

Fertility-Household Credit Burden Nexus at the Present Stage

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Abstract

The article examines the relationship between fertility and household credit burden using data for 79 countries for the period from 1990 to 2019. The authors identify 9 patterns describing the mutual influence of fertility and household debt burden. The analysis of patterns shows that the presence of a significant positive impact of households' mortgage debt burden on fertility in future periods may indicate both a direct causal relationship between the indicators and the adoption of conditional decisions on pregnancy planning prior to obtaining mortgage loans to improve housing conditions. The same is true for households' consumer credit burden, as well as for quantitative estimates of the impact of fertility growth on households' debt burden in subsequent periods. The article shows that in developed and developing countries, the growth of the total fertility rate is positively associated with the subsequent dynamics of mortgage and consumer loans in relation to GDP. In developed countries, the growth of mortgage and consumer loans is positively associated with the subsequent fertility dynamics. In developing countries, an increase in mortgage loans is positively but insignificantly correlated with fertility in the following years, while an increase in consumer loans leads to an increase in fertility in the short term, and to its decrease in subsequent years. The results indicate that success in demographic policy aimed at increasing fertility will be accompanied by the growth of households' debt burden, and therefore in subsequent periods households will be forced to pay interest and repay the principal debt, which will reduce families' ability to finance children's education. In this regard, state programmes that provide free education and development of children should be conducted in parallel with the implementation of demographic policy aimed at increasing fertility.

Keywords

Household debt burden, mortgage lending, consumer lending, population growth, fertility

JEL codes: J11, J13, J17, G21, G41

1. Introduction

The purpose of the article is to assess the relationship between fertility and household debt burden. Making a decision about pregnancy planning can lead to significant shifts in consumer behaviour and, as a result, affect the volume of mortgage and consumer loans. At the same time, the dynamics of household debt burden caused by taking out mortgage loans to change housing conditions and consumer loans for the purchase of durable goods (car, furniture, household appliances) may influence the decision on pregnancy planning.

The study of the relationship between fertility and the credit burden of households will improve the effectiveness of decisions in the field of demographic and economic policy. In Russia, the priority is to increase fertility. At the same time, in recent years, growth in the consumer debt burden in the country has outpaced GDP dynamics (in 2021, the debt on consumer loans in relation to GDP amounted to 15%¹). Also, during the COVID-19 pandemic, a preferential mortgage programme was launched, which led to an increase in mortgage lending, as a result, in 2021, the ratio of mortgage loans to GDP exceeded 10% for the first time². The study of the relationship between these indicators and fertility will determine whether changes in fertility should be expected as a result of an increase in households' credit burden; whether successes in demographic policy aimed at increasing fertility will lead to a further increase in households' credit burden; how changes in households' debt burden as a result of an increase in fertility will affect their ability to finance the education and development of children. The present study is therefore relevant.

Research in the field of intertemporal consumer choice and factors of credit market development is widely presented in economic literature (Fisher 1930; Modigliani 1986; Blavatsky 2017). At the same time, there is a large amount of research in the field of the relationship between credit markets and real macroeconomic indicators (Beck et al. 2012; Arcand et al. 2015; Sahay et al. 2015; Leon 2019). The results of the published works prove the existence of a relationship between the population demographic structure and financial sector. For example, the relationship between inflation and demographic burden has been widely studied (Lindh and Malmberg 2000; Lindh 2004; Antonova and Vymyatnina 2018). There are not many studies devoted to the analysis of the relationship between population growth rate and development of credit markets. We managed to find only a few articles that explore the experience of specific countries. For example, in (Deng and Yu 2021), the impact of the number of children in a family on household debt is estimated. Analyzing data from the China Household Finance Survey, which was conducted in China in 2015 and 2017, the authors found a positive correlation between the number of children and household debt. The authors also concluded that the birth of an additional child leads to an increase in household debt. This effect is most strongly observed in families who have not had children before, and in families living in cities.

In (Tishin 2020), based on data for Russia, the impact the demographic structure shifts on the popularity of using financial instruments, among which consumer and mortgage loans were considered, is estimated. Using logistic regression, the author estimates the probability of using a particular financial instrument to invest their own or borrow funds for each age group. The results indicate that the highest demand for mortgage loans is shown by the young population who need their own housing, but do not have a significant amount of accumulated

1 Calculated by the authors on the basis of the Bank of Russia (www.cbr.ru) and Rosstat (www.gks.ru) data.

2 Calculated by the authors on the basis of the Bank of Russia (www.cbr.ru) and Rosstat (www.gks.ru) data.

assets to finance its purchase. According to the author's estimates (Tishin 2020: 15), by 2036 in Russia there will be a decrease in the share of the population in demand for loans by 3 percentage points compared to 2015, as well as the share of the population with unpaid consumer loans – by 1.5 percentage points. In both forecasts, the greatest negative contribution is made by the population aged 25-44 years, positive – by the population aged 45-54 years.

In (Daysal et al. 2021), the authors assess the impact of changes in housing prices on fertility and infant health in Denmark. Using Danish register data on women aged 20-44 years who own residential property, the authors found that for every 100,000 Danish krone increase in housing prices, which is equivalent to 12,000 US dollars, the probability of having a child increases by 0.27 percentage points or 2.35%. Similar results were obtained in (Lovenheim and Mumford 2013) using data for the USA.

Thus, there is no consensus in the scientific literature on the relationship between household credit burden and population growth. The topic needs an in-depth analysis with consideration of individual components of the credit burden of families: mortgage and consumer lending.

2. Decision-making on pregnancy planning and borrowing by households

Decision-making may be conditional or unconditional. For example, a household may decide to take out a mortgage loan to improve housing conditions only in the event of the childbirth (such a decision is conditional). An unconditional decision to attract a mortgage loan will lead to the receipt of such a loan with a minimum lag (subject to approval from the bank).

The decision to plan a pregnancy can also be conditional or unconditional (immediate). A conditional decision on pregnancy planning means that the household will start planning pregnancy after the realization of some event, for example, after the improvement of housing conditions or the purchase of durable goods (car, furniture, household appliances). An unconditional decision means the immediate start of pregnancy planning.

Note that an individual household can unconditionally plan a pregnancy, but this will not lead to the childbirth due to the state of health of one of the spouses. In this context, it should be added that the use of in vitro fertilization (IVF) may be unacceptable due to the personal views of a married couple. In addition, as a result of each IVF cycle, the probability of having a child is only about 20%¹. On the other hand, the birth of children may be unplanned. However, in general, an increase in the number of decisions on unconditional pregnancy planning will lead to a subsequent increase in fertility. Next, we consider a representative household for which the adoption of an unconditional decision on pregnancy planning in the current period leads to a childbirth in the next period.

The division of decisions into conditional and unconditional enables distinguishing the following patterns of household behaviour in terms of the relationship between fertility and borrowing².

Pattern 1. In $t=1$, the household made a conditional decision to plan pregnancy after improving housing conditions. In $t=2$, the household attracted a mortgage loan, which enabled

1 Calculated by the authors on the basis of: (Registr VRT... 2021).

2 The duration of each of the time periods (from $t+i$ to $t+i+1$) can vary both between patterns and within one pattern.

improving housing conditions in $t=3$. In this regard, in $t=3$, the household made an unconditional decision to plan a pregnancy, and in $t=4$, a child was born.

Pattern 2. In $t=1$, the household made a conditional decision to plan pregnancy after purchasing durable goods (car, furniture, household appliances, etc.). In $t=2$, the household attracted consumer credit, which enabled purchasing durable goods. In this regard, in $t=2$, the household made a decision to plan a pregnancy, and in $t=3$, a child was born.

Pattern 3. As of $t=1$, the household did not make a conditional decision on pregnancy planning, but in $t=1$, the household took out a mortgage loan, which made it possible to improve housing conditions in $t=2$, as a result, in $t=2$, the household decided on unconditional pregnancy planning, and in $t=3$, a child was born.

