FINANCIAL CRISIS AND SAVINGS:
EVIDENCE FROM THE RUSSIA
LONGITUDINAL MONITORING
SURVEY

by

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Abstract

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This thesis investigates the hypothesis whether the financial crisis of 2010's changed the household savings behavior in the Russian Federation. After the careful study of the literature on household savings behavior it was concluded that the financial crisis seems likely to affect household savings behavior by changing the strength of the precautionary savings motive. In order to evaluate the existence of the precautionary savings motive the data for the period of 2005-2009 years from the Russia Longitudinal Monitoring Survey were used. The coefficient of absolute risk aversion that shows the strength of the precautionary savings motive was estimated by using the conditional volatility of household labor income.

The estimated empirical results show that the latest financial crisis indeed influenced savings behavior of Russian households: before the financial crisis of 2010's Russian households saved their assets for the precautionary savings motive, whereas after the financial crisis Russian households started to dissave accumulated assets in order to maintain the permanent level of consumption.

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# LIST OF ABBREVIATIONS

**CARA** –Constant Absolute RiskAversion

**RLMS** – Russia Longitudinal Monitoring Survey

## INTRODUCTION

Saving and investment behavior of individuals has been the subject of economic studies over the past two centuries. It is proved that "increasing saving and investment rates … lift them (countries) to a sustainable, faster growth development" (de Laiglesia and Morrisson, 2008).

With respect to the amount of personal savings that banks received in the form of deposits, the banks decide whether business investment should be financed or not. Invested in shares, household savings can finance the real sector of economy. Private savings invested in government bonds finance public expenditures. At the same time if a person has savings in the form of cash or jewelry it is not invested into economy. If a person has savings in the form of foreign currency it also increases pressure on the national currency and national balance of trade. Therefore, government has an incentive to stimulate private savings and to encourage people to invest their money into financial instruments or bank accounts in order to have higher growth of national economy.

But in the post-Soviet countries the government policy in private savings stimulating seems to be ineffective, as loss of the savings after the collapse of the Soviet Union resulted in people's distrust in banks and other financial institutions across the affected countries, which was further undermined by rampant inflation of 1990's and the Russian financial crisis of 1998.

Global Financial Crisis, which broke out in 2008, also did not leave Russia aside. Changes in export/import conditions and volatility of the major trade

and economic partner's markets destabilized the Russian model of socio-economic development. Russians are frustrated when it comes to their future perspectives. Being uncertain of future people rush to find a reliable venue for their savings.

In any financial crisis some financial institutions or assets in one or several countries unexpectedly lose a large part of their value. At the same time the current financial crisis is characterized by its global nature, almost all economies around the world were affected.

Different authors consider such motives as bequest motives (wish to leave assets to children), precautionary (to smooth consumption in hard times) and life-cycle motives (e.g. savings for retirement, children's education, housing purchases and so on). This thesis investigates not only the motives which induce Russian households to save their assets, but also focuses on the issue whether this mechanism changed due to the latest financial crisis and how exactly it changed.

Assuming a homogeneity among household saving behavior and constant absolute riskaversion utility function for every household it is investigated how households consumption and savings behavior react on changes in labor income. In the model such characteristics of a household as age, education and occupation of household's head,  household annual income and consumption are taken into consideration. After running the regressions, it will be tested whether estimated coefficients before and after the global financial and economic crisis of 2010's significantly differ or not. If such a difference takes place it may be concluded that structural changes in saving behavior did occur.

After conducting this research it is expected to find out what motives determine the household savings behavior in the Russian Federation, and what is the most important to determine whether these characteristics changed during the financial crisis.

The remainder of the paper is structured in the following way: Chapter 2 gives a review of the literature about savings motives and studies of different determinants of the saving behavior; Chapter 3 outlines theoretical and empirical framework of the research; Chapter 4 provides data description and finally in the Chapter 5 estimation results are presented. Conclusions and inferences are given in the Chapter 6.

