WHO SAVES FOR RETIREMENT? SOCIO-ECONOMIC DETERMINANTS OF VOLUNTARY RETIREMENT SAVINGS IN SLOVAKIA

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Abstract: *Rising demographic pressure on public pension systems and the expected decline in wage replacement rates are increasing the importance of individual retirement savings, as insufficient private provision may lead to a decline in living standards in old age. This issue is particularly relevant in the Slovak Republic, which ranks among the most rapidly aging populations in Europe. The aim of this paper is to identify the demographic and socio-economic determinants of voluntary retirement saving. The empirical analysis draws on microdata from the Slovak wave of the 2021 Household Finance and Consumption Survey (HFCS) and focuses on economically active individuals aged 18-64. The determinants of participation are estimated using a binary logistic regression model. The results indicate that the probability of participation follows a nonlinear life-cycle pattern, peaking in middle age. Tertiary education, partnership status, employment in the public sector, and ownership of a second property are positively associated with participation. In contrast, the presence of a retiree in the household is negatively associated with voluntary retirement saving. The findings provide empirical evidence relevant for policies aimed at strengthening financial preparedness for retirement, particularly among younger, lower-educated, and low-income households.*

Keywords: *voluntary retirement savings, retirement behavior, socio-economic determinants, household financial behavior, population aging*

JEL Classification: J11, J26, J32

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1 Introduction

Financial preparedness for retirement has become increasingly important. In the context of demographic aging, rising life expectancy, and the gradual shift of responsibility for securing retirement income from the state to the individual, voluntary retirement saving is becoming an indispensable part of household financial behavior. Retirement planning is therefore not merely a matter of personal financial stability, but also a significant factor in the long-term sustainability of public finances.

According to international projections, the global gap between retirement savings and retirement income needs may widen considerably in the coming decades. This development is driven by a combination of trends, with demographic transformation playing a key role through an increasing share of older individuals in the population and growing pressure on pay-as-you-go pension systems. At the same time, rising life expectancy implies a longer period of retirement, thereby increasing the required volume of accumulated savings.

Recent OECD projections further highlight mounting demographic pressures on pension systems. According to *Pensions at a Glance 2025*, populations in OECD countries are expected to age significantly over the coming decades, with the number of individuals aged 65 and over rising from approximately 33 per 100 working-age persons in 2025 to 52 by 2050. This trend is expected to be particularly pronounced in several European countries, including the Slovak Republic, pointing to a deepening imbalance between contributors and pension beneficiaries. These demographic shifts are likely to intensify financial pressure on public pension systems while reinforcing the importance of individual retirement savings as a supplementary source of income in old age (OECD, 2025).

Declining fertility represents one of the main structural drivers of population aging. OECD data indicate a long-term decline in fertility rates across member countries, from approximately 3.30 children per woman in the early 1960s to around 1.59 in 2022, well below the population replacement level of 2.10. The combination of low fertility and increasing life expectancy is thus gradually reducing the share of the economically active population and placing additional pressure on pension system financing (OECD, 2025).

These global trends are also reflected in the Slovak Republic. The public pension system faces growing demographic pressure, and the debate on its long-term sustainability has become an integral part of economic policy discussions. As noted by Bačová (2021), retirement planning is a process that begins upon entry into the labor market and involves decisions regarding participation in the individual pillars of the pension system. Šebo (2017) further argues that relying solely on public pensions may lead to a substantial decline in consumption in old age if income is not supplemented by individual savings.

Addressing these challenges effectively requires coordination among the state, employers, and individuals. The state can design incentive mechanisms through tax policy and regulatory frameworks, employers may provide occupational pension schemes, and individuals bear responsibility for their own financial planning. The key question, however, remains which factors influence individuals' decisions to participate in voluntary retirement saving. Despite the growing importance of individual retirement savings, empirical evidence on the determinants of such behavior in post-socialist economies, including the Slovak Republic, remains relatively limited.

The pension system of the Slovak Republic is based on a multi-pillar structure combining public pay-as-you-go provision with capitalized and voluntary schemes. Despite the existence of a voluntary third pillar, participation rates remain uneven across socio-economic groups, underscoring the importance of analyzing the factors that influence household decisions to engage in voluntary retirement saving.

Pastoráková et al. (2017) provide one of the first empirical analyses of voluntary retirement saving in the Slovak Republic. Using microdata from the 2010 wave of the Household Finance and Consumption Survey (HFCS), they identify key demographic and socio-economic determinants of individuals' proactive approach to private pension saving. Their findings indicate that 26.93% of economically active respondents participated in voluntary retirement saving, with age, education, income, financial wealth, and ownership of a second property emerging as significant determinants.

Comparing these findings with those presented in this paper suggests that the share of individuals participating in voluntary retirement saving increased from 2010 to 2021, reaching 38.06% in our sample. This development

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may reflect changes in individual behavior in response to demographic and economic pressures, as well as potential differences in methodology or sample definition.

The aim of this paper is to empirically identify the demographic and socio-economic determinants of voluntary retirement saving among Slovak households, with particular emphasis on addressing the research question of who saves for retirement. The analysis draws on microdata from the Slovak wave of the 2021 Household Finance and Consumption Survey (HFCS). This paper contributes to the existing literature in several ways. First, it provides up-to-date empirical evidence on the determinants of voluntary retirement saving in the Slovak Republic, thereby extending earlier findings based on older data. Second, the paper offers a comparative perspective by contrasting the observed patterns with results from the 2010 HFCS wave, allowing for an assessment of changes in retirement saving behavior over time. Third, the analysis highlights differences in how households accumulate and allocate financial resources for retirement, suggesting that some individuals rely on alternative forms of financial assets rather than formal pension schemes. By highlighting these mechanisms, the paper contributes to a better understanding of retirement saving behavior in a post-socialist context and provides relevant insights for the design of policies aimed at strengthening financial preparedness for old age.

