



Aging, Pension System, and Economic Growth in Poland and Thailand

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Abstract

This research aimed to analyze the situation of aging, the pension system, and economic growth. There were two objectives using qualitative and quantitative methodology. The first objective aimed to analyze the situation of aging and the pension system in Poland and Thailand by using comparative analysis. The study found that Poland's pension system ensures that the majority of the population receives retirement benefits by offering rather comprehensive coverage. However, in Thailand, only those who work in the formal sector are covered by Thailand's social security system. It implies that a significant proportion of the population, particularly those in the informal sector and those living in rural areas, does not have enough pension coverage. This makes it challenging to ensure financial stability as one ages. The second objective was to examine the relationship between retirement savings and economic growth in Thailand by using OLS regression. This research used time series data and applied quarterly data from Q1 2007 to Q4 2020. The regression results revealed that five variables had a statistically significant effect on economic growth in Thailand, which were Social Security Fund Article 33 (SSF33), Private Investment (I), Retirement Mutual Fund (RMF), Government Spending (G), and Government Pension Fund (GPF). The results confirm that retirement savings are important to the economy's growth. This research also highlights the important role of pension systems in addressing the challenges of aging populations. A well-planned pension system provides financial security for retirees and supports economic growth. By comparing Poland and Thailand, this study provides valuable understanding for creating sustainable pension systems that can adapt to population changes and strengthen the economy.

Introduction

The world is facing an increase in the proportion of older persons in their population (United Nations, 2017). A society is classified as aging when the population

aged 65 and up is more than 7 percent of the total population; aged when the population aged 65 and up is more than 14 percent of the total population; and super-aged when the population aged 65 and up is more

than 20 percent of the total population (United Nations, 2022). While Thailand has been an aging society since 2005, Poland is already classified as an aged society, reflecting significant demographic differences, which are represented in Figure 1 and Figure 2 (Population Pyramid, 2019a, 2019b). Poland, as a European Union member, has a well-established pension system shaped by EU standards and an aging society typical of developed nations (European Commission, 2013). In contrast, Thailand, a rapidly developing country, faces unique challenges in transitioning from an informal to a formal pension system while addressing the economic pressures of an aging population (United Nations, 2022). The process of aging in Thailand is happening rapidly due to declining birth rates and increasing life expectancy (Mercer, 2021). This creates economic pressures as a decrease in the proportion of working-age people relative to the elderly population. Thailand must balance the dual challenge of fostering economic growth essential for funding pension systems while preparing for the future financial needs of a growing elderly population (Phijaisanit, 2011). At the same time, many workers in the informal economy, for example, farmers and small business owners lack access to traditional pensions, complicating the transition. Conducting a comparative study of aging, pension systems, and economic growth in Poland and Thailand offers valuable insights into how

different socio-economic, cultural, and demographic contexts influence policy outcomes. These differences make it particularly valuable to examine how Poland has managed its aging population, especially regarding policies that ensure the financial stability of retirees, compared to Thailand. Furthermore, it enriches understanding of how institutional capacity and economic structures shape responses to aging and its economic implications. The benefit of this study is that it helps us to understand the situation of the aging society and pension system, and proposes a policy for the government to drive the Thai economy to grow sustainably. Additionally, few studies have directly compared Eastern European and Southeast Asian countries in this regard.

Objectives

1. To analyze the situation of aging and the pension system in Poland and Thailand by using comparative analysis
2. To examine the relationship between retirement savings and economic growth in Thailand by using OLS regression.

Literature review

The Life-Cycle Theory

The life-cycle theory illustrates the relationship among aging, income, consumption, and household

Thailand ▼
2019
Population: 69,625,581

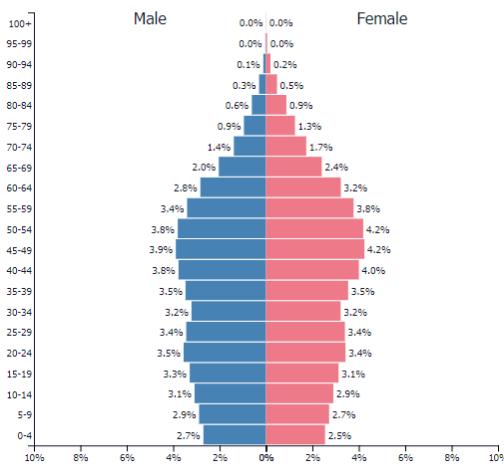


Figure 1 Thailand's Population Pyramid in 2019
Source: Population Pyramid (2019b)