LITERATURE REVIEW

The saving and investment behavior of individuals is the subject of economic studies over the past two centuries. As a rule differences in savings behavior among individuals are related to differences in preferences and income. For example, as shown by Cronquist and Siegel (2011), the life cycle model of savings explains some differences in savings behavior between individuals by heterogeneity in risk preferences and time. According to this model, individuals look ahead, expect the drop in their income after retirement, and estimate how much they have to save to maintain current consumption over their life (Alessie et al., 2011). Some studies questioned the assumed ability of individuals to solve the savings-consumption and savings allocation problems (Benartzi and Thaler, 2007). For example, Lusardi and Mitchell (2008) find that only 1/3 of respondents in the USA are able to do simple interest rate calculations and understand the effects of inflation. Both US households and Dutch households exhibit low levels of financial literacy (Alessie et al., 2011).

However, a lot of different considerations effect saving decisions during the lifetime. Different studies try to investigate a variety of co-existing savings motives that influence household saving behavior. Most studies of household saving behavior focus on one particular savings motive (Kennickell and Lusardi, 2005; Cronquist and Siegel, 2011) and only few studies focus on co-existing motives (Alessie and Lusardi, 1997; Alessie et al., 1999; Schunk, 2009). Meanwhile, the most complete one, in terms of number of investigated motives, seems to be the study of Horioka and

Watanabe (1997). Studying various motives for household saving in Japan they analyzed 12 savings motives: the retirement motive, the illness motive, the education motive, the marriage motive, the housing motive, the consumer durables motive, the leisure motive, the tax motive, the business motive, the peace of mind motive, the bequest motive and others. All these motives can be grouped into 3 types of motives: life-cycle motives, precautionary motives and bequest motive. In the study it was found that in Japan precautionary motives and life-cycle motives "are of dominant importance", while the bequest motive accounts only for 3 % of total savings.

It should be noted that the bulk of literature empirically examines the motives on the basis of surveys containing direct questions about the motives (Horioka and Watanabe, 1997; Canova et al., 2005; Schunk, 2009; etc.), whereas only a few authors attempt to study savings motives by analyzing micro-data that do not contain specific questions on savings motives (Hurd, 1987; Wilson, 2003; Lusardi, 2008; etc.).

While some studies analyze co-existing motives, others are concentrated on single motives. For example, Hurd (1987) found that the level of bequest savings decreased over 20 years by half of its initial level. Wilson (2003) showed that "strength of the precautionary motive, depends on the age, educational attainment and labor supply profiles of households". Dardanoni (1991), Carroll (1994) and Kazarosian (1997) showed that the most significant factor in accumulating household wealth is a precautionary savings motive.

At the same time, there is lack of literature on the study of the effect of financial crises on household savings behavior and as a rule it refers to the

study of savings rates at the macro level. For example, Bachellerie (2011) found that household saving rates in France had obviously increased since the financial crisis of 2007. At the same time it was found that the structure of investment flows had not changed significantly and individuals responded to the economy fluctuations by hedging among financial assets.

As for studies of household saving behavior at the micro level, Van der Cruijsen et al. (2011) analyze whether the households experience during the crisis affects their savings behavior by using the Dutch Household Survey. They also test whether knowledge on banking supervision influences household savings behavior. Respondents were asked about their savings behavior, their knowledge about banking supervision and adverse experiences during the financial crisis. In the paper it was shown that households' experience during the crisis did affect saving behavior. An individual, whose bank received support from the government or went bankrupt during the crisis, collects more information about different banks and financial instruments, which means that he/she is more likely to save at several banks.

Concerning developing countries, Kouzina and Roshchina (2000) investigated the effects of the Russian financial crisis in 1998 on household savings behavior. They tested the effect of different household characteristics on financial assets holdings as well as made similar investigations to find an effect on each form of assets holdings. It was found that "the sharp reduction of household real incomes had caused the usage of the accumulated financial assets for current needs in order to maintain the usual level of consumption". The number of households that had any financial assets had reduced (Kouzina and Roshchina, 2000).

To the best of our knowledge there are no studies on the impact of financial crisis on savings motives. However, it seems logical that the shock caused by changes at the level of population, primarily effected precautionary savings motives, as people had to adjust their saving behavior to uncertainties about future unemployment, income fluctuations and duration of the shock.

To sum up, there is a huge amount of literature on factors and motives explaining saving behavior and effects of financial crisis for households' savings decisions, but it focuses mostly on developed countries. Only one paper by Kouzina and Roshchina (2000) addresses the above issues for one of Commonwealth of Independent States such as Russia.