2 Current State of the Issue

In European countries, a significant shift in pension policies is underway towards greater individualization and diversification of retirement income sources. This trend reflects growing demographic imbalances that undermine the sustainability of traditional pay-as-you-go pension systems. As a result, individuals are increasingly required to assume responsibility for securing adequate income in old age through supplementary pension schemes. Empirical evidence further suggests that public and occupational pensions alone are often perceived as insufficient, with more than half of European respondents considering individual retirement savings an indispensable complement to public pension provision (Insurance Europe, 2023).

According to projections by the European Commission (Ageing Report, 2024), the average gross replacement rate from public pension systems in

the European Union is expected to decline from approximately 45% in 2022 to 38.2% in 2070. In practical terms, this implies that public pensions will cover only about one-third of previous gross earnings. For an individual with a monthly gross income of 2,000 euros, pension income would amount to approximately 764 euros, representing a substantial decline in living standards. The most pronounced declines are projected in Poland (-31.4%) and Portugal (-30.5%). A significant reduction is also expected in Spain (-13.2%), although it is projected to remain above the European Union average at the end of the projection period. Relatively stable trends are anticipated in the Czech Republic and Austria, while Slovakia is expected to experience a decline in the replacement rate from 39.6% to 34.7%. These differences reflect the heterogeneous structure of public pension systems and the varying scope of reforms aimed at ensuring their long-term sustainability. At the same time, they reinforce the importance of private pension schemes as a supplementary source of retirement income. The figures refer primarily to the replacement rate provided by the public pension system and do not fully account for benefits from the second and third pension pillars.

Table 1: Pension wage-replacement rate (%)

Country/Year	2022	2030	2040	2050	2060	2070	change 2022-2070
Austria	53.20	55.60	53.80	54.30	54.30	54.40	1.20
Czechia	47.90	53.10	51.40	50.30	49.30	48.30	0.40
Denmark	29.40	29.60	28.80	26.90	24.80	23.70	-5.80
Lithuania	26.70	26.60	23.60	21.40	19.50	18.50	-8.20
Poland	58.20	47.10	32.20	27.40	27.00	26.80	-31.40
Portugal	69.40	79.90	90.10	38.50	40.10	38.90	-30.50
Slovakia	39.60	40.60	36.80	36.00	34.30	34.70	-4.90
Spain	77.20	76.00	71.10	64.60	63.90	64.00	-13.20
Sweden	30.80	30.80	26.40	24.60	25.70	25.50	-5.30
EU average	**45.00**	**44.80**	**42.30**	**38.50**	**38.40**	**38.20**	**-6.70**

Source: Economic Policy Committee, 2024, own processing.

Rising life expectancy represents one of the most significant long-term

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demographic trends in developed countries. The systematic extension of average life expectancy lengthens the period of pension receipt and increases the volume of benefits paid per insured individual. Maximum life expectancy, particularly among women, has been increasing almost linearly for more than 150 years at approximately 3 months per year (Coughlan et al., 2013; Oeppen & Vaupel, 2002). In pay-as-you-go systems, this implies rising liabilities towards older cohorts without a corresponding increase in the contribution base, thereby undermining the long-term balance between revenues and expenditures.

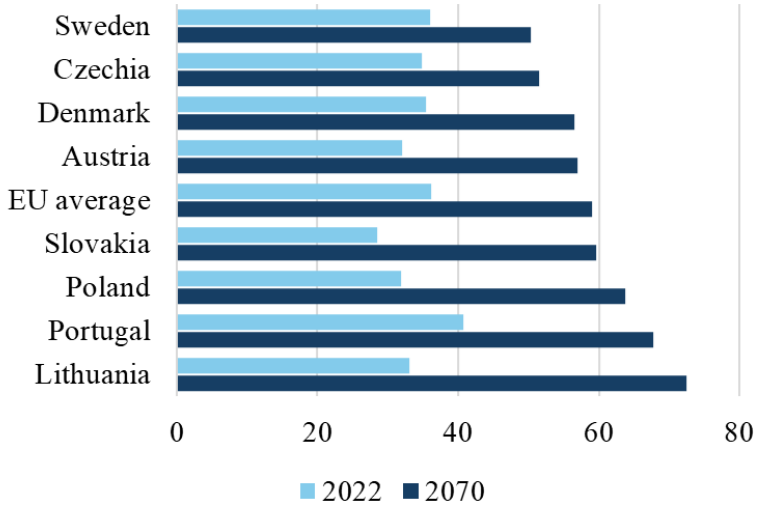
Average life expectancy in the European Union reached 81.7 years in 2024 (Eurostat, 2024), up 0.3 years from 2023. In 15 member states, life expectancy is close to the EU average, while the highest levels are observed in Italy (84.1 years), Sweden (84.1 years), and Spain (84.0 years). The lowest values are recorded in Bulgaria (75.9 years), Romania (76.6 years) and Latvia (76.7 years). Slovakia, at 78.6 years, remains below the European Union average. This gap can be partly explained by differences in population health, lifestyle factors, and socio-economic inequalities. Lower effectiveness of preventive healthcare also affects future demographic structures and pension system dynamics.

The increase in life expectancy occurs alongside population aging and a decline in total population size. According to Eurostat projections, Slovakia's population is expected to decrease from 5,434,712 in 2022 to 4,552,382 by 2100 (-16.2%), while the average age will rise from 41.8 to 48.4 years. The population will thus become both smaller and significantly older. This trend is already reflected in the rising number of old-age pension recipients, which reached 1,174,117 in September 2025, up from 1,099,629 in the same period in 2020.

These demographic shifts are reflected in a substantial increase in the old-age dependency ratio, defined as the ratio of persons aged 65 and over to the population aged 20-64. In Slovakia, this indicator is projected to rise from 28.5 in 2022 to more than 54.7 by 2050, peaking at approximately 63.7 around 2060 before slightly declining to 59.7 in 2070. In practical terms, this implies a reduction in the number of economically active individuals per retiree from roughly four to approximately two. Consequently, a growing number of pension recipients will need to be supported by contributions from a relatively

smaller working-age population, creating pressure to increase contribution rates, reduce replacement rates, or rely more heavily on transfers from the state budget.

