\{\Lambda_{t,t+1}\} \tag{10}$$

Q_t represents Tobin's Q as the real shadow value of capital and $\Lambda_{t,t+1}$ is one period discount factor that has the following form:

$$\Lambda_{t,t+k} \equiv \beta^k\left(\frac{C_{t+k}^0}{C_t^0}\right)\left(\frac{P_t}{P_{t+k}}\right) \tag{11}$$

In this model, it is assumed that only firms determine the amount of working hours at a given wage. Another assumption it that wage is higher than the households' marginal rate of substitution between hours and consumption, so the households work the amount of hours demanded by the firms.

Regarding the rule-of thumb households, the assumption is that they to no take part in any market activities. Their utility function is subject to :

$$P_t C_t^r = W_t N_t^r - P_t T_t \tag{12}$$

And since they don't optimize, they consume their entire income:

$$C_t^r = \frac{W_t}{P_t}N_t^r - T_t \tag{13}$$

The final goods sector is characterized by perfect competition and constant returns to scale. These consumption goods are sold by one representative firm at a price equal to the marginal costs. Using intermediary goods by a CES technology the form maximizes its profits:

$$\max_{X_t(j)} P_t\left[\int_0^1 X_t(j)^{\frac{\epsilon-1}{\epsilon}}dj\right]^{\frac{\epsilon-1}{\epsilon}} - \int_0^1 P_t(j)X_t(j)dj \tag{14}$$

- $X_t(j)$ is the amount of j-th intermediate good
- $P_t(j)$ is the price of j-th intermediate good
- P_t is the final good's price
- ϵ is the elasticity of substitution parameter

The demand is given by:

$$X_t(j) = \left[\frac{P_t(j)}{P_t}\right]^{-\epsilon} \tag{15}$$

One of the hypotheses, that unit cost equals unit price, $P_t = \int_0^1 P_t(j)X_t(j)dj$ leads to the final good price expression in terms of intermediate goods:

$$P_t = \left[\int_0^1 P_t(j)^{1-\epsilon}dj\right]^{\frac{1}{1-\epsilon}} \tag{16}$$

The objective is to minimize the real costs of producing the quantity demanded by final good sector. Using a Cobb-Douglass production technology:

$$Y_t(j) = K_t(j)^\alpha N_t(j)^{(1-\alpha)} \tag{17}$$

The associated Lagrangian is:

$$L = -\frac{W_t}{P_t}N_t - \frac{R_t^k}{P_t}K_t + \lambda(K^\alpha N^{1-\alpha} - Y_t(j)) \tag{18}$$

Where $Y_t(j) = X_t(j)$

From the first order conditions the optimal capital/labour ration is calculated:

$$\frac{K_t}{N_t} = \frac{\alpha}{1-\alpha_t}\frac{P_t}{R_t^k} \tag{19}$$

$$N_t = \left(\frac{\alpha}{1-\alpha}\right)^{-\alpha}\left(\frac{W_t}{R_t^k}\right)^{-\alpha} Y_t \tag{20}$$

$$K_t = \left(\frac{\alpha}{1-\alpha}\right)^{-\alpha}\left(\frac{W_t}{R_t^k}\right)^{-\alpha} Y_t \tag{21}$$

And the real marginal cost is:

$$MC_t = \left(\frac{W_t}{P_t}\right)^{1-\alpha}\left(\frac{R_t}{P_t}\right)^{-\alpha}\frac{1}{\Phi} \tag{22}$$

Where $\Phi = \alpha^\alpha(1-\alpha)^{1-\alpha}$

The firms cannot change their prices optimally in every period, only a fraction of the firms reset their price every period. This proportion is set in a way proposed by Calvo (1983) and is 1-θ . Once they change their prices the new optimal price level is $P_t^\bullet$, the price level in period t, given by Eq. [16] is:

$$P_t = [\theta P_{t-1}^{1-\epsilon} + (1-\theta)(P_t^\bullet)^{1-\epsilon}]^{\frac{1}{1-\epsilon}} \tag{23}$$

