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Financial literacy and over-indebtedness: Is there a relationship?

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Abstract

This paper assesses the relationship between financial literacy and over-indebtedness of Russian households using panel data from the Survey of Consumer Finances collected in Russia during 2018–2024. Russia is an interesting case: a relatively young consumer-finance market in which a lack of financial literacy may increase the likelihood of household over-indebtedness. To test this hypothesis, we use a household fixed-effects panel regression model to control for all unobservable time-invariant household characteristics, together with an instrumental-variable (IV) approach with clustered standard errors based on a two-stage least squares (2SLS) procedure to correct for potential simultaneity between financial literacy and over-indebtedness. The instrument is the number of universities per region. Our main finding is that both the fixed-effects panel regression and the 2SLS estimates indicate no relationship between financial literacy and household over-indebtedness in Russia in 2018–2024; this result is robust to alternative specifications of variables and models.

Keywords: financial literacy, over-indebtedness, household finance.
JEL classification: D14, G51, G53.

1. Introduction

Over the last 15 years, financial literacy has become an important issue for both academic and policy research. In 2023, more than 65 countries worldwide were actively developing or implementing national strategies aimed at improving people's financial literacy (OECD, 2023a, p. 11). To evaluate and improve the efficiency of policy decisions, the international research community has generated strong evidence on how financially literate people are distributed across countries and various target groups (Fernandes et al., 2014; Miller et al., 2014; Klapper and Lusardi, 2020; Goyal and Kumar,

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2021; Khan et al., 2022; Xiao et al., 2022; Lusardi and Mitchell, 2023; Molina-Garcia et al., 2023).

Early research focused mainly on the conceptual and operational definitions of financial literacy (Lusardi and Mitchell, 2008; Huston, 2010; Lusardi and Mitchell, 2011; Xu and Zia, 2012; Lusardi, 2015; Bucher-Koenen et al., 2016; Allgood and Walstad, 2016; Clark et al., 2017; Warmath and Zimmerman, 2019; Klapper and Lusardi, 2020; Yakoboski et al., 2022; Lusardi and Mitchell, 2023). Conceptually, financial literacy refers to both knowledge and behavior; practical skills and appropriate attitudes toward managing finances matter as well. Together, these capacities enable people to make informed financial decisions and enhance their overall well-being. The widely used OECD definition treats it as "a combination of financial awareness, knowledge, skills, attitudes and behaviour necessary to make sound financial decisions and ultimately achieve individual financial well-being" (OECD/INFE, 2011, p. 3).

Conceptual definitions of financial literacy are still contested, and the diversity of operational indicators reflects this. The range of measurement techniques varies from simple scales based on basic questions on compound interest, inflation, and risk diversification (Lusardi and Mitchell, 2008) to more complex tools, such as the financial literacy score devised by the OECD/INFE (2011) or the financial capability index (Warmath and Zimmerman, 2019).

Research across countries with varying levels of economic and financial-intermediation development reveals a positive relationship between financial literacy and sound household financial behavior (Fernandes et al., 2014; Brüggen et al., 2017; Stolper and Walter, 2017; Grohmann et al., 2018; Lee and Kim, 2019; Deuflhard et al., 2019; Gomes et al., 2021; Kaiser et al., 2022). Whether this reflects association or causation is still under discussion because of potential endogeneity (Arrondel et al., 2012; Babiarz and Robb, 2014; Kimball and Shumway, 2010; van Rooij et al., 2011). The threat to causal claims is that financial literacy is not randomly assigned to individuals, which confounds the results. A meta-analysis by Fernandes et al. (2014) found that 24 of the 111 studies reviewed used an instrumental-variable (IV) approach to address the endogeneity of financial literacy, while the rest relied on regression models that cannot establish a causal effect of financial literacy on financial behavior. Kaiser and Lusardi (2024) highlight that financial illiteracy has an impact on financial decision-making. For example, higher financial literacy is associated with better retirement planning, greater stock-market participation, and more responsible borrowing habits. Although scholars have thoroughly explored how financial literacy relates to the asset side of household financial behavior, its implications for household indebtedness remain under-examined (Kaiser and Lusardi, 2024).

This paper contributes to the literature by addressing the endogeneity problem when examining the association between financial literacy and over-indebtedness in Russian households, using panel data from the Survey of Consumer Finances collected in Russia in 2018–2024. Russia is an interesting case: a relatively young but fast-developing consumer-finance market. Before 1988, there were no commercial banks in Russia, and apart from one state bank and one state insurance company, there were no other financial institutions. The market emerged at the turn of the 1980s and 1990s, when the 1988 law "On

Cooperation" was enacted and private banks, along with insurance companies, began to appear. Only in the 2000s did bank cards and consumer loans become available to mass consumers (Kuzina, 2015). The rapid development of financial markets gave consumers access to a wide range of financial services; however, the population still lacked the knowledge and skills to manage these products. In 2024, only 11% of Russians reported that they had good or excellent competency with personal finances (Bank of Russia, 2024a). According to macroeconomic statistics, Russia's debt-to-GDP and debt-to-GDI ratios are not particularly high relative to other countries (OECD, 2023b). However, the share of non-performing loans in total gross loans and advances is roughly twice as high as in the EU, indicating a higher level of over-indebtedness among Russian households relative to European ones (European Central Bank, 2024a). According to the latest statistics, the number of bank borrowers with three or more loans reached 12.7 million by the end of 2024, accounting for 49.6% of the total debt on retail loans. Furthermore, the share of mortgages issued in 2024 that have overdue debts of more than 90 days has more than doubled compared with loans issued in 2023 (Bank of Russia, 2024b). The Russian Government[1] has responded by launching the program "Strategy for improving financial literacy and developing financial culture until 2030" in order to improve financial well-being, including better management of loan products. These considerations provide convincing grounds to expect financial literacy to be associated with the over-indebtedness of Russian households, which we test in this study.

