

A CONSUMPTION-BASED EVALUATION OF RETIREMENT SAVINGS ADEQUACY IN MALAYSIA

(Penilaian Berasaskan Penggunaan Terhadap Kecukupan Simpanan Persaraan di Malaysia)

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ABSTRACT

This study employs a consumption-based evaluation framework grounded in the World Bank's Five Pillar Model to assess the adequacy of retirement savings in Malaysia, considering all major sources of retirement income. The study applies two key indicators, projected consumption level and consumption shortfall compared to a minimum adequacy benchmark. Using nationally representative data from the Malaysian Ageing and Retirement Survey (MARS) for individuals aged 40 and above, this study estimates consumption by aggregating income from mandatory contributions, voluntary contributions, non-contributory support, informal support, and other assets. Each individual's projected consumption is compared against nationally adjusted adequacy thresholds, enabling us to calculate the proportion of individuals likely to experience a shortfall. The findings reveal that a significant proportion of respondents, particularly those in rural areas, are at risk of falling below minimum retirement consumption standards, even under the most inclusive projection. These results highlight the need for strengthened social protection mechanisms, increased participation in voluntary savings schemes, and targeted support for vulnerable groups. This research contributes to the field of retirement economics by providing a practical, data-driven evaluation tool for policymakers.

Keywords: consumption shortfall; retirement adequacy; retirement income

ABSTRAK

Kajian ini menggunakan kerangka penilaian berasaskan penggunaan berpaksikan kepada Model Lima Tiang Bank Dunia untuk menilai tahap kecukupan simpanan persaraan di Malaysia, dengan mengambil kira semua sumber utama pendapatan persaraan. Kajian ini menggunakan dua indikator utama, iaitu anggaran tahap penggunaan dan jurang penggunaan dibandingkan dengan penanda aras minimum kecukupan. Dengan menggunakan data perwakilan nasional daripada Malaysian Ageing and Retirement Survey (MARS) bagi individu berumur 40 tahun ke atas, kajian ini menganggarkan tahap penggunaan dengan menjumlahkan pendapatan daripada caruman mandatori, simpanan sukarela, sokongan tidak berasaskan caruman, sokongan tidak formal, dan aset-aset lain. Anggaran penggunaan setiap individu dibandingkan dengan ambang kecukupan yang dilaraskan secara nasional untuk mengira individu yang mungkin mengalami kekurangan penggunaan. Dapatan kajian menunjukkan bahawa sebahagian besar responden, terutamanya mereka yang tinggal di kawasan luar bandar, berisiko tidak mencapai tahap minimum penggunaan persaraan, walaupun dalam unjuran paling menyeluruh. Keputusan ini menekankan keperluan kepada pengukuhan mekanisme perlindungan sosial, peningkatan penyertaan dalam skim simpanan sukarela, serta sokongan bersasar kepada kumpulan rentan. Kajian ini menyumbang kepada bidang ekonomi persaraan dengan menyediakan satu penilaian praktikal berasaskan data untuk kegunaan pembuat dasar.

Kata kunci: kekurangan penggunaan; kecukupan persaraan; pendapatan persaraan

1. Introduction

The adequacy of retirement savings has become an increasingly pressing policy concern as populations age and life expectancy rises, particularly in middle-income countries such as Malaysia. Malaysia is experiencing a rapid demographic shift, with its population expected to reach 42.4 million by 2060, compared to 32.45 million in 2020, and a growing proportion of people aged 60 and above, at 15.3% (Department of Statistics Malaysia 2025). This demographic transition poses concerns for the financial well-being of retirees. A sustained income flows are required to ensure that retirees are financially secure throughout retirement, supplemented with equitable access to various sources of retirement support to increase retirement funds. In response, many countries have adopted a multi-pillar retirement system (Constantinescu & Georgescu 2024; Knoef *et al.* 2016; Sørensen *et al.* 2016; Wu 2019) by combining public pensions, mandatory savings schemes, voluntary contributions, non-contributory social transfers, and private assets, as outlined by the World Bank's Five Pillar Framework (World Bank 2008).

Malaysia's retirement framework reflects this structure (Bank Negara Malaysia 2022), with the Employee Provident Fund (EPF) and government public pension scheme acting as the primary formal mechanisms for retirement savings among the workforce, complemented by social assistance programmes, and household assets. Despite these multiple pillars, concerns remain about whether individuals can achieve adequate consumption in retirement, particularly those in the informal sector or with limited earning capacity.

This study evaluates the adequacy of projected retirement savings in Malaysia by simulating retirement outcomes under four projection scenarios. Each projection incorporates a different combination of retirement income sources as modelled by the World Bank's Five Pillar Framework (World Bank 2008). Projection 1 includes mandatory contributions through EPF and government pension, aligning with Pillars 1 and 2 of the framework. Projection 2 adds voluntary contributions and personal savings, corresponding to Pillar 3, to capture individual efforts in supplementing mandatory savings. Projection 3 incorporates non-contributory transfers of Pillar 0 to provide a basic safety net for those with limited formal coverage, such as zakat and state assistance. Projection 4 represents the most comprehensive scenario, encompassing both private and household financial and non-financial assets, such as land, valuables, rental income, and other resources, as captured under Pillar 4.

This study also applies metrics introduced by Burnett *et al.* (2018) to measure the adequacy of retirement savings. In their study, Burnett *et al.* (2018) introduced four metrics. Two of these metrics assess adequacy in terms of consumption levels, and the other two focus on retirement duration. However, this study focuses exclusively on the first two metrics, specifically to project annual consumption during retirement and the shortfall relative to the predefined adequacy benchmark for evaluating whether individuals can meet basic retirement needs within the Malaysian context. The analysis is stratified by age group to differentiate those who are still in the workforce (aged 40-59) and those who are already in retirement (aged 60 and older). Malaysia Ageing and Retirement Survey (MARS) Wave 2 (2021-2022) data from the Social Wellbeing Research Centre (SWRC) will be used in the analysis, comprising nearly 5,000 respondents from various backgrounds.

Thus, this study seeks to:

- (1) Estimate projected retirement savings under four scenarios that progressively incorporate different income sources based on the Five Pillar Framework.
- (2) Simulate the level of retirement consumption that individuals can potentially achieve based on the projected accumulated savings in each scenario.

- (3) Assess the adequacy of retirement consumption by comparing the projected consumption to a defined benchmark and computing the consumption shortfall for each individual.
- (4) Examine disparities in retirement outcomes by age cohort (40-59 and 60+) and residential strata (rural and urban), to identify vulnerable populations at risk of inadequate retirement income.

2. Literature Review

The adequacy of retirement income is a growing concern worldwide, particularly in the context of ageing populations, evolving labour markets, and rising life expectancy. Traditional pension systems in many countries face challenges in maintaining sustainability and equity for the varying demographic backgrounds of current and future retirees. The systems are under severe strain due to a combination of fiscal, demographic, and structural pressures. Governments are facing increasing expenditure commitments to fund pensions and social protection as the population ages, extending the period of benefit payments (Herbay *et al.* 2024a; Ranganathan 2017; Skuflić *et al.* 2020). However, economic uncertainties limit their capacity to sustain these obligations (Holzmann 2013; Organisation for Economic Co-operation and Development 2024). Demographically, lower fertility rates and a smaller working-age population relative to retirees decrease the amount of contributions needed to fund retirement benefits (Alho *et al.* 2008; Alonso-García *et al.* 2018; Luque *et al.* 2023). At the structural level, gaps in pension coverage remain uneven, particularly among informal workers (Ngadi *et al.* 2025; Yang 2022), self-employed individuals (Hlochova *et al.* 2025), and rural residents (Wang & Huang 2023; Zhu *et al.* 2025), who are less likely to participate in formal pension arrangements, making them more vulnerable to old-age poverty. These challenges make it increasingly difficult for pension systems to remain financially sustainable and socially equitable, forcing many governments to raise retirement ages, reduce benefits, or shift towards defined contribution (DC) models that transfer risk to individuals (Alonso-García *et al.* 2018; Ardito & D'Errico 2018; Herbay *et al.* 2024b; Vukorepa 2015). Therefore, each individual is expected to take greater responsibility for their financial well-being after retirement.

