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Heterogeneity of households and the effects of fiscal policy in CEE countries

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Abstract

We analyse the effects of fiscal policy in non-EMU Central and Eastern European counties. The analysis is based on new Keynesian model, which takes into account both optimizing Ricardian households and non-Ricardian households with liquidity constraints. Results of the study indicate that the share of non-Ricardians has significant impact on fiscal multipliers. The government spending multiplier reaches 3 in the country with highest share of non-Ricardian households, whereas in the country with lowest share of non-Ricardians is lower than one. Also effects of government spending shocks on consumption are very sensitive to the share of households with liquidity constraints.

Key words: fiscal policy, government spending, new Keynesian model, heterogeneity of households, non-Ricardian households.

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Introduction

In standard new Keynesian model it is assumed that households are homogeneous and make consumption decisions based on the intertemporal optimization. This assumption means that households take into account permanent income, as indicated in seminar papers of Brumberg and Modigliani (1954) and Friedman (1957). It follows, however, from empirical studies, that the current income has a significant impact on current consumption of households. Flavin (1981) shows that impact of current income on consumption is much stronger than permanent income hypothesis predicts. Moreover, consumption depends on current income more than predicted by overlapping-generations model (see among others Hall, 1978). Campbell and Mankiw (1989) found that about half of households make decisions not based on permanent income but on rule-of-thumb rules. Also later studies show that current income has a significant impact on consumption (see for example Deaton, 1992, Johnson, Parker and Souleles, 2004).

Households that make decisions based on permanent income and behave according to the intertemporal budget constraint are called Ricardian households. Non-optimizing households, using rule-of-thumb rules based on current income are called non-Ricardians. Possible interpretations for the non-optimizing behavior of non-Ricardian households are: liquidity constraints, myopia, fear of saving or ignorance of trading opportunities (see Stiglitz and Weiss, 1981, Galí, López-Salido and Vallés, 2004, Coenen and Straub, 2005, Andersson, 2010). For example, Stiglitz and Weiss (1981) point out that liquidity constraints may happen when interest rates are lower than interest rates clearing the market. Banks set interest rates which do not clear the market because it increases the ratio of safety loans (lower interest rates make safe investment projects with lower rate of return available). Lower interest rate results in credit rationing and liquidity constraint.

The standard new Keynesian model with homogenous optimizing households predicts a negative response of consumption to government spending. However, the empirical analyses show a positive effects of government spending on consumption (see among others Fatas and Mihov, 2001, Perotti, 2002, Mountford and Uhlig, 2009). This is one of the main reasons for which Mankiw (2000) indicates that new Keynesian model should take into account heterogeneity of households - the fact that some households act in forward-looking manner whereas others follow a rule-of-thumb behavior. According to Mankiw such a heterogeneity has both micro and macroeconomic foundations. He points out that rule-of-thumb behavior is

typical for low income households, which do not save and are not able to smooth consumption (see Coenen and Straub, 2005).

First models focused on consequences of rule-of-thumb behavior for monetary policy (see Gali 2004). Coenen and Straub (2005) extended new Keynesian model with Ricardian and non-Ricardian households with fiscal policy. They conducted their analysis for euro area and extend Smest and Wouters (2003) with fiscal policy rule and heterogeneity of households. Coenen and Staub obtained small ratio of non-Ricardian households in euro area and consequently negative impact of government spending on consumption. The possible reason for low share of rule-of-thumb households in euro area is low level of financial market participation costs (see Fatas and Mihov 2001, Perotti, 2002).

The aim of this article is to estimate and compare the effects of fiscal policy in non-EMU Central and Eastern Europe countries, taking into account different shares of non-Ricardian households in these countries. As Galí, López-Salido and Vallés (2007) indicate the estimates of fiscal multipliers taking into account heterogeneity of households enable more precise assessment of effectiveness of fiscal policy. However there is a lack of similar studies for a group of CEE countries with derogation. Moreover, conclusions for euro area can't be easily adopted for CEE countries, because the share of non-Ricardian households with liquidity constrain is much higher in non-EMU CEE countries than in euro area. The credit market in analyzed countries in comparison with most countries of euro area is relatively underdeveloped, which translate into a larger share of households with no access to the credit market. Moreover, the average income in CEE countries with derogation is much lower than average income in euro area, what, as indicated by Mankiw (2000), generates a higher share of non-Ricardian households.

The analysis is based on new Kenesian DSGE model of Galí, López-Salido and Vallés (2007). We analyze the version of the model with perfectly competitive labour market. The estimates of the share of non-Ricardian households are based on Eurostat data on total population which is unable to face unexpected financial expenses.