Pattern 4. As of $t=1$, the household did not make a conditional decision on pregnancy planning, but at the same time, in $t=1$, the household took out consumer credit, which made it possible to purchase durable goods in $t=1$, as a result, in $t=1$, the household decided on unconditional pregnancy planning, and in $t=2$, a child was born.

Pattern 5. In $t=1$, the household made an unconditional decision to plan pregnancy and a conditional decision to improve living conditions after the childbirth. As a result, a child was born in $t=2$, in $t=2$ and in the subsequent period $t=3$ (as the child grows up), the household needs to improve housing conditions, but household incomes, other things being equal, do not change. This leads to an increase in mortgage lending in $t=2$ or in $t=3$.

Pattern 6. In $t=1$, the household made an unconditional decision to plan pregnancy and a conditional decision to purchase durable goods and increase expenses in the event of the childbirth. As a result, a child was born in $t=2$, in $t=2$ and in the subsequent period $t=3$ (as the child grows up), the household's current expenses increase, as well as the need for purchasing durable goods, but household incomes, other things being equal, do not change. This leads to an increase in consumer lending in $t=2$ or in $t=3$.

Pattern 7. In $t=1$, the household made an unconditional decision to plan pregnancy, but did not make plans to improve living conditions after the childbirth. As a result, a child was born in $t=2$, in $t=2$ and in the subsequent period $t=3$ (as the child grows up), the household needs to improve housing conditions, but household incomes, other things being equal, do not change. This leads to an increase in mortgage lending in $t=2$ or in $t=3$.

Pattern 8. In $t=1$, the household made an unconditional decision to plan pregnancy, but at the same time did not plan to purchase durable goods and increase consumer spending after the childbirth. As a result, a child was born in $t=2$, in $t=2$ and in the subsequent period $t=3$ (as the child grows up), the household's current expenses increase, as well as the need for purchasing durable goods, including products and services for children. However, household incomes, other things being equal, do not change. This leads to an increase in consumer lending in $t=2$ or in $t=3$.

Patterns 1-4 predict a positive impact of household lending on fertility in the following periods. In patterns 1 and 2, there is a conditional decision on pregnancy planning, which is the root cause of both an increase in the household credit burden and an increase in fertility. In patterns 3 and 4, the increase in household credit burden itself has a direct causal effect on the increase in fertility. Note also that patterns 2 and 4 predict a positive impact of the growth of consumer lending on fertility only if this lending is aimed at the purchase of durable goods.

Patterns 5-8 predict a positive impact of fertility on the households' credit burden (both with and without a lag). In patterns 5 and 6, there is an unconditional decision on pregnancy planning and conditional decisions on improving housing conditions and purchasing durable goods, which together are the root cause of both an increase in fertility and an increase in the

credit burden of households. In patterns 7 and 8, the increase in fertility itself has a direct causal effect on the increase in the households' credit burden. It should be noted that in accordance with patterns 7 and 8, at the time of pregnancy planning, the household either did not think about the needs for improving housing conditions and increasing consumer spending after the childbirth, or mistakenly believed that there would be no such need after the birth of a child.

In accordance with patterns 1, 2, 5, 6, a statistically significant relationship can be identified between the households' credit burden and fertility, but none of these indicators will be the root cause of the other. The potential effect of these patterns limits the interpretation of the results obtained, in which a change in one of the indicators in the framework of this study will lead to a change in the other. For example, if the dynamics of mortgage lending and fertility are determined in accordance with pattern 1, then it is incorrect to conclude from the significant positive impact of mortgage lending on the dynamics of fertility in the following periods that the growth of mortgage lending influenced the increase in fertility.

Moreover, if a significant positive effect of mortgage lending on the dynamics of fertility in subsequent periods has not been revealed, then this cannot be interpreted as the absence of influence of mortgage lending on fertility, since in accordance with pattern 5, such a quantitative result can be observed if households make conditional decisions to attract mortgage loans to improve housing conditions after the birth of children. In this situation, the increase in the availability of mortgages will lead to the fact that households will more often make decisions about the birth of children and the subsequent improvement of housing conditions with the involvement of mortgage lending, but quantitatively this will lead to a significant positive impact of fertility on the dynamics of mortgage lending.

Similar reasoning is also true for consumer lending, as well as for analyzing the results of studies that revealed (or did not reveal) the positive impact of fertility on the dynamics of lending in subsequent periods.

Schematically, the influence of patterns 1-8 on the results of the quantitative assessment of the dependence between the studied indicators can be reflected as follows (see Table 1).

All the considered patterns suggest a mutual positive impact of fertility and lending. However, it is possible to identify a pattern that can justify the negative impact of household debt burden on fertility.

Pattern 9. In $t=1$, the household took out a loan (mortgage or consumer), in accordance with the model of intertemporal consumer choice (Fisher 1930) in $t=2$, the household will have to reduce consumption. The expected reduction in consumption, all other things being equal, will lead to the fact that in $t=1$, the household will decide not to plan a pregnancy, as a result, in $t=2$, fertility will decrease.

The cumulative effect of household debt burden growth on fertility within the 1-4 and 9 patterns can be either positive, neutral or negative, since patterns 1-4 and pattern 9 act in different directions.

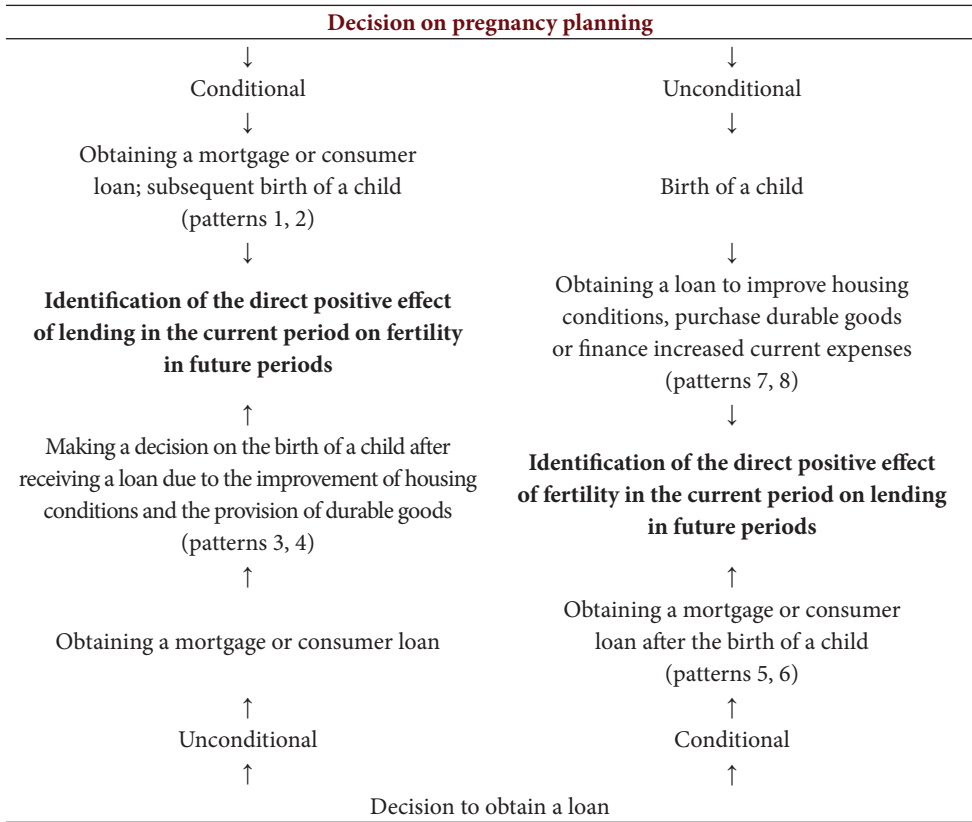
The simultaneous effect of patterns 1-9 also means that household credit burden and fertility are interdependent indicators. In particular, the dynamics of household credit burden is determined by changes in fertility in the current and past periods, which, in turn, depend on changes in household credit burden in past periods.