The rest of the paper is organized as follows. First, we review the conceptual justifications and empirical findings on the relationship between financial literacy and household indebtedness in the existing literature. Next, we present our conceptual framework, empirical methodology, and the data used. The main model is a panel logistic regression with fixed effects. Using four waves of the nationally representative Survey of Consumer Finances (2018, 2020, 2022, and 2024), we find no statistically significant effect of financial literacy on household over-indebtedness in Russia.

2. Literature Review

2.1. Over-indebtedness

Over-indebtedness is defined as an inability to meet recurring expenses and, therefore, should be seen as an ongoing rather than a temporary or one-off state of affairs (Fondeville et al., 2010). How to operationalize the concept of over-indebtedness in measurable indicators is still partially unresolved in the literature. Threshold values of over-indebtedness are difficult to identify unambiguously, because the conditions under which the debt burden becomes to differ extensively across circumstances, and "the term should certainly not be confused with the existence of high levels of debt in the economy" (Disney et al., 2008, p. 11). The literature offers several proposals for the indicators to use when measuring over-indebtedness in household surveys.

[1] Strategy for improving financial literacy and developing financial culture until 2030 (in Russian). http://static.government.ru/media/files/FJj6iZ8geL94xUACfr2s32ZqoUgqP7fd.pdf

One indicator of over-indebtedness is whether households are one, two, or three months in arrears on a debt payment. However, there is a question of which time horizon to choose. D'Alessio and Iezzi (2013) point out that this measure does not differentiate between those who have temporary problems due to shocks such as job or income loss and those who are in an ongoing rather than a temporary state of inability to meet recurring expenses. Another indicator is the number of outstanding loans that a household must repay. The Department of Trade and Industry (DTI) in the UK identified that having four credits can be a good estimator of this condition (Kempson, 2002). However, this indicator does not account for the size of debt, because many small credits may be manageable and need not lead to a troublesome situation. Moreover, the number of such households is likely to be very low in Russia (Kuzina and Krupensky, 2018). One of the most common indicators of over-indebtedness is the debt-service-to-income ratio (Ottaviani and Vandone, 2018; Noventi and Danarsari, 2017; Idris et al., 2016; French and McKillop, 2016; Bartiloro et al., 2015). To be more precise, households are considered over-indebted if they spend more than 30% of their gross monthly income on loan repayments. This approach is criticized in the financial literacy literature for being income-related, because high-income households can sustain these repayments even when they spend more than 30% of their gross monthly income on loans (D'Alessio and Iezzi, 2013). Low-income households are more vulnerable to income shocks and consumption fluctuations, whereas high-income households can absorb them more easily (Bartiloro et al., 2015). Even though this indicator is popular, it is not possible to justify what the threshold should be — 30%, 40%, or 50%. As a result, researchers tend to choose the level that best fits their empirical setup. Finally, a household can be considered over-indebted if its debt-servicing costs push it below the poverty line. D'Alessio and Iezzi (2013) note that this indicator is good, but is not used often in the empirical literature.

The study by Fondeville et al. (2010) suggests that even though the indicators of over-indebtedness are quite diverse, there are common characteristics associated with having too much debt. First, the unit of measurement is the household rather than the individual, because incomes, consumption, savings, and therefore liabilities are usually pooled. Second, all financial commitments of the household, including arrears on utility bills or rent, should be taken into account. Third, over-indebtedness is an ongoing rather than a temporary inability to meet regular expenses. Finally, debt problems cannot be solved by resorting to new borrowing.

It is important to identify the causes of over-indebtedness, because it can be hard to escape and can lead to deterioration in both household well-being and the stability of financial markets (Alleweldt et al., 2013). What are the drivers of becoming over-indebted? If households are fully rational and can process all available information, the only factors that can lead to over-indebtedness are unforeseen shocks (economic crises, sudden rises in interest rates, unexpected death of a family member, family breakdown, and so on). However, this assumption is too strong to be realistic. People may not know how to find or process information, may be overconfident, may have self-control problems, or may have weak numerical skills (Lusardi and Mitchell, 2014; Disney and Gathergood, 2011; Gerardi et al., 2013; Lusardi and Tufano, 2015).

2.2. Financial literacy

Up to the 2010s in Russia, financial literacy was taught neither in educational institutions nor within families. As a result, the level of financial literacy among Russians is relatively low. Many Russians do not keep track of their income and expenses, and a considerable number do not understand fundamental concepts such as interest compounding or deposit insurance (Klapper et al., 2013). On average, Russians lack the knowledge and skills needed to assess credit costs and the risks associated with credit products (Vovchenko et al., 2018). According to the International Survey of Adult Financial Literacy, Russia ranked 13th among 23 European countries, behind Slovenia, Estonia, Poland, the Czech Republic, and Moldova (OECD/INFE, 2020, p. 15).