Poland ▼
2019
Population: 37,887,771

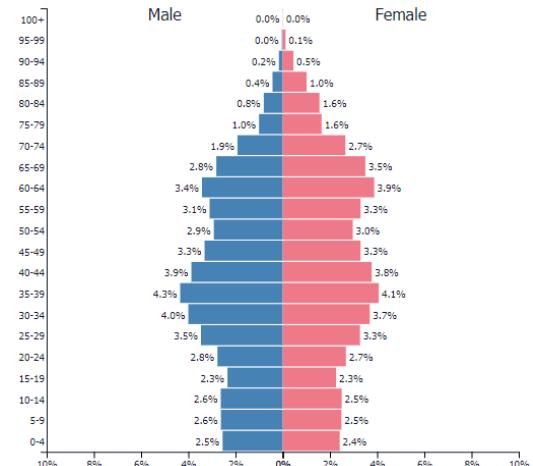


Figure 2 Poland's Population Pyramid in 2019
Source: Population Pyramid (2019a)

savings in the economy (Jappelli & Modigliani, 1998). People do not consume based on only current income but based on estimated lifetime income. This is to maximize their utility and smooth their consumption over time. According to the life-cycle hypothesis, savings are beneficial for younger people but detrimental for older people (Mankiw, 2013). According to the life-cycle theory, people save money while they are employed to support themselves in retirement when their income declines. Throughout a person's lifetime, the pattern of saving and dissaving serves to smooth consumption and maintain a relatively steady level of living as indicated by the horizontal consumption line (Ahmed et al., 2020).

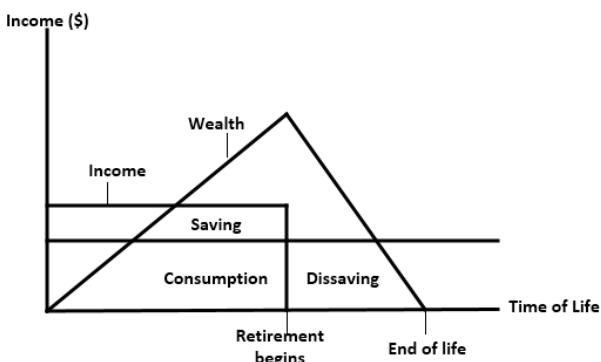


Figure 3 Life-Cycle Theory
Source: Mankiw (2013)

The five pillars of retirement plans

The World Bank (2012) announced the five pillars of modern retirement systems, which is a concept of pension systems of countries all over the world with the aim of helping people live after retirement without falling below the poverty line. This framework begins with providing basic social welfare for the elderly. Additionally, savings models have been created, both compulsory and voluntary, to support living after retirement. The five pillars model intends to ensure financial security and reduce poverty among the elderly population worldwide. If individuals have sufficient post-retirement income, the government can reduce the burden of welfare expenses for the elderly and allocate the remaining budget towards investments for national development. This helps mitigate the risk of fiscal burden and public debt, which could potentially pose problems for the country in the future. The essential characteristics of different pension plans around the world are represented according to the five pillars of modern retirement systems, as shown in Table 1 (World Economic Forum, 2013).

Table 1 The Five Pillars of Retirement Plans

Pillar	Characteristics	Type of Management	Participation
Pillar 0	People do not pay. It provides minimal money to help the elderly or the poor.	Public	Non-contributory
Pillar 1	Individuals must pay, typically on a pay-as-you-go basis, and the government will pay a subsidy.	Public	Mandatory
Pillar 2	Individuals pay to save during the working period, typically in a defined contribution plan.	Private	Mandatory
Pillar 3	Independent saving and investment for retirement, disability, or death; the government offers support with tax incentives.	Private	Voluntary
Pillar 4	Both informal and formal support; the informal support comes from family, and the formal support comes in the form of healthcare, housing, and reverse mortgages.	Private	Non-financial

Source: Adapted from the World Economic Forum (2013).

According to the World Bank's theoretical retirement systems, each country can develop its pension systems based on the Five Pillar Framework (Holzmann et al., 2008).

Retirement saving schemes in Thailand

In Thailand, we have two main retirement saving schemes, which are (1) compulsory and (2) voluntary retirement saving schemes. This section is to briefly explain each of the retirement savings schemes in Thailand.

Compulsory retirement saving schemes

The compulsory retirement saving schemes are for government and private employees; therefore, they are offered to only formal workers. The compulsory retirement saving schemes include the Government Pension Fund (GPF) and Social Security Fund (SSF) Article 33. Government employees in Thailand are offered the opportunity to contribute to the Government Pension Fund (GPF). The GPF is a defined contribution scheme. It was established under the GPF Act in 1997, and former government workers had the option to remain in the previous defined benefit plan on a non-contributory basis or join the GPF. However, all new government employees must contribute to the GPF savings system. The members contribute three percent of their monthly salary, and the government matches this amount. When the members retire, they receive a lump-sum retirement allowance from the GPF together with interest (Government Pension Fund [GPF], 2022).

On the other hand, private employees in Thailand are offered the opportunity to contribute to Social

Security Fund (SSF) Article 33. Social security is a fund that not only provides benefits in the form of an old-age pension but also ensures against unknown emergencies and allows members to receive compensation or an allowance in the case of unemployment, childbirth, sickness, injury, invalidity, and death. In Thailand, the Social Security Fund (SSF) is split into three different categories of insured persons, which are SSF Article 33, SSF Article 39, and SSF Article 40 (Social Security Office [SSO], 2022).

The SSF under Article 33 is a mandatory contributory system. Employees and employers each need to contribute 5% of each employee's wages. The monthly minimum salary used in the calculation is 1,650 THB and the maximum is 15,000 THB. Therefore, the monthly minimum contribution is 83 THB. Although an employee's salary may be more than 15,000 THB, the maximum contribution will still be 750 THB (SSO, 2022).