Consequently, pension reforms have increasingly emphasised DC accounts, supplementary voluntary savings, and personal asset accumulation as critical pillars of old-age security (Bajtelsmit *et al.* 2013; Organisation for Economic Co-operation and Development 2023). Under such systems, retirement outcomes depend heavily on individuals' ability to contribute consistently, make sound investment choices, and maintain financial discipline over a long period of time (Lusardi *et al.* 2017; Ye *et al.* 2025). This reflects a broader policy shift toward transferring key risks, such as investment, longevity, and inflation risks, from governments and employers to individuals, who must now navigate the financial decisions to secure their old-age income (Borzi 2006; Ezra 2005). However, it raises concerns about inequality for low-income earners, workers in informal sectors, and those with limited financial literacy, as they are structurally disadvantaged in their ability to accumulate sufficient wealth, causing persistent disparities in retirement preparedness across socioeconomic groups (Assifuah-Nunoo & Yeboah 2025; Jachimowicz *et al.* 2020; Neuberger *et al.* 2022).

Building on these global concerns, Malaysia is undergoing a demographic transformation that intensifies the challenge of retirement adequacy. The country experiences a notable demographic shift from 2030 to 2060, where the number of young and working-age individuals declines, while the older age group increases (Department of Statistics Malaysia 2025). Furthermore, the proportion of people aged 60 and above is projected to rise from 10.3% in 2020 to 24.2% by 2060, making the country a super-aged society (Department of Statistics

Malaysia 2025; World Bank 2020). However, the majority of citizens are exposed to insufficient retirement funds to sustain their post-retirement consumption. The EPF reported that a majority of the members do not meet the basic savings by age and have inadequate balances, with half of them depleting their retirement savings within five years of withdrawal (Berita RTM 2025; Employees Provident Fund 2023). Moreover, while non-contributory safety nets, such as cash transfers and social assistance, provide some relief, these initiatives are based on income eligibility criteria and have limited reach, resulting in uneven coverage and inadequate protection against poverty in old age (World Bank 2020). The participation rate for voluntary savings instruments, for instance, private retirement schemes (PRS) and i-Saraan, remains low relative to the size of the labour force, indicating that the plans are not yet widely recognised, especially among informal and rural workers (Employees Provident Fund 2023).

2.1. The World Bank's Multi-Pillar Pension Model

The World Bank's Five-Pillar Pension Framework provides a comprehensive foundation for analysing retirement income systems across countries. This framework comprises five distinct yet complementary components, as outlined in Table 1. The strength of this framework lies in its flexibility and comprehensiveness to be tailored to local realities, as different countries have different institutional capacities and economic conditions (Holzmann & Hinz 2005; Koch 2012).

Table 1: World Bank's Five Pillar Framework for Malaysia's Pension System

Pillar 0	Pillar 1	Pillar 2	Pillar 3	Pillar 4
Non-contributory (tax-financed)	Mandatory (mix of tax-financed and contributions-based)	Mandatory contributions	Voluntary contributions	Non-financial (e.g., financial and non-financial assets)
Financial assistance, for example, from zakat and state assistance	Government pension	Employee Provident Fund	Individual savings and private contributions	Other individual financial and non- financial assets

Source: Bank Negara Malaysia (2022), World Bank (2008)

Malaysia's retirement system incorporates elements from all five pillars. Pillar 0 encompasses non-contributory forms of support, including zakat, cash assistance, and state aid for vulnerable groups. This pillar is funded through general taxation and acts as basic non-contributory income support, designed to prevent poverty among older adults. Pillar 1 comprises public pensions for civil servants that are typically contributory and defined benefit (DB) in nature to replace a share of pre-retirement income. Pillar 2 is represented by the EPF, which covers private sector workers through mandatory contributions that are fully funded and DC in nature. Pillar 3 is reflected in voluntary savings options, including PRS, unit trusts, and bank deposits. Pillar 4 includes additional resources for old-age support, such as financial and non-financial assets, family support, and personal assets. This study adopts this framework to structure four projection scenarios that progressively incorporate all pillars to assess retirement adequacy under varying degrees of income inclusiveness.

2.2. Measuring retirement savings adequacy

Retirement adequacy can be defined as the extent to which an individual or household can maintain a desired standard of living after retirement. Traditionally, replacement rates have been widely used as a measure of retirement adequacy by comparing retirement income to pre-retirement earnings. However, this measure has several limitations as it assumes stable income

projections, ignores individual consumption needs, and excludes non-income sources of support (Bajtelsmit *et al.* 2013; Chybalski & Marcinkiewicz 2016; VanDerhei 2006). Hence, Burnett *et al.* (2018) propose four metrics, namely consumption level, consumption shortfall, run-out age, and age gap, that align with a broader shift toward consumption-based approaches to reflecting real-life needs, preferences, and vulnerabilities. This study only adopts the first two metrics to focus on adequacy rather than sustainability. The consumption level and consumption shortfall metrics are sufficient to evaluate whether individuals can afford to meet basic needs post-retirement and by how much they fall short.

Other studies have moved beyond traditional income-based measures by incorporating consumption behaviour, asset composition, and household-specific characteristics. For example, Madrian *et al.* (2007) used survey and administrative data to assess annuitized net wealth relative to poverty thresholds. A lifecycle consumption-savings model with heterogeneous preferences has been employed by Crawford and O'Dea (2020) to evaluate preparedness based on final and lifetime income, highlighting that simple replacement rates can misrepresent adequacy depending on income profiles and asset types. The limitations of the replacement rate have also been addressed by Alonso-Fernandez *et al.* (2018) through developing a synthetic indicator that combines multiple adequacy dimensions across the European Union. Meanwhile, consumption and wealth patterns have been observed in other studies, demonstrating that retirement consumption is shaped by financial constraints, individual preferences, and policy design, reinforcing the importance of using consumption-based approaches to assess retirement adequacy accurately (Chen & Munnell 2021; Christensen *et al.* 2022; Kolsrud *et al.* 2024). These studies collectively support the shift toward frameworks that measure adequacy in terms of actual living standards, rather than relying solely on income ratios.

While these international studies demonstrate a significant shift towards frameworks that evaluate adequacy in terms of consumption needs, wealth accumulation, and household heterogeneity rather than simple replacement ratios, their insights must be contextualised within Malaysia's socio-economic environment. In Malaysia, the EPF dominates as the formal retirement system. However, the contributions remain heavily dependent on wage-based contributions, leaving large gaps for informal workers, women, and rural populations who often experience lower and less stable earnings. Subsequently, assessing adequacy in Malaysia requires not only adopting global metrics but also accounting for local structural vulnerabilities, such as geographic cost-of-living differences, reliance on informal family support, and participation in voluntary retirement savings schemes.

