Rule-of-thumb households in the Czech Republic

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Abstract. Most modern macroeconomic models assume that households smooth consumption over their lifetime. However, there is substantial evidence that a sizable fraction of households faces liquidity constraints, thus the assumption of consumption smoothing is not met. This might be one of the reasons why the predictions of some models fail, for example those concerning effects of fiscal policy on consumption. To overcome this problem, some models assume that only a part of households (Ricardian households) smooth their consumption and the other part (rule-of-thumb households) consume their whole current disposable income. This paper estimates the fraction of rule-of-thumb households in the Czech Republic, based on the modified Euler equation using instrumental variables (approach by Campbell and Mankiw [4]). Furthermore, potential time variation in this parameter is investigated using the two-step strategy proposed by Kim [10] that deals with the endogeneity problem. Our results suggest that the share of rule-of-thumb consumers exceeds 40%. In addition, this share is unstable over time, however the decline in the recent years is puzzling and worth exploring further.

Keywords: consumption, rule-of-thumb households.

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1 Introduction

The current mainstream macroeconomic models based on microfoundations used for the analysis of economic policies and for forecasting (RBC and NK DSGE models) use consumption smoothing as one of their main building blocks. This follows from the assumption that households maximize their lifetime utility subject to their intertemporal budget constraints. However, it has been shown that the assumption of consumption smoothing is not met in reality because some households face liquidity constraints or behave in a myopic way. One way to model the departure from consumption smoothing is to assume that a fraction of consumers in the economy exhibit a rule-of-thumb behaviour, i.e. they consume their whole current income instead of their permanent income, as suggested by the theory. Although this is still a relatively strong assumption, models incorporating rule-of-thumb households give usually more plausible results than those assuming fully optimizing behaviour only (e.g. [7]).

This is particularly the case of models for analysing fiscal policy. It has been shown that both RBC and New Keynesian models fail to predict the behaviour of consumption following a government spending shock (e.g. [11]), which has been empirically shown to rise. Incorporating rule-of-thumb households mitigates this problem. For example, Galí et al. [7] show that fiscal expansion that increases incomes of these rule-of-thumb households will have a direct effect on their consumption, since it is directly influenced by the current income and not by net present value of all future incomes. Furthermore, when the share of the rule-of-thumb households is large, fiscal policy affecting the incomes of rule-of-thumb households has direct macroeconomic effects on the aggregate consumption. Therefore, the consumption might increase in response to an increase in government expenditures, which is in a sharp contrast to the predictions given by most of the current RBC and NK DSGE models. Similarly, the presence of rule-of-thumb households has policy implications for fiscal consolidations: their negative effects on economic

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growth tend to be more pronounced in economies, where consumption of an important share of households follows the rule-of-thumb pattern rather than consumption smoothing.

In this paper, we estimate the share of rule-of-thumb households in the Czech Republic using a two stage least squares regression suggested in [4]. We show that this fraction has been significant, which suggests that rule-of-thumb behaviour should be taken into account in macroeconomic models. In addition, we attempt to estimate time-varying share of these households. Our results are however puzzling in that they show some decline before 2007 but a sharp drop after that, which is not expected. This issue is subject to future research.

2 Related literature

The life cycle hypothesis and the permanent income hypothesis ([3], [6]) imply that consumers smooth their consumption over their lifetimes. Both approaches are in a sharp contrast to the theory of consumption by Keynes [9] who claims that the level of current consumption is a function of the current disposable income only. Instead, the two more recent theories assert that consumers optimize their consumption profiles intertemporally through their lifetime, taking into account their income profiles. In their optimization, consumers regard their consumption in each period as a different commodity and maximize their lifetime utility, which provides the theory of consumption with solid microfoundations. The predictions of both, permanent income and life cycle hypotheses, are very similar - the optimization of a concave utility function leads to consumption smoothing, i.e. one does not want her consumption to fluctuate through time.

The permanent income hypothesis has been widely empirically tested with mixed results ([1] is a good starting point for a literature survey). For example, Hall [8] finds an evidence for the modified version of the hypothesis – i.e. that consumption follows a random walk, if we assume that changing the volume of consumption is time demanding. That implies that any policy that does not affect permanent income is inefficient. On the other hand, Campbell and Mankiw [4] claim that permanent income hypothesis can be rejected. This is because there are two types of consumers – one that behaves optimally and smooths its consumption over lifetime; the other type consumes its whole current income (due to liquidity constraints, myopia or unwillingness to participate in financial markets). The share of the second type of households was estimated as highly significant and reached about 0.5 in the USA under various specifications. This means, for example, that additional, even transitory, income will be spent by the second type of households and thus fiscal spending is a plausible means to stimulate output. In his additional paper, Mankiw [12] summarizes the evidence of rule-of-thumb behaviour, which characterizes particularly households, whose net wealth approaches zero. As this behaviour is common in the economy, he calls for the inclusion of rule-of-thumb households into all models analyzing macroeconomic, particularly fiscal, policies.