Voluntary retirement saving schemes

The voluntary retirement saving schemes include the Provident Fund (PWD), Retirement Mutual Fund (RMF), SSF under Article 39, and SSF under Article 40. Voluntary retirement saving schemes such as SSF under Article 39 and SSF under Article 40 are aimed at informal workers, including employers, own-account workers, and unpaid family workers.

The Provident Fund (PWD) is a voluntary investment fund established by businesses and employees to provide long-term retirement savings. The provident fund consists of four parts, which are (1) the employee's contribution, funded by the employee's monthly salary, (2) the investment returns generated by the employee's contribution, (3) the employer's contribution, and (4) the benefits derived from the employer's contribution (Provident Fund [PWD], 2022).

The Retirement Mutual Fund (RMF) is an investment fund that has a goal to encourage people to save and invest money to plan for retirement. Investors will receive tax benefits, and the amount invested in an RMF must not exceed 500,000 THB. This amount must not exceed 30 percent of the disposable annual income when combined with the contribution to the provident fund or pension fund. The investment in an RMF must be held for a period of more than 5 years from the initial investment and can be redeemed when the investor is 55 years old (Association of Investment Management Companies [AIMC], 2022).

The SSF under Article 39 is for a person who used to be insured under Article 33 and has paid contributions

for at least 12 months; they are no longer an insured person and no longer an employee. If the employee wishes to be insured, he must contact the Social Security Office within 6 months and contribute 432 THB to the fund by the 15th of the following month. After that, he will be entitled to three types of benefits, which are sickness, invalidity, and death (SSO, 2022).

The SSF under Article 40 is for individuals who are not employees under Articles 33 or 39. They can apply to be an insured person under Article 40 by informing the Social Security Office. This scheme is optional, and members can choose between two options. For the first option, members have to contribute 70 THB per month and the government will contribute 30 THB per month. The second option requires members to contribute 100 THB per month and the government will contribute 50 THB per month. Members receive benefits such as sickness, invalidity, and death. The SSF schemes offer the above benefits in addition to retirement savings (SSO, 2022).

Economic growth theory

Every country in the world desires to have economic growth. According to the Harrod-Domar Growth Model, saving is an important factor in achieving economic growth (Ahmed et al., 2020).

The economic growth model starts with savings as a proportion of the national income according to the savings rate :

$$S = sY \quad (1)$$

Accordingly, national investment should be equal to national savings (S), so

$$I = S \quad (2)$$

On the other hand, investment (I) equals the change in capital (K):

$$I = \Delta K \quad (3)$$

because the capital per output coefficient (k) is calculated from the change in the capital (ΔK) and the change in national income (ΔY):

$$k = \frac{\Delta K}{\Delta Y} = \Delta K = k \Delta Y \quad (4)$$

If we combine equations (1), (2), (3), and (4):

$$S = sY = I = \Delta K = k \Delta Y \quad (5)$$

$$\text{then } sY = k \Delta Y \quad (6)$$

$$\text{and the economic growth model is } \frac{\Delta Y}{Y} = \frac{s}{k} \quad (7)$$

It can be seen that the economic growth model begins with saving and investment. Then, investment increases capital and national income, respectively (Le & Nguyen, 2019).

Conceptual framework

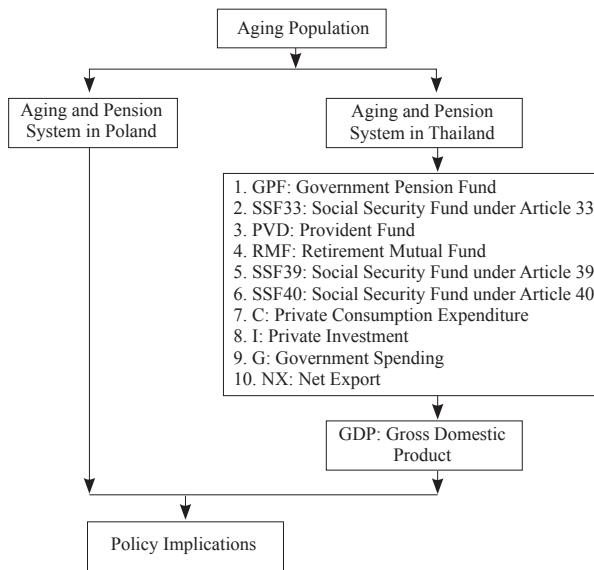


Figure 4 Conceptual framework

Research methodology

A mixed-methods approach is applied to this research by combining qualitative comparative analysis and quantitative analysis. Qualitative analysis provides depth and identifies similarities and differences pension structures across countries. The method enables in-depth exploration of how demographic trends and policy frameworks in Poland and Thailand shape their aging and pension systems. Quantitative analysis provides systematic and precision by measuring the economic impact of retirement savings in Thailand. The combination of qualitative and quantitative methods bridges the gap between policy analysis (Objective 1) and empirical economic evaluation (Objective 2). The mixed-methods approach ensures that the research not only explores theoretical and structural aspects of pension systems but also demonstrates practical economic implications, making the findings more actionable for policymakers.