The analysis enables formulating the following hypotheses for conducting a quantitative study.

Hypothesis 1. Increasing fertility has a positive effect on the increase in the mortgage and consumer credit burden of households in the current or subsequent periods.

Confirmation of this hypothesis on the basis of quantitative analysis will enable drawing two different, but not mutually exclusive conclusions:

Table 1. The influence of household behaviour patterns on the assessment of the relationship between fertility and lending



Source: compiled by the authors based on the conducted analysis.

- in accordance with patterns 5 and 6, the adoption of an unconditional decision on pregnancy planning and conditional decisions on improving housing conditions and purchasing durable goods leads to an increase in fertility and a subsequent increase in the households’ credit burden;
- in accordance with patterns 7 and 8, an increase in fertility itself leads to an increase in the credit burden of households.

Hypothesis 2. The growth of households’ mortgage and consumer burden significantly affects the increase in fertility. Confirmation of this hypothesis on the basis of quantitative analysis will enable drawing two different, but not mutually exclusive conclusions:

- in accordance with patterns 1 and 2, the adoption of a conditional decision on pregnancy planning leads to an increase in households’ credit burden and a subsequent increase in fertility, while patterns 1, 2 have a more significant impact than pattern 9;
- in accordance with patterns 3 and 4, an increase in households’ credit burden (and the associated improvement in housing conditions or the purchase of durable goods) leads to an increase in fertility, while patterns 3, 4 have a more significant impact than pattern 9.

The identification of the negative impact of household debt burden on fertility in subsequent periods will mean the adoption of an alternative hypothesis to the second one. In this case, such a quantitative dependence may mean, in particular, that pattern 9 has a more significant impact on pregnancy planning decisions than patterns 1-4.

3. Methodology

The quantitative study was conducted on the basis of panel-structured data for 79 countries for the period from 1990 to 2019. Data for 2020-2021 are not included in the sample due to the impact of the COVID-19 pandemic on both fertility and credit burden indicators. The main data sources are databases of the World Bank (<https://www.worldbank.org/>), the International Monetary Fund (<https://www.imf.org/>), national statistical agencies, in particular, Rosstat (<https://rosstat.gov.ru/>). The source of data on the structure of household debt (mortgage and consumer lending) is the paper (Leon 2018). Based on the analysis of descriptive statistics, obviously erroneous information was deleted. In particular, Benin was excluded from the sample, since its demographic dependency ratio in the World Bank database was less than 1%. Note that the data on the structure of household debt, derived from the paper by (Leon 2018), could be subject to measurement errors that could lead to a shift to zero of the estimated coefficients, showing the effects of households' mortgage and consumer debt burden on fertility and increase the standard error of the coefficients, which show the effect of fertility on households' consumer and mortgage debt burden.

The article uses the total fertility rate as the main indicator of fertility. To test the robustness of the results obtained, the work also uses the crude birth rate (per 1,000 people) and the compounded annual (over 5 years) growth rate (CAGR) of the number of children aged 0 to 14 years. Note that the use of these indicators generally leads to estimates that do not contradict the main results presented below. It should also be noted that when verifying the direct causal relationship between household credit burden and fertility, the availability of data on lending for 2014 (there are no data for subsequent years) enables assessing their impact on the growth rate of the number of children in 2014-2019. When used as a dependent variable of the fertility rate, the upper time limit for the study is limited to $(2014+L)$, where L is the length of the lag in the regression.

The ratio of consumer loan debt to GDP and the ratio of mortgage debt to GDP are used as indicators of household credit burden. Using the ratio of debt to GDP enables interpreting the increase in this indicator as an outstripping (relative to GDP) increase in the households' debt burden. Dividing loans into mortgage and consumer ones enables separately considering the impact of the patterns highlighted in the previous section and specifying the results of hypothesis testing.

As control variables we use the compound annual growth rate of GDP per capita over 5 years in national currency in constant prices and the natural logarithm of GDP per capita in US dollars in constant 2010 prices to account for the level of income in countries (Yoon et al. 2014), inflation, uncertainty of inflation expectations in accordance to the model of systematically upside biased static expectations (SUBSE) (Gurov 2020), the average number of years of schooling at all levels of education per capita, as well as the share of savings in GDP. The choice of these control variables is due to the fact that they can have a significant impact both on the intertemporal choice of households (Błaszczewicz et al. 2003; Ericson and Laibson 2018) and on the decision-making process about the birth of a child (Mason 1988; Sobotka et al. 2011). Omissions of significant variables can lead to bias and an increase in the standard errors of the estimated coefficients.

Descriptive statistics for the variables used and their first differences (separately for developed and developing countries) are presented in the Appendix. The regressions were evaluated using the first differences of variables, which allowed solving the problem of non-stationarity of a number of regressors. Due to the fact that the fulfillment of the dependencies described above can strongly depend on country and cultural characteristics, the assessment was carried out separately for developed and developing countries.

As part of a quantitative study of the one-sided relationship between fertility and the subsequent dynamics of household debt burden, the following dependencies were assessed:

$$\frac{borr_home}{GDP} = const_1 + b_1 \cdot TFR_{-k} + d_1 \cdot CV + \varepsilon, \tag{1}$$

$$\frac{borr_nonhome}{GDP} = const_2 + b_2 \cdot TFR_{-k} + d_2 \cdot CV + \varepsilon, \tag{2}$$

where TFR is the total fertility rate; $\frac{borr_home}{GDP}$ is the ratio of mortgage loans to GDP; $\frac{borr_nonhome}{GDP}$ is the ratio of consumer credit to GDP; CV is the set of control variables;

b_1, b_2 are the assessed coefficients for the variables of interest; k is fertility indicators lag (values from 0 to 5 years are used), d_1, d_2 are the vectors of estimated coefficients, for the control variables, ε are errors in the regression model.

As part of a quantitative study of the one-sided relationship between the debt burden of households and the subsequent dynamics of fertility, an assessment of the following dependencies was carried out:

$$TFR = const_3 + b_3 \cdot \left(\frac{borr_home}{GDP} \right)_{-k} + d_3 \cdot CV + \varepsilon, \tag{3}$$

$$TFR = const_4 + b_4 \cdot \left(\frac{borr_nonhome}{GDP} \right)_{-k} + d_4 \cdot CV + \varepsilon, \tag{4}$$

where b_3, b_4 are estimated coefficients for the variables of interest; d_3, d_4 are vectors of estimated coefficients for the control variables.

A fixed-effects model was used as the main method for estimating dependencies (1)-(4). To verify the robustness of the obtained results, time effects were also included in the models and additional estimates were carried out based on regressions with random effects and a weighted least squares method.

As noted earlier, there may be an inverse relationship between fertility and household debt burden. This can lead to the problem of endogeneity in the model and inconsistency of the coefficient estimates. Since in each of the equations (1)-(4) the dependent variable and the variable of interest may depend on the lagged values of the dependent variable, to solve the problem of endogeneity, coefficient estimates b_1, b_2, b_3, b_4 based on a model with fixed effects were used with the addition of the lagged value of the dependent indicator to the list of regressors. Adding lagged values does not enable evaluating the fixed effects themselves, however, it makes it possible to assess the robustness of previously obtained estimates and take into account the endogenous nature of the variable of interest.