Table 1: Old-age Dependency Ratio in Selected EU Countries, 2022 and 2070



Source: European Commission, 2024.

Demographic developments also increase the need to diversify retirement income sources. In response, European countries have strengthened the funded pillars of their pension systems. The second pillar takes various institutional forms, ranging from mandatory funded schemes to occupational pension funds based on collective agreements. Differences across countries reflect historical developments, macroeconomic conditions, labor market structures, and levels of trust in financial institutions.

In the Slovak Republic, the second pillar constitutes an important component of the pension system, with 2,057,712 participants recorded as of 31 December 2025, reflecting a high level of participation among economically active individuals (Social Insurance Agency, 2026). However, the existence of a funded pillar does not automatically ensure sufficient diversification of retirement income, as pension outcomes depend on individual decisions, contribution levels, and the duration of saving. This underlines the importance of analyzing the determinants of voluntary retirement saving at the individual level.

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Countries with stable labor markets, such as Denmark and the Netherlands, where the second pillar is strongly based on occupational pension funds, exhibit the highest shares of private occupational pensions relative to GDP. In the Netherlands, this share amounted to 5.1% of GDP in 2022 and is projected to increase to 5.9% by 2070. An even more pronounced rise is expected in Denmark, from 4.0% to 6.3% of GDP. Sweden, which operates a mandatory funded system, shows steady growth from 1.7% to 2.2% of GDP over the same period. These outcomes can be attributed to high participation rates in collective schemes, often supported by automatic enrolment and strong collective bargaining structures. In contrast, in countries such as Spain and Portugal, where the second pillar is less developed, the share of occupational pensions is expected to decline over the long term.

Participation in private pension schemes across the European Union has gradually increased over the past few decades. Most member states use tax incentives and institutional instruments to support the accumulation of supplementary retirement savings and alleviate demographic pressures on public systems. In this context, the third pillar, representing voluntary individual retirement saving, plays an important role. Its institutional forms vary widely across countries, ranging from individual pension accounts managed by financial institutions to employer-sponsored schemes supported by tax incentives.

Although projections by the Economic Policy Committee (2024) indicate growth in the volume of individual pensions, their share of GDP remains relatively low. This suggests that the development of voluntary retirement saving is not an automatic response to demographic change but rather depends on a combination of institutional incentives and individual behavior.

Differences across countries are most clearly reflected in the structure of retirement income sources. According to OECD data (2025), public transfers constitute the dominant source of income for individuals aged 65 and over in most countries, although their relative importance varies significantly. In Austria and the Czech Republic, public transfers account for 78.2% and 75.5% of retirement income, respectively. In contrast, in Denmark and Sweden, their shares are lower (43.2% and 50.3%) and are complemented by higher shares of private occupational transfers (14.7% and 18.4%).

Slovakia belongs to the group of countries with relatively low diversification

of retirement income. Public transfers account for 59.3% of income among older individuals, while capital income remains negligible at 0.4%. At the same time, the relatively high share of labor income (40.3%) suggests that a significant proportion of older individuals remain economically active. This structure increases seniors' living standards' vulnerability to changes in the public pension system. A comparison of income sources for persons aged 65 and over is presented in Table 2.

Table 2: Income sources of persons aged 65 and over, 2022 (in %)

Country	Public transfers	Private occupational transfers	Capital	Work
Austria	78.20	0.00	5.10	16.70
Czechia	75.50	0.00	2.70	21.80
Denmark	43.20	14.70	22.00	20.20
Lithuania	65.00	0.00	4.00	30.90
OECD average	55.90	7.10	10.00	27.00
Poland	61.00	0.00	1.00	38.00
Portugal	68.90	0.00	4.80	26.30
Slovakia	59.30	0.00	0.40	40.30
Sweden	50.30	18.40	15.00	16.30

Source: OECD Income Distribution Database (2025), own processing.

These findings suggest that the extent of voluntary retirement saving is not an automatic response to demographic trends, but rather the result of a complex interaction of economic, institutional, and behavioral determinants. Despite the growing importance of supplementary pension schemes, participation rates remain significantly differentiated across countries.

In the case of the Slovak Republic, where capital income accounts for only 0.4% of retirement income and further declines in replacement rates are expected, the identification of the determinants of voluntary retirement saving is of critical importance. Understanding these factors is essential for designing effective policies to strengthen retirement financial preparedness.

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3 Literature Review

Individual retirement preparation has become an essential component of financial behavior in recent decades. It is important not only from the perspective of the individual seeking to maintain living standards and financial stability in old age, but also from a macroeconomic perspective, as it affects the long-term sustainability of public pension systems. Retirement planning is a complex process that involves gathering information, formulating goals, selecting an investment strategy, and implementing financial decisions. It is a gradual, dynamic process that requires financial knowledge, motivation, and the ability to make long-term decisions.

The importance of individual behavior has increased due to changes in pension systems. Spicker (2011) emphasizes that private pensions are not guaranteed by the state and that their value depends on financial market performance, which increases the risks to the stability and security of savings. In the context of declining adequacy of public pension systems, individual retirement savings are gaining importance, as responsibility for securing adequate income in old age is gradually shifting to individuals (Cupak et al., 2019). Lagoutte and Reimat (2013) add that public systems based on social insurance provide a higher degree of certainty and equity; however, they are sensitive to demographic developments and may lead to growing deficits, prompting countries to implement reforms and limit social expenditures.

In the context of the Slovak Republic, one of the key empirical contributions is the study by Pastoráková et al. (2017), which, based on data from the 2010 wave of the Household Finance and Consumption Survey (HFCS), identified age, education, income, and household wealth characteristics as significant determinants of private retirement savings participation. The authors also highlight the presence of population groups with low participation rates that may face an increased risk of insufficient income in old age. The present study builds upon and extends this research stream by providing updated empirical evidence on the determinants of voluntary retirement savings in the Slovak Republic.