1. Population and samples

This study has two objectives. The first objective aimed to analyze the situation of aging and the pension system in Poland and Thailand by using comparative

analysis. For the population, the study considers global aging and pension systems, focusing specifically on Poland and Thailand as case studies. For the samples, the analysis uses purposive sampling to select data specific to Poland and Thailand from global datasets. Key demographic and pension-related indicators from 2019-2050 were extracted, as well as policy descriptions for each country's pension system across the four pillars (non-contributory, mandatory, voluntary, and non-financial). The second objective was to examine the relationship between retirement savings and economic growth in Thailand by using OLS regression. This study used time series data and applied quarterly data from Q1 2007 - Q4 2020.

2. Research instrument

For objective 1 (qualitative), the study relies on secondary data sourced from reputable government and international organizations including document analysis, policy reports, and datasets as the instruments for comparative analysis. For objective 2 (quantitative), the data obtained were analyzed by using a statistical package for econometric analysis, namely Gretl.

3. Data sources

The first objective was to analyze the situation of aging and the pension system in Poland and Thailand by using comparative analysis. Data types for the study include demographic indicators including old-age dependency ratio, population changes; pension system structures including coverage, funding mechanisms, and benefits; policy documents and reports analyzing challenges and reforms in aging and pensions. The following data sources and their detailed contributions support the analysis of the first objective. International Institute for Applied System Analysis (IIASA) offers detailed demographic projections and analysis, including the aging index and population structure forecasts, which used to analyse long-term trends and policy implications. International Labor Organization (ILO)'s database includes global statistics on social protection, including pension coverage, informal employment rates, and labor force participation trends. United Nations (UN) provides demographic data through its World Population Prospects and insights into aging and social policies. World Bank offers extensive economic and demographic data through its World Development Indicators. World Economic Forum (WEF) publishes reports on global economic competitiveness, workforce dynamics, and future trends, including aging's impact on productivity and pensions. These organizations' websites and databases offer

comprehensive insights and data on demographics, economic policies, and pension systems in Poland and Thailand.

The second objective was to use OLS regression to examine the connection between retirement savings and economic growth in Thailand. This study used time series data and applied quarterly data from Q1 2007 - Q4 2020, which were obtained from various official sources, including Office of the National Economic and Social Development Council (NESDC), Social Security Office (SSO), Government Pension Fund (GPF), Provident Fund (PVD), and Association of Investment Management Companies (AIMC). If the data collected was monthly data, the data was converted into the quarterly format. Then, the growth rates (%) of all variables were calculated. The data used in the study were as follows.

Table 2 Variables used in the regression and their data sources

Variables	Sources
GDP: Gross Domestic Product (as growth rate)	Office of the National Economic and Social Development Council (NESDC, 2022)
GPF: Government Pension Fund (as growth rate)	Government Pension Fund (GPF, 2022)
SSF33: Social Security Fund under Article 33 (as growth rate)	Social Security Office (SSO)
PVD: Provident Fund (as growth rate)	Association of Investment Management Companies (AIMC, 2022)
RMF: Retirement Mutual Fund (as growth rate)	Association of Investment Management Companies (AIMC, 2022)
SSF39: Social Security Fund under Article 39 (as growth rate)	Social Security Office (SSO)
SSF40: Social Security Fund under Article 40 (as growth rate)	Social Security Office (SSO)
C: Private Consumption Expenditure (as growth rate)	Office of the National Economic and Social Development Council (NESDC, 2022)
I: Private Investment (as growth rate)	Office of the National Economic and Social Development Council (NESDC, 2022)
G: Government Spending (as growth rate)	Office of the National Economic and Social Development Council (NESDC, 2022)
NX: Net Export (as growth rate)	Office of the National Economic and Social Development Council (NESDC, 2022)

4. Data analysis

The qualitative method employs mainly three analysis techniques, which are content analysis, thematic analysis, and comparative analysis. Content analysis analyzed policy documents and reports to identify key themes, challenges, and solutions in pension systems. Thematic analysis identified patterns in demographic and policy data, focusing on aging trends, system sustainability, and adequacy of pensions. Comparative analysis indicated similarities and differences between Poland and Thailand, relating demographic pressures to the

structure and outcomes of their pension systems.

The quantitative method uses OLS regression to examine the connection between retirement savings and economic growth in Thailand. The relationship between retirement savings and economic growth in Thailand can be estimated as follows:

$$GDP_t = b_0 + b_1 GPF_t + b_2 SSF33_t + b_3 PVD_t + b_4 RMF_t = \\ b_5 SSF39_t + b_6 SSF40_t + b_7 C_t + b_8 I_t + b_9 G_t + b_{10} NX_t + e_t$$

Before the data was used for the analysis, it was cleaned to ensure that it was correct and usable. Because our data was time series data, a stationary test needed to be applied. Then, autocorrelation, heteroscedasticity, and multicollinearity were checked respectively. The explanation of the data cleaning process is as follows.

1) To perform the stationary test, a unit root test was used. The unit root test has many methods that can be used, of which the Augmented Dickey-Fuller test (ADF) is the most recognized method. Therefore, this paper used the ADF. If the p-value from the ADF test is equal to or less than 0.05, the data is considered as stationary. However, if the p-value is more than 0.05, it can be considered as non-stationary. If the data is shown to be non-stationary, adding the difference is a solution to the problem of non-stationary data.