To solve the problem of endogeneity, the system of vector autoregression equations was also evaluated on panel data with the addition of exogenous variables based on the generalized method of moments (Sigmund and Ferstl 2019):

$$\begin{cases} TFR = const_5 + a_5 \cdot TFR_{-m} + b_5 \cdot \left(\frac{borr_{home}}{GDP} \right)_{-m} + d_5 \cdot CV + \varepsilon, \\ \frac{borr_{home}}{GDP} = const_6 + a_6 \cdot \left(\frac{borr_{home}}{GDP} \right)_{-m} + b_6 \cdot TFR_{-m} + d_6 \cdot CV + \varepsilon, \end{cases} \quad (5)$$

where m is the lag of the endogenous variables (m is determined on the basis of comparative analysis of the main information criteria), TFR_{-m} is the vector of the values of the total fertility rate with a lag of 1 to m ,

$\left(\frac{borr_{home}}{GDP} \right)_{-m}$ is the vector of the values of mortgage loans to GDP ratio with a lag of 1 to m ,

a_5, a_6, b_5, b_6 are the estimated coefficients of the variables of interest, d_5, d_6 are the vectors of estimated coefficients of the control variables, ε are errors in the regression model.

Also, the system of equations was evaluated for the indicator of the debt burden on consumer loans:

$$\begin{cases} TFR = const_7 + a_7 \cdot TFR_{-s} + b_7 \cdot \left(\frac{borr_{nonhome}}{GDP} \right)_{-s} + d_7 \cdot CV + \varepsilon, \\ \frac{borr_{nonhome}}{GDP} = const_8 + a_8 \cdot \left(\frac{borr_{nonhome}}{GDP} \right)_{-s} + b_8 \cdot TFR_{-s} + d_8 \cdot CV + \varepsilon, \end{cases} \quad (6)$$

where $\left(\frac{borr_{nonhome}}{GDP} \right)_{-s}$ is the vector of the values of consumer loan debt to GDP with a

lag from 1 to s , a_7, a_8, b_7, b_8 are the estimated coefficients for variables of interest, d_7, d_8 are the vectors of estimated coefficients for control variables.

Estimates of systems of equations (5), (6) were carried out on the basis of the generalized method of moments in R based on the `pvargmm` function in the `panelvar` library. It should be noted that during the evaluation process it was revealed that a change in the dimension of any regressor leads to a disproportionate change in the regression coefficients. For example, if the value of mortgage loans to GDP is 20%, then in the sample this indicator is usually represented as either 0.2 or 20. If the coefficient estimates are calculated correctly in the regression model, then such differences in dimension will only lead to a proportional (i.e. 100-fold) change in the coefficient estimates. However, with such a change in dimension, when evaluating models using the `panelvar` library, the coefficients do not change by a factor of 100, but the models give different response functions. To check this error, the authors also formed a synthetic sample with a panel structure based on the Monte Carlo method, and when multiplying one of the variables by 100, a disproportionate change in coefficient estimates was also observed. Hypothetically, this may indicate computational problems. It was found experimentally that the most correct estimates are obtained when using all the data in the sample with the same dimension and with the minimum number of exogenous

variables (or their absence). The results of the evaluation of the vector autoregression model are presented in the paper, however, due to the identified problem, the authors do not consider them as the main ones.

4. Results

The results of the quantitative study show that the increase in fertility is accompanied by an increase in the debt burden of households in subsequent periods. In developed countries, an increase in the total fertility rate by 0.053 (which corresponds with the standard deviation of this indicator for a sample of developed countries in the period under review) led to an increase in the ratio of mortgage loans to GDP by 0.61 percentage points and to an increase in the ratio of consumer loans to GDP by 0.21 percentage points (see Table 2). The results are statistically significant at a 1% level. In developing countries, an increase in the total fertility rate by 0.064 (which corresponds with the standard deviation of this indicator for developing countries in the period under review) led to an increase in the ratio of mortgage loans to GDP by 0.41 percentage points at a 5% significance level, as well as to an increase in the ratio of consumer loans to GDP by 0.34 percentage points at a 20% significance level (see Table 2).

To account for the endogenous nature of the fertility rate (that is, the potential impact of the households' debt burden in previous periods on it), lagged values of the dependent variable (household debt burden) were included in the four constructed models. As a result, the estimates of significant coefficients for the total fertility rate have changed only for the case of the effect on mortgage lending in developing countries (see Table 3).

Based on the results obtained, the presence of impact of fertility on the volume of mortgage and consumer loans in developed countries can be concluded to be statistically significant at a 1% level, on the volume of mortgage loans in developing countries – at a 5% significance level. There is also a weak in terms of statistical significance (at a 20% level) influence of fertility on consumer lending in developing countries.

The results of the quantitative study also indicate that the growth of households' mortgage lending led to an increase in fertility in the period under review only in developed countries (see Table 4).

With an increase in the ratio of mortgage debt to GDP by 3.8 percentage points (1 standard deviation for a sample of developed countries), there was an increase in the total fertility rate by 0.007 statistical child, the dependence is significant at a 5% level (see Table 4).

When the lagged values of the dependent variable are added to the model, the estimates for the total fertility rate do not change significantly, but become less significant (see Table 5).

In developed countries, with an increase in the ratio of consumer loan debt to GDP by 2.1 percentage points (1 standard deviation for the sample of developed countries), there was an increase in the total fertility rate by 0.007–0.011 (the dependence is significant at a 20% level), and the smaller the lag, the greater this influence in absolute value (see Table 6). In developing countries, this dependence is significantly positive for a lag of 1 year: with an increase in the ratio of consumer loan debt to GDP by 1.6 percentage points (which corresponds with the standard deviation for a sample of developing countries), an increase in the total fertility rate by 0.0032 was observed in the period under review, the dependence is significant at a 5% level. However, in two years after an increase in the ratio of consumer loan debt to GDP by 1.6 percentage points in the period under review, there was a decrease in the total fertility rate by 0.0026, the dependence is significant at a 1% level.

Table 2. Results of regression analysis: dependence of household mortgage and consumer loans burden on fertility

Model	A	B	C	D
Subsample of countries	Developed		Developing	
Estimated equation	(1)	(2)	(1)	(2)
Dependent variable	Ratio of mortgage loans to GDP	Ratio of consumer loans to GDP	Ratio of mortgage loans to GDP	Ratio of consumer loans to GDP
Const	0.85*** (0.10)	-0.13*** (0.04)	0.58*** (0.07)	0.05 (0.09)
Total fertility rate with a lag of 1 year	11.52*** (3.39)	4.02*** (1.39)	6.45** (2.31)	5.38(*) (3.95)
Natural logarithm of GDP per capita in US dollars in constant 2010 prices	17.60** (6.94)	7.10*** (2.02)	-2.73 (3.50)	8.46* (4.75)
Compound annual growth rate of GDP per capita over 5 years in national currency in constant prices	-0.64*** (0.19)	-0.08 (0.07)	0.11 (0.10)	-0.27 (0.27)
Number of years of schooling	-0.51 (0.58)	-0,29(*) (0.22)	0.38 (0.37)	0.10 (0.68)
Inflation	-0.11(*) (0.07)	-0.07* (0.04)	0.07** (0.03)	0.10 (0.09)
Uncertainty of inflation expectations	0.32(*) (0.22)	0.15* (0.07)	0.04 (0.10)	0.25(*) (0.16)
Share of savings in GDP	-2.11 (6.27)	0.07** (0.03)	-0.07** (0.03)	-0.09 (0.08)
R-square	0.22	0.17	0.40	0.23
R-square (within)	0.08	0.08	0.22	0.13
Akaike criterion	-1365	-1952	-729	-535
Number of countries	27	27	25	25
Number of observations	321	321	115	115

Source: authors' calculations.

Note: ***, **, *, (*) indicate significance at levels of 1%, 5%, 10% and 20%, respectively. Standard errors are indicated in parentheses.

Table 3. Change in the coefficient for the total fertility rate variable when adding lagged values of the dependent variable to the regression models A, B, C, D

Model to which changes are being made	A	B	C	D
Subsample of countries	Developed		Developing	
Estimated equation	(1)	(2)	(1)	(2)
Dependent variable	Ratio of mortgage loans to GDP	Ratio of consumer loans to GDP	Ratio of mortgage loans to GDP	Ratio of consumer loans to GDP
In the initial model (without lagged dependent variable)	11.52*** (3.39)	4.02*** (1.39)	6.45** (2.31)	5.38(*) (3.95)
In regression with the addition of a lagged dependent variable with a lag of 1 year	8.29*** (2.65)	3.73*** (1.16)	6.00** (2.25)	-0.47 (2.13)
In regression with the addition of a lagged dependent variable with a lag of 2 years	10.56*** (3.72)	3.62** (1.16)	5.82*** (1.82)	7.48(*) (4.48)
In regression with the addition of a lagged dependent variable with a lag of 3 years	10.28*** (3.61)	4.09** (1.68)	3.69*** (1.72)	1.32 (2.56)

Source: authors' calculations.