Empirical literature identifies age as one of the most consistent determinants of retirement savings. Numerous studies confirm that the probability of planning and saving for retirement increases with age (DeVaney & Chiremba,

2005; Hira et al., 2009; Huberman et al., 2007; Lum & Lightfoot, 2003; Mansor et al., 2015; Stinglhamber et al., 2007; Van Rooij et al., 2011). This relationship is primarily explained by greater awareness of future income risks and increasing proximity to retirement. Empirical findings also suggest a nonlinear pattern, with participation in voluntary pension schemes typically peaking in middle age, particularly among individuals aged 40 to 49 (Metzger, 2017). Younger cohorts often exhibit lower participation rates due to limited financial resources, lower knowledge of pension systems, or a preference for current consumption (Foster, 2017). Evidence from Slovakia confirms this pattern: the highest participation rate is observed in middle age, while younger and older cohorts show lower participation (Cupak et al., 2019).

Gender represents another important determinant. Research repeatedly indicates that men generally show a higher propensity to plan and save for retirement (Huberman et al., 2007; Lum & Lightfoot, 2003). Women, however, face several structural disadvantages, such as lower income levels, shorter and interrupted career paths, and a higher incidence of unpaid family care responsibilities, which weaken their financial preparedness for retirement (Clark et al., 2012). Foster et al. (2016) further suggest that women exhibit specific attitudes towards retirement savings and often have lower self-confidence in this domain than in other forms of saving. Nevertheless, empirical evidence is not fully conclusive. Some studies indicate that gender alone may not play an independent, decisive role in retirement savings decisions once other socio-demographic and economic factors are controlled for (Mansor et al., 2015). More recent findings support this conclusion, suggesting that observed gender differences are largely mediated by age, income, and labor market status (Xie et al., 2023). At the same time, gender differences may manifest in specific life situations. For instance, living in a single-person household has been found to positively affect retirement savings among women compared to women in multi-person households, which may be explained by greater sensitivity to future income risks and lower reliance on household income pooling (Fernández-López et al., 2015).

Marital status is among the frequently analyzed socio-demographic determinants of retirement behavior, as financial decisions are strongly influenced by family commitments and joint future planning. Empirical literature generally indicates that married individuals exhibit a higher propensity to save for retirement (Johannisson, 2008), which is explained by

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greater responsibility for household financial stability and the need to secure future family income. Lusardi (2003) finds that individuals who do not engage in retirement planning are less likely to be married, while Johannisson (2008) emphasizes that retirement savings decisions within marriage are often made jointly. Recent empirical data support this pattern - according to Insurance Europe (2023), married individuals account for as much as 68% of retirement savers. However, evidence remains mixed. Ares, López, and Búa (2015) did not find a statistically significant effect of marital status on the decision to save for retirement, while more recent findings suggest that its effect may be more pronounced among younger age groups (Xie et al., 2023).

Although gender plays an important role, even more pronounced differences in retirement behavior are associated with education and financial literacy, which shape individuals' ability to make informed financial decisions. Empirical studies generally confirm that higher education increases the likelihood of retirement savings participation (Mansor et al., 2015; Van Rooij et al., 2011) and is linked to higher income, more stable employment, and more effective use of financial products (DeVaney & Chiremba, 2005; Lum & Lightfoot, 2003).

The literature devotes particular attention to financial literacy. Causal evidence suggests that higher levels of financial knowledge significantly increase the probability of participation in voluntary pension schemes, with a stronger effect observed in purely voluntary arrangements than in employer-sponsored schemes (Cupak et al., 2019). The positive impact of formal education is primarily explained by the reduction of informational and psychological barriers to entering retirement savings products (Ares et al., 2015) and by improved cognitive abilities necessary for long-term planning (Banks & Oldfield, 2007).

Despite these positive findings, the results are not entirely conclusive. Some studies question the effect of formal financial education on financial behavior (Mandell & Klein, 2009), while others confirm its positive impact regardless of its source (Xiao & O'Neill, 2016; Xiao & Porto, 2017). Ye et al. (2025) identify an interesting paradox: a negative correlation between higher education and active retirement planning, but a positive association with savings goals. This apparent contradiction is explained by the fact that higher education increases earning potential (Banks at el., 2010), which may temporarily reduce motivation for active planning (Hershey et al., 2013;

Lusardi, 2003), although in the long run it supports wealth accumulation.

Existing literature thus identifies a broad spectrum of socio-demographic, economic, and behavioral determinants of voluntary retirement savings, with age, education, and financial literacy among the most consistently confirmed factors. However, empirical findings are not always uniform, and their relevance varies across institutional and economic contexts.

Most available studies are conducted in developed Western European or Anglo-Saxon economies, while empirical evidence for post-socialist countries, including the Slovak Republic, remains relatively limited. The institutional design of the pension system, the level of financial literacy, and the historical development of the labor market may significantly influence households' decisions to participate in voluntary retirement savings. There is therefore a need for a microeconomic analysis of the determinants of voluntary retirement savings among Slovak households, enabling the identification of factors with the greatest explanatory power and contributing to a deeper understanding of individual behavior in the domain of long-term financial security.

4 Data and Methodology

The empirical analysis focuses on identifying the determinants of voluntary retirement savings participation among Slovak households. The study uses microdata from the most recent available wave of the Household Finance and Consumption Survey (HFCS), conducted in 2021 by the National Bank of Slovakia in cooperation with the European Central Bank (NBS, 2021). The survey provides detailed information on household assets, liabilities, income, financial assets, and retirement savings, as well as on the demographic characteristics of individual household members.

The analysis is conducted at the individual level. The sample includes economically active respondents of working age (18-64 years). Observations with missing values in relevant variables were excluded from the analysis. The final analytical sample consists of 2,801 individuals. Given the complex survey design, calibrated household weights are applied to ensure the representativeness of the results for the population of the Slovak Republic.