2) To check whether the data had autocorrelation or not, the researchers used the Durbin-Watson (DW) test and selected White's test as a tool for checking heteroscedasticity. In addition, the researchers used the Variance Inflation Factor (VIF) to check for multicollinearity. These methods were selected because they are the most widely used tools for checking those issues.

Results

The results of this study are structured into two distinct parts, corresponding to the research objectives.

Part I: Analysis of aging situation and pension systems in Poland and Thailand

This section addresses the first objective, which focuses on analyzing the situation of aging and the pension systems in Poland and Thailand through a comparative analysis. The findings in this part are qualitative, providing insights into demographic trends, the structure and challenges of pension systems, and the socio-economic implications of aging in both countries.

Situation of aging in Poland and Thailand

The data from International Institute for Applied Systems Analysis (IIASA, 2018) and the United Nations (2019), as shown in Table 3, highlights key demographic trends regarding aging populations in Poland, Thailand, and their regional and global contexts. Based on the number of people aged 65 and over, it can be analyzed into 2 parts, which are (1) Global and regional context and (2) Poland compared to Thailand. For the analysis in the first part, the global population aged 65 and over was approximately 703 million in 2019. This number is projected to grow significantly, reaching nearly 1 billion by 2030, reflecting the global trend of population aging. Europe, as a region, had 140 million individuals aged 65 and over in 2019, a figure expected to increase by 21.3% by 2030. Asia had 395 million individuals aged 65 and over in 2019, which is projected to grow by 48.6% by 2030, indicating a faster aging process compared to Europe. For the analysis in the second part, Poland had 6.86 million individuals aged 65 and over, while Thailand had 8.64 million in 2019. Despite having fewer elderly individuals, Poland is aging more steadily as a developed country. By 2030, Poland's elderly population is projected to increase by 25%, reaching 8.58 million, while Thailand's elderly population is expected to grow by 59.7%, reaching 13.8 million. This indicates a much more rapid aging process in Thailand, aligning with demographic shift trends in many developing countries (Rzeczpospolita Polska, 2017). Based on population change as a percentage during 2019 to 2030, Thailand exhibits a sharp 59.7% growth in the 65 and over population over the decade, which is a much more rapid rate compared to Poland's 25% increase in the same period. This suggests that Thailand's population is aging more quickly, with a larger share of the population entering older age in a shorter time frame. Since Europe's population is already aging, the growth rate of the elderly population is slower. The 21.3% growth indicates that the elderly population is still growing, but it is a more gradual process because the demographic transition from a younger to older population is already underway.

In essence, Europe has fewer younger people entering the elderly age group at the same time as countries like Thailand or those in Asia. Asia's 48.6% growth illustrates that many Asian countries are undergoing a more rapid shift to an older population, reflecting the transition from younger to older demographics that developing countries typically experience. Based on old-age dependency ratio (65+/20-64), which measures the burden on the working-age population to support retirees, in 2019, Poland's old-age dependency ratio was significantly higher at 29.2, compared to Thailand's ratio of 19.3, reflecting Poland's more advanced stage of demographic aging. However, Thailand's old-age dependency ratio is expected to rise sharply to 32.3 by 2030, indicating a rapidly increasing economic burden on its working-age population. By 2050, Poland's old-age dependency ratio is projected to reach 60.8, exceeding both Europe's ratio of 53.3 and Thailand's ratio of 54.4. This suggests Poland will face substantial challenges in sustaining its pension system due to the high proportion of elderly dependents (The Social Insurance Institution ([ZUS]), 2019). In terms of comparative trends and implications, it can be stated that Poland, as a developed nation, is already an aged society and will experience a steady but significant increase in the elderly population and dependency ratios. Its pension system must address long-term sustainability, as the workforce shrinks relative to retirees. Thailand is undergoing a rapid demographic shift, transitioning from a young society to an aging one at a much faster pace. This accelerated aging process, coupled with its developing economic status, presents challenges in establishing a robust pension system to support its growing elderly population (World Bank, 2022).

The pension system in Poland and Thailand

Based on the data from the World Economic Forum (2013), the pension systems in Poland and Thailand are structured around multiple pillars, each serving distinct purposes. Below is a comparative analysis of the characteristics and implementation of each pillar in the two countries.

Table 3 Demographic indicators of aging in the World, Europe, Poland, Asia, and Thailand from 2019-2050

Variables	Sources	World	Europe	Poland	Asia	Thailand
Number of people 65 years of age or over (thousands)	2019	702,935	140,410	6,864	395,344	8,638
	2030	997,488	170,273	8,579	587,415	13,797
Population Change as a Percentage in population aged 65 or over	2019-2030	41.9	21.3	25.0	48.6	59.7
	2019	15.9	31.3	29.2	14.3	19.3
Old-age dependency ratio (65+/20-64)	2030	20.5	40.6	40.2	19.7	32.3
	2050	28.3	53.3	60.8	30.7	54.4

Source: Adapted from IIASA (2018) and the United Nations (2019).