This article is organized as follows. In the next section we present the assumptions of the new Keynesian model with heterogeneous households. Than we describe the parameters of the model which is followed by the presentation of the empirical results of the study. The concluding remarks and the scope for further research are presented in the last section.

The model

There is a continuum of household indexed by $j \in <0,1>$. We assume that are two fraction of households. One group of households (Ricardian households) have an access to capital markets and is optimizing consumption according to Ricardian equivalence. The second group of households (non-Ricardians) does not own assets. Ricardian households are able to smooth consumption. Non-Ricardian households behave according to rule-of thumb rule, that is consume their current income.

Ricardian households take into account not only the current utility, but also future discounted utility. We assume, that households with access to the credit market face the following budget constraint:

$$U^R = E_t \left(\sum_{t=0}^{\infty} \beta^t \left(\ln C_t^R - \frac{(l_t^R)^{1+\varphi}}{1+\varphi} \right) \right), \tag{1}$$

where C_t^R and l_t^R is respectively consumption and labour supply of Ricardian households, $\beta \in (0,1)$, $\varphi \geq 0$,

In case of Ricardian households the budget constraint becomes:

$$P_t (C_t^R + I_t^R) + \frac{B_{t+1}^R}{(1+r_t^n)} + P_t T_t^R = w_t P_t l_t^R + (1+r_t^k)P_t^R k_t^R + B_t^R + D_t^R, \tag{2}$$

where: I_t^R, k_t^R and B_t^R is respectively investments, capital and bonds of Ricardian households, r_t^k and r_t is respectively return on capital and bonds, D_t^R - dividends paid to firms owned by Ricardian households, T_t^R – lump sum tax paid by Ricardian households, w_t - wages, P_t - price.

Capital accumulation is described by the following equation:

$$k_{t+1}^R = (1-\delta)k_t^R + f\left(\frac{I_t^R}{k_t^R}\right)k_t^R, \tag{3}$$

where : $f' > 0$, $f'' < 0$, $f(\delta) = \delta$, $f'(\delta) = 1$.

Thus we obtain the following conditions of discounted utility maximization:

$$E_t \left(\beta \frac{C_t^R}{C_{t+1}^R} \right) = \frac{1}{1+r_t} \ , \tag{4}$$

$$E_t \left(\beta \frac{C_t^R}{C_{t+1}^R} \left(1 + r_{t+1}^k + Q_{T,t+1} \left(1 - \delta + f\left(\frac{I_{t+1}^R}{k_{t+1}^R} \right) - \frac{I_{t+1}^R}{k_{t+1}^R} f'\left(\frac{I_{t+1}^R}{k_{t+1}^R} \right) \right) \right) \right) = P_t \ Q_{T,t} \ , \tag{5}$$

where $Q_{T,t}$ is Tobin's Q ratio:

$$Q_{T,t} = \frac{1}{f'\left(\frac{I_t^R}{k_t^R} \right)} \ . \tag{6}$$

Non-Ricardian households take into account only the current period, so during each period they maximize the following utility function:

$$U^{NR} = \ln C_t^{NR} - \frac{\left(l_t^{NR} \right)^{1+\varphi}}{1+\varphi} \ , \tag{7}$$

where C_t^{NR} and l_t^{NR} is respectively consumption and labour supply of non-Ricardian households.

Non-Ricardian households do not make decisions based on intertemporal budget constraint, because of the lack of access to credit markets. In case of rule-of-thumb households the budget constraint becomes:

$$P_t \ C_t^{NR} + P_t \ T_t^{NR} = w_t \ P_t \ l_t^R \ , \tag{8}$$

where T_t^{NR} - lump sum tax paid by non-Ricardian households.

Thus in real terms we obtain:

$$C_t^{NR} = w_t \ l_t^R - T_t^{NR} \ . \tag{9}$$

We assume the competitive labour market in the model. Thus, the labour supply of both Ricardian and non-Ricardian households must satisfy:

$$w_t = C_t^R \left(l_t^R \right)^{\varphi}, \tag{10}$$

$$w_t = C_t^{NR} \left(l_t^{NR} \right)^{\varphi}, \tag{11}$$

Let's define C_t, l_t as aggregate level of consumption and labour respectively. Thus:

$$C_t = \lambda C_t^{NR} + (1-\lambda) C_t^R, \tag{12}$$

$$l_t = \lambda l_t^{NR} + (1-\lambda) l_t^R, \tag{13}$$

whereas in case of aggregate level of investments (I_t), capital (k_t) and bonds (B_t) we obtain:

$$I_t = (1-\lambda) I_t^R, \tag{14}$$

$$k_t = (1-\lambda) k_t^R, \tag{15}$$

$$B_t = (1-\lambda) B_t^R, \tag{16}$$

because only Ricardian households invest and benefit from the credit market. Therefore they have all investments, capital stock and bonds.