2.3. Retirement adequacy in the Malaysian context

Malaysia faces significant challenges in ensuring retirement adequacy for all citizens despite having a relatively structured formal pension system. For instance, over half of the EPF contributors exhaust their savings within five years of retirement (Bernama 2023; Employees Provident Fund 2016). This is worrisome as there are more than 16 million individuals who are EPF members, with over half of them currently active (Employees Provident Fund 2024b). Existing studies on Malaysian retirement adequacy have primarily focused on EPF account balances, replacement ratios, or the retirement confidence survey (Alaudin *et al.* 2017; Saidi *et al.* 2017; Vaghefi *et al.* 2017). While these provide useful insights, they do not capture the full spectrum of retirement income sources or disaggregate results by age group or residential strata, which are crucial in understanding inequalities in retirement preparedness. This study provides a valuable foundation for evaluating retirement adequacy by integrating diverse sources of

income and applying the World Bank's Five Pillar Framework to project retirement savings, annual consumption, and potential shortfalls.

Moreover, this study uses a benchmark to determine whether projected income meets basic living needs. Commonly used benchmarks include the national poverty line (Dunn & Maharaj 2024; Engerman 1997; Love *et al.* 2007) or absolute thresholds based on minimum living standards (International Labour Organization 2022; Johnston & Menon 2022; Padley & Davis 2025). The Organisation for Economic Co-operation and Development (2017) uses relative benchmarks, such as 50-60% of median income, to assess income poverty in old age. This study adopts benchmark values of RM12,000 per year for rural individuals and RM14,400 for urban individuals. The benchmark of RM12,000 per year reflects the EPF Basic Savings of RM240,000 for minimum retirement savings with a 20-year retirement period (Employees Provident Fund 2024c). An upward adjustment is made for urban residents to account for the higher living costs in cities compared to rural areas in Malaysia. According to the average monthly Basic Expenditure of Decent Living (PAKW) per capita, urban areas exceed RM496 per month with an average household size of 3.7 persons, compared to rural areas (Department of Statistics Malaysia 2024a). This study deliberately uses a lower adjustment of RM100 per person per month to reflect the more modest consumption patterns of retired households. Assuming a typical two-person retired household, this results in an urban benchmark of RM14,400 per year. Applying different benchmarks by strata accounts for geographic variations in living costs and household composition, and enables more precise targeting of interventions, such as subsidies or matching contributions.

3. Methodology

This section describes the methodology used to estimate projected retirement savings, annual consumption levels, and consumption shortfalls among Malaysian adults aged 40 and above. The analysis was conducted using R Studio and incorporates a mathematical simulation model proposed by Burnett *et al.* (2018) based on a multi-pillar framework. It also applies annuity-based consumption estimates and uses nationally representative microdata to assess retirement adequacy across various income scenarios.

3.1. Data source

This study utilises individual-level microdata from the Malaysia Ageing and Retirement Survey (MARS) Wave 2, initiated by the Social Wellbeing Research Centre (SWRC) Universiti Malaya. MARS Wave 2 is a nationally representative longitudinal survey conducted between October 2020 and April 2022 that includes a sample of 4,821 respondents aged 40 years and above. The sample is stratified by urban-rural location, with 63.8% of respondents residing in urban areas ($n = 3,077$) and 36.2% in rural areas ($n = 1,744$). The data is designed to support research and policy development by providing comprehensive data on the ageing process, retirement preparedness, and the socioeconomic well-being of middle-aged and older adults in Malaysia. The rich scope of the dataset makes it particularly suitable for this study as it includes detailed variables on income sources, savings and assets, demographic characteristics, and living arrangements. These variables are essential for estimating projected retirement savings, annual retirement consumption, and consumption shortfall under different income pillar scenarios.

3.2. Retirement income projection scenarios

This study constructs four distinct projection scenarios based on the World Bank's Five Pillar Framework, classified by their institutional nature, financing structure, and relevance to the Malaysian context. Each scenario incorporates additional sources of retirement income and support from MARS Wave 2 to simulate the potential impact of relying on different combinations of formal, informal, and non-contributory mechanisms.

The first scenario, referred to as Projection 1, includes income sources from mandatory contributions of Malaysia's retirement system, as represented by Pillar 1 and Pillar 2. These sources are income from pension, social security, and current savings in EPF. The second scenario, Projection 2, builds upon Projection 1 by incorporating individual voluntary contributions from Pillar 3. The variables included in this group are voluntary contributions to the EPF, and savings in banks, Tabung Haji, unit trusts, shares, cooperatives, private retirement schemes, cash, and others. The third scenario, Projection 3, adds elements from Pillar 0 to Projection 2. This includes non-contributory transfers and social assistance intended to support low-income individuals. The income received from financial aids used in this projection comprises *Bantuan Sara Hidup*, zakat, state assistance, non-government organisations (NGO), and cash assistance. Finally, the fourth scenario, Projection 4, incorporates additional sources from Pillar 4 to capture non-financial and informal income through personal or household assets. These include income and money received from rental, relatives, children, parents, dividends, and others. Moreover, the values of land, valuables, commercial property, livestock, and others are also included. However, the values of home and vehicle are not included as they are often preserved as family assets and passed on to children. Additionally, the value of the insurance policy is also excluded since it reflects the death benefits or conditional payouts, rather than guaranteed income streams.

3.3. Estimating retirement consumption

This study employs a simulation model adapted from Burnett *et al.* (2018) to estimate projected retirement savings. The model calculates the total retirement fund K_{t+1} at time $t+1$ based on the previous year's accumulated savings K_t , the total contribution rate, and the wage income at time t . Pillars 0 to 4 are consolidated into a single asset class, assumed to yield a common after-tax rate of return. The value of these combined assets is denoted as K and projected to evolve according to Eq. (1) during the accumulation phase.

$$K_{t+1} = K_t (1+r) + ((sg + s)w_t(1-T) - c) \left(1 + \frac{r}{2}\right) \quad (1)$$

In this model, r represents the annual return on savings, which is conservatively assumed to be 5%, in line with the average EPF's dividend rate performance trends (Employees Provident Fund 2024a). The total contribution rate includes mandatory contributions, $sg = 24\%$ (13% employer and 11% employee contributions to EPF) and voluntary contributions, $s = 3\%$, based on averages from voluntary schemes such as i-Saraan where members usually contribute between 2% and 5% of wages (Employees Provident Fund 2022). The term w_t denotes an individual's wage at time t . However, the values of the tax rate, T and administration and insurance costs, c , are assumed to be 0 in line with current Malaysian policies that exempt the EPF from income tax and do not impose direct charges on members' retirement accounts, as

the costs are assumed to be already reflected in the net rate of return (Employees Provident Fund n.d.).

$$w_{t+1} = (1+i)(1+f)w_t \quad (2)$$

Wage growth over time is incorporated into the model through Eq. (2). The price inflation i is set at 2.5% and the real wage growth rate f is set at 1%, derived from historical trends and averages (Department of Statistics Malaysia n.d.).

$$A = \frac{K}{a_{n|r}} = \frac{K}{\frac{1-(1+r)^{-n}}{r}} \quad (3)$$

The total retirement savings K are accumulated to the retirement age and then converted into an equivalent annual retirement consumption amount A withdrawn over n years of retirement, given a constant investment return r , as indicated by Eq. (3). The retiree is assumed to draw a fixed amount each year until the fund is fully depleted at the end of the retirement period.

$$C_l = A_l - B_l \quad (4)$$

Retirement adequacy is assessed by comparing the projected annual consumption A_l to the predefined benchmark B_l that reflects the minimum basic living costs as represented by Eq. (4). The benchmark is set at RM12,000 per year for rural respondents and RM14,400 per year for urban respondents. The consumption shortfall C_l is then calculated as the difference between the projected annual consumption amount and the benchmark for respondent l . A positive shortfall value indicates that the individual is projected to exceed the minimum required consumption level, whereas a negative value implies that the projected income falls below the adequacy threshold.

