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THE IMPACT OF ECONOMIC SHOCKS ON FINANCIALLY VULNERABLE SLOVAK HOUSEHOLDS: A SOCIO-ECONOMIC AND DEMOGRAPHIC ANALYSIS

Abstract:

This study identifies financially vulnerable indebted Slovak households most at risk of defaulting on loan payments due to socio-economic and demographic factors. The recent economic shifts, including a surge in Slovakia's inflation rate peaking at 15.4% in February 2023, have exacerbated financial strain. Analysis of HFCS microdata shows increased household indebtedness, particularly mortgage debt, from 2011 to 2021. Households with negative financial margins, limited liquid assets, younger (16-34) and older (65+) age groups, single-person households, and those in the lowest income and wealth quintiles are most vulnerable. Logistic regression reveals that gross income is the most significant determinant of default probability, with higher income households being less likely to default. The study highlights the need for targeted policy measures to support these vulnerable groups and mitigate default risks.

Keywords:

Slovak household indebtedness, socio-economic and demographic factors HFCS, household vulnerability, logistic regression

JEL Classification: D14, E43, C21

1   Introduction[1]

The objective of this study is to identify which financially vulnerable indebted Slovak households are more vulnerable and have a higher probability of default on their loan payments across a range of socio-economic and demographic characteristics. The latest economic shifts have placed households in the euro area in a challenging position. The rising costs of gas, energy, and food are hindering their ability to maintain their accustomed standard of living.

In recent years, Slovakia has experienced a surge in inflation, reaching levels that have not been seen before. Our paper's inflation shock analysis is based on Slovakia's inflation rate trends, which peaked at 15.4% in February 2023. The average inflation rate was 2.8% in 2021, 12.8% in 2022, and 10.5% in 2023 (NBS). In response to the elevated inflation rates observed across the euro area, the European Central Bank (ECB) has enacted a series of monetary policy rate hikes. The interest rate on main refinancing operations increased from 0 basis points in June 2022 to 450 basis points in September 2023. In order to develop a framework for stress testing, we drew upon the evolution of these indicators. We devise three hypothetical scenarios, which were designed to simulate the combined impact of rising interest rates and simultaneous price level increases.

Given these economic conditions, it is even more critical to focus on indebted households, as they are likely to be disproportionately affected. The increased cost of living, combined with higher interest rates, can exacerbate their financial vulnerability, making it harder for them to service their debts. Identifying and supporting these households should be a priority in policy measures to mitigate the broader impacts of the current economic situation.

The rising indebtedness of Slovak households is also confirmed by the HFCS microdata presented in Table 1. The HFCS dataset is a valuable repository of microdata providing comprehensive information about the financial situation of households, including both the liability and asset side of household´ balance sheets. We can observe that the total debt participation of Slovak households increase over the waves from 26.7% in 2011 to 38.8% in 2021. On contrary, the proportion of households without any debt decreased from 73.2% in 2011 to 61.1% in 2021. There was a significant increase in households with only mortgage debt, rising from 6.8% in 2011 to 21.2% in 2021. This indicates a growing preference or need among households to engage in property purchases or investments requiring mortgage financing. Furthermore, in 2021, the share of households with only mortgage debt exceeded the share of households with only non-mortgage debt. The proportion of households with only non-mortgage debt initially increased from 17.1% in 2011 to 20.4% in 2014, before declining to 13.4% by 2021. Households with both mortgage and nonmortgage debt remained relatively low but increased from 2.7% in 2011 to 5.4% in 2017, then slightly decreased to 4.1% in 2021. The median and mean amounts of debt for households with any form of debt have exhibited a consistent upward trend. For instance, the median debt for households with any type of debt grew from 6.0 thousand euros in 2011 to 18.4 thousand euros in

2021, and the mean debt increased from 12.4 thousand euros to 33.9 thousand euros. This indicates that both the number of indebted households and the amount of debt per household have increased.