The optimal price set by firms in period t is obtained from the following program:

$$\max_{P_t^\bullet} \sum_{k=0}^{\infty} E_t\{\Lambda_{t,t+k}Y_{t+k}(j)(P_t^\bullet - P_{t+k}MC_{t+k})\} \tag{24}$$

subject to $\quad Y_{t+k}(j) = X_{t+k}(j) = \left[\frac{P_t^\bullet}{P_{t+k}}\right]^{-\epsilon} Y_{t+k}$

The firms maximize their expected discounted profit having two channels of uncertainty. The first channel of optimizing their prices in the period *t+k* and second channel given by wages and return on capital in *t+k.* The first order condition associated is:

$$\sum_{k=0}^{\infty} \theta^k E_t\left\{\Lambda_{t,t+k}Y_{t+k}(j)\left(P_t^\bullet - \frac{\epsilon}{\epsilon-1}P_{t+k}MC_{t+k}\right)\right\} = 0 \tag{25}$$

The model doesn't explicitly takes into account the labour sector, the wage is given by[1]:

$$\frac{W_t}{P_t} = H(C_t, N_t) \tag{26}$$

Firms decide how much labour to hire given the prevailing wage, assumed to be higher than the one demanded by households given the amount of labour, $H(C_t, N_t) > C_t^j N_t^\varphi$, j=r,o. Another assumption is that firms don't discriminate between the types of households, therefore $N_t^r = N_t^o$

The government expenditures are composed from repayment of one year bonds and actual government consumption. The revenues are given from lump-sum taxes and the face value of bonds that mature in the next period. The government budget constraint is given by:

$$P_t T_t + R_t^{-1} B_{t+1} = B_t + P_t G_t \tag{27}$$

In order to determine the deviation of government debt and expenditures from steady state we use a fiscal policy rule of the form:

$$t_t = \phi_b b_t + \phi_g g_t \tag{28}$$

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[1] Both derivates in C and N are positive.

Where $g_t = \frac{G_t - G}{Y}, t_t = \frac{T_t - T}{Y}, b_t = \frac{\frac{B_t}{P_{t-1}} - \frac{B}{P}}{Y}$ are deviations from the steady state of government expenditure, taxes and real bond holdings. At steady state a balanced budget and zero level of debt are assumed. The government consumption follows an AR (1) process:

$$g_t = \rho_g g_{t-1} + \epsilon_t \tag{29}$$

Where $0 < \rho_g < 1$ and ϵ_t is a white noise process.

In this model we assume a simple version of the Taylor rule (Taylor (1993)):

$$r_t = r + \phi_\pi \pi_t \tag{30}$$

Where r_t is the nominal interest rate, r is the steady state interest rate and ϕ_π is the parameters of the response of interest rate to inflation. This simplified version of Taylor rule seeks to stabilize the price level only.

At equilibrium, households, intermediate and final-goods firms, the government and the monetary authority maximize their optimization problems in each time period t.

In terms of aggregation, the consumption $C_t \equiv \lambda C_t^r + (1 - \lambda) C_t^o$ is sum of optimizing and non-optimizing households. Investments and capital is subject only to optimizing households therefore the aggregate consumption is $I_t \equiv (1 - \lambda) I_t^o$ respectively the aggregate capital $K_t \equiv (1 - \lambda) K_t^o$.

Both types of households supply the same amount of labour. Total labour and capital supplied by households equal the total labour and capital demanded by intermediate good sector, $N_t = \int_0^1 N_t(j) dj$ respectively $K_t = \int_0^1 K_t(j) dj$. Demand for each good j is equal to supply of good j in each period of t, $Y_t(j) = X_t(j), \forall j$. The total gross domestic product consists in consumption, investments and government expenditures.