The model differentiates between age groups to simulate the duration over which retirement consumption is expected to occur. Individuals aged below 80 are projected to have annual consumption and shortfall until age 80, reflecting the expected lifespans of the Malaysian population, where life expectancy is approximately 75.2 years, with females living slightly longer (Department of Statistics Malaysia 2024b). Thus, projecting to age 80 is deemed reasonable to realistically estimate the consumption level without overstating adequacy. For respondents aged 80 or older, consumption is assumed to occur over one additional year beyond their current age to ensure that every individual has a defined projection horizon while recognising natural longevity limits. This approach captures the standard post-retirement consumption window and the potential for extended longevity, particularly relevant for assessing financial sufficiency among older cohorts.

4. Results

The findings of projected retirement savings are examined under four distinct scenarios represented by Projections 1 to 4. Results are reported by age group (40-59 and 60+) and residential strata (rural and urban) to capture demographic heterogeneity in retirement adequacy. The outcomes are assessed based on the accumulated retirement savings, annual

consumption potential, and consumption shortfall relative to the defined adequacy benchmark. As indicated, Projection 1 will cover mandatory contributions of Pillars 1 and 2, Projection 2 combines mandatory and voluntary contributions from Pillars 1 to 3, Projection 3 adds Pillar 0 (non-contributory) to Projection 2, and Projection 4 will include all Pillars.

4.1. Projecting accumulated retirement savings

Table 2 presents the summary statistics for projected accumulated retirement savings across four scenarios, representing increasing inclusiveness of retirement income sources. Rural respondents aged 40–59 record RM0 as the median projected savings under Projection 1, with savings increasing modestly in subsequent scenarios. This indicates that at least half of the respondents in this group will retire with no accumulated savings if they solely rely on the government pension and EPF mandatory contributions. The median reaches RM25,625 under Projection 4, while the 90th percentile rises to RM539,413. However, the increasing values of standard deviation from RM564,548 to RM625,082 across the scenarios reflect a growing dispersion in savings levels, with the top 10% (p90) holding over RM500,000 in Projection 4.

In contrast, urban respondents in the same age group show higher median savings overall, rising from RM0 in Projection 1 to RM34,529 in Projection 4. The 90th percentile reaches RM938,093 in the final scenario, marking a higher value than in rural areas. However, extreme standard deviations, particularly over RM23 million in Projections 2–4, suggest the presence of outliers with substantial accumulated assets.

Older rural respondents aged 60 and above continue to show low median projected savings, with RM0 under Projection 1 and only RM25,830 under Projection 4, reflecting limited formal retirement savings for older cohorts. The top 10% remains high (p90 = RM497,672), but mean values are significantly affected by dispersion, as shown by standard deviations over RM490,000. This again suggests concentrated wealth existed among a minority of this group.

Table 2: Summary statistics of projected accumulated retirement savings (RM)

Projection	p10	p25	Median	p75	p90	Mean	SD
People aged 40–59							
Strata: Rural							
1	0	0	0	47,825	332,946	153,130	564,548
2	0	0	2,272	69,924	361,073	159,495	566,478
3	0	451	8,647	73,602	364,777	163,405	566,777
4	0	4,253	25,625	143,805	539,413	216,608	625,082
Strata: Urban							
1	0	0	0	105,000	692,439	300,814	1,078,846
2	0	0	8,996	132,504	768,884	895,266	23,813,729
3	0	817	15,303	137,700	777,803	899,661	23,813,629
4	31	5,948	34,529	206,628	938,093	943,859	23,843,095
People aged 60+							
Strata: Rural							
1	0	0	0	1,312	128,583	91,479	354,843
2	0	0	481	25,284	190,013	102,502	358,568
3	0	175	4,984	32,247	204,483	106,996	360,605
4	0	4,212	25,830	148,165	497,672	192,584	496,199
Strata: Urban							
1	0	0	0	12,816	158,806	185,709	934,569
2	0	0	1,317	39,418	281,548	211,653	954,162
3	0	0	7,166	50,106	292,084	216,333	954,762
4	0	4,896	24,391	110,939	532,716	295,377	1,351,467

Notes: p10, 10th percentile; p25, 25th percentile; p75, 75th percentile; p90, 90th percentile; SD, standard deviation.

Urban respondents aged 60 and older demonstrate similar upward trends across projections, with the median increasing to RM24,391 under Projection 4. Notably, the 90th percentile reaches RM532,716, and the standard deviation remains high at over RM1.3 million. This highlights the cumulative impact of voluntary contributions, social transfers, and private assets.

4.2. Projecting annual retirement consumption and shortfall

Table 3 reports the projected annual retirement consumption levels (Panel A) and consumption shortfall (Panel B) across the four projection scenarios, with a targeted consumption level of RM12,000 for rural and RM14,400 for urban. Overall, the figures indicate a low consumption potential for most respondents, particularly in the mandatory-only scenario (Projection 1), with marked differences across rural–urban and age dimensions.

Rural respondents aged 40–59 report a median consumption level of RM0 under Projection 1, which increases modestly to RM2,056 in Projection 4. However, the levels are still far from achieving the targeted consumption level. Even at the 75th percentile, annual consumption remains below the adequacy benchmarks, for example, RM11,539 in Projection 4, implying that the majority remain in deficit. Yet, the shortfall gradually improves across projections, reaching -RM461 at the 75th percentile in Projection 4, indicating the inclusion of additional pillars can narrow the shortfall gap.

Urban respondents in this group show a slightly improved pattern, although most of them still experience a shortfall, despite other financial and non-financial assets to support their consumption level. The median consumption level improves more significantly from RM0 under Projection 1 to RM2,771 under Projection 4. The 90th percentile in Projection 4 reaches RM75,275, reflecting greater potential consumption among higher-income individuals. However, the extreme standard deviations (over RM1.9 million) suggest the presence of significant outliers likely due to large asset values or exceptional income flows. The median shortfall under Projection 1 is -RM14,400, improving to -RM11,629 under Projection 4. However, the top 10% reported a surplus of RM60,875, and the mean shortfall rises to RM61,338, again influenced by high outliers.

Older respondents in rural areas also demonstrate very low consumption levels, exposing them to the consumption shortfall. The median under Projection 1 remains RM0, only reaching RM3,307 in Projection 4. However, taking other assets into account significantly increased the consumption level. The median shortfall remains at or below -RM12,000 in Projections 1–3, improving only to -RM8,693 in Projection 4. While the mean shortfall turns positive (RM18,625) in Projection 4, the dispersion (SD = RM204,558) highlights the continued disparity.