Note: ***, **, *, (*) indicate significance at levels of 1%, 5%, 10% and 20%, respectively. Standard errors are indicated in parentheses.

Table 4. Results of regression analysis: dependence of the total fertility rate on the households' mortgage loans burden

Model	E	F	G	H
Subsample of countries	Developed		Developing	
Estimated equation	(3)			
Dependent variable	Total fertility rate			
Const	0.01*** (0.002)	0.01*** (0.002)	-0.02*** (0.004)	-0.02*** (0.004)
Ratio of mortgage loans to GDP with a lag of 1 year	0.19** (0.09)	-	0.13 (0.38)	-
Ratio of mortgage loans to GDP with a lag of 1 year	-	0.19** (0.09)	-	0.21 (0.41)
Natural logarithm of GDP per capita in US dollars in constant 2010 prices	0.14 (0.12)	0.08 (0.12)	0.12 (0.10)	0.08 (0.08)
Compound annual growth rate of GDP per capita over 5 years in national currency in constant prices	0.77** (0.35)	0.92** (0.49)	-0.54 (0.43)	-0.28 (0.33)

Model	E	F	G	H
Number of years of schooling	-0.02(*) (0.01)	-0.02(*) (0.01)	0.03* (0.01)	0.02* (0.01)
Inflation	0.05 (0.16)	0.16 (0.16)	0.01 (0.09)	0.08 (0.08)
Uncertainty of inflation expectations	0.29 (0.38)	0.34 (0.35)	0.06 (0.33)	-0.09 (0.25)
Share of savings in GDP	-0.25** (0.10)	-0.26(*) (0.18)	-0.19* (0.10)	-0.24(*) (0.18)
R-square	0.20	0.21	0.58	0.58
R-square (within)	0.11	0.11	0.07	0.07
Akaike criterion	-1122	-1161	-563	-563
Number of countries	27	27	26	26
Number of observations	333	343	135	153

Source: authors' calculations.

Note: ***, **, *, (*) indicate significance at levels of 1%, 5%, 10% and 20%, respectively. Standard errors are indicated in parentheses.

Table 5. Change in the coefficient for the ratio of mortgage loans to GDP variable when adding lagged values of the dependent variable to models E, F, G, H

Model to which changes are being made	E	F	G	H
Subsample of countries	Developed		Developing	
Estimated equation	(3)			
Dependent variable	Total fertility rate			
Regressor	Ratio of mortgage loans to GDP			
Regressor lag	1	2	1	2
In regression without a lagged dependent variable	0.19* (0.09)	0.19* (0.09)	0.13 (0.38)	0.21 (0.41)
In regression with the addition of a lagged dependent variable with a lag of 1 year	0.18(*) (0.12)	0.18* (0.09)	0.34 (0.38)	0.24 (0.44)
In regression with the addition of a lagged dependent variable with a lag of 2 years	0.14 (0.12)	0.17* (0.10)	-0.07 (0.37)	0.12 (0.44)
In regression with the addition of a lagged dependent variable with a lag of 3 years	0.23* (0.12)	0.23** (0.09)	0.13 (0.38)	0.05 (0.47)

Source: authors' calculations.

Note: ***, **, *, (*) indicate significance at levels of 1%, 5%, 10% and 20%, respectively. Standard errors are indicated in parentheses.

Table 6. Results of regression analysis: dependence of the total fertility rate on the households' consumer loans burden

Model	I	J	K	L
Subsample of countries	Developed		Developing	
Estimated equation	(4)			
Dependent variable	Total fertility rate			
Const	0,01*** (0,002)	0,01*** (0,002)	-0,02*** (0,004)	-0,02*** (0,004)
Ratio of consumer loans to GDP with a lag of 1 year	0,53(*) (0,37)	-	0,20** (0,09)	-
Ratio of consumer loans to GDP with a lag of 2 years	-	0,34(*) (0,21)	-	-0,16*** (0,04)
Natural logarithm of GDP per capita in US dollars in constant 2010 prices	0,15(*) (0,10)	0,11 (0,10)	0,13 (0,11)	0,07 (0,08)
Compound annual growth rate of GDP per capita over 5 years in national currency in constant prices	0,75(*) (0,45)	0,81* (0,45)	-0,50(*) (0,36)	-0,33 (0,29)
Number of years of schooling	-0,02(*) (0,01)	-0,02(*) (0,01)	0,03* (0,02)	0,02* (0,02)
Inflation	0,07 (0,17)	0,14 (0,17)	0,01 (0,09)	0,06 (0,08)
Uncertainty of inflation expectations	0,34 (0,35)	0,40 (0,37)	-0,02 (0,31)	-0,02 (0,22)
Share of savings in GDP	-0,26(*) (0,18)	-0,27(*) (0,18)	-0,19* (0,11)	-0,24(*) (0,18)
R-square	0,21	0,20	0,66	0,58
R-square (within group)	0,11	0,10	0,08	0,08
Akaike criterion	-1123	-1159	-500	-564
Number of countries	27	27	26	26
Number of observations	333	343	135	153

Source: authors' calculations.

Note: ***, **, *, (*) indicate significance at levels of 1%, 5%, 10% and 20%, respectively. Standard errors are indicated in parentheses.

When the lagged values of the dependent variable are added to the model, the estimates for the total fertility coefficient do not change (see Table 7).

Table 7. Change in the coefficient for the ratio of consumer loans to GDP variable when adding lagged values of the dependent variable to models I, J, K, L

Model to which changes are being made	I	J	K	L
Subsample of countries	Developed		Developing	
Estimated equation	(3)			
Dependent variable	Total fertility rate			
Regressor	Ratio of consumer loans to GDP			
Regressor lag	1	2	1	2
In regression without a lagged dependent variable	0.53(*) (0.37)	0.34(*) (0.21)	0.20** (0.09)	-0.16*** (0.04)
In regression with the addition of a lagged dependent variable with a lag of 1 year	0.49(*) (0.36)	0.30(*) (0.21)	0.29*** (0.10)	-0.12** (0.05)
In regression with the addition of a lagged dependent variable with a lag of 2 years	0.40 (0.32)	0.27(*) (0.20)	0.19* (0.11)	-0.21*** (0.05)
In regression with the addition of a lagged dependent variable with a lag of 3 years	0.55(*) (0.40)	0.42* (0.22)	0.19** (0.09)	-0.22*** (0.06)

Source: authors' calculations.

Note: ***, **, *, (*) indicate significance at levels of 1%, 5%, 10% and 20%, respectively. Standard errors are indicated in parentheses.

To account for the potential endogeneity, the authors also evaluated vector autoregressions. According to the results obtained, the increase in fertility leads to an increase in the mortgage and consumer burden of households in both developed and developing countries. The increase in debt burden of households leads to an increase in fertility, and this effect lasts for 6 or more years in the case of mortgage debt and 4-5 years in the case of consumer loans (see Tables 8, 9, Figs 1-4).