This research will add to the scarce literature that studies whether household saving behavior changes under the influence of the financial crisis or not.

METHODOLOGY

As was already mentioned, the main purpose of this study is to estimate effects of recent financial crisis on household saving behavior in general and the precautionary savings motive in particular. In the first part of this chapter the theoretical basis of precautionary savings motive investigation is described, while in the second part the methodology, used for empirical estimation, is presented.

In order to understand whether household savings behavior changes under the influence of financial crisis or not, first of all, it is necessary to find out if the financial crisis influences the strength of the precautionary motive of a household to save its assets.

One of the most popular models is the Classical life-cycle theory that goes back to Brumberg and Modigliani (1954) and deduces saving and consumption behavior from the intertemporal optimization problem. According to the model rational and forward-looking agents smooth the utility of consumption over their life assuming the fact that income is lower after retirement than before. Thus it may be concluded that the classical life-cycle theory defines a retirement *provision  motive*, i.e. that a household saves throughout working years to accumulate assets to ensure sustainable consumption after retirement.

Wilson (2003) extended  the Classical life-cycle model in order to evaluate a *precautionary savings motive*. In the model a household faces the uncertain labor

income path and maximizes the value of future utility from consumption up to the time of death T:

$$\max_{C_{i,t+j}} E_t \sum_{j=0}^{T-t} (1 + \beta_i)^{-j} U_i(C_{i,\,t+j})$$

(1)

The household is limited by the intertemporal budget constraint:

$$A_{i,t+j+1} = (1 + r_i)(A_{i,t+j} - C_{i,t+j}) + Y_{i,t+j+1}$$

(2)

Also the agent faces the borrowing constraint:

$$A_{i,t} - C_{i,t} \geq 0 \; \forall t$$

(3)

Where $C_{i,t}$ stands for consumption, $A_t$ – total wealth, $Y_t$ – labor income, $\beta_i$ – discount rate for time preferences and $r_i$ – real interest rate.

This model demonstrates that expected shocks in disposable income force agents to save in order to smooth the consumption path, i.e. savings not only to ensure consumption after retirement, but also to insure households' income shocks (*savings for precautionary motives*).

Solving the above mentioned household's problem gives the following first-order condition:

$$\left(\frac{1 + r_i}{1 + \beta_i}\right) E_t[U_t'(C_{i,\,t+1})] = U_t'(C_{i,\,t}), \qquad for \; j = 1$$

(4)

Wilson (2003) argues that "the existence of precautionary saving behavior can be assessed by measuring the response of the change in household

consumption to changes in the volatility of future labor income" (Wilson, 2003). Following his methodology, let's assume that the utility function for every household has the constant absolute riskaversion (CARA) form:

$$U_t(C_{i,t}) = -\frac{1}{\rho_i} e^{-\rho_i C_{i,t}}$$

(5)

Where $\rho_i$ is the coefficient of absolute risk aversion for household i.

According to microeconomic theory, high risk-averse preferences imply high saving rates (Jehle, 2000). Moreover, agents "increase their willingness to engage in precautionary saving following bad shocks if they expect future economic conditions to remain poor" (De Paoli, 2012).

Substituting (5) to (4) and assuming for simplicity that $\beta_i = r_i$ it can be shown that:

$$E_t e^{-\rho_i C_{i,t+1}} = e^{-\rho_i C_{i,t}}$$

(6)

Wilson (2003) showed that applying a second-order Taylor approximation to the condition (6) the relating changes in consumption to the volatility of labor income can be found (Appendix A):

$$\Delta C_{i,t} = \frac{\rho_i}{2} \sigma_{i,t}^2 + \beta C r_{i,t} + \epsilon_{i,t}$$

(7)

Where $\Delta C_{i,t} = C_{i,t} - C_{i,t-1}$, $\sigma_{i,t}^2$ – the conditional variance of labor income for household i in time period t, $Cr_{i,t}$ – the dummy variable indicating the year of financial crisis and $\epsilon_{i,t}$ is the expectation error.