Table 4 Pension Systems in Poland and Thailand

Pillar	Characteristics	Poland	Thailand
Pillar 0: A non-contributory “zero pillar” of the social security system	This fund is not paid into; it is non-contributory. It provides the elderly with a basic minimum income for the rest of their lives through grants.	n.a.	It could cover all seniors (universal) or just the poor, like old-age income security.
Pillar 1: A mandatory “first pillar” with compulsory payment	This fund is partly funded by the individual and partly funded with a government subsidy.	Pensions are paid out by the Social Insurance Institution (ZUS). The pension amount depends on the sum of collected contributions (indexed according to inflation rate) and the so-called “initial capital”.	This fund is controlled by government organizations and offers members with a minimal set of benefits, similar to those provided by the social security system, including pensions.
Pillar 2: A mandatory defined contribution “second pillar” with compulsory payment.	The government forces an individual to increase savings during the working period to have money guaranteed in the retirement period.	Open pension funds managed by private companies - pension societies - form a mandatory funded pillar, subject to supervision by the state (Polish Financial Supervision Authority - KNF)	These funds, such as the Government Pension Fund, provide privately managed individual savings accounts.
Pillar 3: A volunteer-funded “third pillar” of the voluntary sector.	Individual savings accounts contribute to the retirement fund (defined contribution scheme). This fund offers individually managed savings accounts.	This pillar consists of the employee pension program (PPE), individual retirement accounts (IKE), and individual retirement protection accounts (IKZE) as well as life insurance policies with savings characteristics and employee savings programs.	The government helps by offering tax incentives for mutual funds, annuity life insurance, provident funds, RMFs, and life insurance.
Pillar 4: A non-financial “fourth pillar” that keeps the system to ensure adequacy, affordability, sustainability, equity, predictability, and robustness	This involves having access to official services like healthcare, housing, and informal support networks like family.	n.a.	Home loans known as reverse mortgages may be used by the elderly.

Source: Data from the World Economic Forum (2013), analyzed and interpreted by the authors.

For Pillar 0: Non-Contributory “Zero Pillar” of the social security system, Poland is not applicable (n.a.). Poland does not have a non-contributory system providing a universal or targeted basic minimum income for the elderly. However, Thailand offers a non-contributory pension scheme designed to provide basic income security for the elderly. This scheme may either be universal or targeted at low-income seniors, such as the old-age income security system. It implies that Thailand’s implementation of Pillar 0 is significant for ensuring income security for vulnerable populations, particularly in a developing economy. Poland’s absence of such a system reflects its reliance on contributory pillars to address elderly income needs.

For Pillar 1: A mandatory “first pillar” with compulsory payment, Poland is managed by the Social Insurance Institution (ZUS). The contributions come from both the individual and government subsidies. The pension amount depends on collected contributions, indexed to inflation. It means that the amount of pension a person will receive in the future is directly linked to how much they have contributed to the system during

their working years. The more someone contributes, the higher their pension will be when they retire. It is indexed to inflation. It means that the pension benefits are adjusted for inflation, which means that the amount of money received in retirement will increase over time to keep up with the rising cost of living. This ensures that retirees’ purchasing power is not eroded by inflation. For Thailand, like Poland’s system, workers in Thailand are required by law to contribute to the pension system. These contributions are typically deducted from their wages, and both employees and employers are responsible for making these payments. The pension system in Thailand is managed by government bodies. These organizations are responsible for overseeing the collection of contributions and the distribution of pensions to eligible retirees. The benefits offered by this system are relatively basic and are intended to provide a minimum level of financial support in retirement. The amount paid out is usually not enough to fully replace a worker’s income, but it provides a safety net similar to social security programs in other countries. The pension payments are financed by the mandatory contributions made by

workers during their working years. This is the primary source of funding for the pensions, and the amount a person receives in retirement depends on how much they have contributed to the system. It implies that Poland's first pillar is more developed and personalized, with pensions linked to contributions and inflation adjustments. Thailand's first pillar focuses on providing basic benefits, reflecting the early stages of its pension system's evolution.

For Pillar 2: A mandatory defined contribution "second pillar" with compulsory payment, Poland involves mandatory contributions to open pension funds managed by private companies, supervised by the Polish Financial Supervision Authority (KNF). Thailand consists of government-controlled funds such as the Government Pension Fund, where private companies manage individual savings accounts. It implies that both countries aim to ensure retirement savings through compulsory contributions. Poland's approach incorporates private sector involvement with government oversight, while Thailand's system emphasizes government control with optional private management.

For Pillar 3: A volunteer-funded "third pillar" of the voluntary sector, Poland includes voluntary savings mechanisms like employee pension programs (PPE), individual retirement accounts (IKE), and individual retirement protection accounts (IKZE). Poland also offers tax incentives to encourage savings through life insurance policies and employee savings programs. Thailand encourages voluntary retirement savings with tax incentives for mutual funds, provident funds, retirement mutual funds (RMFs), and life insurance products. It implies that both Poland and Thailand provide incentives for voluntary contributions to supplement retirement savings. Poland's system is more comprehensive, with multiple programs providing for various savings preferences, while Thailand focuses on tax benefits to encourage participation.