Growing interest in financial literacy as an independent factor of household financial behavior has led to a rise in publications on how to define and measure this variable. The first conceptual definition of financial literacy as the financial knowledge that enables people to make informed financial decisions was given by Noctor et al. (1992). However, it was soon recognized that financial knowledge alone, without the corresponding skills and attitudes, does not help people manage their money efficiently. As a result, most conceptual definitions of financial literacy encompass several dimensions. Although there is no single, mutually accepted definition, the most comprehensive one was proposed by Atkinson and Messy (2011) and later adopted in OECD reports: "a combination of financial awareness, knowledge, skills, attitudes and behaviors necessary to make sound financial decisions and ultimately achieve individual financial well-being" (OECD/INFE, 2011, p. 3).

In contrast to 'financial literacy,' which focuses on knowledge, 'financial capability' examines the application of knowledge in practice (Kempson et al., 2005). It thus relies on a more behavior-oriented than knowledge-oriented concept of financial literacy. The main drawback of financial-capability measures is that they rely on self-reported subjective assessments rather than objective tests. However, expert-derived scales and tests of financial literacy can also lack objectivity, because the knowledge experts select may reflect the interests of retail finance companies and financial-market regulators and may not always correspond to the conditions in which people actually live and operate.

Both approaches are used in the empirical literature. Some authors prefer to use knowledge because it can be measured by objective tests (Varum and Kolyban, 2014), whereas others rely on financial capability, which captures the ability to apply appropriate financial knowledge to make sound financial decisions and to navigate everyday financial matters (Xiao et al., 2022). There are also researchers who use both capability and knowledge (Servon and Kaestner, 2008).

How to measure financial literacy is still a contested issue in the literature (Ottaviani and Vandone, 2018). Some authors use terms such as literacy, knowledge, and skills interchangeably. However, the most common approach is to form an index from correct answers to the "Big Three" questions (Lusardi and Mitchell, 2008). These questions test respondents' understanding of interest compounding, inflation, and the risks associated with portfolio diversification (Disney and Gathergood, 2011; Gathergood, 2012; Bucher-Koenen and Ziegelmeyer, 2014; Lusardi and Tufano, 2015; Idris et al., 2016; Ooijen and van Rooij, 2016;

Cao-Alvira et al., 2020). The FINRA Investor Education Foundation (2013) uses four key components of financial capability: making ends meet, planning ahead, managing financial products, and financial decision-making. The first toolkit for measuring financial literacy and financial inclusion was developed by the OECD International Network on Financial Education (OECD/INFE) in 2010 and was modified in 2015, 2018, and 2022. In the 2022 version of the questionnaire, there were 7 questions on financial knowledge, 9 on financial behavior, and 4 on financial attitudes. The overall financial literacy score is calculated as the sum of correct answers to all 20 questions, with equal weight on each question (OECD/INFE, 2022, p. 46). Sub-scores can also be computed for knowledge, behavior, and attitudes as sums of correct answers in each domain. The scale proposed by Ćumurović and Hyll (2019) contains 9 questions that measure the degree to which individuals understand the concepts and products of financial markets. The main criticism of measuring financial literacy through scoring with a small number of questions is that it cannot cover all of the domains identified in conceptual definitions. However, when the number of questions increases, equal weighting becomes problematic, because it is not clear whether all questions are equally important. If they are not, then a disproportionate share of influence is assigned to less important topics, which skews the overall score. Rieger (2020), by testing the reliability and validity of different financial literacy measurement tools, concluded that the scales proposed by Lusardi and Mitchell (2011) and Ćumurović and Hyll (2019) are the ones best suited for measuring financial literacy. Overall, the academic literature suggests using testing rather than self-assessment questions on financial arithmetic and financial knowledge in financial literacy scores, and limiting the number of questions to a maximum of nine to avoid the problem of unequal weighting.

2.3. Financial literacy and over-indebtedness

What are the arguments for and against a relationship between financial literacy and consumer over-indebtedness? The majority of previous foreign empirical research has examined indebtedness and its types rather than over-indebtedness (Appendix A). For example, having high numeracy skills (calculating compound interest, inflation, and so on) is positively associated with the debt-service-to-income (DSTI) ratio and is not associated with obtaining high-cost borrowings, whereas money-management skills are negatively related to both, as shown using different samples (Northern Ireland and Colombia) and methods (2SLS and OLS) (French and McKillop, 2016; Cao-Alvira et al., 2020). In addition, a negative relationship has been found between debt financial literacy (an adaptation of the Big Three questions to the debt context) and reporting credit arrears (more than one month) in the UK (Disney and Gathergood, 2011; Gathergood, 2012). Moreover, financial literacy operationalized through the Big Three questions has a negative association with the number of outstanding loans among residents of the capital of Croatia (Bahovec et al., 2015). Likewise, financially literate Americans are less likely to engage in poor credit behaviors (being charged late fees, paying only the minimum required, and so on) (Mottola, 2013). When it comes to over-indebtedness measured through subjective self-assessment of debt burden, there is a negative relationship with financial or debt literacy indices in the UK, the US,

and Poland (Disney and Gathergood, 2011; Lusardi and Tufano, 2015; Kurowski, 2021). However, when financial literacy itself is measured by self-assessment, the relationship disappears (Kurowski, 2021). In addition, no relationship has been found between a financial literacy index and financial fragility (which takes debt levels into account) among Colombian households during the COVID-19 crisis (Cardona-Montoya et al., 2022).

A major concern in studies of the influence of financial literacy on financial behavior is the endogeneity of financial literacy. Only two of the studies cited above address this problem, using two instrumental variables: having financial education while in full-time education (Disney and Gathergood, 2011) and religion (being Catholic or Protestant; French and McKillop, 2016).

