Estimation of the consumption function of Russian households using RLMS microdata

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Abstract

In this paper we consider a simple model of permanent income in which households consume a certain share of permanent income, the value of which is estimated using the adaptive expectations process based on the dynamics of actual income. The parameter of propensity to consume itself depends on the characteristics of a household, such as income decile, household size, number of children, level of education, etc. The model employs RLMS microdata using OLS and IV methods and provides interpretable estimates of propensity to consume. The results can be used for the purposes of formulating economic policy.

1. Introduction

The key hypothesis in modeling consumption is the Friedman's Permanent Income hypothesis (Friedman 1958). According to this hypothesis, households, when choosing consumption, focus not on their current income, but on the level of their permanent income — that is, the amount of income that they can rely on throughout their lives. Hall (1978) formulated a stochastic version of permanent income, according to which consumption is a Martingale. The conclusions of Hall's work have been repeatedly tested on empirical data and challenged (see, for example, Flavin 1981, Blanchard and Mankiw 1988, Campbell 1987, Sargent 1987). Even so, modern empirical research in the field of consumption modeling is constructed in line with the hypothesis of permanent income (see, for example, a review in Meghir and Pistaferri 2011 with corresponding references).

In this paper a model of permanent income is estimated using RLMS (Russia Longitudinal Monitoring Survey) microdata. The specification of the consumption function is quite simple; even so, this form of the household consumption function is often used in agent-based models (Ashraf et al. 2016, Ashraf et al. 2017). Empirical estimates utilizing the present work can be useful for constructing an agent-based model for the Russian economy, and the empirical applications can also be used to describe the consumption of other countries. The paper estimates not only the influence of household characteristics on the propensity to consume, but also the parameter of adjustment in the adaptive expectations process.

Accounting for heterogeneity in the propensity to consume taking into account the characteristics of households figures prominently in modern economic analysis, and the present work is a contribution to the wide range of research that adopts this approach (see, for example, Christelis et al. 2019, Jappelli and Pistaferri 2014, Ampudia et al. 2019).

2. Method of estimating the marginal propensity to consume

The model is based on Friedman's Permanent Income hypothesis (Friedman 1958), according to which the economic agent consumes a certain share of its permanent income with some random error, which is transitive consumption. In this paper the value of permanent income is expressed through the process of adaptive expectations based on the dynamics of actual income (see, for example Chapter 11 of Dougherty 2011), and eliminated through the Koyck transformation (for all derivations see the Appendix). The propensity to consume (in

our specification, the marginal propensity to consume is equal to the average propensity to consume) is a function of the social characteristics of the economic agent, and time. In this work the economic agent is a household; a set of characteristics includes the number of people and number of children in the household; education level; income level of the household relative to other households in the sample (decile income groups); age of the head of household; location and period of observation, as well as type of housing (for variables and data description see the Appendix).

Final econometric equation is written as follows:

$$\Delta log(C_{i,t}) = \beta^D Decile_{i,t} + \beta^P People_{i,t} + \beta^C Child_{i,t} + \beta^H HighEduc_{i,t} \qquad (1)$$
$$+ \beta^{CR} Credit_{i,t} + \beta^{HO} Housing_{i,t} + \beta^A Age_{i,t} + \beta^{CI} City_{i,t}$$
$$+ \beta^Y Year_t + \lambda \left(log(Y_{i,t}) - log(C_{i,t-1}) \right) + \omega_{i,t}$$

$C_{i,t}$ is current consumption and $Y_{i,t}$ is actual observable income.

Estimation of this equation allows us to obtain values of average propensities of the social group to consume out of permanent income. To check robustness, we shall use two alternative approaches for estimation of the parameters of equation (1). As the first method, we shall use the simplest least squares method. It has the advantage of simplicity, but can give biased estimates for the λ parameter owing to the non-zero correlation between the regressor $log(Y_{i,t}) - log(C_{i,t-1})$ and the error term $\omega_{i,t} = \xi^c_{i,t} - (1 - \lambda)\xi^c_{i,t-1}$, since $log(C_{i,t-1})$ contains the error $\xi^c_{i,t-1}$.