Table 1. Development of Slovak household indebtedness – HFCS all waves

Debt Participation	Participation %				Conditional Median *EUR thousand*				Conditional Mean *EUR thousand*			
	2011	2014	2017	2021	2011	2014	2017	2021	2011	2014	2017	2021
No debt	73.2	63.3	63.3	61.1								
Any debt	26.7	36.7	36.6	38.8	3.2	6.0	11.4	18.4	12.4	14.6	25.3	33.9
Mortgage debt only	6.8	11.3	15.2	21.2	24.5	22.2	32.0	34.3	27.6	27.7	39.2	48.1
Nonmortgage debt only	17.1	20.4	15.9	13.4	1.0	1.5	2.3	3.2	3.0	3.5	4.7	5.4
Mortgage and nonmortgage debt	2.7	4.8	5.4	4.1	29.1	26.6	35.3	52.1	33.2	31.2	46.8	53.4

Source: Own calculation based on HFCS 2021, ECB & NBS

Table 2 illustrates the proportion of different types of debt in the aggregate total household debt. Mortgages for main residences represent the largest share of total debt across all waves. This share has increased progressively from 77.14% in 2011 to 87.88% in 2021, indicating a growing trend towards investing in primary residential property and rising property prices, which require larger mortgages. The proportion of nonmortgage debt decreased significantly over the decade, from 18.83% in 2011 to just 6.93% in 2021.

This study aims to identify the group of financially vulnerable indebted households in Slovakia that are the most susceptible and significantly affected by simultaneous adverse economic shocks of varying severity.

Table 2. Shares of Debt Types
As a percentage of aggregated total debt

	2011	2014	2017	2021
Shares of Debt Types				
Main residence mortgages	77,14	74,04	82,28	87,88
Mortgages on other property	*NA*	8,19	6,84	5,19
Nonmortgage debt	18,83	17,77	10,88	6,93

Note: Descriptive statistics labelled with *NA* could not be computed due to the lack of observations (fewer than 20 in the sample)
Source: Own calculation based on HFCS 2021, ECB & NBS

This study aims to identify the group of financially vulnerable indebted households in Slovakia that are the most susceptible and significantly affected by simultaneous adverse economic shocks of varying severity. It is therefore of the utmost importance to identify the households most affected

by these economic changes in order to develop policy measures that are tailored to their specific needs. The structure of this paper is as follows: it begins with a literature review in Section 1, followed by an introduction to the HFCS microdata in Section 2. Section 3 details the methodology used in the study, and Section 4 presents the findings. The paper concludes with Section 5, where we summarize and discuss the implications of our results.

2   Literature Review

The life-cycle hypothesis offers a comprehensive framework for comprehending the behavioural patterns exhibited by households in relation to debt across the various stages of their lives (Modigliani & Brumberg, 1954). Overall, the life-cycle hypothesis suggests that individuals make consumption and saving decisions based on their age, expected future income, and the desire to maintain a stable standard of living throughout their lives. Younger households face limitations based on their current income, preventing them from maximising their utility. Therefore, the life cycle hypothesis suggests that younger households tend to experience a period of borrowing and debt accumulation early in their working lives, often to finance investment in education or the purchase of their first home. As they grow older and their income increases, they move towards saving and accumulating wealth in preparation for future consumption and retirement. This is because younger households expect their income to increase over time and peak during middle age, enabling them to pay off debts and save for future financial needs, including retirement.

Numerous prior studies have employed data from household surveys, administrative registers from national statistical offices, or a combination of these sources to investigate households' financial fragility through microsimulation-based stress tests. These studies aim to evaluate the potential credit risk that the household sector may pose to financial stability. Specifically, research focusing on the financial fragility of European households utilizes micro-level stress testing to assess its impact on the broader financial stability landscape (Johansson and Persson, 2006 for Sweden; Herrale and Kauko, 2007 for Finland; Holló and Papp, 2007 for Hungary; Albacete and Fessler, 2010 for Austria; Michalengeli and Pietrunti, 2014 for Italy; Ampudia, van Vlokhoven and Zochowski, 2016 for Euro Area; Galuscak and Jakubik, 2016 for Czechia; Jaanika and Room, 2020 for Estonia; Giordana and Ziegelmeyer, 2020 for Luxembourg; Abela and Georgakopoulus, 2022 for Malta). Studies concerning non-European countries (Faruqui, Liu and Robert, 2012 for Canada; Martinez et al., 2013 for Chile; Bilston, Johnson and Read, 2015 for Australia; Funke, Sun and Zhu, 2021 for China). Furthermore, the aforementioned studies analysed which socio-economic and demographic characteristics of groups of financially vulnerable indebted households are most significantly impacted by adverse economic shocks.