Coefficient of absolute risk aversion $\varrho_i$ is a measure of the responsiveness of household consumption to the risk of income loss. De Paoli and Zabczyk argues that "the size of the "precautionary correction" is increasing in the degree of volatility" (De Paoli, 2012). This means, that if $\varrho_i$ is positive, then increases in labor income variability gives higher saving. Thereby, the size of $\varrho_i$ determines the strength of the precautionary savings motive for household i.

In order to find a conditional variance of labor income of a household, it is necessary to estimate the following model:

$$Y_{i,t} = \alpha + \gamma' Z_{i,t} + u_{i,t} \tag{8}$$

Where $u_{i,t}$ is standard normal, $Y_t$ – labor income, $\alpha$ and $\beta$ are constants, $\gamma$ – vector of constants, Z – vector of known exogenous variables.

$$Z_{i,t} = [D_{i,t}, age_{i,t}, age_{i,t}^2, unmpl_{i,t}] \tag{9}$$

Where D is a set of dummy variables indicating the education and occupation of the household head; $age_{i,t}$ stands for the age of household head $i$ in year $t$, and $unmpl_{i,t}$ indicates the total amount of unemployment hours of household head $i$ in year $t$.

Equation (8) can be estimated by fixed-effects methodology as it allows to control for the unobserved time-invariant individual effect (Wooldridge, 2002). In equation (8) it is controlled for some household characteristics, while it is expected that there are some latent time-independent effects for each household (e.g. abilities of a household head and other household members spouse that influence the amount of household income).

Using generated conditional variance of labor income the equation (7) can be estimated with the help of Ordinary Least Squares (OLS).While coefficients estimated from equation (7) are consistent the standard errors and test statisticsmay be invalid as the regressor was generated while estimation of equation (6)(Wooldridge, 2002). Such Generated Regressor problem usually is solved by instrumentation of the regressor and using 2SLS models. In our case, such remedy can not be implemented as conditional variance of labor income is not a linear function of any instruments. Moreover, to the best of our knowledge there are no studies discussing possible remedies of Generated Regressor problem in case on non-linear models.

*C h a p t e r   4*

## DATA DESCRIPTION

To analyze the influence of recent financial crisis on savings behavior, the panel data from the Russia Longitudinal Monitoring Survey (RLMS) is used. RLMS is a longitudinal survey of private households and individuals in the Russian Federation that provides information on health and socio-demographic variables. The sample is representative for the Russian Federation. The RLMS has been undertaken annually since 1992 up to the present and there are 19 rounds of data conducted by the National Research University Higher School of Economics and ZAO "Demoscope" in cooperation with Carolina Population Center, University of North Carolina at Chapel Hill and the Institute of Sociology, the Russian Academy of Sciences. The RLMS has information on nutrition, health, reproduction, health care, income, expenditures, assets, employment, time use, and education from Russian households as well as from members of households.

The household questionnaire contains information about the structure of the household, income, expenditures and household assets, while the individual questionnaire contains information on individual characteristics of household members, their main and additional jobs, wages, education, skills, health, and sources of income.

For the purpose of model estimation, the data from years 2005 and 2009 are taken. Since each round or the RLMS is conducted in September – December annually and the consequences of the global financial crisis of 2008 mostly affected Russian households in early 2009, which seems to be consistent to study the above-mentioned period.

The extract used in this study contains data on food consumption, labor income and such demographic characteristics such as education, occupation and age for the years 2005 through 2009 for a balanced panel of 2623 households. As this thesis deals with the issue of how consumption changes in response to changes in labor income volatility, the hard restrictions for sample selection in order to minimize an amount of income variability not directly related with labor activity were imposed.

In order to use RLMS data in the model of precautionary savings it is necessary to identify the household as the decision-making unit and then to examine volatility of household non-capital (labor) income. Thus, all households which during any time in the sample period experienced marriage, divorce, the death of a spouse, another a change in household head, movers into and out of the family unit other than children are excluded from the sample. The sample was also restricted to include only families whose head was at least 26 years old at the beginning of the sample period and was not retired at the end of the period (55 years old if a household head is a female person and 60 years old if a household head is a male one), for which there are available data on education, occupation, disposable labor income and food consumption. Also, from the sample were excluded households with income less than poverty level. Applying these restrictions there selected 332 households with minimized income variability not directly related with labor activity (Table 1).