To eliminate this problem, as a second approach to estimation of equation (1) we shall use the method of instrumental variables.. In this case, the variable $log(Y_{i,t}) - log(Y_{i,t-1})$ is used as an instrument for the endogenous variable, i.e. we assume that the shocks of transitive consumption do not affect income.

An income level can be potentially endogenous, especially, if one analyses income and consumption dynamics on the aggregated macro-level (Keynesian cross, Macro Simultaneous Equations Models). Even so, it seems that the problem is not so dramatic on the micro-level, and there are numerous examples in which authors have assumed consumption shock to be exogenous to income (Abowd and Card 1989, Blundell 2008). We follow these examples and assume an exogenous income process on the household micro level.

3. Results

To estimate the model, we use RLMS microdata. The estimations of the parameters are presented in Table I. Using the OLS method (Column 1), the estimate of total income elasticity of current consumption λ is equal to 0.57. Estimations of the parameters obtained by method IV (Column 2) do not much differ from those obtained by the OLS method; the total income elasticity parameter of current consumption λ is 0.54. The significance level for each variable remains unchanged when compared with the OLS estimates, which testifies to the robustness of the model.

The λ parameter could be interpreted as a certain average value of transitive and permanent income elasticities which are identified separately in more complicated consumption function specifications (Blundell et al. 2008, Gorodnichenko et al. 2010). Gorodnichenko's estimates for Russia of transitive and permanent elasticities averaged at 0.08 and 0.7, respectively. In addition, the parameter has an interpretation of the adjustment coefficient of the adaptive expectation process, and its value can be used in agent-based models.

Table I Model estimations

	OLS (1)		IV (2)	
Variable	Coefficient	SD	Coefficient	SD
(Intercept)	-0,1	0,09	-0,1	0,09
$\log(Y_{i,t}) - \log(C_{i,t-1})$	0,57***	0,00	0,54***	0,01
decile2	-0,14***	0,01	-0,13***	0,01
decile3	-0,2***	0,01	-0,18***	0,01
decile4	-0,24***	0,01	-0,23***	0,01
decile5	-0,28***	0,01	-0,26***	0,01
decile6	-0,3***	0,01	-0,28***	0,01
decile7	-0,34***	0,01	-0,31***	0,01
decile8	-0,37***	0,01	-0,34***	0,01
decile9	-0,42***	0,01	-0,4***	0,01
decile10	-0,51***	0,01	-0,47***	0,02
child1	0,04***	0,01	0,04***	0,01
child2	0,04***	0,01	0,04***	0,01
child3	0,05**	0,02	0,05**	0,02
child4	0,08**	0,04	0,07**	0,04
people2	0,09***	0,01	0,09***	0,01
people3	0,13***	0,01	0,13***	0,01
people4	0,17***	0,01	0,16***	0,01
people5	0,18***	0,01	0,18***	0,01
people6	0,19***	0,02	0,18***	0,02
people7	0,22***	0,02	0,21***	0,02
year2002	-0,04**	0,02	-0,04**	0,02

year2003	-0,09***	0,02	-0,09***	0,02
year2004	-0,13***	0,02	-0,12***	0,02
year2005	-0,14***	0,02	-0,13***	0,02
year2006	-0,2***	0,02	-0,19***	0,02
year2007	-0,21***	0,02	-0,2***	0,02
year2008	-0,26***	0,02	-0,24***	0,02
year2009	-0,29***	0,02	-0,28***	0,02
year2010	-0,26***	0,02	-0,25***	0,02
year2011	-0,28***	0,02	-0,27***	0,02
year2012	-0,28***	0,01	-0,27***	0,02
year2013	-0,29***	0,01	-0,27***	0,02
year2014	-0,31***	0,02	-0,3***	0,02
year2015	-0,34***	0,02	-0,33***	0,02
year2016	-0,33***	0,02	-0,32***	0,02
Renting	-0,02*	0,01	-0,02*	0,01
Dormitory	-0,03*	0,02	-0,03*	0,02
Credit	0,05***	0,01	0,04***	0,01
AGE	0,00	0,01	0,00	0,01
I(AGE^2)	0,00	0,00	0,00	0,00
I(AGE^3)	0,00	0,00	0,00	0,00
high_educ	0,03***	0,01	0,03***	0,01
location2	-0,05***	0,01	-0,05***	0,01
location3	-0,01	0,01	-0,01	0,01
location4	-0,04***	0,01	-0,04***	0,01
R2	0,33		0,33	
*** - 0.01, ** - 0.05, * - 0.1				