We assume that there is a continuum of monopolistically competitive firms, which product differentiated intermediate goods. The production function of final goods (Y_t) is given by the following formula:

$$Y_t = \left(\int_0^1 y_t(i)^{\frac{\eta-1}{\eta}} \, di \right)^{\frac{\eta}{\eta-1}}, \tag{17}$$

where $y_t(i)$ is an intermediate good i, $\eta > 0$. Thus we obtain:

$$y_t(i) = P_t \left(\frac{p_t(i)}{P_t} \right)^{-\eta}, \tag{18}$$

$$P_t = \left[\int_0^1 p_t(i)^{1-\eta} \, di \right]^{\frac{1}{1-\eta}}, \tag{19}$$

where $p_t(i)$ is price of intermediate good i.

Prices of intermediate goods are set according to Calvo (1983) schedule:

$$P_t = \left[(1-\xi_p) P_t^{*1-\eta} + \xi_p P_{t-1}^{1-\eta} \right]^{\frac{1}{1-\eta}}, \tag{20}$$

where P_t^* is price optimized at time t, $\xi_p \in (0,1)$.

The production function of intermediate good is given by Cobb-Douglass function with a constant returns technology:

$$y_t(i) = k_t(i)^{-\alpha} l_t(i)^{1-\alpha} \, , \tag{21}$$

where $k_t(i)$ and $l_t(i)$ is respectively capital and labour hired by a firm to produce intermediate good i.

In analyzed model the real marginal cost (MC_t) is given by formula:

$$MC_t = \frac{\left(r_t^k\right)^\alpha w_t^{1-\alpha}}{\alpha^\alpha (1-\alpha)^{1-\alpha}} \, . \tag{22}$$

The budget constraint of government is:

$$P_t T_t + \frac{B_{t+1}}{(1+r_t)} + = B_t + P_t G_t \tag{23}$$

where T_t and G_t is respectively aggregate level of taxes and government spending. Taxes are paid by both Ricardian and non-Ricardian households:

$$T_t = \lambda T_t^{NR} + (1-\lambda) T_t^R \, . \tag{24}$$

Government spending deviations from steady state are described by first order autoregressive process:

$$\frac{G_t - G^*}{Y^*} = \rho_{g/y} \frac{G_{t-1} - G^*}{Y^*} + \xi_t \, , \tag{25}$$

where G^* and Y^* is steady state level of government spending and GDP respectively, $\rho_{g/y} \in (0,1)$.

We assume the following fiscal policy rule:

$$T_t - T^* = \phi_{g/y}\left(G_t - G^*\right) + \phi_{B/y}\left(\frac{B_t}{P_{t-1}} - \frac{B^*}{P^*}\right), \tag{26}$$

where B^* and P^* is are steady state level of bonds and price respectively, $\phi_{g/y}, \phi_{B/y} > 0$.

Central bank sets the nominal interest rate according to the following rule:

$$r_t = r^* + \phi_\pi \pi_t \qquad , \tag{27}$$

where r^* - steady state interest rate, π_t - inflation, $\phi_\pi \geq 0$. That is, we assume Taylor (1993) rule with zero inflation target and zero coefficient on output gap (see e.g. Baranowski, 2011).

Parameters

We analyze the dynamics of the model for six non-EMU CEE countries: Bulgaria, Croatia, Czech Republic, Hungary, Poland and Romania. The parameters of the model are calibrated for quarterly data.

The approximation of the share of non-Ricardian households which face liquidity constraint is estimated as the percentage of total population unable to face unexpected financial expenses. The Eurostat data concerning liquidity constraint in analyzed non-EMU countries of CEE is shown in table 1.

Table 1. The percentage of total population which is unable to face unexpected financial expenses in 2014.

Country	Percentage of non-Ricardians
Bulgaria	49.6
Croatia	63.7
Czech Republic	40.8
Hungary	75.9
Poland	48.6
Romania	51.8

Source: Eurostat.

The share of non-Ricardian households varies significantly among CEE countries - in Hungary is almost twice higher than in Czech Republic.[3] However, in all analyzed countries share of households which face liquidity constraint is higher than average share for euro area, that is 36.0%.

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[3] The specific case of Hungarian households savings is described by Bethlendi (2009).

Elasticity of output with respect to capital is set at 0.4. We set this elasticity at higher than standard level, because parameter α in CEE countries is significantly higher than in US or Western European countries (see for example Krajewski, 2012).