The dependent variable captures participation in voluntary retirement savings and is constructed from information on pension plan ownership available in the

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HFCS 2021 dataset. Specifically, it is based on the HFCS variable PFA020$x, which identifies the type of pension plan held by the respondent. Individuals are classified as participants if they report ownership of at least one non-public retirement-related financial arrangement, including occupational pension plans (code 2), voluntary pension schemes (code 3), whole life insurance contracts (code 4), or other retirement-related savings products (code 5). Public pension plans (code 1) are excluded from the definition. Although these arrangements differ in their institutional design, they share the common feature of representing voluntary, non-public forms of long-term retirement provision. Consequently, the analysis adopts a broader concept of voluntary retirement saving that captures participation in private retirement provision rather than participation in a specific retirement product.

Based on the review of the existing literature, selected socio-demographic and economic characteristics of the individual and the household were included in the model. Age captures the life-cycle stage and planning horizon, while education serves as a proxy indicator of human capital and financial literacy. Definitions of the variables used are provided in Table 3.

Table 3: Definition of the Dependent Variable and Explanatory Variables

Variable	Definition
Voluntary retirement savings	Binary variable equal to 1 if the individual voluntarily saves for retirement, and 0 otherwise
Female	Binary variable indicating gender; equals 1 if the respondent is female and 0 otherwise
Age	Age of the respondent
Tertiary education	Binary variable equal to 1 if the respondent has completed tertiary education and 0 otherwise
Partnered	Binary variable equal to 1 if the respondent is married or living with a partner and 0 otherwise
Employment in finance or insurance	Binary variable equal to 1 if the respondent works in the finance or insurance sector and 0 otherwise
Employment in the public sector	Binary variable equal to 1 if the respondent works in the public sector and 0 otherwise
Financial wealth	Binary variable equal to 1 if net financial wealth (financial assets minus total debt) is positive and 0 otherwise

Household income	Annual equivalized gross household income in euros
Ownership of a second property	Binary variable equal to 1 if the household owns a second property (in addition to the main residence) and 0 otherwise
Retiree in the household	Binary variable equal to 1 if at least one retiree is present in the household and 0 otherwise
Children in the household	Binary variable equal to 1 if children are present in the household and 0 otherwise

Source: Economic Policy Committee, 2024, own processing.

The model also includes the presence of children and a retiree in the household. The presence of children reflects the household's expenditure burden and life-cycle stage, and its effect on retirement savings may be either positive or negative. The presence of a retiree allows for controlling potential intergenerational effects - experience with pension income may increase motivation to accumulate one's own retirement savings, while at the same time potentially representing an additional financial burden.

The household's wealth position is captured by a binary indicator of financial wealth, defined as a positive net financial position (the difference between financial assets and total debt). The variable equals 1 if the household's financial assets exceed its total debt, and 0 otherwise. It is intended to distinguish households with a positive net financial position from those with a negative net financial position, rather than to measure the exact level of financial wealth.

Household income is measured as annual equivalized gross household income reported in the HFCS dataset. The measure is based on the modified OECD equivalence scale, which adjusts household income for differences in household size and composition. Due to the skewed distribution of income, the natural logarithm of household income and its squared term are included in the regression analysis. This specification allows for a potentially non-linear relationship between income and the probability of participation in voluntary retirement savings.

Ownership of the primary residence was not included in the model, as it is almost universal in the Slovak Republic. According to Eurostat data, approximately 93% of the population lived in owner-occupied housing in

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2024. The low variability of this variable would therefore substantially limit its explanatory power in the regression model. In contrast, ownership of a second property is included and interpreted as an indicator of higher wealth status and household investment activity, which may serve as an alternative form of long-term financial security.

Although the unit of analysis is the individual respondent, several explanatory variables are measured at the household level. This approach assumes that retirement-saving decisions are influenced not only by individual characteristics but also by the household's broader economic and demographic conditions.

The model specification is further complemented by sectoral variables capturing employment or self-employment in the finance and insurance sector and in the public sector. These variables allow testing whether the professional environment and the type of institutional employer influence the probability of participation in voluntary retirement savings.

The chosen model specification thus enables a comprehensive assessment of demographic, economic, wealth-related, and sectoral factors that may influence individual decision-making regarding voluntary retirement provision.

Three model specifications are estimated to examine the role of different groups of explanatory variables. Model 1 represents the full specification and includes all explanatory variables. Model 2 focuses on demographic and employment-related characteristics, while Model 3 includes economic and household characteristics. This approach allows the relative importance of different determinants of voluntary retirement saving participation to be examined separately and in combination.

Given the dichotomous nature of the dependent variable, a logistic regression model is employed to estimate the determinants. The logit model is a standard statistical approach for analyzing dependent variables that take values of 0 or 1 and allows the simultaneous inclusion of multiple explanatory variables, enabling the estimation of their relative importance for the probability of the observed outcome (Siegmann, 2017). The model is specified as follows:

$$\log\left(\frac{p(x)}{1-p(x)}\right) = \beta_0 + x \cdot \beta \qquad (1)$$

where $p(x)$ represents the probability that an individual participates in

voluntary retirement savings, x is the vector of explanatory variables, and β denotes the vector of estimated parameters. The results are presented as logit coefficients with corresponding standard errors.

The logistic model was chosen for its standard use in analyzing binary decision outcomes and its more straightforward interpretation of results. Empirical differences compared to a probit specification are negligible. All data preparation and statistical analyses were performed using Stata 19.

5 Results and Discussion

Among the 2,801 economically active individuals analyzed, 38.06% participate in voluntary retirement savings. This share indicates that private retirement provision represents an important, though not universally utilized, instrument of retirement preparation in Slovakia.