3 Methodology

The share of rule-of-thumb households in an economy is usually estimated using two approaches. The first one was introduced by Campbell and Mankiw [4] as a means of testing the permanent income hypothesis. The second approach estimates this share as a parameter of a DSGE model (e.g. [5]). The drawback of the latter approach is that the estimation is sensitive to the specification of the model and priors for the model's parameters, thus we will use the first approach.

In can be easily shown that the permanent income hypothesis implies that under some weak assumptions, consumption follows a random walk. If a fraction λ of households is assumed to consume their whole current disposable income, we arrive at the following modified Euler equation (e.g. [5]):

$$\Delta c_t = \alpha + \lambda \Delta y_t + \epsilon_t \tag{1}$$

where c_t is personal consumption and y_t is personal disposable income. Under the permanent income hypothesis, λ should be equal to zero, i.e. change in consumption should follow a random walk.

3.1 Time invariant estimates

The estimation of the time invariant share of rule-of-thumb households is relatively straightforward and follows from Equation 1. However, one must bear in mind that this equation is endogenous (ϵ_t is correlated with Δy_t) and thus an instrumental variable approach needs to be used. As Campbell and Mankiw [4] suggest, any lagged variables that help to predict changes in income can be used, since they are uncorrelated with changes in consumption.

3.2 Time-varying estimates

It is plausible that λ is not constant over time ([2], [13]). This is particularly true for the case of the Czech Republic, which has undergone a process of economic transformation, during which the financial system has changed significantly. Various credit institutions have been set up, earnings have become more dispersed among the population, both of which have led to changing structure of liquidity constraints and rule-of-thumb behaviour.

The time-varying λ can be estimated in the framework of time-varying regression with endogenous covariates. A standard Kalman filter approach cannot be used, so we use a method by Kim [10] to estimate the share of rule-of-thumb households.

We assume that the parameters in the endogenous regression follow a random walk:

$$\begin{cases} \Delta c_t = \alpha_t + \lambda_t \Delta y_t + e_t & \\ \alpha_t = \alpha_{t-1} + u_{\alpha,t} & u_{\alpha,t} \sim N(0, \sigma_\alpha^2) \\ \lambda_t = \lambda_{t-1} + u_{\lambda,t} & u_{\lambda,t} \sim N(0, \sigma_\lambda^2) \end{cases} \tag{2}$$

Similarly, parameters in the first stage are also assumed to follow random walks:

$$\begin{cases} \Delta y_t = z_t' \delta_t + \sigma_v v_t^* & \\ \delta_t = \delta_{t-1} + u_{\delta,t} & u_{\delta,t} \sim N(0, \sigma_{delta}^2) \end{cases} \tag{3}$$

The endogeneity in the regression is assumed to have the following form:

$$\begin{pmatrix} v_t^* \\ e_t \end{pmatrix} \sim iidN \left(\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 & \rho\sigma_e \\ \sigma_e\rho & \sigma_e^2 \end{pmatrix} \right) \tag{4}$$

Then a relatively straightforward procedure can be used (see [10] for its derivation):

- Step 1: Estimate a time-varying equation $\Delta_t = z_t' \delta_t + \sigma_v v_t^*$ using Kalman filter, obtain $v_{t|T}^*$
- Step 2: Estimate an adjusted time-varying equation: $\delta c_t = \alpha_t + \lambda_t \Delta Y_t + \sigma_e \rho v_{t|T}^* + \omega_t$

4 Data

Two main variables - consumption and income - in Equation 1 had to be chosen. We use consumption of non-durable goods and services as a variable representing consumption. This variable has been downloaded from the Czech Statistical Office. Next, we use GDP as the variable for income. GDP is only a proxy and it has been chosen because the variable on disposable income has been constructed only since 2007 by the CZSO[1].

The time series are deflated by consumption / GDP deflator and are transformed to logarithmic per capita values. Lagged changes in the two variables, along with changes in 3 month money market rates are used as instruments. In addition, we use an error correction term $c_{t-2} - y_{t-2}$ of log real per capita values as an instrument.

[1] A similar variable was published by the Czech National Bank but it is not constructed any more. Unfortunately, the methodology for the two differs and they are not comparable

5 Results

5.1 Time invariant share

Several instruments have been used to account for endogeneity in Equation 1: lagged changes in real per capita consumption, income, interest rates and finally an error correction term $c_{t-2} - y_{t-2}$. As Campbell and Mankiw [4] argue, variables at least at two lags should be used to prevent autocorrelation in the results, thus we follow this advice.

Based on R^2 from the first stage, the models reported in Table 1 are used for the estimation. The reported data in Table 1 are estimated on the sample ending in 2007Q4. This is because the development of GDP growth in the period of financial crisis was hardly predictable using macroeconomic data and including the mentioned data could distort our results.