Meanwhile, older urban respondents experience slightly better outcomes. The median consumption increases from RM0 in Projection 1 to RM3,287 in Projection 4, and the 90th percentile surpasses RM66,000, again reflecting better access to alternative income sources and savings. Nonetheless, a large proportion remains well below minimum adequacy levels. Meanwhile, the median shortfall ranges from -RM14,400 in Projection 1 to -RM11,113 in Projection 4, while the 90th percentile reaches a positive value of RM52,434. The mean shortfall of RM17,204 and SD of RM138,552 reflect notable gains for some, but the typical respondent remains below the benchmark. It can also be seen that the older urban respondents have a lower consumption level than the older rural respondents, which might be caused by the difference in the amount of assets they own.

Table 3: Summary statistics of consumption level and consumption shortfall (RM)

Projection	p10	p25	Median	p75	p90	Mean	SD
Panel A: Consumption level							
People aged 40-59							
Strata: Rural							
1	0	0	0	3,838	26,716	12,288	45,301
2	0	0	182	5,611	28,973	12,798	45,456
3	0	36	694	5,906	29,271	13,112	45,480
4	0	341	2,056	11,539	43,284	17,381	50,158
Strata: Urban							
1	0	0	0	8,425	55,563	24,138	86,569
2	0	0	722	10,632	61,697	71,838	1,910,875
3	0	66	1,228	11,049	62,413	72,191	1,910,867
4	2	477	2,771	16,580	75,275	75,738	1,913,232
People aged 60+							
Strata: Rural							
1	0	0	0	221	19,973	9,373	33,167
2	0	0	60	3,169	24,334	11,301	37,498
3	0	30	735	4,440	26,231	11,927	37,691
4	0	660	3,307	20,654	68,208	30,625	204,558
Strata: Urban							
1	0	0	0	2,098	17,245	17,935	90,589
2	0	0	201	5,018	31,050	20,984	92,560
3	0	0	1,031	6,289	33,135	21,636	92,584
4	0	618	3,287	16,017	66,834	31,604	138,552
Panel B: Consumption shortfall							
People aged 40-59							
Strata: Rural							
1	-12,000	-12,000	-12,000	-8,162	14,716	288	45,301
2	-12,000	-12,000	-11,818	-6,389	16,973	798	45,456
3	-12,000	-11,964	-11,306	-6,094	17,271	1,112	45,480
4	-12,000	-11,659	-9,944	-461	31,284	5,381	50,158
Strata: Urban							
1	-14,400	-14,400	-14,400	-5,975	41,163	9,738	86,569
2	-14,400	-14,400	-13,678	-3,768	47,297	57,438	1,910,875
3	-14,400	-14,334	-13,172	-3,351	48,013	57,791	1,910,867
4	-14,398	-13,923	-11,629	2,180	60,875	61,338	1,913,232
People aged 60+							
Strata: Rural							
1	-12,000	-12,000	-12,000	-11,779	7,973	-2,627	33,167
2	-12,000	-12,000	-11,940	-8,831	12,334	-699	37,498
3	-12,000	-11,970	-11,265	-7,560	14,231	-73	37,691
4	-12,000	-11,340	-8,693	8,654	56,208	18,625	204,558
Strata: Urban							
1	-14,400	-14,400	-14,400	-12,302	2,845	3,535	90,589
2	-14,400	-14,400	-14,199	-9,382	16,650	6,584	92,560
3	-14,400	-14,400	-13,369	-8,111	18,735	7,236	92,584
4	-14,400	-13,782	-11,113	1,617	52,434	17,204	138,552

Notes: p10, 10th percentile; p25, 25th percentile; p75, 75th percentile; p90, 90th percentile; SD, standard deviation.

4.3. Retirement consumption adequacy

The analysis in this study reveals that the median projected annual retirement consumption under each scenario consistently remains below its respective benchmarks in all projections (Figure 1). Even in Projection 4, the median does not reach RM5,000 when all sources of retirement income are included. Nonetheless, the consumption level steadily rises from Projection 1 to Projection 4, verifying that incorporating additional income sources other than mandatory contributions does improve retirement consumption. Urban respondents exhibit

slightly higher median consumption than rural respondents in all projections, particularly in Projections 3 and 4, where non-contributory and other assets were added. Nevertheless, the shortfalls remain large and consistent across strata, suggesting that individuals should not rely solely on individual mandatory and voluntary contributions.

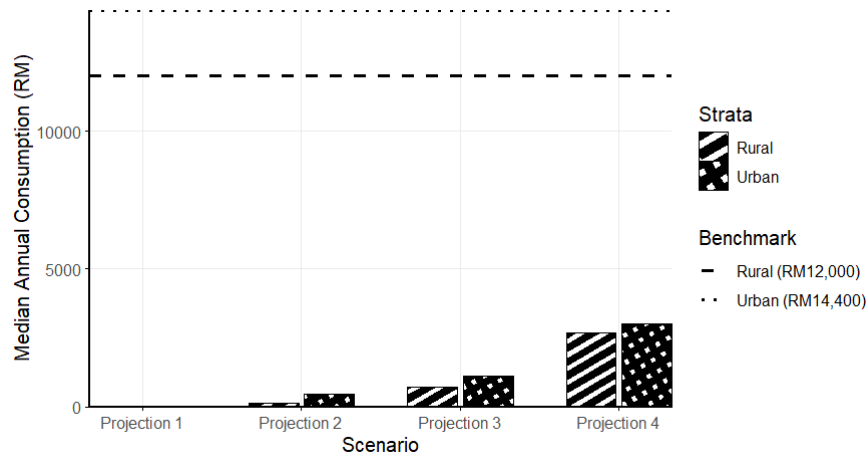


Figure 1: Median Retirement Consumption vs Target Benchmark

More than 75% of the respondents in both rural and urban groups fall below the minimum consumption benchmark, as shown in Figure 2. This situation implies that retirement inadequacy is not confined to a specific geographic area, though urban respondents consistently perform slightly better than rural respondents in each projection. The inclusion of additional income sources does lead to some improvement, but they are not substantial enough to reduce the inadequacy for the majority. In addition, the figure shows that non-contributory transfers alone may not be sufficient to significantly boost retirement savings, as the decline in adequacy from Projection 2 to Projection 3 is minimal.

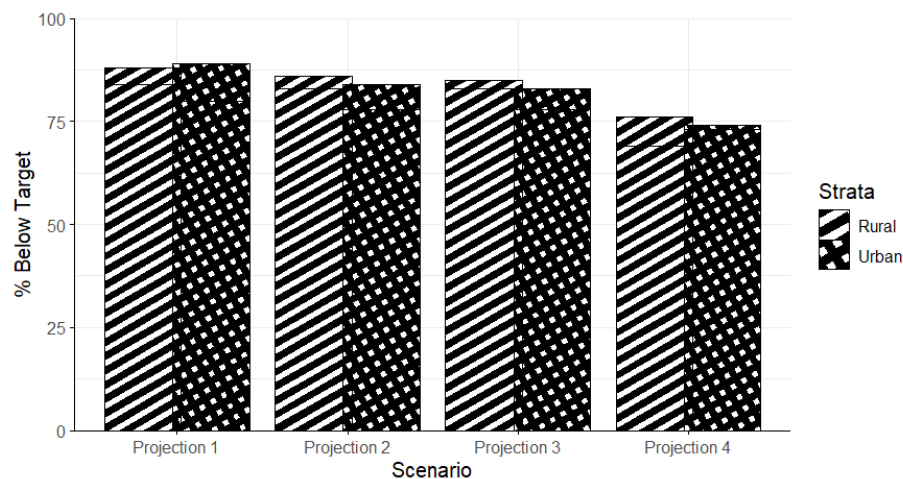


Figure 2: Percentage of respondents below retirement consumption target

5. Discussion

The simulation results presented in the previous section offer critical insights into the adequacy of retirement savings among Malaysian adults, highlighting substantial disparities across income sources, age groups, and geographic strata. This discussion interprets the key findings, which reflect the structural features of Malaysia's multi-pillar retirement system, examining the improvements achieved through the inclusion of additional income sources and the persistent gaps that remain.