3. Empirical results

Based on the evidence highlighted in the literature review, it is underlined that liquidity constraints play a very important role when one studies the properties of consumption and the effects of fiscal policy. Thus, we should not disregard the fact that liquidity constraints bind the behaviour of households, which departs significantly from the one that would arise when the households had an unlimited access to credit markets. This paper presents a model in which we will capture how the predictions of the New Keynesian framework change under the presence of liquidity constrained households. In this paper we analyzed the effects of fiscal spending shocks on the Romanian economy.

The study of the literature has suggested that the standard real business cycle and New Keynesian models have difficulties in predicting the effects of fiscal policy on the economy, particularly in predicting the response of private consumption. One possible reason of this problem is that they ignore the fact that a significant fraction of households does not behave in a forward-looking manner. In this respect we use a New Keynesian model, where rule-of-thumb households, which consume their current income, coexist with the standard optimizing households. We will follow closely the model proposed by Galí et al. (2007), which shows the impacts of fiscal spending shocks in the presence of non-Ricardian households. The calibration, model predictions and sensitivity analyses with respect to several parameters are presented for the Romanian economy.

The discount factor of is set at 0.99. Reviewing the work from Galatescu et al. (2007) I set the value for annual depreciation rate at 5% and the share of capital in production function at 0.33. This leads to an annual percent of real interest rate of 6%. The elasticity of substitution of goods resulted to be 2.94 for Romanian data which implies a value of the markup of 1.51, higher than the one found in Jakab and Vilagi (2008) (assume a 1.2 markup in goods market). Further the labor supply elasticity is found to be 1 matching the value used in Jakab and Vilagi (2008) and Gerali et al (2010).

Table 1.

Parameter	Description of the parameter	Value
β	Discount factor	0.99
ϵ	Elasticity of substitution among intermediate goods	2.94
δ	Depreciation rate	0.0123
η	Elasticity of investment	2
α	Capital share on output	0.33
ψ	Wage elasticity	1
λ	Proportion of rule of thumb consumers	[0-0.6]
θ	Price stickiness in a Calvo framework	0.7
ϕ_π	Response of monetary authority to inflation	1.5
ϕ_a	Response of taxes to expenditures	0.123
ϕ_b	Response of taxes to debt	0.292
ρ_a	Autoregressive parameter in government spending shock	0.9

The responses of consumption to a 5% shock to governmental expenditures are presented in the figure below, for different values of lambda, the proportion of rule of thumb consumers.
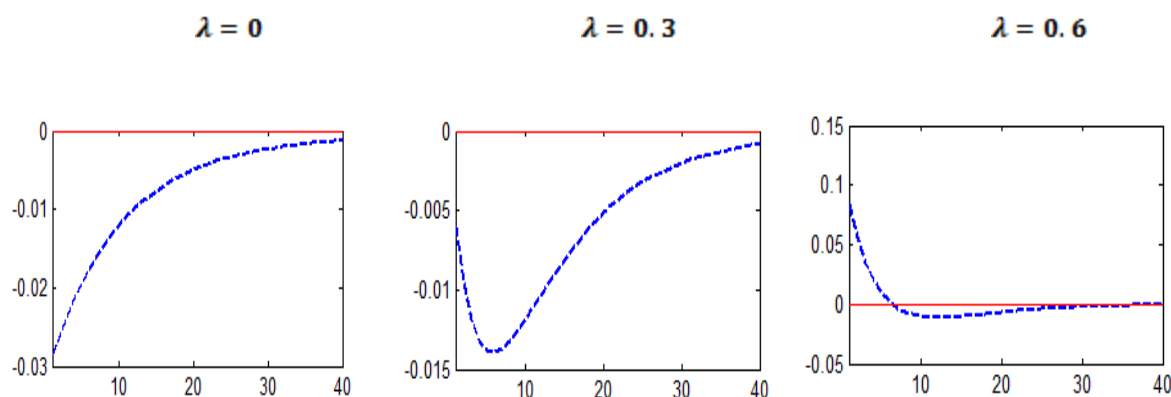

Figure 1. The response of consumption on different values of lambda

The response of Ricardian households when $\lambda =$, due to a negative wealth effect of governmental consumption, which is caused by a higher tax burden in the future, these households cut back on their consumption with almost 3%. When the proportion of rule of thumb consumers increases, the negative response is diminished almost on half reaching to be positive while the value of lambda is higher than 0.5.