When it comes to the Russian context, only a few articles are closely related to our research topic. Klapper et al. (2013) find a positive effect of financial literacy (measured as an index corresponding to the number of correct answers to four arithmetic questions) on holding formal credit (including consumer debt, credit-card debt, and mortgages) among Russian households in 2009. At the same time, financial literacy has a negative effect on holding informal credit. The instruments used are the number of newspapers and the number of universities in a region (Klapper et al., 2013). In another study, the authors find a positive relationship between a financial literacy index (based on the number of correct answers to 12 questions on various aspects of financial arithmetic skills and knowledge) and both the fact of holding a credit and the intention to take out a credit among Russian households in 2023 (Sinyakov and Shelovanova, 2025). Kuzina and Krupensky (2018) find that the financial literacy of borrowers is higher than that of non-borrowers. However, this finding does not establish the direction of the relationship: are borrowers more financially literate as a result of their consumer-credit experience, or are those who are more competent with financial services more likely to take out credit? According to one of the most recent studies, by researchers from the Bank of Russia, there is no relationship between the financial literacy of a household's head and a combined score representing debt burden in a nationally representative sample of Russian households (Zvereva et al., 2024). In that study, the authors use a cross-sectional sample from the All-Russian Survey of Consumer Finances in 2022–2024. Financial literacy is instrumented with two variables: the average financial literacy score of other adults in the household and the average financial literacy score of other households in the region to which the given household belongs. The debt-burden score is calculated as an average across 8 dummy variables: having more than four different loans, having been refused a loan, having a high-interest loan, having more than two outstanding loans, holding more than three credit cards, having arrears on debt payments, holding outstanding loans from microfinance organizations, and having a debt-service-to-income ratio above 80%.

Thus, there are few empirical works dedicated to studying the relationship between financial literacy and the credit behavior of Russian households. Even fewer are related to over-indebtedness, and these have some important drawbacks. First, the authors do not exploit the potential of panel data to control for unobserved and time-invariant household characteristics, which are likely to matter in financial decision-making — including cognitive abilities, attitudes toward debt, and family values. Second, the composite debt-burden index introduces measure-

ment bias, because components of varying importance and nature are given equal weight, it is unclear why particular threshold values are chosen, and information is lost when continuous variables are converted into binary indicators.

The literature review allows us to draw several important conclusions. First, there is no consensus on how to measure over-indebtedness, and authors in their empirical work primarily rely on subjective self-assessment rather than objective indicators such as the one according to which a household is considered over-indebted if its debt-servicing costs push it below the poverty line. Second, the most common approach to constructing a financial literacy measure is limited to three questions (the Big Three), which could be broadened to cover more diverse aspects. Third, financial literacy is negatively related to poor credit behaviors (high-cost borrowing, arrears, number of loans, and so on) and to self-assessment of debt burden in non-Russian contexts, but the results are sensitive to how financial literacy is measured (objective vs. subjective, numerical vs. behavioral). Fourth, there is almost no closely related research on Russia, except for one study that is criticized for its combined debt-burden index and for not exploiting the potential of panel data. The current article aims to address these gaps in the literature.

3. Data

The All-Russian biennial panel Survey of Consumer Finances has been conducted since 2013 and is currently sponsored by the Bank of Russia. LLC Demoskop has served as the coordinating and executing contractor for all waves of the survey, including the field work. In addition to information on the demographic characteristics of households, the data set contains detailed information on households' balance sheets in Russia. The sample includes around 12,000 individuals aged 18 and over, living in approximately 6,000 households per wave. The survey is conducted using a methodology similar to the ones used in the United States and European countries (Federal Reserve System, 2024; European Central Bank, 2024b).

Because we are interested in how financial literacy relates to the borrowing behavior of households, the final subset is restricted to the last four waves, in which all questions on financial literacy were asked, and to households with liabilities across all four waves. The basic unit of data collection and analysis is the household, while the reference person is the head of the household, whose personal characteristics are used in the analysis. Because the question ("Who is responsible for the main financial decisions in the household?") for identifying the household head was asked only in 2022 and 2024, a uniform algorithm for determining the head was applied across all four waves of observation. The head of the household is defined as the member with the highest monthly income, as that person is likely to be responsible for making financial decisions in the household (Disney and Gathergood, 2011). However, this filter is not sufficient for the entire sample, since 8% of households include two or more adult members with the same income. In these cases, the older member is treated as the head, because the heads tend to be older than non-heads in the 2022 and 2024 data (Appendix B). For the remaining less than 1% of observations, for which the described algorithm does not yield a unique head, males are identified as the heads.

The resulting sample depends on the model specification, which is described in the Empirical strategy section.

4. Variables

Over-indebtedness (*Over-indebted*) is measured as a dummy variable equal to 1 if a household's monthly income minus monthly debt repayments is below the poverty line, where the poverty line is calculated as the income needed to provide a basic standard of living for the household, using information on the household's demographic composition and the official regional poverty thresholds for children, adults, and pensioners.[2] Debt includes bank loans with regular monthly payments, such as consumer loans, car loans, and mortgages, which is consistent with the recommendation in the relevant literature by D'Alessio and Iezzi (2013).

The financial literacy variable (*Finindex*) is measured as an index with values from 0 to 8, corresponding to the number of correct and relevant answers to eight questions on financial arithmetic, knowledge, and behavior. The construction of the index is based on the methodology of the Big Three questions, in which the index equals the number of correct answers. However, the index is enriched with additional questions, in order to increase its variability and capture financial literacy on a broader scale. The wordings of the survey questions and the percentages of correct and relevant answers are presented in Supplementary material Tables C.1 and C.2.