Table 8. Results of the evaluation of the system of equations (5)

Model	M	N		
Subsample of countries	Developed			
Estimated system of equations	(5)			
Dependent variable	Total fertility rate	Ratio of mortgage loans to GDP	Total fertility rate	Ratio of consumer loans to GDP
Const	0.10 (0.13)	-0.02 (0.10)	0.07 (0.19)	-0.03 (0.12)
Total fertility rate with a lag of 1 year	1.15*** (0.14)	0.5 (0.09)	1.13*** (0.12)	0.08(*) (0.05)
Ratio of mortgage loans to GDP with a lag of 1 year	0.05 (0.25)	1.26*** (0.25)	-	-

Model	M		N	
Ratio of consumer loans to GDP with a lag of 1 year	-	-	0.30 (0.69)	0.97*** (0.34)
Total fertility rate with a lag of 2 years	-0.20(*) (0.143)	-0.02 (0.07)	-0.17 (0.18)	-0.04 (0.07)
Ratio of mortgage loans to GDP with a lag of 1 year	-0.07 (0.24)	-0.31 (0.17)	-	-
Ratio of consumer loans to GDP with a lag of 2 years	-	-	-0.39 (0.43)	0.15 (0.17)
Akaike criterion	-3668		-3668	
Number of countries	37		37	
Number of observations	390		390	

Source: authors' calculations.

Note: ***, **, *, (*) indicate significance at levels of 1%, 5%, 10% and 20%, respectively. Standard errors are indicated in parentheses.

Table 9. Results of evaluation of the system of equations (6)

Model	O		P	
Subsample of countries	Developing			
Estimated system of equations	(6)			
Dependent variable	Total fertility rate	Ratio of mortgage loans to GDP	Total fertility rate	Ratio of consumer loans to GDP
Const	0.06(*) (0.04)	0.03(*) (0.02)	0.12** (0.05)	0.08(*) (0.05)
Total fertility rate with a lag of 1 year	1.35*** (0.13)	0.02 (0.04)	1.25*** (0.15)	-0.01 (0.06)
Ratio of mortgage loans to GDP with a lag of 1 year	0.12 (0.18)	1.19*** (0.12)	-	-
Ratio of consumer loans to GDP with a lag of 1 year	-	-	0.10 (0.13)	1.16*** (0.12)
Total fertility rate with a lag of 2 years	-0.38*** (0.12)	0.03 (0.03)	-0.30* (0.13)	-0.01 (0.06)
Ratio of mortgage loans to GDP with a lag of 1 year	-0.13 (0.28)	-0.27* (0.12)	-	-
Ratio of consumer loans to GDP with a lag of 2 years	-	-	0.11 (0.12)	-0.50** (0.18)
Akaike criterion	-3665		-3663	
Number of countries	42		42	
Number of observations	381		381	

Source: authors' calculations.

Note: ***, **, *, (*) indicate significance at levels of 1%, 5%, 10% and 20%, respectively. Standard errors are indicated in parentheses.

According to the estimates obtained on the basis of vector autoregressions, both in developed and developing countries, in response to the increase in the total fertility rate, there is an increase in the ratio of mortgage loans to GDP (see Figs 1, 3) and an increase in the ratio of consumer loans to GDP (see Figs 2, 4) for over 6 years. Also, according to the estimates obtained, the growth of the mortgage debt burden affects the growth of fertility for 5 years or more, and the growth of the consumer debt burden affects the growth of fertility for 4-5 years, and then becomes negative. Nevertheless, as noted above, when evaluating vector autoregressions on panel data using the panelvar library, the authors revealed disproportionate changes in the coefficients and response functions when changing the dimension of the regressors, and therefore the obtained estimates of the systems of equations (5) and (6) are used only as a supplement to the obtained estimates of equations (1)-(4).

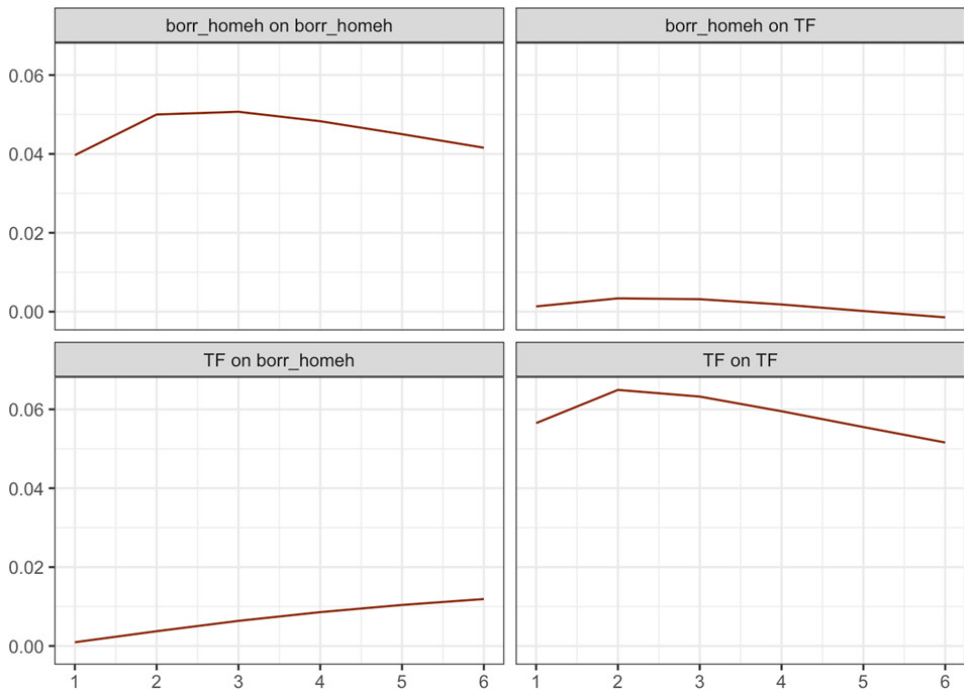


Figure 1. Generalized impulse response function for a sample of developed countries. Interdependent variables are the total fertility rate and the ratio of mortgage debt to GDP. Years are marked on the abscissa axis (the forecast for 6 years), the forecast of changes in the dependent indicator when the explanatory indicator changes by 1 standard deviation is positioned on the ordinate axis. *Source:* compiled by the authors in the R program.

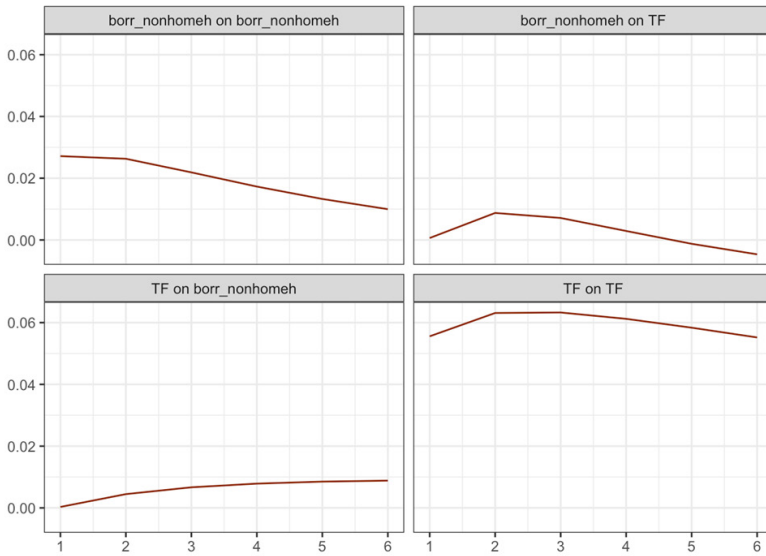


Figure 2. Generalized impulse response function for a sample of developed countries. Interdependent variables are the total fertility rate and the ratio of consumer loans to GDP. Years are marked on the abscissa axis (the forecast for 6 years), the forecast of changes in the dependent indicator when the explanatory indicator changes by 1 standard deviation is positioned on the ordinate axis. *Source:* compiled by the authors in the R program.