The study by Johansson and Persson (2006) provides detailed insights into the indebtedness and financial capabilities of Swedish households, with a specific focus on demographic and socio-economic groups. The find that certain groups, such as lower-income households, younger households, and single-parent households, exhibit higher indicators of financial distress due to their higher debt burdens relative to their financial capacity. Herrala and Kauko (2007) analyse the risk of household loan losses in Finland using micro-level data. The study estimates potential loan losses and performs simulations to understand the impact of various economic scenarios on household loan defaults. The simulations demonstrate that macroeconomic shocks, such as

increases in unemployment rates or interest rates, greatly impact households' ability to service their debt. These shocks can lead to a higher number of financially distressed households and increase the aggregate amount of debt at risk. Households with lower net incomes after taxes and loan servicing costs are significantly more likely to experience financial distress. Younger households, particularly those headed by individuals under 35, are more vulnerable to economic fluctuations due to their higher loan-to-income ratios. Households headed by individuals with higher educational attainment and stable employment have a lower risk of financial distress. Education and stable employment contribute to higher earning potential and better financial management skills.

The study by Dániel Holló and Mónika Papp (2008) analyses the main factors contributing to household credit risk in Hungary, using survey data collected by the Central Bank of Hungary. The find that unemployed households and households with lower disposable income after loan payments are at higher risk of default. Moreover, they find that younger households and those with lower educational attainment show higher risk levels due to less financial stability and lower incomes. The study by Nicolas Albacete and Pirmin Fessler (2010) examines the financial stability risks of Austrian households using a household level microdata. The study reveals that younger households and those with lower incomes are more vulnerable to financial distress. In addition, households with higher education levels and stable employment show better resilience against economic shocks. Furthermore, the study by Valentina Michelangeli and Mario Pietrunti (2014) offers a comprehensive analysis of the financial vulnerability of Italian households using a microsimulation model. The study defines vulnerable households as those with a debt-service ratio (DSR) above 30% and income below the median. It finds that the percentage of vulnerable households remained relatively stable from 2012 to 2015, at about 2.7% in 2015. Changes in household composition, such as the birth of a child or divorce, can affect income available for debt repayment, thus influencing financial vulnerability. These factors are crucial for a more accurate prediction of household financial health. The research highlights significant variation in resilience based on socio-economic and demographic factors. Households with lower incomes, single-parent households, and younger households show higher levels of financial vulnerability. The most recent study by by Jaanika Meriküll and Tairi Rõõm (2020) assesses the financial risks of the household sector in Estonia using microsimulation-based stress tests. The study identifies that younger households, particularly those headed by individuals under 35, are more likely to experience financial distress due to higher debt levels and lower accumulated wealth. The next study by Gastón Giordana and Michael Ziegelmeyer (2020) evaluates the resilience of Luxembourg households to severe economic shocks using HFCS microdata. Socioeconomically disadvantaged households, such as those with low income, low net wealth, low education levels, or with three or more dependent children, are more likely to default under severe stress conditions. For example, the probability of default (PD) for households in the lowest income quintile increases from 9.3% in the no-shock scenario to 14.8% in the severe shock scenario. The study by Kirsten Abela and Ilias Georgakopoulos (2022) outlines a comprehensive approach to evaluating the financial resilience of Maltese households under adverse macroeconomic condition. The study examines the impact of four types of economic shocks: an increase in interest rates, a rise in the unemployment rate, a decline in real estate prices, and a reduction in the value of liquid assets. They find that households with lower incomes and those with multiple dependents children are more vulnerable to economic shocks. Moreover, younger households are particularly at risk due to lower financial buffers and higher debt levels. Households with stable employment are more resilient, while those facing

unemployment are significantly more likely to experience financial distress. Higher levels of education correlate with better financial stability, as these households tend to have higher incomes and better financial management skills.

However, household indebtedness must be assessed in relation to available resources to determine debt sustainability. The "financial margin" (FM) method, which identifies financially vulnerable households by subtracting basic living costs and loan servicing costs from monthly disposable income, typically categorizes households with a negative financial margin as likely to default, following the "binary default" interpretation (Albacete et al., 2014; Bilston, Johnson and Read, 2015; Galuscak and Jakubik, 2016). However, a more sophisticated approach considers households' liquid financial buffers, allowing for a "continuous default" interpretation where the probability of default varies based on the amount of liquid assets. Our paper will use this "continuous default" interpretation, incorporating households' liquid assets to better assess the probability of default (Ampudia, van Vlokhoven and Zochowski, 2016; Jaanika and Room, 2020).

This study employs the most recent Slovak HFCS microdata to identify financially vulnerable indebted households. This is achieved by examining their financial margins and probability of default, while accounting for their liquid financial buffers. A microsimulation-based stress test was conducted to evaluate how these households' ability to service loans is impacted by adverse macroeconomic shocks, particularly in the context of rising interest rates and high inflation in the euro area. The objective of this stress test is to identify the most vulnerable groups by analysing the effects of these shocks on households' socio-economic and demographic characteristics.