Based on the previous research, the major control variables are included in the model.

Characteristics related to the head of the household:

- *Female* — a dummy variable equal to 1 if the household head is female and 0 if male;
- *Age* — the number of full years of the household head;
- *Age²* — the squared age, to account for non-linear effects;
- *Higher Education* — a dummy variable equal to 1 if the household head had a higher education at the time of the survey and 0 otherwise;
- *Unemployed* — a dummy variable equal to 1 if the household head is not employed but is of working age, and 0 otherwise;
- *Retired* — a dummy variable equal to 1 if the household head receives a pension and does not work, and 0 otherwise;
- *Risk-tolerance* — an ordinal variable from 1 to 4, based on the self-assessed level of financial risk-taking (Supplementary material Table C.3);
- *Future orientation* — an index from 1 to 4, constructed via PCA of attitudes toward three statements: whether the respondent only thinks about the immediate future, lives more for today than for the future, or does not worry about the future because it does not depend on him or her personally. The higher the value, the more future-oriented the head (Supplementary material Table C.4).
- *Emotionality* — an index from 1 to 4, constructed via PCA of attitudes toward three statements: whether the respondent often acts without thinking, acts under the influence of emotions, and speaks first and thinks later. The higher the value, the more emotional the head (Supplementary material Table C.5).

[2] Federal State Statistics Service, https://www.fedstat.ru/indicator/30957

- *Dependent Child* — a dummy variable equal to 1 if there is at least one dependent child aged under 18 in the household, and 0 if there are no dependent children;
- *Income Per Capita* — a continuous variable representing the monthly income of a household member. It is transformed into a log scale because it is right-skewed.

Characteristics related to the region:

- *Unemployment rate in a region* — a continuous variable representing the unemployment rate in a particular region. It is transformed into a log scale because it is right-skewed;[3]
- *Income per capita in a region* — a continuous variable representing the average personal income in a particular region. It is transformed into a log scale because it is right-skewed;[4]
- *Rural* — a dummy variable equal to 1 if the household lives in a rural area and 0 if the household lives in a city or town.

The summary statistics of the variables used in the panel and pooled samples are presented in Supplementary material Appendix D.

5. Empirical strategy

Several methods are used to study the relationship between financial literacy and the over-indebtedness of households in Russia. Because the dependent variable is binary, a nonlinear probability panel model (logit) with fixed effects to control for all unobservable time-invariant household characteristics is the appropriate baseline for our research, which is also supported by the Hausman test.[5] This helps to reduce the omitted-variable bias problem (Gathergood, 2012), together with the broad range of sociodemographic, economic, and regional control variables. There is a concern of sample depletion, since logit regressions with household fixed effects require observations of households that change their status from over-indebted to not over-indebted, and vice versa. In addition, households may become over-indebted not only because of the high amount of debt they hold but also because of the low amount of income they earn. For this reason, the sample is restricted to households whose income is above the poverty line, which further depletes the sample by more than 30%. As a result, the logistic regression with fixed effects can be estimated on 728 observations, whereas the pooled regression is applicable to 3,770 observations (Supplementary material Tables D.1–D.2).

To show that the obtained results are robust, the following sensitivity analyses are conducted:

1. Two additional specifications of the response variable are used, similar to those presented in the literature reviewed above:

- a binary variable equal to 1 if the debt-service-to-income (DSTI) ratio exceeds 30%;

[3] Federal State Statistics Service. https://www.fedstat.ru/indicator/43062

[4] Federal State Statistics Service. http://ssl.rosstat.gov.ru/storage/mediabank/tab4-zpl_2024.xlsx

[5] Hausman test shows that fixed effects model is preferred to random effects model: $\chi^2(17) = 3242$, $p > \chi^2 = 0.0134$.

- the logarithm of the debt-service-to-income (DSTI) ratio.

2. The financial literacy index is modified in several ways:

- It is reduced from eight to three questions (covering compound interest, inflation, and risk-return), which is similar to the Big Three questions used by Lusardi and Mitchell (2008);
- It is replaced with self-assessed financial literacy on a five-point scale, ranging from no knowledge and skills to excellent ones (Supplementary material Table C.2);
- It is replaced with the mean financial literacy score in the household, using the same eight questions;
- It is replaced with the maximum financial literacy score in the household, using the same eight questions.

Since panel logit regression with fixed effects examines within-household variation, the relationship may instead operate at the between-household level, so a pooled probit with household-level clustered standard errors is also tested.

Although the endogeneity of financial literacy in Russia is less important than in developed countries because of the relatively low level of development of financial markets and of financial education (Klapper et al., 2013), it can still matter, because reverse causality from participation in the credit market to the level of financial literacy may be observed. Therefore, to address the endogeneity of financial literacy, an instrumental-variable technique is used. The instrument should not have a direct effect on the dependent variable, as it should influence selection into the treatment condition only (French and McKillop, 2016). The instrumental variable used here is the number of universities per region (both public and private)[6]. This variable can be a relevant instrument by being correlated with financial literacy while not correlating with the error term. It is likely to be correlated with financial literacy, because people surrounded by highly educated individuals are more exposed to a wide range of information, including economic and financial knowledge (Klapper et al., 2013). In addition, as the number of universities grows, competition among them intensifies, which raises the quality of education. Because including instrumental variables in a panel-data setup with fixed effects can be problematic owing to the low within-household variability of the instrument across waves (Supplementary material Table D.3), Two-Stage Least Squares (2SLS) with household-clustered standard errors is used instead, which is a common approach in empirical work. Such a model can also ensure that first-stage residuals are not correlated with the covariates (Angrist and Pischke, 2008, p. 143).