Table 4: Demographic and Socio-Economic Distribution of the Sample

Variable	No. of obs.	Mean	Standard Deviation	Min	Max
Voluntary retirement savings	2,801	0.3806	0.4856	0	1
Female	2,801	0.5123	0.4999	0	1
Age	2,801	44.95	13.49	18	64
Tertiary education	2,801	0.2563	0.4367	0	1
Partnered	2,801	0.5605	0.4964	0	1
Employment in finance or insurance	2,801	0.0196	0.1388	0	1
Employment in the public sector	2,801	0.0785	0.2691	0	1
Financial wealth	2,801	0.6808	0.4662	0	1
Household income	2,801	12,889.84	7,449.48	348	60137
Ownership of a second property	2,801	0.2974	0.4572	0	1
Retiree in the household	2,801	0.1864	0.3895	0	1
Children in the household	2,801	0.3092	0.4622	0	1

Source: HFCS NBS 2021, own processing.

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The composition of the analyzed sample reflects the structure of the economically active population of working age. Women account for 51.23% of respondents, and the average age is 44.95 years. Approximately 25.63% of individuals have completed tertiary education, and 56.05% live in a marital or partnership arrangement. A total of 1.96% of respondents are employed in the finance or insurance sector, while 7.85% work in the public sector. More than two-thirds of respondents (68.08%) possess positive net financial wealth, and 29.74% own a second property. The average annual household income is 12,890 euros, with substantial income dispersion, indicating considerable heterogeneity in household economic positions.

The descriptive analysis reveals several differences between savers and non-savers. Individuals participating in voluntary retirement savings are, on average, older (46.55 years compared to 43.97 years), more likely to have a tertiary education (36.97% compared to 18.85%), and more frequently live in a marital or partnership arrangement (67.92% compared to 48.76%). These differences suggest that participation in voluntary retirement savings is associated with several demographic and socio-economic characteristics. More detailed results are presented in Table 5.

Table 5: Demographic and Socio-Economic Characteristics of Savers and Non-Savers

Variable	Non-savers		Savers	
	Mean	Standard Deviation	Mean	Standard Deviation
Female	0.5020	0.5001	0.5291	0.4994
Age	43.97	14.82	46.55	10.79
Tertiary education	0.1885	0.3912	0.3697	0.4822
Partnered	0.4876	0.5000	0.6792	0.4670
Employment in finance or insurance	0.0115	0.1068	0.0328	0.1783
Employment in the public sector	0.0530	0.2241	0.1201	0.3252
Financial wealth	0.6899	0.4627	0.6660	0.4718
Household income	11,696.46	7,261.54	14,832.16	7,345.20
Ownership of a second property	0.2646	0.4412	0.3508	0.4775

Retiree in the household	0.2150	0.4110	0.1398	0.3469
Children in the household	0.2957	0.4565	0.3311	0.4708
Number of Observations	**1,735**		**1,066**	

Source: HFCS NBS 2021, own processing.

Pronounced differences are also observed in the economic domain. Savers are more likely to be employed in the finance or insurance sector (3.28% compared to 1.15%) and in the public sector (12.01% compared to 5.30%). They also report a higher average annual household income (14,832 euros, compared to 11,696 euros) and are more likely to own a second property (35.08% compared to 26.46%), indicating greater investment activity and wealth accumulation. The share of households with positive net financial wealth is slightly lower among savers (66.60%) than among non-savers (68.99%), though the difference is relatively small.

Overall, the descriptive analysis indicates that voluntary retirement savings are more prevalent among older, better-educated, partnered, and economically more advantaged individuals. These associations will be further examined within a multivariate regression framework.

Table 6: Determinants of Voluntary Retirement Savings Participation

	Participation in voluntary retirement savings		
Variable	**Model 1**	**Model 2**	**Model 3**
Female	0.043 (0.086)	-0.005 (0.084)	
Age	**0.330***** (0.028)	**0.305***** (0.027)	
Age squared	**-0.004***** (0.000)	**-0.003***** (0.000)	
Tertiary education	**0.548***** (0.100)	**0.797***** (0.095)	
Partnered	**0.428***** (0.102)	**0.554***** (0.091)	

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Employment in finance or insurance	**0.609**** (0.307)	**0.833***** (0.299)	
Employment in the public sector	**0.507***** (0.154)	**0.594***** (0.151)	
Financial wealth	-0.023 (0.098)		-0.128 (0.091)
Log household income	**3.934**** (1.693)		**3.331**** (1.612)
Log household income squared	**-0.172*** (0.091)		-0.128 (0.087)
Ownership of a second property	**0.198**** (0.095)		**0.201**** (0.089)
Retiree in the household	**-0.384***** (0.117)		**-0.311***** (0.111)
Children in the household	-0.025 (0.114)		**0.355***** (0.092)
Constant	**-29.395***** (7.845)	**-7.359***** (0.569)	**-20.458***** (7.487)
Number of observations	2,801	2,801	2,801

Note: Standard errors in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1. Model 1 includes all explanatory variables. Model 2 includes demographic and employment-related characteristics. Model 3 includes economic and household characteristics.

Source: HFCS NBS 2021, own processing.

However, given the cross-sectional nature of the data, these results should be interpreted as associations rather than causal effects. The results of the logistic regression indicate significant associations between several socio-demographic and economic determinants and the probability of participation in voluntary retirement savings. Age emerges as a statistically significant determinant with a nonlinear pattern. The coefficient on age is positive and statistically significant, while the coefficient on age squared is negative, indicating that the probability of participation increases with age, reaches a maximum in the early forties, and subsequently declines. This finding is consistent with the results of Pastoráková et al. (2017), who identified a similar age profile of retirement

savings participation in the Slovak context.

Figure 2 compares the age profile of participation in voluntary retirement savings based on HFCS 2010 results reported by Pastoráková et al. (2017) and the HFCS 2021 data analyzed in this study. The data indicate that, compared to 2010, participation increased notably across most age groups. An exception is the 23-25 age group, where the share of savers declined slightly (from 25% to 19.7%), which may partly reflect a growing proportion of individuals in full-time education and thus their lower representation among the economically active population. In addition, labor market disruptions and income uncertainty associated with the COVID-19 pandemic may have reduced younger individuals' ability or willingness to participate in voluntary retirement savings. A more pronounced increase is observed in the 26-28 age group (from 30% to 33.3%). Among individuals aged 30 and over, the share of savers in 2021 generally exceeds 38%, with the highest participation rate observed in the 41-43 age group (51.9%). In contrast, in 2010, the highest participation rate was recorded in the 32-34 age group (37%), indicating a shift towards older age categories. These descriptive patterns are consistent with the logistic regression results, which reveal a non-linear relationship between age and the probability of saving, with a maximum in middle age. These trends are illustrated in Figure 2.