According to RLMS instructions the head of household was "assigned according to the following demographic hierarchy: (1) the oldest working-aged male in the household, (2) if no working-aged males, then the oldest working-age female, (3) if no working-age females, then the youngest retirement-age male, (4) if no retirement-age males, then the youngest

retirement-age female, and finally (5) if no retirement-age females, then the oldest child" (RLMS web-site, 2012). If more than one person in a household of the same age-gender is determined as the head, then or the first person surveyed is chosen.

Tables 2, 3 and 4 presents an explanation and descriptive statistics for main variables used in a model.

EMPIRICAL RESULTS

In this section the empirical results on the strength of the precautionary savings motiveof Russian households are presented.

Given the fact that most of explanatory variables in the model are categorical it is necessary to omit one of the categories in order to avoid multicollinearity. Thus, the interpretation of coefficients is done from the point of comparison with the omitted category.

In the Table 5 outcomes of two regressions are presented: for the sample of all households that participated in all five waves of the survey and had no changes in the household head (Unrestricted sample) and for the sample of households to which the restrictions listed in Chapter 4 are applied (Restricted sample).

It was found that the main factors affecting household labor income in the Russian Federation are household head age, attendance of professional courses, presence of a post-graduate degree (Master's, a candidate of science, a Doctor of Science), as well as the occupied position of a Legislator, Senior Manager, Official, Plant/Machine Operators and Assembler or Elementary Occupation. For example, the elder a head of a household, the higher household labor income (each additional year adds 27.5 thousands rubles to the annual household labor income), an Unskilled and Plant/Machine operators or Elementary Occupation earns 57 thousands rubles more than an unemployed person. Being a Legislator, Senior Manager or Official, a person receives 107.8 thousands rubles more, than an unemployed

one.Attendance of professional courses adds to thehousehold labor income about 52 thousands rubles on average (see Table 5, Column 1).

Thereby, empirical results of this study confirm results of Grogan (1997), who found that in the Russian Federation "experience exerts a statistically significant but very small influence on wages" as well as "obtain significantly higher pay than those working in unskilled jobs". At the same time Grogan's findings that completion of an university or an institute indeed explains wage differentiation among Russianswere not confirmed. Only post-graduate occupation adds significantly to the household labor income comparing with Unemployed people.

At the same time, in a restricted sample there are 3 significant factors affecting household income: the household head post-graduate degree (adds 833.89 thousands rubles), his occupation in a position of a Legislator, Senior Manager or Official (140.8 thousands rubles comparing with Unemployed household head) as well as Plant/Machine Operators or Assembler Occupation (approximately 64 thousands rubles of additional household labor income) (see Table 5, Column 2).

As was mentioned earlier, this study of precautionary savings motive assumes that Russian households are homogeneous in their sensitivity to risk. Using the generated conditional variance of labor income it was found that income uncertainty positively affects consumption growth (Table 6,Column 1). Though the presence of the precautionary savings motivewas found, its strength is still questionable. The estimated coefficient of labor income volatility for the Unrestricted sample of 4195 observations has a value of 0.000003and is significant at the 1% level. Thereby, thecoefficient of absolute risk aversion for the Unrestricted sample is equal to 0.000006.

It was also found that the financial crisis of 2010's indeed affected household savings behavior in the Russian Federation. After the financial crisis the coefficient of absolute risk aversion decreased by 0.000007 and became negative (equal to -0.000004). So, it can be concluded that after the financial crisis Russian households started to dissave their accumulated assets in order to maintain permanent level of consumption.

At the same time it is not appropriate to use the conditional income labor volatility generated by using Unrestricted sample, as in order to capture the existence and strength of the precautionary savings motive it is necessary to exclude all other savings motives. Therefore, the restrictions listed in Chapter 4 were imposed on the household sample, and the remained households save assets only with the precautionary savings motive.

The outcome of the regression for the Restricted sample also shows the presence of the precautionary savings motive in the Russian Federation(Table 6,Column 2). Moreover, the estimated coefficient of labor income volatility for the Restricted sample is 7 times higher then that for Unrestricted sample. These findings can be explained by eliminatingall savings motives other than precautionary motive.

The estimated coefficient of labor income volatility for the Restricted sample of 332 households has a value of 0.00002and is significant at the 10% level. Moreover, it was found that the recent financial crisis indeed affected Russian household savings behavior as the estimated coefficient changed to the opposite side and amounted to -0.00001.