3   Data

In this study we employed cross-sectional household-level microdata from the fourth wave of the Household Finance and Consumption Survey (HFCS), coordinated by the European Central Bank (ECB) to ensure harmonization across countries. Since 2010, data has been collected every three years by national central banks and statistical offices in the participating euro area and Eurosystem countries. In Slovakia, the HFCS was conducted in 2011, 2014, 2017, and 2021. The 2021 HFCS dataset comprises 10,870 observations from 2,174 households, with missing values imputed five times.

The HFCS survey aims to collect detailed microdata on the financial status of households, covering a wide array of balance sheet components such as real and financial assets, net wealth, mortgage and non-mortgage debt, income, and expenditure. These financial metrics are integrated with socio-demographic and economic data, including variables like gender, age, education, employment status, and household size, providing a comprehensive view of household financial behaviour.

For the fourth wave of HFCS in Slovakia, the sampling design utilized a two-stage stratified random probability sampling method based on census data. Wealthy households were intentionally oversampled to enhance the survey's representation of household wealth. The HFCS dataset includes multiple imputed observations and uses survey and replicated weights, which are essential

for ensuring the accuracy and representativeness of our analyses in various statistical calculations and regressions.

4 Methodology

Firstly, a measure of the financial margin (FM) is calculated for each individual household *i*. This compares a household's monthly disposable income to its basic living costs and regular debt repayments. The definition of this measure is as follows:

$$FM_i = NI_i - (DS_i + BLC_i) \tag{1}$$

where FM_i is the monthly financial margin of household *i*, NI_i is monthly net income, DS_i refers to total current debt service costs and BLC_i is the basic living costs.

Monthly net income (NI_i) is calculated by adjusting the annual gross income for taxes and social security contributions, accounting for all relevant tax levy rates and tax credits. The total debt service costs (DS_i) include the monthly payments made by households towards both mortgage and non-mortgage debt. These payments encompass mortgages, car loans, consumer and installment loans, as well as loans from relatives, friends, and employers. However, it should be noted that the total debt service costs do not include credit card debt, credit lines, or overdrafts, as the HFCS dataset does not provide information about monthly payments for these types of debts.

The metric used to quantify the monthly essential consumption of a household is the living income, which is calculated by the National Bank of Slovakia (NBS). Living income is defined as the amount necessary for a household to meet all essential needs, though not all discretionary wants. This concept is shaped by the level of economic development and various social and cultural factors. Consequently, in Slovakia, the living income for 2021 represents the minimum income required to satisfy the basic needs of a given household.

The living income is calculated individually for a single adult household (1+0) and for a household with two economically active adults and two dependent children (2+2). This calculation draws from multiple data sources and includes costs for a nutritious diet, adequate housing, basic clothing and footwear, transport, education, healthcare, and a budget for communication, recreation, and other miscellaneous goods. Further details on the Slovak living income calculation can be found in the NBS Occasional Paper 1/2022, entitled "The Living Income for Slovak Households" (Fabo B., Guzi M., Šofranková B., 2022)[1].

The estimation utilises the living income for two model households, both owner-occupiers of their main residence. For a single adult household, the living income is €335, while for a household with two adults and two dependent children, it is €847. For households that do not fit these categories, the living income is calculated by multiplying the amount for a single adult household by the sum of

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[1] National Bank of Slovakia (NBS). Available on: https://nbs.sk/dokument/bb6917d7-e827-4495-877d-00d85db0aa5a/stiahnut/?force=false

consumption weights from the OECD equivalence scale[1]. Furthermore, the total monthly rent is incorporated into the calculation of the living income for households residing in rented accommodation.

A negative financial margin does not immediately lead to insolvency, as it is assumed that households can sell their liquid assets to cover basic living costs and service their debt. Our hypothesis is that households will continue to service their debt until they deplete their financial assets. Therefore, we define financially vulnerable households as those with insufficient liquid assets to bridge the gap between disposable income and monthly expenses for at least M months. In theory, the minimum buffer period of M months provides vulnerable households with time to resolve their liquidity issues and avoid defaulting on their debt payments. However, our framework does not explicitly model such adjustments; rather, M is treated as a calibrated parameter.