The findings for retirement adequacy suggest three major implications. First, the widespread incidence of zero or near-zero median savings, especially among rural and older populations, emphasises the limitations of the mandatory-only retirement system. The public pension and EPF schemes alone are insufficient to ensure a basic level of post-retirement financial security. This concern is supported by EPF statistics, which show that more than half of members do not meet the basic savings level based on age (Employees Provident Fund 2024c). In addition, frequent early withdrawals and irregular contribution patterns among low-income earners further weaken the long-term adequacy of mandatory savings accounts (World Bank 2019). Previous studies also indicate that rural and informal workers face greater disadvantages due to unstable unemployment and lower contribution rates, which contribute to unequal retirement preparedness (Bose & De Roy 2019; Jachimowicz *et al.* 2020). These findings are supported by broader international evidence from middle-income countries, where DC plans without strong complementary pillars often result in insufficient replacement rates and increase the risk of poverty in old age (World Bank 2019).

Second, although adding voluntary contributions, social transfers, and personal assets (Projections 2 to 4) substantially improves projected savings, the benefits appear to be unevenly distributed. Urban and likely higher-income individuals benefit disproportionately, as indicated by large increases in the upper percentiles (p75 and p90). Several factors can contribute to this situation. First, urban individuals generally have higher disposable incomes, which enable them to save more and accumulate diverse financial assets, such as unit trusts, shares, and property (Peng *et al.* 2021; Zhong *et al.* 2021). Next, higher-income and urban residents tend to be more financially literate than lower-income and rural residents (Mawad *et al.* 2022; Moreno-García *et al.* 2023). This enables them to make more informed decisions about savings, investing, and planning for retirement. Additionally, urban and higher-income workers are more likely to be employed in formal sectors with stable pension plans, employer-sponsored benefits, and supplementary savings options compared to rural and lower-income workers (Hu & Stewart 2009). In contrast, rural individuals and lower-income households often face liquidity constraints that limit their ability to save more (Mawad *et al.* 2022). Besides, lower awareness of retirement planning options and dependence on informal work arrangements further reduce their participation in voluntary savings schemes (Solarz 2021). In effect, the inclusion of additional pillars widens the inequality gap rather than closing it.

Third, the large standard deviations and significant gaps between mean and median values indicate highly skewed distributions. This signifies growing inequality in retirement preparedness, where a small group holds most of the wealth, and a large portion may still fall below adequacy thresholds even under the most inclusive scenario. This difference is especially prominent among urban respondents, where a minority enjoy disproportionately high consumption levels, likely driven by accumulated assets and multiple income sources. Urban residents are more likely to hold diversified financial portfolios that provide income and capital appreciation over time, such as savings deposits, unit trusts, equities, and property investments (Peng *et al.* 2021; Zhong *et al.* 2021). Hence, their capacity to sustain higher post-retirement consumption is improved by several income streams, such as rental returns from property,

dividends from investments, or business income. These advantages accumulate over time, enabling small but affluent urban individuals to maintain or even increase their standard of living by the time they reach retirement age. In contrast, many rural respondents lack access to such opportunities, which widens the existing gap in financial resilience. Such inequality highlights structural disparities in access to employment-related savings, financial literacy, and asset accumulation, particularly between urban and rural areas.

These results emphasise the need for a more equitable and inclusive multi-pillar retirement system that not only strengthens coverage through social safety nets but also encourages sustained voluntary and household savings, particularly for vulnerable groups such as rural populations and the informal workforce. Without appropriate redistributive mechanisms or targeted policy support, the existing multi-pillar retirement system may unintentionally widen socioeconomic inequalities. Although the system expands the potential sources of retirement income, its benefits are often disproportionately captured by those already in better financial positions. Policymakers should consider introducing potential measures such as guaranteed minimum pension schemes, targeted cash transfers, or expanded incentives for voluntary retirement savings, particularly for vulnerable populations.

6. Conclusion

The assessment of retirement adequacy savings using nationally representative data from MARS Wave 2 reveals substantial disparities in retirement preparedness across income pillars, age groups, and urban-rural strata. The most critical finding of this study is that the majority of Malaysians are unlikely to achieve adequate retirement savings and consumption, even when all income sources from all Pillars are included. This persistent inadequacy is particularly severe among older and rural residents, who remain most vulnerable to failing below the minimum benchmark for basic living standards.

Projections based solely on mandatory contributions demonstrate that most individuals will fall short of achieving the minimum benchmark required for an adequate standard of living in retirement. Although the inclusion of voluntary savings and social assistance modestly improves consumption levels, it is only when other assets and informal supports are included that a meaningful proportion of respondents approach or exceed adequacy thresholds.

Yet, even under the most inclusive scenario, retirement adequacy remains unequally distributed, with older and rural respondents at higher risk of experiencing a consumption shortfall. The analysis further shows that a significant share of respondents across all projections are unlikely to meet the annual consumption benchmarks used to reflect minimum basic living costs based on national standards. It also underscores the limitations of relying solely on formal retirement savings systems and highlights the critical role of voluntary savings, public transfers, and informal family support in bridging the adequacy gap. However, such reliance also reveals systemic vulnerabilities, as access to these supports varies widely by demographic and socioeconomic characteristics.

In conclusion, this study contributes to the growing body of research advocating for a more holistic and inclusive approach to retirement policy in Malaysia. It provides empirical evidence that supports the need for policymakers to encourage greater participation in voluntary savings schemes, for example, PRS and i-Saraan, and strengthen social protection mechanisms, particularly for those in rural areas and the informal sector. Nevertheless, any reforms must also be grounded in Malaysia's current political and fiscal realities. Expanding voluntary savings participation may be feasible in the short term, but addressing adequacy for rural and informal workers requires more targeted social protection and efficient resource allocation. In practical terms, strengthening PRS and i-Saraan could primarily benefit middle- and higher-income

groups, while expanding cash transfers and healthcare support would have a greater impact on the most vulnerable populations. These policy directions, although constrained by fiscal capacity, could reduce old-age poverty risks and improve retirement security in a gradual yet sustainable manner.

Future research should further disaggregate retirement adequacy analysis by other demographic factors, such as gender, marital status, education level, and employment sector, to help provide more precise results of which groups are most at risk of old-age poverty. Moreover, incorporating longevity risks, health expenditure modelling, or stochastic simulations will further improve the estimation of retirement security. In addition, future work could also examine behavioural and structural drivers of retirement adequacy, such as saving behaviour, financial literacy, and employment patterns, to provide a deeper understanding of the mechanisms shaping retirement outcomes.