For Pillar 4: A non-financial "fourth pillar", Poland is not applicable (n.a.). However, Thailand provides elderly access to informal and formal support systems, including reverse mortgages as a financial tool for housing security. It implies that Thailand's inclusion of Pillar 4 reflects its focus on broader support for the elderly, beyond financial measures, to ensure social and housing stability. Poland's lack of a fourth pillar highlights a more finance-oriented approach to retirement planning.

The key differences between Poland and Thailand's pension systems lie in their focus on inclusivity, structure, and sustainability. Thailand's pension system prioritizes inclusivity through non-contributory measures (Pillar 0) and non-financial supports (Pillar 4), reflecting efforts to address the needs of its rapidly aging population. These universal and informal support frameworks aim to ensure basic financial security for all seniors, regardless of their work history or income level. In contrast, Poland's pension system is primarily built on contributory mechanisms, including mandatory and voluntary pillars (Pillars 1, 2, and 3), and lacks universal or informal support frameworks. This reflects a focus on incentivizing individual contributions and linking benefits directly to prior earnings.

The structure of Poland's pension system is more sophisticated, with strong private sector involvement and personalized benefits tied to individual contributions. Private pension funds and defined contribution schemes provide more options for individuals to customize their retirement savings. On the other hand, Thailand's system is still evolving, relying heavily on government-managed programs such as the Government Pension Fund (GPF) and Social Security Fund (SSF). These programs offer fewer opportunities for individual customization compared to Poland's more diversified approach.

In terms of adaptability and sustainability, Poland's emphasis on defined contributions and private management suggests a long-term focus on ensuring financial sustainability and coping with demographic changes. Meanwhile, Thailand's approach, which incorporates universal coverage and non-financial supports, reflects an effort to address immediate needs. However, as Thailand's aging population continues to grow, these measures may face significant sustainability challenges in the future. The pension system is crucial for ensuring economic stability both now and in the future, which will be necessary for the development of an aging society, lowering inequality and poverty (International Labor Organization [ILO], 2022).

Part II: Relationship between retirement savings and economic growth in Thailand

This section corresponds to the second objective, which examines the relationship between retirement savings and economic growth in Thailand. The analysis in this part is quantitative and employs Ordinary Least Squares (OLS) regression to identify and measure the impact of retirement savings on economic growth.

Data cleaning results

The findings of the unit root test were performed using the Augmented Dickey-Fuller (ADF) method revealed that the null hypothesis could be rejected for all variables at a 95 percent confidence level. In other words, it could be concluded that our variables, which were GDP, GPF, SSF33, PVD, RMF, SSF39, SSF40, C, I, G, and NX were stationary at this level.

The Durbin-Watson test showed that the model had DW values in the range of 1.5 - 2.5, indicating that the error values for each variable were independent. This made it possible to conclude that the model did not have autocorrelation problems. From White's test, it was found that the p-values (prob. chi-square) were greater than 0.05, so the null hypothesis could be accepted. In other words, it can be concluded that the model used in the estimation did not have heteroskedasticity at a 95 percent confidence level. The test results for multicollinearity, or the checking of the relationship between independent variables by looking at the Variance Inflation Factor (VIF) of all independent variables, found that the model did not have multicollinearity. This is because no variable in the equation had a VIF value greater than 10.

Regression results

Table 5 presents the regression results. It was found that the R-squared (R^2) value is 0.79 means that the model had 79% goodness of fit. It can be stated that 79% of the GDP growth can be explained by the

Table 5 The relationship between retirement savings and economic growth in Thailand

Variable	2007-2020		
	Coefficient	t-ratio	p-value
const	0.00	-0.06	0.95
SSF33	1.44	3.06	0.00***
I	0.23	2.78	0.01***
RMF	0.21	2.92	0.01***
G	0.12	1.73	0.09*
GPF	0.08	2.48	0.02**
C	0.31	1.59	0.12
SSF39	0.09	0.56	0.58
NX	0.05	1.25	0.22
SSF40	0.00	-1.37	0.18
PVD	-0.24	-1.39	0.17
R^2	0.79		
Adjusted R^2	0.74		
P-value (F)	0.00		
F	14.75		
DW	1.64		

Source: Data of the present study, analyzed by the authors

Remark * $p < .05$ (Correlation is significant at the .05 level (2-tailed))

** $p < .01$ (Correlation is significant at the .01 level (2-tailed))

*** $p < .001$ (Correlation is significant at the .001 level (2-tailed))

independent variables included in the regression model, which made up of SSF33, I, RMF, G, GPF, and others. The regression results revealed that five variables had a statistically significant effect on GDP growth in Thailand, which were SSF33, I, RMF, G, and GPF. The relationship between them can be explained as follows.

The growth rate of Social Security Fund Article 33 (SSF33) has a positive relationship with GDP growth, which has a coefficient of 1.44. It indicates that if all other variables are kept constant, when the growth rate of SSF33 increases by 1 percent, GDP in Thailand will increase by 1.44 percent at a 99% confidence interval.

The growth rate of Private Investment (I) has a positive relationship with GDP growth, which has a coefficient equal to 0.23. It indicates that if all other variables are kept constant, when the growth rate of I increases by 1 percent, GDP in Thailand will increase by 0.23 percent at a 99% confidence interval.