A probability of default (PD) is calculated for each household by combining its financial margin with information on its liquid assets. The PD for household i is defined as follows:

$$PD_i = \begin{cases} 0 \; if \; FM_i \geq 0 \; or \; |FM_i| \; \times \; M \; \leq \; LIQ_i \\ 1 - \dfrac{LIQ_i}{|FM_i| x \; M} \; if \; FM_i < 0 \; and \; |FM_i| \; \times \; M \; > LIQ_i \end{cases} \tag{2}$$

where PD_i is the probability of default of household *i*, FMi represents the financial margin of household *i*, and LIQi denotes the liquid assets of household i. The financial assets include the sum of deposits, mutual funds, bonds, non-self-employment private business wealth, publicly traded shares, and managed accounts, minus the amount of non-collateralized debt such as credit card balances, credit lines, and overdrafts. M represents the number of months required by the household to restore a non-negative financial margin or the number of months a negative financial margin needs to be covered by exhausting the household's liquid assets. Accordingly, we define financially vulnerable households as those that do not possess sufficient liquid assets to bridge the gap between their disposable income and necessary monthly expenses for a minimum of M months.

In accordance with Equation (2), the pdi is set to zero for households with a positive financial margin (FMi). For households with a negative FMi, Equation (2) sets pdi to zero if their liquid assets (LIQi) are sufficient to cover the negative FMi for more than M months. For other households with a negative FMi, the pdi is equal to one if LIQi holdings are zero, and it falls within the open interval (0,1) if liquid assets cover the negative FMi for less than M months. Consequently, households are considered to be financially vulnerable if their pdi is greater than zero. Equation (2) indicates that the value of the pd will decrease in the event of an increase in the value of liquid assets or a reduction in the required buffer period, M.

The methodology employed in our research is consistent with the approaches of Ampudia et al. (2016), Jaanika and Room (2020), and Giordana and Ziegelmeyer (2020). The objective is to

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[1] The first adult member of the household is assigned a weight of 1, with each subsequent member aged at least 14 assigned a weight of 0.5, and each additional member aged less than 14 assigned a weight of 0.3.

calibrate the value of M in order to achieve an estimated ratio of exposure at default (EAD) that is consistent with the aggregated ratio of non-performing loans (NPL) from household loans across the entire banking system. The NPL ratio was calculated as the proportion of household loans that were past due for more than 90 days relative to the total loan stock between July and October 2021. The resulting figure was 2.6% during the survey period. Following calibration to align the value of M with the NPL ratio in Slovakia, it was determined that M is 2. This relatively low value suggests that Slovak households may restore their financial solvency relatively quickly.

4.1 Logistic regression

The objective of this study is to examine the socio-economic and demographic determinants that impact households' probability of default. Logistic regression was employed to assess the impact of selected socio-economic and demographic characteristics on the likelihood of households defaulting on their loan payments. Logistic regression is a technique used when the dependent variable is dichotomous, allowing independent variables to include both qualitative and quantitative data. The logistic distribution allows for the specification of the logistic regression model as follows (Scott and Jeremy, 2014).

$$p(X) = \frac{e^{\beta_0 + \beta_1 X_1 + \beta_k X_k}}{1 + e^{\beta_0 + \beta_1 X_1 + \beta_k X_k}} \tag{3}$$

The relationship between probability p(X) and the predictors is nonlinear. However, the predictors can be linearised using a simple transformation. This transformation is called the logit transformation and is defined as:

$$\frac{p(X)}{1 - p(X)} = e^{\beta_0 + \beta_1 K_1 + \beta_k X_k} \tag{4}$$

$$log\left(\frac{p(X)}{1 - p(X)}\right) = \beta_0 + \beta_1 X_1 + \beta_k X_k \tag{5}$$

In our logistic regressions, the dependent variable is equal to 1 if a household defaults on their loan payments, and 0 otherwise. The independent variables include various categorical socio-economic and demographic variables. The detailed characteristics of the categorical independent variables are presented in Table 3.

Table 3: Independent variables in logistic regression model

Independent variable	Response Categories*
Age of household´s reference person	**16 – 34**
	35 – 44
	45 – 54
	55 – 62
	63+
Household size	**1**
	2

	3
	4
	5 and more
Education of reference person, Canberra definition	**Primary**
	Secondary
	Tertiary
Main labour status of reference person, Canberra definition	**Employee**
	Self-employed
	Unemployed
	Retired
	Other
Gross Income - Quartiles	**I quartile**
	II quartile
	III quartile
	IV quartile
Gross Wealth - Quintiles	**I quintile**
	II quintile
	III quintile
	IV quintile
	V quintile

*Reference categories marked in bold type.
Source: The authors´ own compilation based on HFCS data

Based on the literature review we created our hypothesis:
H1: Younger households have higher probability of default on their loan payments.
H2: Higher income households have lower probability of default on their loan payments.