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References

- Alaudin R.I., Ismail N. & Isa Z. 2017. Determinants of retirement wealth adequacy: A case study in Malaysia. *Institutions and Economies* **9**(1): 81–98.
- Alho J.M., Jensen S.E.H. & Lassila J. (Eds.). 2008. *Uncertain Demographics and Fiscal Sustainability*. Cambridge, UK: Cambridge University Press.
- Alonso-Fernandez J.-J., Meneu-Gaya R., Devesa-Carpio E., Devesa-Carpio M., Dominguez-Fabian I. & Encinas-Goenechea B. 2018. From the replacement rate to the synthetic indicator: A global and gender measure of pension adequacy in the European Union. *Social Indicators Research* **138**(1): 165–186.
- Alonso-Garcia J., Boado-Penas M. del C. & Devolder P. 2018. Adequacy, fairness and sustainability of pay-as-you-go-pension-systems: defined benefit versus defined contribution. *The European Journal of Finance* **24**(13): 1100–1122.
- Ardito C. & d'Errico A. 2018. The dark side of work life extension: Health, welfare and equity concerns. *Sociologia del Lavoro* (150): 101–119.
- Assifuah-Nunoo E. & Yeboah A. 2025. Financial planning and financial well-being of informal sector workers in central region of Ghana: The moderating and mediating role of financial literacy. *Proceedings of The 5th International Conference of Accounting & Business*, pp. 479–503.
- Bajtelsmit V., Rappaport A. & Foster L. 2013. *Measures of retirement benefit adequacy: Which, why, for whom, and how much?* Society of Actuaries. <https://www.soa.org/globalassets/assets/files/research/projects/research-2013-measures-retirement.pdf>
- Berita RTM. 2025. *Simpanan majoriti ahli KWSP habis dalam tempoh lima tahun selepas bersara*. <https://berita.rtm.gov.my/nasional/senarai-berita-nasional/senarai-artikel/simpanan-majoriti-ahli-kwsp-habis-dalam-tempoh-lima-tahun-selepas-bersara-mof> (2 September 2026).
- Bernama. 2023. *6.3 juta ahli KWSP bawah 55 tahun miliki simpanan kurang RM10,000*. <https://www.bernama.com/bm/news.php?id=2246257>
- Bank Negara Malaysia. 2022. *Rebuilding retirement savings and financial safety nets in Malaysia*. In *Economic and Monetary Review 2022* (Box Article 1). https://www.bnm.gov.my/documents/20124/10150285/emr2022_en_box1.pdf
- Borzi P.C. 2006. Changing risks confronting pension participants. *Restructuring Retirement Risks*. Oxford UK: Oxford University Press.
- Bose M. & De Roy S. 2019. Conditions of employment and livelihood security of informal workers: A study of four villages in Jalpaiguri District, West Bengal. *Agrarian South: Journal of Political Economy* **8**(3): 414–439.
- Burnett J., Davis K., Murawski C., Wilkins R. & Wilkinson N. 2018. Measuring the adequacy of retirement savings. *Review of Income and Wealth* **64**(4): 900–927.
- Chen A. & Munnell A.H. 2021. Do retirees want constant, increasing, or decreasing consumption? *SSRN Electric Journal*. <https://ssrn.com/abstract=3979740>.

- Christensen B.J., Kallestrup-Lamb M. & Kennan J. 2022. *Consumption and saving after retirement* (NBER Working Paper No. 29826). National Bureau of Economic Research. <https://www.nber.org/papers/w29826>
- Chybalski F. & Marcinkiewicz E. 2016. The replacement rate: An imperfect indicator of pension adequacy in cross-country analyses. *Social Indicators Research* **126**(1): 99–117.
- Constantinescu D. & Georgescu M.-R. 2024. The evolution of multi-pillar pension systems: Balancing between necessity, opportunity and complexity. *Manager (University of Bucharest, Faculty of Business & Administration)* **39**(1).
- Crawford R. & O'Dea C. 2020. Household portfolios and financial preparedness for retirement. *Quantitative Economics* **11**(2): 637–670.
- Department of Statistics Malaysia. 2024a. Cost of Living Indicators, 2023. <https://open.dosm.gov.my/>
- Department of Statistics Malaysia. 2024b. *Life Expectancy*. <https://open.dosm.gov.my/dashboard/life-expectancy> (28 June 2025).
- Department of Statistics Malaysia. n.d. Publications. <https://open.dosm.gov.my/> (30 June 2025).
- Department of Statistics Malaysia. 2025. *Population projection*. https://open.dosm.gov.my/publications/population_projection_2060 (23 September 2025).
- Dunn S. & Maharaj P. 2024. Poverty among older people in South Africa. In Maharaj P. (ed.). *Navigating Ageing in South Africa: Interdisciplinary Perspectives*: 87–111. Singapore: Springer Nature Singapore.
- Engerman S.L. 1997. The standard of living debate in international perspective: measures and indicators. In Steckel R.H. & Floud R. (eds.). *Health and Welfare during Industrialization*: 17–46. Chicago, Illinois: University of Chicago Press.
- Employees Provident Fund. 2016. *Social protection insight*. Employees Provident Fund. https://www.kwsp.gov.my/documents/d/guest/social_protection_insight_vol-1_2016
- Employees Provident Fund. 2022. *Integrated annual report 2022*. Employees Provident Fund. <https://cdn.heyzone.com/files/uploaded/v2/dd3813935c40fb8146803c36691fc5168f68c242.pdf>
- Employees Provident Fund. 2023. *Integrated annual report 2023*. Employees Provident Fund. https://www.epfweb.org/sites/default/files/2024-04/EPF_Annual_Report2023_MAR22%20%28003%29.pdf
- Employees Provident Fund. 2024a. *EPF dividend 2024*. <https://www.kwsp.gov.my/ms/lain-lain/sumber-maklumat/dividen> (29 June 2025).
- Employees Provident Fund. 2024b. *EPF sustains solid performance with 5.50% dividend for Simpanan Konvensional and 5.40% for Simpanan Syariah*. <https://www.kwsp.gov.my/en/w/epf-sustains-solid-performance-with-5-50-percent-dividend-for-simpanan-konvensional-and-5-40-percent-for-simpanan-shariah-ln> (29 June 2025).
- Employees Provident Fund. 2024c. *EPF releases Belanjawanku 2024/2025 and retirement income adequacy framework*. <https://www.kwsp.gov.my/en/w/epf-releases-belanjawanku-2024/2025-and-retirement-income-adequacy-framework> (29 September 2025).
- Employees Provident Fund. n.d. *Benefits as a Member*. <https://www.kwsp.gov.my/en/member/overview/benefits> (29 June 2025).
- Ezra D. 2005. Retirement income guarantees are expensive. *Financial Analysts Journal* **61**(6): 74–77.
- Herbay J.J.O., González G.F.L. & Quezada N.I.C. 2024a. Main challenges of pension systems: A systematic review of the literature. *Relações Internacionais no Mundo Atual* **3**(45): 199–214.
- Hlochova H., McNally B., Hayden M.T. & Kinsella A. 2025. Pension provision in the farming sector – Lessons from Europe. *Journal of Rural Studies* **116**: 103596.
- Holzmann R. 2013. Global pension systems and their reform: Worldwide drivers, trends and challenges. *International Social Security Review* **66**(2): 1–29.
- Holzmann R. & Hinz R. 2005. *Old-Age Income Support in The 21st Century: An International Perspective on Pension Systems and Reform*. Washington, DC: World Bank.
- Hu Y.-W. & Stewart F. 2009. *Pension coverage and informal sector workers: International experiences* (OECD Working Papers on Insurance and Private Pensions, No. 31). OECD Publishing.
- International Labour Organization. 2022. *Setting adequate wages: The question of living wages*. International Labour Organization. <https://www.ilo.org/>
- Jachimowicz J.M., Szaszi B., Lukas M., Smerdon D., Prabhu J. & Weber E.U. 2020. Higher economic inequality intensifies the financial hardship of people living in poverty by fraying the community buffer. *Nature Human Behaviour* **4**(7): 702–712.
- Johnston D.W. & Menon N. 2022. Income and views on minimum living standards. *Journal of Economic Behavior & Organization* **199**: 18–34.
- Knoef M., Been J., Alessie R., Caminada K., Goudswaard K. & Kalwij A. 2016. Measuring retirement savings adequacy: Developing a multi-pillar approach in the Netherlands. *Journal of Pension Economics and Finance* **15**(1): 55–89.
- Koch M. 2012. *International organizations in development and global inequality: The example of the World Bank's pension policy*. United Nations University World Institute for Development Economics Research (UNU-WIDER). <https://www.wider.unu.edu/>