Thus, before the financial crisis the coefficient of absolute risk aversion had a value of 0.00004,which indicates that the precautionary savings motive determined household savings behavior in the Russian Federation

makingpeople save assets. Being affected by the financial crisis of 2010's the coefficient of absolute risk aversion amounted -0.00001,which indicates that Russian households have started to dissave their accumulated assets in order to maintain the permanent level of consumption.

CONCLUSIONS

The hypothesis tested in this Master thesis is whether the financial crisis of 2010's changed the household savings behavior in the Russian Federation.

After the careful study of the literature on household savings behavior it was concluded that the financial crisis seems likely to affect household savings behavior by changing the strength of the precautionary savings motive. The existence and strength of the precautionary savings motive among Russian households were tested by using the Russia Longitudinal Monitoring Surveyfor the period of 2005-2009 years and following the methodology of Wilson (2007). In order to eliminate all savings motivesother than precautionary savings motive several strong restrictions were imposed on dataset. Thereby, the conditional volatility of labor income was generated, which enables to estimate the coefficient of absolute risk aversion.

The estimated empirical results show that the latest financial crisis indeed influenced savings behavior of Russian households: before the financial crisis of 2010's Russian households saved their assets for the precautionary savings motive, whereas after the financial crisis Russian households started to dissave their accumulated assets in order to maintain the permanent level of consumption.

The further research on household savings behavior in the Russian Federation could be performed in the direction of weakening the assumption of homogeneous attitude towards risk among Russian householdsand studying the impact of financial crisis on other

savingsmotives. Also, in the case of data availability one could study the effect of financial crisis on the structure of assets accumulated by households in the Russian Federation.

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Table 1. Sample construction.

| | Year | Number of observations | |
|---|---|---|---|
| | | Dropped | Total |
| Number of observations by years | 2009 | 4811 | |
| | 2008 | 4579 | |
| | 2007 | 4430 | |
| | 2006 | 4276 | |
| | 2005 | 3436 | |
| After a drop of missing variables in all years | 2009 | 3038 | |
| | 2008 | | |
| | 2007 | | |
| | 2006 | | |
| | 2005 | | |
| After a drop of duplicates (to avoid split of families) | 2009 | -60 | 2978 |
| | 2008 | -99 | 2879 |
| | 2007 | -100 | 2779 |
| | 2006 | -76 | 2703 |
| | 2005 | -80 | 2623 |
| After a merge with household samples | | -1006 | 1617 |
| After applying restrictions described in Chapter 4 | | -1285 | 332 |

Table 2. Description statistic for main variables used in a model (for balanced panel with restrictions)

| | Year | | | | |
|---|---|---|---|---|---|
| | 2005 | 2006 | 2007 | 2008 | 2009 |
| Income, thousand rubles | 240.98 (257.07) | 288.88 (259.1) | 323.17 (198.3) | 405.32 (216.06) | 455.7 (347.49) |
| Consumption thousand rubles | 58.29 (36.37) | 69.63 (40.91) | 82.44 (49.04) | 100.95 (58.86) | 107.34 (62.23) |
| Age | 39.9 (8.3) | 40.1 (8.3) | 41.9 (8.3) | 42.9 (8.3) | 43.7 (8.3) |
| Unemployment | 124.6 (408.4) | 101.3 (362.4) | 84.8 (335.4) | 94.1 (351.2) | 126.1 (408.4) |
| # of observations | 332 | | | | |

Note: Standard deviations are reported in parentheses.

Table 3. Description statistic for main variables used in a model (for unbalanced panel without restrictions)

| | Year | | | | |
|---|---|---|---|---|---|
| | 2005 | 2006 | 2007 | 2008 | 2009 |
| Income, thousand rubles | 162.44 (257.07) | 217.11 (470.7) | 224.44 (184.9) | 308.58 (290.17) | 331.04 (285.94) |
| Consumption thousand rubles | 44.1 (32.16) | 53.81 (42.33) | 63.64 (43.43) | 80.11 (54.8) | 86.87 (62.1) |
| Age | 39.9 (8.3) | 40.1 (8.3) | 41.9 (8.3) | 42.9 (8.3) | 43.7 (8.3) |
| Unemployment | 124.6 (408.4) | 101.3 (362.4) | 84.8 (335.4) | 94.1 (351.2) | 126.1 (408.4) |

Note: Standard deviations are reported in parentheses. Number of observations differ across variables.