The growth rate of the Retirement Mutual Fund (RMF) has a positive relationship with GDP growth, which has a coefficient equal to 0.21. It indicates that if all other variables are kept constant, when the growth rate of the RMF increases by 1 percent, GDP in Thailand will increase by 0.21 percent at a 99% confidence interval.

The growth rate of Government Spending (G) has a positive relationship with the GDP growth, which has a coefficient of 0.12. It indicates that if all other variables are kept constant, when the growth rate of G increases by 1 percent, GDP in Thailand will increase by 0.12 percent at a 90% confidence interval.

The growth rate of the Government Pension Fund (GPF) has a positive relationship with GDP growth, which has a coefficient equal to 0.08. It indicates that if all other variables are kept constant, when the growth rate of the GPF increases by 1 percent, GDP in Thailand will increase by 0.08 percent at a 95% confidence interval.

Discussion

The discussion draws on the results of Objectives 1 and 2. The results from Objective 1, which analyzed the aging situation and pension systems in Poland and Thailand through comparative analysis, and Objective 2, which examined the relationship between retirement savings and economic growth in Thailand using OLS regression, pointed out critical connections between demographic trends, pension structures, and economic outcomes.

Thailand's rapid aging poses significant economic implications. According to Objective 1's findings,

Thailand's aging population is growing at a rapid pace, with its old-age dependency ratio projected to reach 32.3% by 2030 and 54.4% by 2050. This sharp increase places significant pressure on the pension system, particularly as the majority of contributions are directed through the Social Security Fund (SSF33), the Government Pension Fund (GPF), and voluntary savings channels like the Retirement Mutual Fund (RMF). According to Objective 2's findings, the results show that retirement savings through SSF33 have the strongest positive impact on GDP growth (coefficient 1.44), followed by RMF (coefficient 0.21) and GPF (coefficient 0.08). This indicates that robust pension contributions not only provide financial security for retirees but also serve as a significant driver of economic growth through investment and capital accumulation. It implies that Thailand's rapid aging necessitates a stronger and more inclusive pension system to sustain economic growth while addressing the growing financial needs of retirees. Expanding Pillar 3 (voluntary contributions) and improving returns on Pillar 2 (mandatory savings) could enhance the role of pension funds in GDP growth.

Poland's gradual aging is managed through an advanced pension system. According to Objective 1's findings, Poland's pension system is highly structured, with significant private sector involvement and well-regulated mandatory savings (Pillar 2). The old-age dependency ratio is projected to rise to 60.8% by 2050, significantly higher than Thailand, indicating greater pressure on the working population and government subsidies to maintain the system's solvency. The implication from Objective 2, although the OLS regression focuses on Thailand, lessons can be drawn from Poland's experience. Poland's well-regulated mandatory and voluntary savings schemes contribute to economic growth. Poland's reliance on private pension funds under Pillar 2 mirrors Thailand's RMF, which encourages individual savings, can have a comparable positive impact on GDP growth, emphasizing the importance of effective regulation and savings mechanisms.

Savings play a key role in lessening aging-related economic pressures, with retirement savings acting as a stabilizer for economic growth. According to Objective 2's findings, the strong positive relationship between SSF33 and GDP growth (coefficient 1.44) in Thailand emphasizes the roles of pension contributions of providing retirement security and driving economic expansion. Similar mechanisms likely occur in Poland's

mandatory funded pillar, which relies heavily on private management and government regulates to ensure capital market stability. The growth of RMF (0.21 coefficient) and GPF (0.08 coefficient) further emphasizes the importance of voluntary and public pension funds in economic performance. These mechanisms are crucial for countries experiencing aging, as they provide financial independence for retirees while channeling funds into productive investments.

Policy implications and suggestions

To address the challenges of a rapidly aging population and socioeconomic shifts, Thailand's pension system should be strengthened and made more sustainable. Expanding coverage under Pillar 0 to provide a universal safety net for all elderly individuals will reduce dependence on informal family support. Additionally, pension funds like the Government Pension Fund (GPF) and Social Security Fund Article 33 (SSF33) should focus on improving investment strategies and returns, as their growth rates directly correlate with economic growth. Voluntary savings by implementing Retirement Mutual Funds (RMF) should be incentivized through enhanced tax benefits and public awareness campaigns. Recognizing that over half of Thai workers are in the informal economy, the pension system must be redesigned to accommodate workers with flexible employment arrangements, support labor market formalization, and encourage participation in occupational pension plans. Furthermore, increasing minimum assistance for the most vulnerable seniors and promoting retirement savings awareness will ensure long-term sustainability and improve national income security.

Poland faces significant pressures from an increasing old-age dependency ratio. To maintain financial sustainability, Poland should encourage higher contributions in voluntary-funded pillars (Pillar 3) and leverage the experience of Thailand's SSF33 and RMF to balance mandatory and voluntary savings. Expanding coverage through non-contributory measures inspired by Thailand's Pillar 0 initiatives could also provide additional support for its aging population. Strengthening private pension governance and optimizing capital allocation through mandatory and voluntary systems will enhance long-term system sustainability.

Both Thailand and Poland can learn from each other in addressing the economic and social challenges of aging populations. Poland's advanced pension

structure, with strong private-sector engagement, can inspire Thailand to improve its pension system and enhance sustainability.

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