4.2   Microsimulation stress test scenarios

In our paper, we examine the impact of a simultaneous combined shock of increased interest rates and rising price levels. The interest rate shock immediately affects household loan payments with adjustable interest rates. For households with fixed interest rates, the impact is deferred until the loans are renegotiated. According to HFCS data, 55.5% of households with a household main residence (HMR) and 80.9% of households with mortgages on other properties have adjustable interest rate contracts. In our analysis, we assume that interest rate increases only impact mortgage loan payments with adjustable rates. Conversely, mortgage loan payments with fixed interest rates and non-mortgage loan payments are assumed to remain unaffected by these interest rate shocks.

Table 4 outlines the scenarios of combined adverse economic shocks. It also illustrates the extent to which each scenario has been implemented, highlighting which variables and vulnerability indicators are most affected by the selected economic shocks.

Table 4: Overview of interest rate and inflation shock simulations

		Baseline	Scenario 1	Scenario 2	Scenario 3
Combined shock	**Magnitude**	+0 basis points & 0%	+300 basis points & 5%	+300 basis points & 10%	+500 basis points & 10%

	Affected variables	Mortgage loans with adj. interest rates & Living income	Mortgage loans with adj. interest rates & Living income	Mortgage loans with adj. interest rates & Living income	Mortgage loans with adj. interest rates & Living income
	For the following measures	FM, pd	FM, pd	FM, pd	FM, pd

Source: Own calculation

5   Results

This section will examine the selected socio-economic and demographic characteristics of vulnerable households following exposure to combined shocks of increased price levels and interest rates.

Table 5. Selected characteristics of indebted households with negative financial margins in case of a simultaneous increase in interest rates and price levels

	Scenario 0	Scenario 1	Scenario 2	Scenario 3
	baseline	3% increase in interest rates & 5% increase of price levels	3% increase in interest rates & 10% increase of price levels	5% increase in interest rates & 10% increase of price levels
	living income	living income	living income	living income
Age of Reference Person				
16 - 34	14.43	18.31	18.81	18.81
35 - 44	10.86	14.23	16.56	18.75
45 - 54	6.04	6.30	6.60	7.18
55 - 64	8.41	9.51	9.63	11.25
65 and more	13.24	16.00	21.54	21.54
Household size				
1	15.24	18.22	19.58	20.66
2	8.73	9.35	11.47	12.36
3	9.51	10.62	11.47	13.47
4	10.24	13.94	16.21	17.65
5 and more	9.86	14.05	14.05	14.05
Net Income Quintiles				
1st quintile	74.95	78.93	84.80	84.80
2nd quintile	15.82	26.84	32.99	38.13
3rd quintile	4.40	6.68	7.01	7.74
4th quintile	0.00	0.03	0.03	1.65
5th quintile	0.35	0.35	0.35	0.35
Net Wealth Quintiles				
1st quintile	16.58	19.27	20.63	21.41
2nd quintile	10.21	15.77	17.72	20.92
3rd quintile	8.34	9.12	10.78	11.99
4th quintile	6.11	7.35	9.04	9.21

5th quintile	8.38	8.61	8.69	8.76

Source: Own calculation based on HFCS 2021, ECB & NBS

Table 5 Outlines the effect of simultaneous increases in interest rates and price levels on the percentage of indebted households with a negative financial margin (FM). As the combined shocks become more severe, the proportion of households with a negative financial margin (FM) increases notably among the youngest (16-34) and oldest (65 and older) age groups. This could indicate that these groups are either at the beginning of their life cycle with potentially lower earnings and savings, or are retired with fixed incomes, making them more vulnerable to interest rate and price level hikes. Households with one or four members show a notable increase in the percentage share of indebted households with negative FM as interest rates and price levels rise, suggesting higher financial stress. For a single-member household, a higher negative financial margin can be attributed to the fact that households rely on a single source of income, which makes them particularly vulnerable to any disruptions such as job loss, reduced work hours, illness, or disability. Unlike multi-person households, they lack the financial buffer that additional earners provide. The larger households could face higher financial stress, potentially due to larger financial obligations typically associated with such household sizes. Conversely, the largest households (five or more) do not demonstrate a consistent increase, which may indicate the presence of diverse income sources or improved economies of scale in managing household finances. The initial high share of households with negative financial margins is observed in the first and second net income quintiles, with this share increasing further in negative FM across all scenarios. This suggests that low-income households are most at risk due to a limited financial buffer to absorb increased debt costs associated with higher interest rates and higher price levels. The highest income quintiles have demonstrated minimal increases, indicating that they have greater financial resilience and are less exposed to variable interest rates. This is consistent with the findings that, similar to net income, wealthier households (higher net wealth quintiles) show lower increases in negative FM, indicating that greater wealth provides a buffer against the impact of rising interest rates and price levels. The first quintile experiences a notable increase, which serves to illustrate the financial vulnerability of those with the lowest wealth. The univariate analysis provide clear evidence that households in the lowest net income and net wealth quintiles are found to be particularly vulnerable, experiencing the highest increases in the percentage with negative FM under varying economic stress scenarios. In the next table 6, we will examine the mean probability of default of indebted households across selected socio-economic and demographic characteristics.