Because the importance of financial literacy may vary over time, probit and 2SLS regressions are also estimated by year.

6. Results

The main results of the panel-data logit regression with fixed effects are presented in Table 1. All the models are statistically significant, and including the control variables increases the value of the pseudo-R^2. Pairwise correlations and VIF values are reported in Supplementary material Tables D.4–D.5.

[6] Ministry of Science and Higher Education of the Russian Federation, https://minobrnauki.gov.ru/action/stat/highed/

As the results show, there is no statistically significant relationship between the *financial literacy* of the household head and the probability that the household is *over-indebted*. *Female*-led households are more likely to be over-indebted than male-led ones. *Age* has a statistically significant relationship with over-indebtedness, displaying an inverted U-shape. *Income per capita* is negatively related to over-indebtedness. The other control variables show no statistically significant relationship with over-indebtedness in the panel logit specification with fixed effects.

The lack of a relationship between financial literacy and over-indebtedness also holds when the response variable is changed to a dummy equal to 1 if the debt-service-to-income (DSTI) ratio exceeds 30%, and 0 otherwise. The same is true when the response variable is the continuous DSTI, which allows us to use a sample four times as large. Reducing the financial literacy index from 8 values to only 3 values, in line with the Big Three questions (Lusardi and Mitchell, 2008), or replacing it with a self-assessed indicator, does not change the re-

Table 1
The panel data logit regression with household fixed effects.

Response variable: Over-indebtedness	(1)	(2)	(3)	(4)	(5)	(6)
Finindex	–0.042	–0.040	–0.045	–0.084	–0.086	–0.089
	(0.056)	(0.056)	(0.056)	(0.095)	(0.095)	(0.097)
Female		0.511**	0.537**	0.817*	0.860*	0.844*
		(0.241)	(0.253)	(0.458)	(0.491)	(0.493)
Age		0.153*	0.154*	0.276***	0.321***	0.333***
		(0.073)	(0.083)	(0.097)	(0.113)	(0.113)
Age^2		–0.001*	–0.002**	–0.003***	–0.003***	–0.004***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Higher education			–0.181	–0.294	–0.085	–0.043
			(0.343)	(0.646)	(0.687)	(0.68)
Dependent child			0.537	–0.654	–0.652	–0.657
			(0.327)	(0.490)	(0.480)	(0.510)
Unemployed				10.839	10.621	10.775
(ref: employed)				(10.757)	(10.869)	(10.894)
Retired				–0.457	–0.488	–0.448
(ref: employed)				(0.99)	(10.062)	(10.059)
Income per capita (Log)				–110.331***	–110.736***	–110.790***
				(10.260)	(10.412)	(10.417)
Risk-tolerance					0.127	0.151
					(0.243)	(0.240)
Future orientation					–0.027	–0.001
					(0.297)	(0.298)
Emotionality					–0.282	–0.262
					(0.311)	(0.314)
Unemployment rate in a region (Log)						10.368
						(0.990)
Income per capita in a region (Log)						–10.672
						(50.750)
Year	Yes	Yes	Yes	Yes	Yes	Yes
Observations	842	842	841	838	728	728
Pseudo R^2	0.063	0.073	0.078	0.641	0.652	0.656
Prob > Chi^2	0.000	0.000	0.000	0.000	0.000	0.000

Note: The variable *Female* is not omitted from the model because a household head can change over time. Standard errors are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.
Source: Authors' calculations.

sult. Furthermore, replacing the household head's financial literacy with both the mean and the maximum values across all adult members of the household leaves the coefficient insignificant (Table 2).

The financial literacy of the household head is also unrelated to over-indebtedness in models with much larger samples, such as pooled probit and 2SLS specifications (Table 3). In addition, the result is stable across each year separately (Supplementary material Table E.3). The instrumental variable, *the number of universities in a region*, can be considered acceptable, since the F-statistic of

Table 2
Panel data logistic regressions with modifications.

	(1)	(2)	(3)	(4)	(5)	(6)
	DSTI > 30%	DSTI (log)	Over-indebted-ness	Over-indebted-ness	Over-indebted-ness	Over-indebted-ness
Finindex	–0.089	–0.015	–	–	–	–
	(0.060)	(0.012)				
Finindex	–	–	–0.083	–	–	–
(*Big Three*)			(0.062)			
Finindex	–	–	–	–0.024	–	–
(*Self-assessment*)				(0.191)		
Finindex	–	–	–	–	–0.023	–
(*Household mean*)					(0.035)	
Finindex	–	–	–	–	–	–0.036
(*Household maximum*)						(0.049)
Other control variables	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1191	4534	728	707	728	728
Prob > Chi^2	0.000	0.000	0.000	0.000	0.000	0.000

Note: The list of other control variables is the same as in the main specification (Model 6, Table 1). See the full table in Appendix E Table E.1. Standard errors are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.
(1) DSTI > 30%: dummy, equal to 1 if DSTI > 30% and 0 otherwise, where DSTI = debt-service-to-income.
(2) DSTI (log): log of DSTI.
(3) Finindex consists of 3 questions: compound interest, inflation, risk-return.
(4) Self-assessed Finindex (Likert scale from 0 to 4; Appendix C Table C.2).
(5) Finindex as the mean value of Finindex across household members.
(6) Finindex as the maximum value of Finindex across household members.
Source: Authors' calculations.