Model	Instruments	n	R^2	F
IV(1)	$\Delta y_{t-2} \dots \Delta y_{t-4}$	43	0.52	15.6
IV(2)	$\Delta y_{t-2} \dots \Delta y_{t-6}$	41	0.47	7.5
IV(3)	$\Delta y_{t-2} \dots \Delta y_{t-4}, \Delta c_{t-2} \dots \Delta c_{t-4}, c_{t-2} - y_{t-2}$	43	0.53	7.88
IV(4)	$\Delta y_{t-2} \dots \Delta y_{t-4}, \Delta c_{t-2} \dots \Delta c_{t-4}, \Delta i_{t-2} \dots \Delta i_{t-4}, c_{t-2} - y_{t-2}$	43	0.55	6.2

Table 1: Adjusted R^2 and F statistics from the first stage

The second stage results reported in Table 2 suggest that the share of rule-of-thumb households has been significant during the period under consideration. The estimates vary among the four considered models and range from 0.38 to 0.59. This is in line with the results for other countries. For example, [4] have estimated this share to be 0.5 for the US and 0.4 in Italy. Similarly, [5] estimate this share to be 0.37 in their DSGE model of the eurozone. Also, a dummy variable indicating the financial crisis period was added as an explanatory variable but the results have not changed much (thus they are not reported in the table).

	OLS	n	IV(1)	IV(2)	IV(3)	IV(4)
1996Q1 - 2011Q4	0.24	63	0.59	0.49	0.38	0.43
1996Q1 - 2007Q4	0.41	47	0.85	0.7	0.81	0.81
1998Q1 - 2011Q4	0.24	56	0.41	0.37	0.34	0.33
1998Q1 - 2007Q4	0.44	40	0.39	0.15	0.41	0.32

Table 2: Estimated share of rule-of-thumb households (λ) using 2SLS

In contrast, the results vary when the models are estimated on three subsamples - the pre-crisis period, the period starting in 1998Q1 and the period 1998Q1-2007Q4[2]. The varying results point to the instability of the share and suggest that the share has fallen after 2008, which is a puzzling result (one would expect the share to increase due to deteriorating credit conditions) worth further investigation. The first explanation might be that the fall in income was expected to be only short-lived, thus the households did not consume so much less as implied by the change in income (this would be in line with the permanent income hypothesis). The second explanation might be a misspecification of the model or problems connected with the definition of the variables. Both possibilities will be explored in our further research.

5.2 Time-varying share

The puzzling result from the previous section, i.e. the fall in the share, is confirmed also using the time-varying model estimated using the approach by [10]. The results tend to be in line with the permanent income hypothesis since around 2007. This is in contrast with the evidence, i.e. the deteriorating credit conditions of households.

[2]Statistical significance of instability of the estimates was confirmed also by CUSUM and CUSUM-SQ tests.

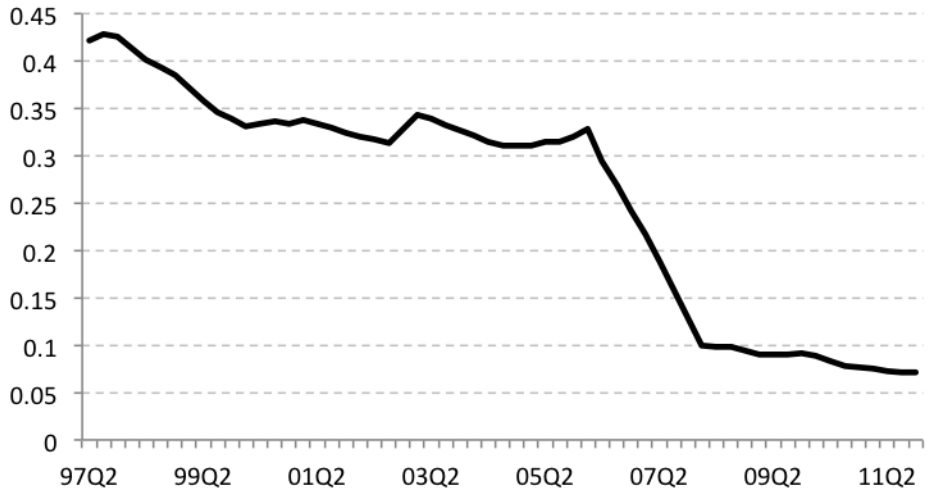

Figure 1: Time-varying share of rule-of-thumb households in the Czech Republic (1997Q2 - 2011Q4)

6 Conclusion

In this paper, we have discussed the importance of incorporating rule-of-thumb behaviour of consumers into macroeconomic models and we have performed both time-invariant and time-varying estimation of the share of rule-of-thumb households. Our results suggest that the permanent income hypothesis is rejected in the Czech economy due to a significant share of rule-of-thumb households. However, the results point to a decline in the recent years, which is not a very plausible result due to deteriorating credit conditions of households. In our future work, we will try to find factors that are behind this decline and find a credible robust estimate of the share that could be used in macroeconomic models.

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