Table 6. The mean probability of default across selected characteristics of indebted households in case of a simultaneous increase in interest rates and price levels

	Scenario 0	Scenario 1	Scenario 2	Scenario 3
	baseline	3% increase in interest rates & 5% increase of price levels	3% increase in interest rates & 10% increase of price levels	5% increase in interest rates & 10% increase of price levels
	living income	living income	living income	living income
	%	%	%	%
Age of Reference Person				

16 - 34	5.10	8.18	8.27	8.51
35 - 44	4.61	6.56	7.56	7.62
45 - 54	4.17	4.57	4.60	4.61
55 - 64	3.99	5.01	5.01	5.01
65 and more	6.84	7.15	8.60	8.60
Household size				
1	8.83	10.41	11.22	11.22
2	5.77	6.22	7.46	7.46
3	4.81	4.73	5.24	5.40
4	1.96	4.28	4.35	4.44
5 and more	5.68	10.20	10.48	10.48
Net Income Quintiles				
1st quintile	37.84	41.63	45.45	45.92
2nd quintile	6.11	13.22	14.17	14.18
3rd quintile	1.53	2.67	2.83	2.94
4th quintile	0.00	0.00	0.00	0.00
5th quintile	0.00	0.00	0.00	0.00
Net Wealth Quintiles				
1st quintile	13.33	16.16	16.72	16.72
2nd quintile	2.51	5.58	5.84	6.11
3rd quintile	0.82	0.42	2.08	2.08
4th quintile	2.91	4.13	4.25	4.28
5th quintile	2.67	2.77	2.77	2.77

Source: Own calculation based on HFCS 2021, ECB & NBS

Table 6 presents the impact of adverse scenarios involving a combination of shocks (namely, an increase in interest rates and inflation) on the mean probability of default across selected households' characteristics. The youngest (16-34) and oldest (65 and more) age groups consistently show a higher probability of default. The oldest group, in particular, maintains the highest default rate across all scenarios, indicating significant financial vulnerability. Households with one person show a higher probability of default across all scenarios compared to larger households. This might reflect the financial instability that can arise from having a single income without any additional financial support from other household members. The probability of default is significantly higher for households in the first net income quintile, peaking at 45.92% in the most adverse economic scenario. In contrast, the fourth and fifth quintiles have zero or near-zero default probabilities, indicating that higher-earning households are less likely to default on their loan payments. A similar pattern emerges when net wealth is considered. The first net wealth quintile exhibits a higher probability, with higher net wealth quintiles showing progressively lower mean default rates. This confirms that greater wealth accumulations provide substantial protection against the risk of default. The results presented in Table 6 also demonstrate that the simultaneous increases in interest rates and price levels compound the financial stress on almost all household groups, with the greatest impact on those who are already financially vulnerable, such as single-

person households, the elderly, the young, and those in the lowest net income and net wealth quintiles. The table 7 presents the results of the logistic regression analysis.