In order to support our assumption of the exogeneity of the instrument we conducted the J-test. This test is informative of the validity of the model and can be also used to check the exogeneity of the instrument. We added an age variable to the set of instruments since the number of instruments should exceed the number of endogenous variables. The test provides strong support of the validity of the instruments (P-value = 0.71) and the coefficients remain almost unchanged.

Let us analyze the impact of household characteristics on the propensity of the household to consume, using IV method estimates. Along with the analysis of general trends based on estimates of regression coefficients, we calculate the exact value of the propensity to consume.

Recalculating the coefficients, we take households from the year 2016, in the 5th income decile, consisting of 3 people, with one child, whose heads have higher education, living in the city in their own home, without debts as "basic". Depending on the influence of a

particular characteristic on the propensity to consume, this characteristic changes, while the other characteristics are fixed at the level of the "basic" household.

Let us analyze the influence of decile groups on the propensity to consume. Table II shows that a household in a higher income decile, ceteris paribus, has a lower marginal propensity to consume.

Table II MPC level depending on decile group

Decile number	decile 1	decile 2	decile 3	decile 4	decile 5	decile 6	decile 7	decile 8	decile 9	decile 10
MPC	0,73	0,57	0,52	0,47	0,45	0,44	0,41	0,39	0,35	0,3

The marginal propensity to consume increases when the number of members in the household increases (Table III), since a new individual in the household requires additional expenditures on current consumption goods that are on average higher than the additional permanent income that this individual brings to the household. In this case, it becomes clear why the effect is enhanced if the new person in the household is a child (Table IV). To see this effect, one can compare, for example, the propensity to consume of households consisting of two adults and one child (0.45, Table IV), and the propensity to consume of households consisting of three adults (0.41, Table III).

Table III MPC level depending on the number of people

Number of people	people1	people2	people3	People4	people5	people6	people7
MPC	0,33	0,38	0,41	0,44	0,45	0,46	0,48

Table IV MPC level depending on the number of children

Number of children	child0	child1	child2	child3	child4
MPC	0,38	0,45	0,47	0,50	0,52

Notes: for households in which there are two adults

All other things being equal, a household in which the head of the family has higher education consumes a larger share of permanent income (0.45) than a household in which the head of the family does not have higher education (0.43). It is important to note that according

to our framework for this comparison, it is assumed that households with different levels of education are in the same income decile. A household in which the head of household does not have higher education may consume a smaller share of permanent income owing to greater influence of the precautionary motive. The income of such a household may be more volatile (for example, the head of the household may be an entrepreneur), and this motivates saving more for a rainy day.

Households with debt obligations consume, on average, 48% of their permanent income; households without debt obligations consume 45%. The existence of debt may indicate a low value of the discount factor of the household, in other words, impatience. Such households value current consumption more and, as a result, save less. Tenants on average consume 43% of their permanent income, while homeowners consume 45%. If we consider the imputed income of homeowners from rent, the total imputed income of such households will increase compared to their current recorded income. Naturally, with an identical share of consumption in imputed income, homeowners will have a larger share of consumption in recorded income when compared to tenants. Households that do not own housing might save some of their regular income in order to purchase housing in the future, which may also explain the difference in the consumption propensities of homeowners and tenants. Households living in dormitories consume 42% of their permanent income.

Households living in the city (mpc = 0.45) or village (mpc = 0.46) save significantly more than households living in regional (Oblast) centers (mpc = 0.49). In the first case, this may be because financial markets are better developed in cities than in regional centers, which allows households to obtain a higher level of financial return, which stimulates savings. In rural areas, the level of income uncertainty is greater — there is the risk of crop failure, for example - compared with regional centers, so households save more in order to protect consumption from unforeseen changes in income (precautionary savings).