Table 4. Explanation of Dummy variables used in a model (for balanced panel with restriction)

| Variable | Description | Frequency, % |
|---|---|---|
| ED1 | If no high school diploma | 5.23 |
| ED2 | If high school diploma | 7.20 |
| ED3 | If Professional courses | 12.62 |
| ED4 | If vocational training school without secondary education | 16.68 |
| ED5 | If vocational training school with secondary education, technical trade school, technical community college, medical, music, pedagogical, art training school | 22.34 |
| ED6 | If institute, university, academy | 34.65 |
| ED7 | If attendeda post-graduate course, has Master's degree, a diploma of candidate of science or a diploma of Doctor of Science | 1.29 |
| O1 | If not working at time of interview | 9.97 |
| O2 | If Legislators, Senior Managers, Officials | 8.98 |
| O3 | If Professionals | 11.75 |
| O4 | If Technicians and Associate Professionals | 11.14 |
| O5 | If Clerks | 2.40 |
| O6 | If Service Workers and Market Workers | 5.85 |
| O7 | If Skilled Agricultural and Fishery Workers | 0.31 |
| O8 | If Craft and Related Trades | 18.28 |
| O9 | If Plant and Machine Operators and Assemblers | 23.20 |
| O10 | If Elementary (Unskilled) Occupations | 7.02 |
| O11 | If in Army | 1.11 |

Table 5. Coefficient Estimatesand Standard Errors for theEstimation Regression of the Conditional Variance of Disposable Labor Income

| Variables | Estimated Coefficients | |
| --- | --- | --- |
| | Unrestricted Sample | Restricted Sample |
| Age | 27.50** | 3.27 |
| | (9.69) | (18.60) |
| Age$^2$ | 0.06 | 0.42 |
| | (0.12) | (0.22) |
| ED2 | -31.10 | 4.10 |
| | (23.965) | (51.30) |
| ED3 | 52.25* | 50.56 |
| | (24.96) | (47.90) |
| ED4 | 4.03 | 33.56 |
| | (22.72) | (42.68) |
| ED5 | 6.73 | 81.22 |
| | (29.79) | (51.72) |
| ED6 | -11.33 | --31.50 |
| | (36.75) | (70.77) |
| ED7 | 665.86*** | 833.89*** |
| | (102.22) | (146.24) |
| O2 | 107.79** | 140.08* |
| | (34.01) | (66.19) |
| O3 | 54.90 | 94.82 |
| | (31.55) | (65.27) |
| O4 | 23.35 | 33.46 |
| | (28.91) | (64.92) |
| O5 | 6.02 | 4.17 |
| | (42.80) | (81.12) |
| O6 | 13.48 | 81.58 |
| | (33.48) | (70.53) |
| O7 | -27.76 | |
| | (98.33) | |
| O8 | 44.36 | 32.00 |
| | (25.87) | (58.79) |
| O9 | 57.90* | 64.3* |
| | (24.60) | (57.55) |
| O10 | 57.09* | 34.33 |
| | (25.36) | (65.00) |
| O11 | 30.38 | 72.58 |
| | (72.31) | (98.98) |
| Unemployment | 0.01 | -0.01 |
| | (0.01) | (40.99) |
| Constant | -972.08*** | -636.28 |
| | (191.52) | (387.47) |
| Observations | 6 552 | 1 660 |
| R$^2$ within | 0.06 | 0.13 |
| Number of Households | 1 760 | 332 |

Note: Standard errors are reported in parentheses.
*** Significance at 1%, ** significance at 5%, * significance at 10%

Table 6.Regressions of Consumption Growth on Conditional Income Volatility

| Variables | Estimated Coefficients | |
|---|---|---|
| | Unrestricted Sample | Restricted Sample |
| Labor income volatility | 0.000003*** | 0.00002* |
| | (0.0000005) | (0.000008) |
| After crisis | -6.99*** | -6.92* |
| | (1.33) | (2.59) |
| Labor income volatility x After crisis | -0.000007* | -0.00003** |
| | (0.000003) | (0.000009) |
| Constant | 11.41*** | 13.71*** |
| | (0.66) | (1.30) |
| Observations | 4 195 | 1 328 |
| R-squared | 0.014 | 0.013 |