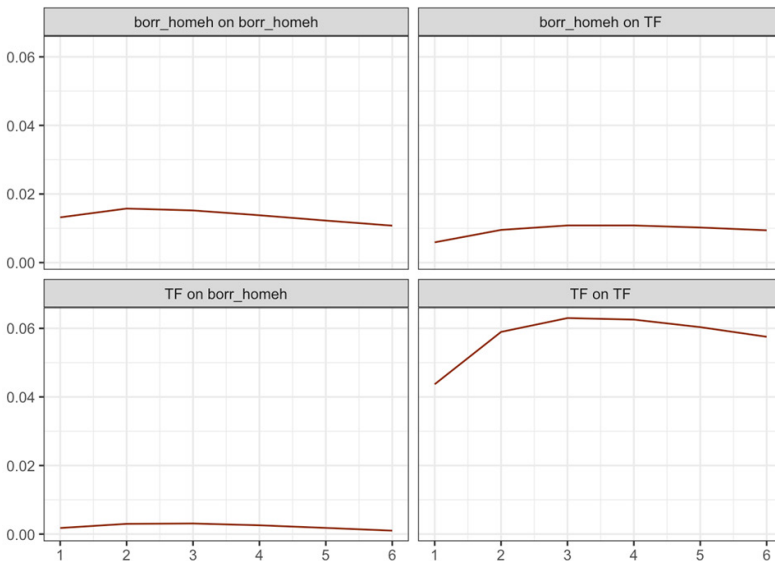


Figure 3. Generalized impulse response function for a sample of developing countries. Interdependent variables are the total fertility rate and the ratio of mortgage debt to GDP. Years are marked on the abscissa axis (the forecast for 6 years), the forecast of changes in the dependent indicator when the explanatory indicator changes by 1 standard deviation is positioned on the ordinate axis. *Source:* compiled by the authors in the R program.

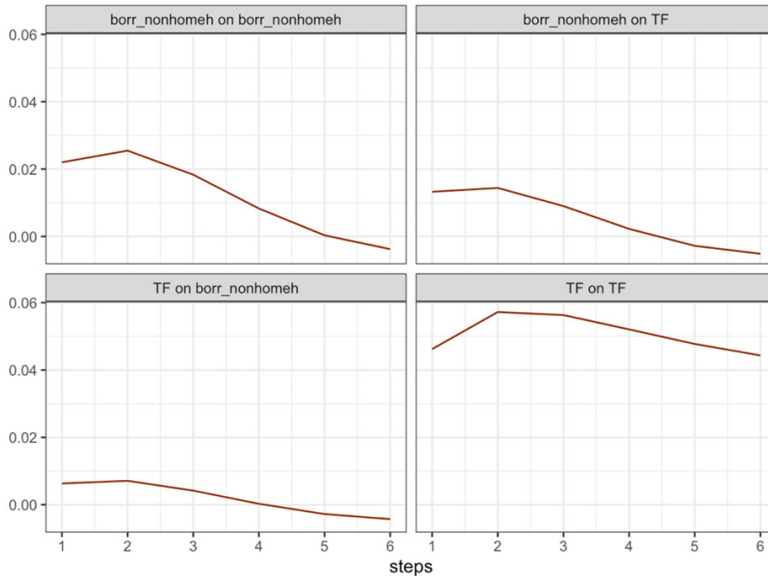


Figure 4. Generalized impulse response function for a sample of developing countries. Interdependent variables are the total fertility rate and the ratio of consumer loans to GDP. Years are marked on the abscissa axis (the forecast for 6 years), the forecast of changes in the dependent indicator when the explanatory indicator changes by 1 standard deviation is positioned on the ordinate axis. *Source:* compiled by the authors in the R program.

5. Discussion

The analysis of household behaviour patterns carried out in this article indicate that a statistically significant relationship between fertility and household lending does not enable drawing an unambiguous conclusion about the presence of causal dependence without making additional assumptions.

The quantitative analysis reveals that an increase in total fertility rate caused a significant increase in the level of mortgage credit burden of households in both developed and developing countries in the period under consideration. All other things being equal, this may happen due to the realization of at least one of the following two patterns:

- households initially made an unconditional decision to plan pregnancy and a conditional decision to attract a mortgage loan to improve housing conditions after the childbirth (pattern 5);
- after making a decision on unconditional planning of pregnancy and childbirth, households decided to improve their living conditions and attracted a mortgage loan (pattern 7).

At the same time, for developing countries, no statistically significant relationship was found between the growth of mortgage lending and fertility in subsequent periods. However, due to the absence of such a connection, it is incorrect to conclude that increasing the availability of mortgages will not lead to an increase in fertility. The absence of such a quantitative relationship only indicates that after receiving a mortgage loan, the household decides

not to plan a pregnancy, in particular, due to the effect of pattern 9 (an increase in the cost of paying interest and principal on the loan). At the same time, an increase in mortgage availability may contribute to an increase in fertility through the pattern 5, but quantitatively this dependence can be assessed as a direct impact of fertility on the growth of mortgage lending, which is significant in both developed and developing countries.

In developed countries, with an increase in fertility, mortgage lending increases 3 times more than consumer lending. In developing countries, with rising fertility, mortgage lending grows only 20% stronger than consumer lending. This can be explained by the fact that household incomes in developed countries have a higher purchasing power, and therefore households can purchase all the goods and services they need with a slight increase in the level of consumer debt burden. This is also confirmed by the fact that in developed countries the median market share of children's goods and services in GDP is 0.33%, and in developing countries – 0.58%¹. At the same time, it should be noted that the dependence of the increase in consumer loans on the growth of the total fertility rate is significant only at the 20% level (while other dependencies are significant at the 1% and 5% levels). Therefore, an alternative assumption that consumer lending in developing countries does not increase with a rise in fertility also seems reasonable. This may be due to the inability to purchase durable goods and increase current expenses at the birth of a child.

In developed countries, an increase in the consumer debt burden has a positive effect on fertility for a number of periods (when using lags from 1 to 4-5 years, as well as without a lag). In developing countries, the positive impact of the consumer debt burden on fertility is observed only for a lag of 1 year (when estimated on the basis of vector autoregressions up to 5 years for developed countries and up to 4 years for developing countries), which indicates the effect of at least one of the two patterns:

- the household planned pregnancy, but before the birth of the child borrowed to purchase durable (pattern 2);
- the household attracted consumer credit to purchase durable goods, and then, due to the improved availability of such goods, decided to plan a pregnancy (pattern 4).

The negative impact of consumer credit growth on fertility in developing countries with some lag may be due to the fact that households received consumer loans not for the purchase of durable goods (violation of pattern 4), but due to the pattern 9 (the need to finance previously taken loans).

In this regard, it should be noted that in Russia, the growth of the consumer debt burden of households may also be a factor reducing fertility. In our previous study, it was shown that the rapid development of consumer lending leads to a slowdown in economic growth in countries with a per capita income of more than 4,700–7,000 US dollars in 2010 prices (Gurov and Kulikova 2021). The results of this study revealed another effect of the households' consumer debt burden growth – the impact on the decline in population growth rate. This effect is negative in the context of existing demographic problems in Russia. In this regard, it is advisable to take measures to limit the advertising of consumer loans, as well as to tighten the requirements for the formation of reserves for issued consumer loans.

The study of the direct positive effect of fertility on the credit burden of households also enables considering the aspect associated with the accumulation of human capital. If the country's task is to develop a demographic policy aimed at increasing fertility, then its successful implementation will lead to the need to solve another task – the formation of sources for fi-

¹ Calculated by the authors based on the Euromonitor.com and World Bank data.

nancing the education and development of children. If fertility increases in the country this year, then in no more than 3-7 years, financial resources (as well as the appropriate infrastructure) should be formed to ensure the education and development of children. Since, after an increase in fertility, households need to pay interest and principal on loans in a higher volume, it is advisable to expand opportunities for de facto free education and development of children.

6. Conclusions

The study shows, that in both developed and developing countries, the increase in fertility leads to a significant increase in the mortgage and consumer debt burden of households in subsequent periods. The first hypothesis of the study is confirmed.

The second hypothesis is fully confirmed only for developed countries, in which mortgage and consumer lending positively affect the growth of fertility in subsequent periods.