Other parameters of the model are calibrated analogically as in Galí, López-Salido and Vallés (2007). The parameter $\rho_{g/y}$ describing persistency of government spending shocks is set to 0.9. The fiscal policy rule parameters $\phi_{g/y}$, $\phi_{B/y}$ are assumed to be equal to 0.1 and 0.33 respectively. The parameter in Taylor rule ϕ_{π} is set equal to 1.5. Discount factor, rate of depreciation, and elasticity of output with respect to capital are set at standard levels for quarterly data (that is 0.99 and 0.025 respectively). We assume the average price duration of one year, what gives the parameter ξ_p value of 0.75. The elasticity of investment-capital ratio with respect to Q was set equal to 1. Steady state price markup is assumed to be equal to 0.2. The elasticity of wages with respect to hours is 0.2, similarly as in Rotemberg and Woodford (1999).

Dynamics of the model

The analysis of model's dynamics was carried out on the basis of log-linearized versions of equations. The effects of government spending shock on key variables of the model in analyzed countries are shown in Appendix 1.

The government spending shock has a positive but transitionary impact on GDP in all non-EMU CEE countries. However, the fiscal multipliers vary significantly among analyzed countries. The fiscal multipliers obtained on the base on impulse-response analysis are shown in table 2.

Table 2. Government spending multipliers.

Country	Multiplier
Bulgaria	1.1
Croatia	1.7
Czech Republic	0.9
Hungary	3.0
Poland	1.1
Romania	1.2

The share of non-Ricardian households has significant impact on fiscal multipliers. On the one hand, the fiscal multiplier is lower than one in Czech Republic, where the share of non-Ricardian households is the lowest. On the other hand, the fiscal almost multiplier reaches 3 in Hungary, where the share of non-Ricardians is the highest. Thus, the share of rule-of-thumb households significantly influences the effectiveness of fiscal policy in CEE countries with derogation.

The model predicts a positive correlation between government spending and consumption of non-Ricardian households and the opposite relationship in case of Ricardian households. Thus, the direction of relationship between government spending and overall consumption depends on the share of non-Ricardians. The correlation between these variables in non-EMU CEE countries obtained on the base of the analyzed model is shown in table 3.

Table 3. Correlation between government spending and consumption.

Country	Correlation
Bulgaria	0.66
Croatia	0.92
Czech Republic	-0.24
Hungary	0.96
Poland	0.61
Romania	0.74

There is a positive correlation between government spending and consumption in almost all non-EMU CEE countries. We obtained negative relationship between analyzed variables only in Czech Republic, that is the country with the lowest share of non-Ricardians. Despite the share of households with liquidity constraints in Czech Republic and Poland does not differ significantly, the direction of fiscal policy impact on consumption is different in these countries. Thus, the obtained results indicate, that the effects of government spending shocks on consumption are very sensitive to the share of non-Ricardian households.

Conclusions

The results of new Keynesian model with heterogeneous households show that the effects of government spending in non-EMU Central and Eastern European countries depend on the share of non-optimizing households with liquidity constraints.

Firstly, the results indicate that the share of non-Ricardian households has significant impact on the effectiveness of fiscal policy. The government spending multiplier reaches 3 in country with highest share of non-Ricardians (Hungary), whereas in country with lowest share of non-Ricardians (Czech Republic) is lower than one.

Secondly, the impulse response analysis shows that dynamics of consumption are very sensitive to the share of non-Ricardian households. Even relatively small differences between countries in this respect translate into significant differences in path of consumption. As a result, in some countries (Croatia, Hungary, Romania) strong positive correlation between government spending and consumption was observed, whereas in other (Czech Republic) model predicts negative correlation between these variables.

The share of non-Ricardian households in non-EMU CEE countries is generally higher than in euro area. It means, that the fiscal multipliers in CEE countries with derogation are higher than in Eurozone. Moreover, in most analyzed countries we observe positive relationship between government spending and consumption, contrary to Coenen and Straub (2005) study for euro area.

We assume in this study, analogically as in Galí Lopez-Salido and Vales (2007), that the share of non-Ricardian households is exogenous. However, Furceri and Mourougane (2010) assume that the share of households with liquidity constraints is a function of output gap. The impact of output gap on the share of non-Ricardians is one of potential reasons of increased fiscal policy effectiveness in CEE countries during crisis, which was observed among others by Furceri and Zdzienicka (2011). The analysis of fiscal policy effects in CEE countries under the assumption of non-Ricardian households share endogenization is the scope for further research.