Note: Standard errors are reported in parentheses.
*** Significance at 1%, ** significance at 5%, * significance at 10%

## APPENDIX A

Derivation of the condition of the relating changes in consumption to the volatility of labor income (Wilson, 2007)

A household faces the uncertain labor income path and maximizes the value of future utility from consumption up to the time of death T:

$$\max_{C_{it+j}} E_t \sum_{j=0}^{T-t} (1+\beta_i)^{-j} U_i(C_{i,\,t+j})$$

(A1)

The household is limited by the intertemporal budget constraint:

$$A_{i,t+j+1} = (1+r_i)(A_{i,t+j} - C_{i,t+j}) + Y_{i,t+j+1}$$

(A2)

Also the agent faces the borrowing constraint:

$$A_{i,t} - C_{i,t} \geq 0 \;\; \forall t$$

(A3)

Where $C_{i,t}$ stands for consumption, $A_t$ – total wealth, $Y_t$ – labor income, $\beta_i$ – discount rate for time preferences and $r_i$ – real interest rate.

Solving the above mentioned household's problem gives the following first-order condition:

$$\left(\frac{1+r_i}{1+\beta_i}\right) E_t[U_t'(C_{i,\,t+1})] = U_t'(C_{i,\,t}), \qquad for\; j=1$$

(A4)

Following the methodology of Wilson (2003), let's assume that the utility function for every household has the constant absolute riskaversion (CARA) form:

$$U_t(C_{i,t}) = -\frac{1}{\rho_i} e^{-\rho_i C_{i,t}}$$

(A5)

Where $\rho_i$ is the coefficient of absolute risk aversion for household i.

Substituting (A5) to (A4) and assuming for simplicity that $\beta_i = r_i$ it can be shown that:

$$E_t e^{-\rho_i C_{i,t+1}} = e^{-\rho_i C_{i,t}}$$

(A6)

Applying a second-order Taylor approximation to the condition (A6) the relating changes in consumption to the volatility of labor income can be found:

$$e^{\uparrow}(-\rho_i C_i(i,T-1)) = \Box E\Box_i(T-1) e^{\uparrow}(-\rho_i i [(1+r_i i)(A_i(i,T-1) - C_i(i,T-1)) + Y_i(i,T))$$

(A7)

$$J(Y_i(i,T)) = \Box E\Box_i(T-1) e^{\uparrow}(-\rho_i i [(1+r_i i)(A_i(i,T-1) - C_i(i,T-1)) + Y_i(i,T))$$

(A8)

$$E_{T-1}J(Y_{i,T}) = J(\overline{Y}_{i,T}) + \frac{1}{2}J''(\overline{Y}_{i,T}) var_{T-1}J(Y_{i,T})$$

(A9)

$$e^{-\rho_i C_{i,T-1}} = \left(1 + \frac{\rho_i^2}{2} var_{T-1}(Y_{i,T})\right) e^{-\rho_i \overline{C}_{i,T}}$$

(A10)

$$-\rho_i C_{i,T-1} = \log\left(1 + \frac{\rho_i^2}{2}\sigma_{i,T}^2\right) - \rho_i \overline{C}_{i,T} = \frac{\rho_i^2}{2}\sigma_{i,T}^2 - \rho_i \overline{C}_{i,T}$$

(A11)

$$-C_{i,T-1} = \frac{\rho_i}{2}\sigma_{i,T}^2 - \overline{C}_{i,T}$$

(A12)

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$$C_{i,T} - C_{i,T-1} = \frac{\rho_i}{2}\sigma_{i,T}^2 + \left(C_{i,T} - \bar{C}_{i,T}\right) \tag{A13}$$

Letting $\Delta C_{i,T} = C_{i,T} - C_{i,T-1}$ and $\epsilon_{i,t} = C_{i,T} - \bar{C}_{i,T}$:

$$\Delta C_{i,t} = \frac{\rho_i}{2}\sigma_{i,t}^2 + \epsilon_{i,t} \tag{A14}$$