In order to assess the importance of the fiscal rule parameters in regard with the consumption behaviour we calculate the responses for a second fiscal rule. The parameters were set half of the initial once.
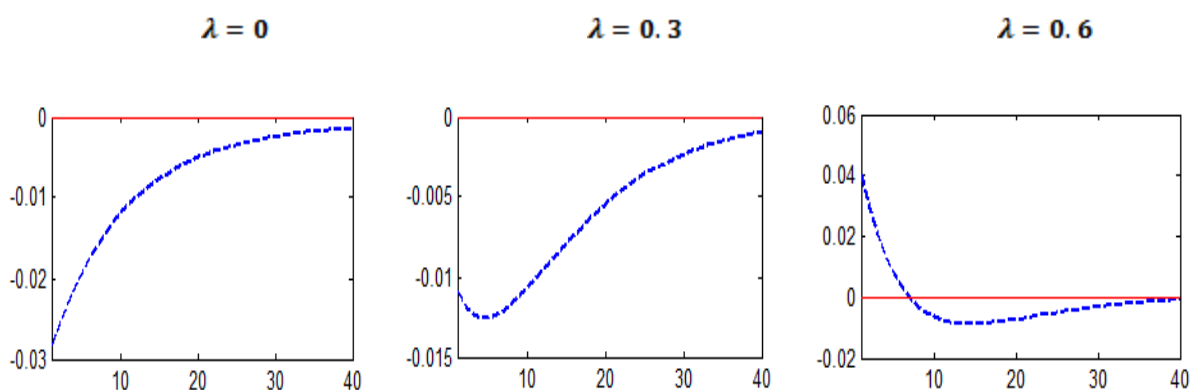

Figure 2. The response of consumption on different values of lambda for the Fiscal Rule 2

The response of Ricardian households, due to a negative wealth effect of governmental consumption, which is caused by a higher tax burden in the future, these households cut back on their consumption and increase their labour supply as it was observed in the first Figure. The extent of the wealth effect depends on the fiscal rule, i.e. how the tax profile changes over time. Because the value of both parameters is higher under Fiscal rule 1, the debt of the government is repaid faster and consumption reverts back faster as well under this rule.

4. Conclusions

In this paper it was analyzed the effects of fiscal spending shocks on the Romanian economy. The study of the literature has suggested that the standard real business cycle and New Keynesian models have difficulties in predicting the effects of fiscal policy on the economy, particularly in predicting the response of private consumption. One possible reason of this problem is that they ignore the fact that a significant fraction of households does not behave in a forward-looking manner. In this respect we use a New Keynesian model, where rule-of-thumb households, which consume their current income, coexist with the standard optimizing households.

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References

1. Flavin, M. (1981). The adjustment of consumption to changing expectations about future income. The Journal of Political Economy, 89(5):974–1009.

2. Friedman, M. (1957). A theory of the consumption function. National Bureau of Economic Research, Inc.

3. Furceri, D. and Mourougane, A. (2010). The Effects of Fiscal Policy on Output and Debt Sustainability in the Euro Area: A DSGE Analysis. OECD Working Paper (forthcoming).

4. Galí, J., López-Salido, J., and Vallés, J. (2004). Rule-of-Thumb Consumers and the Design of Interest Rate Rules. Journal of Money, Credit & Banking, 36(4):739–764.

5. Galí, J., López-Salido, J., and Vallés, J. (2007). Understanding the effects of government spending on consumption. Journal of the European Economic Association, 5(1):227–270.

6. Hájková, D. and Hurník, J. (2007). Cobb-Douglas Production Function: The Case of a Converging Economy. Czech Journal of Economics and Finance (Finance a uver), 57(9-10):465–476.

7. Hall, R. (1978). Stochastic implications of the life cycle-permanent income hypothesis: Theory and evidence. The Journal of Political Economy, 86(6):971–987