Table 3
Panel data logistic regressions with modifications.

Response variable	(1)	(2)
Over-indebtedness	Pooled Probit	2SLS (IV)
Finindex	0.002	0.038
	(0.019)	(0.068)
Rural	0.136*	0.056*
	(0.076)	(0.033)
Other control variables	Yes	Yes
Observations	3770	3770
Prob > Chi^2	0.000	0.000
F-statistics first stage	–	100.270

Note: IV: the number of universities per region. The list of other control variables is the same as in the main specification (Model 6, Table 1). See the full table in Appendix E Table E.2. Standard errors are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.
Source: Authors' calculations.

the first-stage regression is 10.31, which is just above the common threshold of 10 used in this literature (Stock et al., 2002; Keane and Neal, 2023). However, the instrument becomes rather weak when 2SLS is estimated for each wave separately (Supplementary material Table E.4). It is worth noting that living in a rural region increases the probability that a household is over-indebted (see Table 3).

7. Discussion

The panel logit regression with fixed effects shows no statistically significant relationship between the financial literacy of the household head and the probability that the household is over-indebted. This result is robust to changes in model specification, such as including or excluding variables or using different statistical methods.

The over-indebtedness of Russian households is strongly related to household income. Low-income households that struggle to maintain enough savings for unexpected events are more likely to carry a high credit load (Yudaeva, 2023). Without buffer savings, even small loans can place borrowers at higher risk of over-indebtedness, making this group more vulnerable to debt service (Bessonova et al., 2025). Female-led households are more likely to be over-indebted because they are predominantly managed without a partner (just under 43% of female heads are married, compared with 74% of male heads)[7] and because they have lower income. The gender pay gap in Russia has been widening since 2021, reaching approximately 30% in 2024 (Federal State Statistics Service, 2024). Female-headed households also save less often than male-headed ones (Bessonova et al., 2024), which can increase the probability of becoming over-indebted.

Behavioral characteristics such as future orientation, risk orientation, and emotionality are not associated with the over-indebtedness of Russian households, which may indicate that household over-indebtedness in Russia is a consequence of external institutional factors. As the probit model shows, living in rural areas increases the probability of over-indebtedness, and a lack of developed financial infrastructure is a major contributing factor.[8] This may reflect limited competition in the supply of credit in rural areas, which can lead to more expensive loans and less accurate credit scoring. In addition, the average bank interest rate on loans in Russia was approximately 15%[9] between 2018 and 2024, roughly twice as high as in European Union countries, where the average bank interest rate on loans was around 7%.[10] This difference creates additional risks of higher over-indebtedness in Russia, regardless of the level of financial literacy.

8. Conclusion

The goal of the current study was to estimate the relationship between financial literacy and the over-indebtedness of households in Russia, using panel data

[7] Authors' calculations on the data of Survey of consumer finance

[8] Bank of Russia, Increasing financial accessibility. https://www.cbr.ru/Content/Document/File/162469/report_20240731.pdf

[9] Bank of Russia. Rates on loans to individuals in Rubles. https://cbr.ru/eng/statistics/bank_sector/int_rat/

[10] ECB Data Portal. Bank interest rates on loans. https://data.ecb.europa.eu/main-figures/bank-interest-rates/loans?tab=Households

from four waves of a representative sample of households in the All-Russian Survey of Consumer Finances by the Bank of Russia. Using a logit regression with household fixed effects, we find that financial literacy (measured as an index covering the arithmetic, knowledge, and behavioral aspects of the financial literacy of the household head) does not affect household over-indebtedness (measured as the situation in which monthly income, after deducting all monthly loan repayments, is less than the poverty line for the household). The result is robust across different model specifications, including changes in the response variable, the variable of interest, and the type of regression with the corresponding sample.

The contribution of this study is the empirical use of a new indicator of over-indebtedness, which takes into account an objective indicator of poverty, and of a refined indicator of financial literacy — a composite index that captures not only the respondents' arithmetic skills but also their knowledge and behavior. Furthermore, the panel-data approach covering four waves of observations (currently the longest available time span for analysis in Russia) is used to account for unobserved individual effects, whereas other works are limited to one or, rarely, two waves of observations. Unlike the papers by Klapper et al. (2013) and Sinyakov and Shelovanova (2025), which also study Russian samples, the current work focuses not on the fact or intention of holding credit (which is not in itself problematic behavior) but on over-indebtedness, which creates risks for economic stability. The results robustly confirm that financial literacy is not statistically associated with the over-indebtedness of Russian households, in line with the findings of Zvereva et al. (2024), while conceptualizing the key variables and implementing the model differently. The absence of an effect is found across various model specifications: by replacing the response variable with the common alternative debt-service-to-income (DSTI) ratio and by replacing financial literacy with the self-reported value, the average value in the household, and the maximum value in the household.

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Appendix A

Table A1
Major articles closely related to the relationship between financial literacy and indebtedness/over-indebtedness.