- Kolsrud J., Landais C., Reck D. & Spinnewijn J. 2024. Retirement consumption and pension design. *American Economic Review* **114**(1): 89–133.
- Love D.A., Smith P.A. & McNair L.C. 2007. *Do households have enough wealth for retirement?* Finance and Economics Discussion Series No. 2007-17. Board of Governors of the Federal Reserve System. <https://fraser.stlouisfed.org/title/finance-economics-discussion-series-1491/households-enough-wealth-retirement-723093>
- Luque A., Ponce M.C. & Mendoza A.C. 2023. The pension system in the Ecuadorian social security institute (IESS): Analysis and perspectives in the economic and legal fields. *Handbook of Research on Bioeconomy and Economic Ecosystems*: 266–287. Hershey, Pennsylvania: IGI Global.
- Lusardi A., Michaud P.-C. & Mitchell O.S. 2017. Optimal financial knowledge and wealth inequality. *Journal of Political Economy* **125**(2): 431–477.
- Madrian B., Mitchell O.S. & Soldo B.J. 2007. The Sufficiency of Retirement Savings: Comparing Cohorts at the Time of Retirement. In Ameriks J. & Mitchell O.S. (eds.). *Redefining Retirement: How Will Boomers Fare?*: 36–69. Oxford UK: Oxford University Press.
- Mawad J.L., Athari S.A., Khalife D. & Mawad N. 2022. Examining the impact of financial literacy, financial self-control, and demographic determinants on individual financial performance and behavior: An insight from the Lebanese Crisis Period. *Sustainability* **14**(22): 15129.
- Moreno-García E., Hernández-Mejía S. & Salazar Núñez H.F. 2024. Financial literacy and financial fragility in Mexico. *Revista Mexicana de Economía y Finanzas, Nueva Época* **19**(1): e958.
- Neuberger L., Carroll D.A., Bastante S., Rogers M. & Boutemen L. 2022. Taking financial literacy downtown: Leveraging community partnerships to increase communication of essential financial information in an urban area. *Education and Urban Society* **54**(8): 1010–1022.
- Ngadi N., Asiaty D., Nurul Aini Y., Astrelina Purba Y. & Rajagukguk Z. 2025. Increasing labor social security membership for informal workers in Indonesia. *Cogent Social Sciences* **11**(1): 2534139.
- Organisation for Economic Co-operation and Development. 2017. *Pensions at a glance 2017: OECD and G20 indicators*. OECD Publishing.
- Organisation for Economic Co-operation and Development. 2023. Contributions paid into pension plans. *Pensions at a glance 2023: OECD and G20 indicators*. OECD Publishing.
- Organisation for Economic Co-operation and Development. 2024. *Pension markets in focus 2024*. OECD Publishing.
- Padley M. & Davis A. 2025. A life in dignity for all? UK social security support, income adequacy and minimum living standards under austerity, 2008–2023. *Journal of Poverty and Social Justice* **33**(1): 50–70.
- Peng X., Lu H., Fu J. & Li Z. 2021. Does financial development promote the growth of property income of China's urban and rural residents? *Sustainability* **13**(5): 2849.
- Ranganathan N.M. 2017. Universal social pension for elderly individuals in India: Public expenditure requirements and fiscal sustainability. *Indian Growth and Development Review* **10**(2): 89–116.
- Saidi N.A.N., Yusuf M.M. & Basah M.Y.A. 2017. Assessing the adequacy of contribution rates towards employees' provident fund in Malaysia. *AIP Conference Proceedings* **1830**(1): 040006.
- Skuflić L., Krpan M. & Pavković A. 2020. Public pension expenditure in the new EU member states: A panel data approach*. *Finance a Uver - Czech Journal of Economics and Finance* **70**(3): 216–243
- Solarz M. 2021. Determinants of collecting voluntary savings for retirement: Evidence from Poland. *Proceedings of the 36th International Business Information Management Association*, pp. 6678–6691.
- Sørensen O.B., Billig A., Lever M., Menard J.-C. & Settergren O. 2016. The interaction of pillars in multi-pillar pension systems: A comparison of Canada, Denmark, Netherlands and Sweden. *International Social Security Review* **69**(2): 53–84.
- Vaghefi N., Kari F. & Talib M.A. 2017. Poverty and income replacement profile among EPF retiree in Malaysia. *Social Indicators Research* **132**(3): 1065–1078.
- VanDerhei J. 2006. *Measuring retirement income adequacy: Calculating realistic income replacement rates* (EBRI Issue Brief No. 297). Employee Benefit Research Institute. <https://www.ebri.org/>
- Vukorepa I. 2015. Lost between sustainability and adequacy: Critical analysis of the Croatian pension system's parametric reform. *Revija Za Socijalnu Politiku* **22**(3): 279–308.
- Wang H. & Huang J. 2023. How can China's recent pension reform reduce pension inequality? *Journal of Aging and Social Policy* **35**(1): 37–51.
- World Bank. 2008. *The World Bank pension conceptual framework background*. World Bank.
- World Bank. 2019. *Early access to pension savings: International experience and lessons learnt*. <https://www.worldbank.org/>
- World Bank. 2020. *A silver lining: Productive and inclusive aging for Malaysia*. <https://www.worldbank.org/en/country/malaysia/publication/a-silver-lining-productive-and-inclusive-aging-for-malaysia>
- Wu X. 2019. Research on supporting policies of multi-pillar pension system in China. *Proceedings of the 3rd International Seminar on Education Innovation and Economic Management*, pp. 13–16.

- Yang Y. 2022. Toward an inclusive system for informal workers? Diverging impacts of labor informality on Chinese workers' pension enrollment. *International Journal of Social Welfare* **31**(1): 100–111.
- Ye Z., Post T., Zou X. & Chen S. 2025. Savings goals matter—Cognitive constraints, retirement planning, and downstream economic behaviors. *Journal of Behavioral and Experimental Finance* **46**: 101042.
- Zhong Y., Yao J., Xu Y., Zhou Z., Xiao Y. & Gu Q. 2021. Econometric analysis of Chinese urban residents' consumption based on regression analysis. *Proceedings of the 2nd International Conference on Computer Science and Management Technology*, pp. 286–292.
- Zhu L., Peng Z., Deng Q. & Zhang X. 2025. The effectiveness and choice of public pension scheme among Donglan county residents in China. *BMC Geriatrics* **25**(1): 62.

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