For developing countries, the second hypothesis is confirmed only for the short term and only in the case of consumer lending. In the long term, consumer lending in developing countries begins to negatively affect fertility.

The second hypothesis is not confirmed for developing countries with regard to mortgage lending. In developing countries, the growth of mortgage loans is statistically insignificantly positively associated with fertility in subsequent years. However, it cannot be concluded that increasing the availability of mortgages will not lead to an increase in fertility in developing countries, since in accordance with the pattern 5, a household can make an unconditional decision to plan pregnancy and a conditional decision to take out a mortgage loan to improve housing conditions. As a result, there will be a quantitative impact of fertility on the subsequent dynamics of mortgage lending, but de facto households will make conditional decisions about improving housing conditions and attracting mortgage loans while simultaneously making unconditional decisions about pregnancy planning.

Taking into account the effect of the patterns 5, 6 and the revealed positive relationship between fertility and mortgage lending, in relation to Russia it can be concluded that in order to increase fertility, it is advisable to stimulate the development of the mortgage lending market and ensure housing affordability, as well as limit consumer lending. In particular, to limit the advertising of credit products, which allows modifying the indifference curve of intertemporal household preferences. It is in the case of such an external (advertising) impact on the process of intertemporal choice that households make unprofitable and suboptimal decisions, which reduces their utility. In accordance with pattern 9 and the results obtained in this study, such a suboptimal growth in consumer lending may lead to a decrease in fertility in future periods.

The results obtained indicate that the increase in fertility is accompanied by an increase in the credit burden of households, which negatively affects their ability to finance the education of children. Therefore, in order to accumulate human capital during the implementation of demographic policy aimed at increasing fertility, it is especially important to expand state programmes in the field of financing free education and child development.

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The article is dedicated to the memory of Marina E. Doroshenko.

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Appendix

Table A1. Descriptive statistics of variables (data for 37 developed countries for the period from 1990 to 2019)

	Average	St. dev	Median	Minimum	Maximum
Total fertility rate	1.62	0.35	1.57	0.90	3.11
Births per 1000 people	11.57	2.66	11.1	5.90	22.20
Compound annual growth rate (CAGR) of the number of children	-0.37%	1.46%	-0.17%	-4.91%	3.58%
Average annual population growth rate over 5 years	0.60%	0.79%	0.51%	-1.56%	3.66%
Demographic dependency ratio	49.06%	6.10%	49.49%	26.99%	68.28%
Ratio of mortgage loans to GDP	32.92%	21.81%	29.66%	0.25%	105.15%
Ratio of consumer loans to GDP	10.88%	8.98%	8.72%	1.66%	63.08%
Inflation	3.15%	5.83%	2.06%	-5.12%	124.43%

	Average	St. dev	Median	Minimum	Maximum
Uncertainty of inflation expectations	0.92%	1.38%	0.63%	0.13%	28.07%
Number of years of schooling	15.64	1.97	15.7	9.20	23.3
Compound annual growth rate of GDP per capita over 5 years in national currency in constant prices	2.16%	2.06%	1.92%	-5.72%	10.95%
Share of savings in GDP	23.85%	7.31%	22.79%	2.45%	52.30%

Source: calculated by the authors based on World Bank, International Monetary Fund and Rosstat data.

Table A2. Descriptive statistics of the first differences of variables (data for 37 developed countries for the period from 1990 to 2019)

	Average	St. dev	Median	Minimum	Maximum
Total fertility rate	-0.01	0.05	-0.01	-0.25	0.22
Births per 1000 people	-0.14	0.41	-0.10	-4.80	1.20
Compound annual growth rate (CAGR) of the number of children	0.03 pp	0.28 pp	0.02 pp	-1.13 pp	1.24 pp
Average annual population growth rate for 5 years	-0.01 pp	0.15 pp	-0.01 pp	-0.99 pp	1.40 pp
Demographic dependency ratio	0.12 pp	0.61 pp	0.14 pp	-1.94 pp	2.10 pp
Ratio of mortgage loans to GDP	1.42 pp	3.21 pp	1.09 pp	-19.34 pp	35.39 pp
Ratio of consumer loans to GDP	0.07 pp	2.10 pp	0.05 pp	-34.28 pp	16.22 pp
Inflation	-0.42 pp	3.28 pp	-0.14 pp	-78.80 pp	140.01pp
Uncertainty of inflation expectations	-0.07 pp	1.01 pp	-0.02 pp	-19.73 pp	3.43 pp
Number of years of schooling	0.13	0.34	0.10	-2.50	3.10
Compound annual growth rate of GDP per capita over 5 years in national currency in constant prices	0.01 pp	0.89 pp	0.10 pp	-4.84 pp	4.21 pp
Share of savings in GDP	0.02 pp	2.07 pp	0.01 pp	-19.91 pp	10.03 pp

Source: calculated by the authors based on World Bank, International Monetary Fund and Rosstat data.

Table A3. Descriptive statistics of variables (data for 42 developing countries for the period from 1990 to 2019)

	Average	St. dev	Median	Minimum	Maximum
Total fertility rate	3.60	1.62	3.15	1.08	8.61
Births per 1000 people	27.26	10.81	25.76	7.70	55.49
Compound annual growth rate (CAGR) of the number of children	0.86%	1.90%	0.91%	-7.57%	8.20%
Average annual population growth rate over 5 years	1.75%	1.51%	1.67%	-4.35%	17.05%
Demographic dependency ratio	68.99%	19.73%	67.10%	15.74%	117.88%
Ratio of mortgage loans to GDP	8.98%	7.91%	6.53%	0.00%	35.28%
Ratio of consumer loans to GDP	9.73%	7.22%	8.20%	0.25%	45.35%
Inflation	6.42%	10.81%	4.31%	-10.35%	186.82%
Uncertainty of inflation expectations	2.46%	6.07%	1.34%	0.21%	116.40%
Number of years of schooling	10.82	2.90	11.40	2.10	17.70
Compound annual growth rate of GDP per capita over 5 years in national currency in constant prices	2.11%	3.09%	2.13%	-15.58%	13.82%
Share of savings in GDP	22.60%	8.93%	21.15%	3.88%	57.48%

Source: calculated by the authors based on World Bank, International Monetary Fund and Rosstat data.

Table A4. Descriptive statistics of the first differences of variables (data for 42 developing countries for the period from 1990 to 2019)

	Average	St. dev	Median	Minimum	Maximum
Total fertility rate	-0.06	0.06	-0.05	-0.62	0.31
Births per 1000 people	-0.37	0.43	-0.36	-5.30	2.40
Compound annual growth rate (CAGR) of the number of children	-0.03 pp	0.38 pp	-0.04 pp	-2.95 pp	3.99 pp
Average annual population growth rate over 5 years	-0.02 pp	0.28 pp	-0.02 pp	-2.86 pp	3.01 pp
Demographic dependency ratio	-0.67 pp	0.95 pp	-0.63 pp	-6.58 pp	3.70 pp
Ratio of mortgage loans to GDP	0.38 pp	1.06 pp	0.23 pp	-5.63 pp	6.66 pp
Ratio of consumer loans to GDP	2.45 pp	1.59 pp	1.85 pp	-11.52 pp	13.61 pp
Inflation	-0.23 pp	9.04 pp	-0.22 pp	-185.2 pp	101.61pp
Uncertainty of inflation expectations	-0.07 pp	4.42 pp	-0.02 pp	-78.84 pp	70.65 pp
Number of years of schooling	0.12	0.28	0.10	-3.70	3.40

	Average	St. dev	Median	Minimum	Maximum
Compound annual growth rate of GDP per capita over 5 years in national currency in constant prices	0.06 pp	1.31 pp	0.01 pp	-7.50 pp	13.39 pp
Share of savings in GDP	0.07 pp	4.01 pp	0.08 pp	-26.69 pp	35.63 pp

Source: calculated by the authors based on World Bank, International Monetary Fund and Rosstat data.

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