As for the observation periods (Table V), it is important to note the general trend: every year, on average, households begin by spending a smaller share of their permanent income on current goods and save more, or spend more, on durable goods.

Table V

Observation period	year2001	year2002	year2003	year2004	year2005	year2006
MPC	0,8	0,75	0,68	0,64	0,63	0,57

Observation period	year2007	year2008	year2009	year2010	year2011	year2012
MPC	0,55	0,51	0,48	0,51	0,49	0,49

Observation period	year2013	year2014	year2015	year2016
MPC	0,48	0,46	0,44	0,45

Notes: MPC level depending on the period under observation.

4. Conclusion

This paper presents estimates of the marginal propensity to consume out of permanent income for different social groups, as well as the total current income elasticity of current consumption for Russian households. With the growth of current income, households begin to save a greater share of their permanent income. A new person in the family, a child in particular, increases the marginal propensity to consume of the household, since the new person requires costs in excess of the additional permanent income that person brings to the household. Households in which the head has higher education save significantly less than those in which the head does not have higher education. Systematic debt repayments increase the household's propensity to consume. The propensity to consume of homeowners is higher than that of tenants. Households in a city or rural area save significantly more than households in regional centers. On average, households in Russia save an increasing amount of their permanent income every year. These results are valuable in terms of social policy when it comes to forecasting the effective impact of specific measures on the consumption of particular social groups.

5. References

Ampudia, M., Cooper, R., Blanc, J. Le, Zhu, G. (2019) "Mpc Heterogeneity In Europe: Sources And Policy Implications" NBER Working Paper No. 25082.

Ashraf, Q., Gershman, B., Howitt, P. (2017) "Banks, Market Organization, And Macroeconomic Performance: An Agent-Based Computational Analysis" *Journal of Economic Behavior and Organization* **135**, 143–180.

Ashraf, Q., Gershman, B., Howitt, P. (2016) "How Inflation Affects Macroeconomic Performance: An Agent-Based Computational Investigation" *Macroeconomic Dynamics* **20**, 558–581.

Blanchard, O. J. and Mankiw, N. G. (1988) "Consumption: Beyond Certainty Equivalence"

The American Economic Review **78**(2), 173–177.

Blundell, B. R., Pistaferri, L., Preston, I. (2008) "Consumption Inequality and Partial Insurance" *The American Economic Review* **98**(5), 1887–1921.

Campbell, J. Y. (1987) "Does Saving Anticipate Declining Labor Income? An Alternative Test of the Permanent Income" *Econometrica* **55**(6), 1249–1273.

Christelis, D., Georgarakos, D., Jappelli, T., Pistaferri, L., van Rooij, M. (2019) "Wealth Shocks And Mpc Heterogeneity" NBER Working Paper No. 25999.

Dougherty, C. (2011) *"Introduction to Econometrics"* (4th ed.). Oxford University Press.

Flavin, M. A. (1981) "The Adjustment of Consumption to Changing Expectations About Future Income" *Journal of Political Economy* **89**(5), 974–1009.

Friedman, M. (1958) "A Theory of the Consumption Function" *National Bureau of Economic Research, Inc.*

Gorodnichenko, Y., Sabirianova Peter, K., Stolyarov, D. (2010) "Inequality And Volatility Moderation In Russia: Evidence From Micro-Level Panel Data On Consumption And Income" *Review of Economic Dynamics* **13**(1), 209–237.

Hall, R. E. (1978) "Stochastic Implications of the Life Cycle-Permanent Income Hypothesis: Theory and Evidence" *The Journal of Political Economy* **86**(6), 971–987.

Jappelli, T. and Pistaferri, L. (2014) "Fiscal Policy and MPC Heterogeneity" *American Economic Journal: Macroeconomics* **6**(4), 107–136.

Meghir, C. and Pistaferri, L. (2011) *"Earnings, Consumption and Life Cycle Choices"* *Handbook of Labor Economics* **4b**, Elsevier B.V.

Sargent, T. J. (1987) "Rational Expectations, Econometric Exogeneity, and Consumption" *Journal of Political Economy* **86**(4), 673–700.