Table 7: Logit Regression Results – PD in scenario 3

	PD in scenario 3	PD in scenario 3
	Odds ratio	*Average marginal effect (AME)*
Age of Reference Person (base 16-34)		
35 - 44	0.68	-0.02
	(0.4525)	(0.0327)
45 - 54	0.35	-0.04
	(0.2392)	(0.0312)
55 - 64	0.45	-0.03
	(0.4272)	(0.0402)
65 and more	0.29	-0.05
	(0.3429)	(0.0441)
Household size (base 1)		
2	1.44	0.01
	(0.6087)	(0.0093)
3	3.62**	0.04*
	(2.2878)	(0.0223)
4	5.61***	0.06**
	(3.2087)	(0.0225)
5 and more	11.53***	0.10*
	(10.4159)	(0.0544)
Main labour status of Reference Person (base Employee)		
Self-employed	1.23	0.01
	(1.1612)	(0.0416)
Unemployed	20.24***	0.26**
	(15.5314)	(0.1063)
Retired	0.44	-0.02
	(0.3955)	(0.0272)
Other	6.15	0.12
	(7.6989)	(0.1114)
Education of Reference Person (base Primary)		
Secondary	0.59	-0.02
	(0.3019)	(0.0234)
Tertiary	0.31	-0.04
	(0.3056)	(0.0298)
Gross Wealth Quintiles (base I quintile)		
II quintile	0.26**	-0.05**
	(0.1465)	(0.0215)
III quintile	0.07***	-0.07***
	(0.0579)	(0.0210)
IV quintile	0.55	-0.03
	(0.3750)	(0.0282)
V quintile	0.60	-0.02
	(0.5242)	(0.0379)
Gross Income Quartiles (base I quartile)		
II quartile	0.12***	-0.17***
	(0.0744)	(0.0584)
III quartile	0.02***	-0.21***
	(0.0193)	(0.0619)
IV quartile	0.03***	-0.20***

	(0.0351)	(0.0613)
Constant	0.62	
	(0.5419)	
Observations	2,174	2,174

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The results of the logistic regression analysis indicate that gross income is the most significant determinant of households' probability of default in the most adverse scenario 3. With regard to age categories, the findings do not provide evidence that age has a statistically significant impact on households' probability of default. In contrast, the analysis suggests that, on average, larger households (five or more members) are 10% more likely to default on their loan payments than single-member households. This highlights the fact that, in particular, households with five or more members may face greater challenges in managing their overall living costs. In this case, our regression analysis does not confirm that younger households have a statistically significant higher probability of loan payments default.

With regard to the employment status of the reference person, the results indicate that households with an unemployed reference person were, on average, 26% more likely to default on their loan payments than households with an employed reference person. Overall, the employment status of households does not appear to have a significant impact on the probability of households defaulting. The results of our analysis indicate that education does not exert a significant influence on the probability of default among households.

Furthermore, households in the highest gross income classes are significantly less likely to default on their loan payments. For instance, households in the highest quartile are on average 20% less likely to default on their loan payments than households in the lowest quartile. This finding is in line with our second hypothesis and confirms that higher income households are less likely to default on their loan payments. This indicates that a significant portion of a lower income household's annual income is allocated to debt repayment. In the event of a household encountering financial difficulties, the capacity of an indebted household to fulfil debt obligations may be diminished, thereby increasing the probability of default.

6. Conclusion

This study has identified the Slovak households most vulnerable to defaulting on loan payments due to recent economic challenges, including high inflation and rising interest rates. Slovakia's inflation rate peaked at an unprecedented 15.4% in February 2023, significantly exacerbating financial strain on households already struggling with rising costs of living. The analysis reveals a notable rise in household indebtedness, with the percentage of households holding debt increasing from 26.7% in 2011 to 38.8% in 2021. Particularly, mortgage debt has surged, indicating a growing trend towards property investments among Slovak households.

Households with negative financial margins and limited liquid assets are identified as particularly at risk. The probability of default is notably higher among younger (16-34) and older (65 and above)

age groups, single-person households, and those in the lowest income and wealth quintiles. Logistic regression analysis revealed that gross income is the most significant determinant of a household's probability of default. Households in the highest income quartiles have a significantly lower probability of default compared to those in the lowest quartile. Larger households, especially those with five or more members, and those with an unemployed reference person, also exhibited higher default probabilities.

Contrary to expectations, age and educational attainment did not show a statistically significant impact on the likelihood of default, underscoring the predominant influence of income and employment status. The study's findings underscore the necessity for targeted policy measures to support financially vulnerable households. Policymakers should prioritize interventions for low-income households, single-person households, and those with high dependency ratios.

Enhancing financial literacy, providing debt restructuring options, and ensuring adequate social safety nets can mitigate the risk of default and enhance financial stability. Moreover, tailored financial assistance programs and improved access to affordable credit can help these vulnerable households manage their debt more effectively. As Slovakia continues to navigate these economic challenges, the insights from this research are crucial for crafting effective interventions aimed at supporting the financial well-being of its citizens and maintaining overall economic stability.

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