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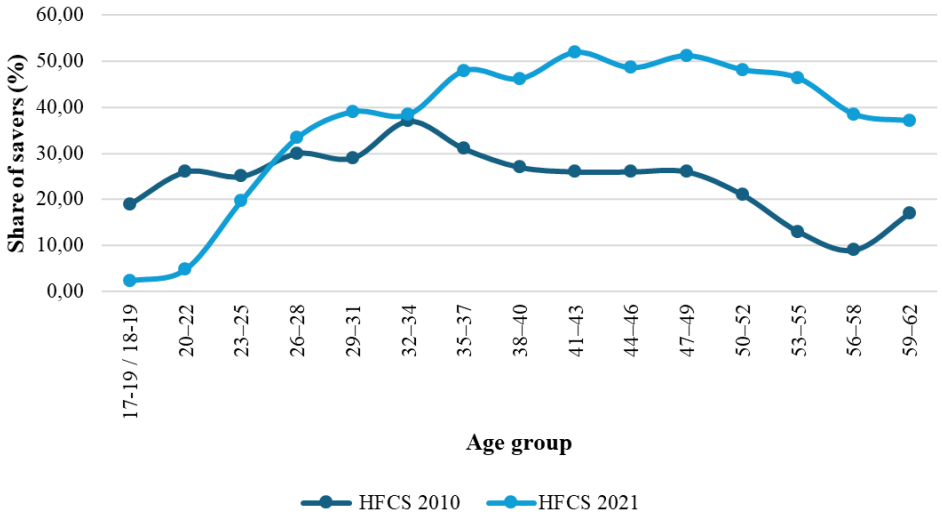
Figure 1: Share of Retirement Savers by Age Group: HFCS 2010 vs. HFCS 2021



Source: Pastoráková et al. (2017), HFCS NBS 2021, own processing.

Despite this positive development, participation among younger individuals remains relatively low compared to middle-aged groups. Early entry into retirement saving is crucial, as it allows individuals to fully benefit from compound interest and a longer investment horizon. Delayed participation may therefore result in significantly lower accumulated savings in the future.

The overall increase in participation between 2010 and 2021 likely reflects a combination of factors. Institutional changes in the pension system have played an important role, particularly the strengthening of funded pillars and the increasing emphasis on individual responsibility for retirement income. At the same time, improvements in financial literacy and greater availability of information on retirement planning can be assumed, along with a broader range of financial products designed for long-term saving. However, younger individuals face specific barriers: they often have lower incomes, higher income uncertainty, and greater expenditures associated with labor market entry, independent living, and housing. From a behavioral economics perspective, low participation may also be linked to a preference for present consumption and a tendency to underestimate long-term financial risks. As a result, many individuals postpone retirement saving until later stages of the life cycle, when their income stabilizes and awareness of the need for financial security in old

age increases.

Tertiary education represents one of the strongest and most robust determinants of participation in voluntary retirement savings. Its positive effect persists even after controlling for income and wealth characteristics, suggesting that retirement decision-making is shaped not only by economic resources but also by financial literacy and planning capabilities. This relationship may be explained by several mechanisms. Higher education is typically associated with a better understanding of financial products, a greater ability to process complex information, and lower informational barriers when making long-term financial decisions. More educated individuals also tend to exhibit higher financial self-confidence and a greater capacity to assess risks related to future retirement income. An additional explanation may lie in a stronger long-term orientation and a higher propensity for future planning, both of which are commonly linked to higher educational attainment in the literature. As a result, more educated individuals are more likely to allocate part of their resources to long-term savings instruments despite their lower liquidity. This finding is consistent with the results of Van Rooij et al. (2011) and Cupak et al. (2019).

A positive and statistically significant effect is also identified for marital status. Married individuals exhibit a higher probability of participating in voluntary retirement savings, which may reflect greater financial responsibility and a stronger long-term orientation towards securing future household income. This relationship may be explained by several factors. Marriage or partnership often leads to joint financial planning and coordination of economic decisions, promoting a more systematic approach to long-term financial security. Multi-income households typically benefit from more stable income streams and a greater capacity to accumulate savings, thereby reducing liquidity constraints associated with long-term saving. From a behavioral perspective, partnership may also strengthen mutual monitoring of financial decisions and increase motivation to secure future financial stability not only for the individual but for the household as a whole. The finding is therefore consistent with the literature, which emphasizes the importance of the family context in shaping retirement saving behavior.

Regarding employment status, working in the public sector appears to be a significant determinant, as public-sector employees are more likely to save voluntarily. This effect may be related to greater job stability and lower

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income uncertainty, which facilitate long-term financial planning and the ability to commit to long-term savings arrangements. Public sector employees also typically operate in an environment characterized by greater exposure to formal information about pension systems and social security, which may increase awareness of future retirement risks and encourage preventive financial behavior. Institutional characteristics of public employers may further contribute, as financial benefits and supplementary pension arrangements are often communicated more systematically than in some segments of the private sector.

In contrast, employment in the finance or insurance sector is also positively associated with participation in voluntary retirement savings. The effect remains statistically significant in both Model 1 and Model 2, suggesting that individuals working in this sector may benefit from greater familiarity with financial products and retirement planning. This finding may indicate that access to information alone is insufficient to change financial behavior, as long-term saving decisions are also shaped by individual preferences, time orientation, and risk perceptions.