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Appendix 1. Impulse-response analysis – the effects of 1% of GDP government spending shock.

Bulgaria
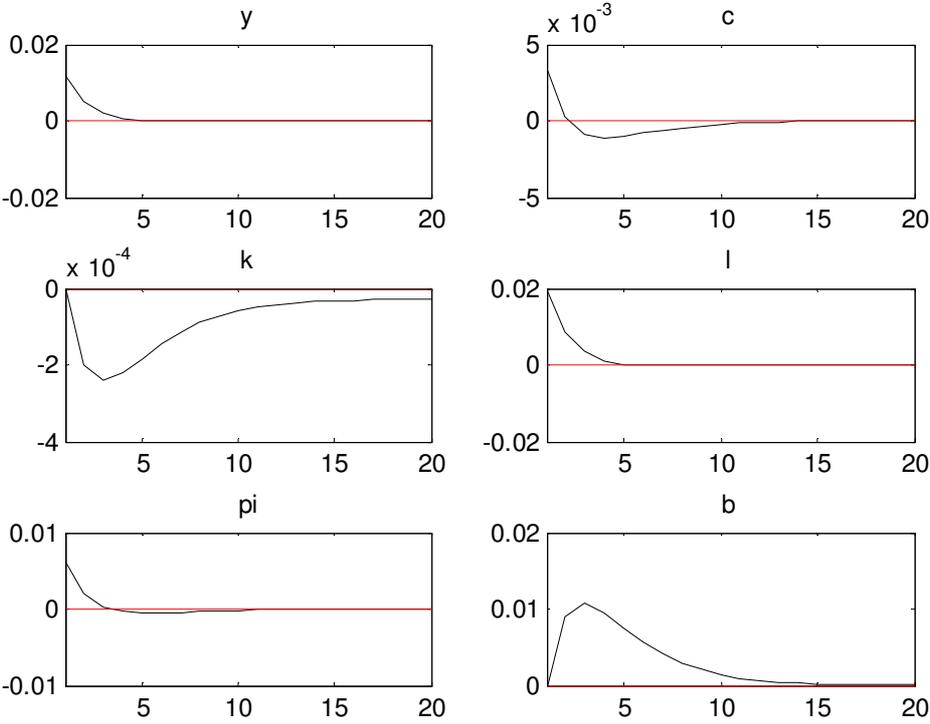
Croatia
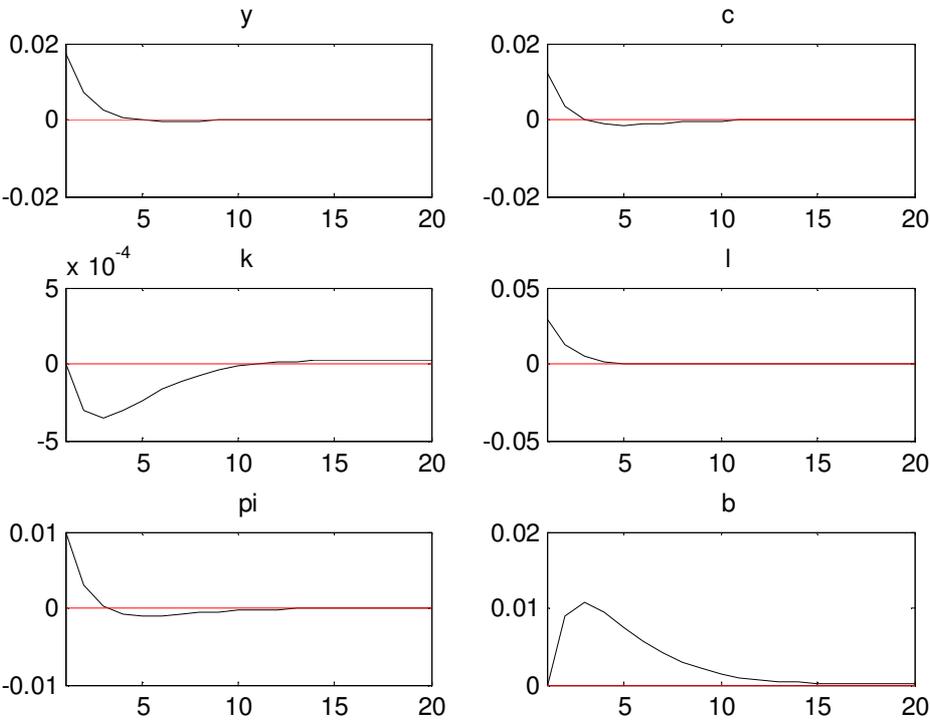
Czech Republic

Hungary

Poland

Romania

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