Article	Sample	Model	Variable of interest	Instrument variable	Response variable					
					Objective					Subjective
					(1) DSTI	(2) Arrears (>1 month)	(3) High-cost of borrowing	(4) Number of different loans	(5) Derivative variable	(6) Self-assessment
Foreign-country sample										
Disney & Gathergood, 2011	UK, 2439 individuals, national representatives, cross-section	IV Probit	Debt literacy index from 0 to 3 (adoption of Big Three)	Having financial education whilst in full-time education	–	Negative	–	–	–	Negative
Gathergood, 2012	UK, ~3,000 households, national representatives, cross-section	Probit	Debt literacy index from 0 to 3 (adoption of Big Three)	No	–	Negative	–	–	–	No
Mottola, 2013	USA, 28,146 individuals, national representatives, cross-section	Logit	Dummy: high financial literacy — 4 or 5 correct answers to 5 questions	No	–	–	–	–	Negative (at least two out of six bad credit behaviors)	–
Bahovec et al., 2015	Croatia, city of Zagreb, cross-section	Rank-based nonpara-metric test	Big Three	No	–	–	–	Negative	–	–
Lusardi & Tufano, 2015	USA, ~1,000 individuals, cross-section	Multinomial Logit	Debt literacy index from 0 to 3 (adoption of Big Three)	No	–	–	–	–	–	Negative

(continued on next page)

Table A1 *(continued)*

Article	Sample	Model	Variable of interest	Instrument variable	Response variable					
					Objective					Subjective
					(1) DSTI	(2) Arrears (>1 month)	(3) High-cost of borrowing	(4) Number of different loans	(5) Derivative variable	(6) Self-assessment
French & McKillop, 2016	Northern Ireland, 499 credit union households, cross-section	2SLS	Numeracy skills index from 0 to 4	Religion (catholic or protestant)	Positive	–	No	–	–	–
			Money management skills from 0 to 9		Negative	–	Negative	–	–	–
Noventi & Danarsari, 2017	Indonesia, 103 low-income households, cross-section	OLS	Numeracy skills from 0 to 4	No	No	–	–	–	–	–
			Money management skills from 0 to 5		No	–	–	–	–	–
Ottaviani & Vandone, 2018	Italy, 445 Caucasian individuals, cross-section	OLS	PCA score with questions covering financial knowledge	No	No	–	–	–	–	–
Cao-Alvira et al., 2020	Colombia, ~33,000 households, national representatives, cross-section	Logit, OLS	Big Three	No	Positive	–	No	–	–	–
			Money management skills dummy		Negative	–	Negative	–	–	–
Kurowski, 2021	Poland, 1300 individuals, national representatives, cross-section	Multinomial Logit	Financial literacy index from 0 to 4 (similar to Big Three)	No	–	–	–	–	–	Negative
			Financial literacy self-assessed score		–	–	–	–	–	No

(continued on next page)

Table A1 *(continued)*

Article	Sample	Model	Variable of interest	Instrument variable	Response variable					
					Objective					Subjective
					(1) DSTI	(2) Arrears (>1 month)	(3) High-cost of borrowing	(4) Number of different loans	(5) Derivative variable	(6) Self-assessment
Russian sample										
Zvereva et al., 2024	Russia, ~12,000 households, panel, 2 waves	IV Ordered Probit	Financial literacy index from 0 to 8	Average financial literacy index of adult in a households	–	–	–	–	No	–
				Average financial literacy index in a region	–	–	–	–	No	–

Note: Big Three refers to the Big Three questions covering understanding of compound interest, inflation, and diversification (Lusardi & Mitchell, 2008). "–" means the variable is not used; "No" in the response variable columns means no relationship; "Positive"/"Negative" in the response variable columns means a positive/negative relationship.
Source: Compiled by the authors.

Appendix B

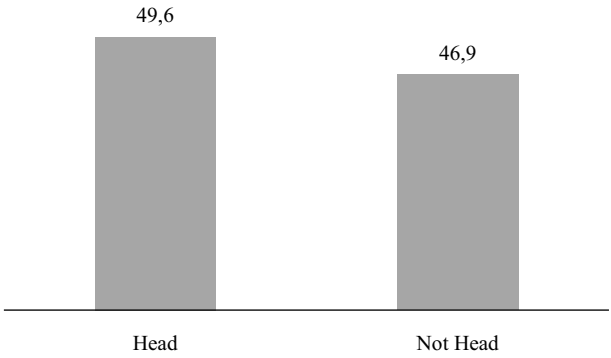

Fig. B1. Average age of household heads compared with non-heads, 2022–2024 (%).

Source: Authors' calculations using the Survey of Consumer Finances, 2022–2024.

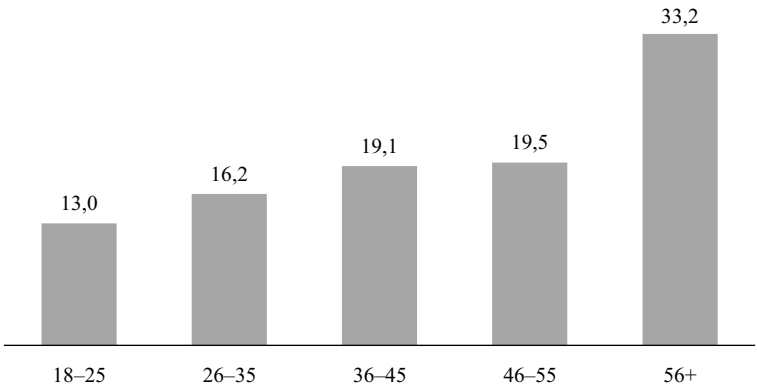

Fig. B2. Who is responsible for the main financial decisions in the household in 2022–2024 (age group, % of total sample).

Source: Authors' calculations using the Survey of Consumer Finances, 2022–2024.

Supplementary material

List of industries

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Data type: Text

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