Among wealth-related characteristics, ownership of a second property is positively associated with participation, indicating complementarity between different forms of investment behavior, as households with higher accumulated wealth typically possess greater experience with investment decisions and a stronger capacity to diversify their long-term financial security. Ownership of a second property may also reflect a higher degree of financial planning and a forward-looking orientation, with retirement savings serving as an additional instrument for wealth diversification.

In contrast, the coefficient on financial wealth is negative but not statistically significant. Therefore, no robust conclusion can be drawn regarding a potential substitution between financial wealth and voluntary retirement saving. One possible explanation is that households holding greater financial wealth may perceive these resources as providing sufficient financial security in old age, thereby reducing the incentive to participate in formal voluntary retirement saving schemes. At the same time, financial assets generally offer greater liquidity and flexibility than pension products, which may make them attractive alternatives for long-term financial planning. Overall, the results do not provide strong evidence of a substitution effect between financial wealth

and voluntary retirement saving, but they point to potential differences in household portfolio allocation strategies.

The presence of children in the household is positively associated with voluntary retirement savings in Model 3, although the effect becomes statistically insignificant once the full set of controls is included. This finding is consistent with a life-cycle perspective, which holds that households with children may place greater emphasis on future financial security. One possible explanation is that parents are more likely to consider long-term financial commitments and retirement preparedness when making financial decisions. However, the lack of statistical significance in the full specification suggests that this relationship should be interpreted with caution.

Gender does not appear to be a statistically significant determinant once other factors are controlled for, suggesting that differences in retirement behavior between men and women are largely mediated by socio-economic characteristics, such as income, education, and labor market status, rather than by gender itself.

Overall, the results confirm that voluntary retirement saving in Slovakia is not a random phenomenon but is systematically associated with specific socio-demographic and economic characteristics of individuals. Human capital, the stability of the family and employment environment, and the ability to accumulate wealth play a decisive role.

These findings have direct policy implications: effective support for voluntary retirement saving requires targeted measures aimed particularly at younger age groups, low-income households, and individuals without tertiary education who exhibit the lowest participation rates and, at the same time, face the highest risk of inadequate income security in old age.

6 Conclusion

The aim of this paper was to identify the key demographic and socio-economic determinants of voluntary retirement savings among Slovak households using microdata from the HFCS 2021 survey. The empirical analysis indicates that participation in voluntary retirement saving is systematically associated with an individual’s life-cycle stage, educational attainment, and the household's

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economic position.

The relationship between age and the probability of saving is non-linear, with the highest participation observed in middle age. This finding is consistent with previous empirical studies (DeVaney & Chiremba, 2005; Metzger, 2017; Van Rooij et al., 2011), as well as earlier evidence for Slovakia (Pastoráková et al., 2017). Of particular concern is the persistently low participation of younger age groups, who paradoxically have the most to gain from early entry into retirement saving.

Education is associated with a higher probability of participation, highlighting the importance of financial literacy and planning capabilities (Cupak et al., 2019; Van Rooij et al., 2011). Family status is also associated with participation, particularly among married individuals, consistent with the literature emphasizing the role of joint financial planning and households' life-cycle behavior (Johannisson, 2008). The positive association observed for households with children is less robust and becomes statistically insignificant in the full model specification.

Regarding employment status, public sector employees are more likely to participate in voluntary retirement savings, which may be related to income stability and greater institutional awareness. Asset-related characteristics further point to heterogeneity in household financial behavior: ownership of a second property appears to complement retirement saving, while financial wealth may serve as an alternative form of old-age security. However, the empirical evidence does not provide strong support for a substitution effect between financial wealth and voluntary retirement saving. In contrast, some factors traditionally considered important, such as gender, do not appear statistically significant after controlling for other variables.

These findings gain additional relevance in light of OECD projections indicating rapid population aging and increasing pressure on pension systems in advanced economies. The expected rise in the old-age dependency ratio, combined with persistently low fertility and increasing life expectancy, suggests that demographic pressure on pension systems represents a structural rather than temporary challenge. In this context, strengthening individual retirement savings becomes an important complement to public pension provision and a key component of the long-term sustainability of pension systems (OECD, 2025).

Particularly important is the selectivity of participation. Groups with the lowest participation rates - younger individuals, lower-educated households, and low-income households - are also those facing the highest risk of inadequate income in old age. Without targeted policy intervention, voluntary retirement saving risks remaining primarily a tool for those who would save even in the absence of additional incentives.

The findings suggest that the mere existence of voluntary pension schemes is not sufficient to ensure broad participation. Effective support for the third pillar should not rely solely on tax incentives but needs to be complemented by systematic and targeted financial education, particularly aimed at younger cohorts and lower-educated households. Evidence from abroad also highlights the importance of behavioral tools, such as default options and automatic enrolment, which can help mitigate inertia and procrastination in long-term financial decision-making.

The study has several methodological limitations. First, the analysis is based on a single imputation of the HFCS dataset and does not implement the full multiple-imputation framework available in the survey. Second, given the cross-sectional nature of the data, the estimated relationships should be interpreted as statistical associations rather than causal effects. Third, multiple economically active individuals may belong to the same household. As a robustness check, the regression models were re-estimated using household-level clustered standard errors, and the main conclusions remained qualitatively unchanged. Nevertheless, future research could further account for the hierarchical structure of the data and the full HFCS survey design.

Future research should focus on a more detailed analysis of the behavior of different age cohorts and the behavioral determinants of saving decisions, such as time inconsistency, decision-making inertia, and the role of default settings in pension schemes. From a methodological perspective, the use of panel data would allow for a better understanding of changes in retirement saving behavior over time and facilitate a more rigorous assessment of potential causal relationships between socio-economic characteristics and participation in voluntary retirement saving.

From a policy perspective, the results highlight the need for a comprehensive approach to strengthening individual retirement provision, combining economic incentives, appropriate institutional design, and tools that support

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long-term financial planning. In the context of Slovakia, where demographic pressures on public finances are expected to be among the strongest in Europe in the coming decades, supporting individual retirement saving is not merely a matter of personal responsibility, but a necessary component of building a sustainable and socially equitable pension system.

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