# Determinants of Pension Fund's Required Return: A Scenario-based simulation of Civil Service Pension Fund

**Muhammad Irfan[1] and Wee-Yeap Lau[2]**

## ABSTRACT

This study examines the required return to fund a defined pension benefit of the Civil Service Pension Fund, managed by KWAP. Based on the four variables, contribution rate, retirement age, life expectancy, and length of service, this study simulates 648 scenarios of required return corresponding to the years of service and post-retirement benefits. Our findings show: First, the minimum years of service for the pension eligibility shall be increased to 20 years. Second, the Government shall increase the contribution rate to at least 13% per worker to KWAP. Third, there are no significant changes in the required rate of return even though the Government extended the retirement age from 55 to 60. Hence, extending the retirement age will not reduce the pension cost. Fourth, this study shows that the contribution period is more crucial than the post-retirement period for the Government to sustain the pension fund. Lastly, there is a need for the Government to set a minimum funding ratio for the KWAP pension fund to ensure its long-term sustainability. As a policy suggestion, the current pension fund needs refinement to ensure long-term sustainability.

**Keywords**: Public Pension; Malaysia; Investment Performance; Internal Rate of Return; Scenario Analysis; Simulation

**JEL Classification:** C32; G11; H55; H75; J32

[1] University of Malaya, Malaysia
[2] University of Malaya, Malaysia

## 1.0 INTRODUCTION

Malaysian civil servants can opt for the defined benefit pension scheme during their service with the Government. Upon their retirement, they are entitled to pension and medical benefits. This pension scheme is the government-sponsored retirement plan stipulated in the Pensions Act 1980. When the Government introduced the new salary scheme for civil servants in 2012, more than 600,000 pensioners were given a one-off pension adjustment amounting to RM600 million as stipulated by the Pension Adjustment Act 1980 (Act 238). In addition, effective from 2013, the Government has implemented an annual pension increment of 2% without waiting for any remuneration system or salary adjustment reviews.[3] Besides, the Malaysia Public Service Department Post-Service Division is assigned to facilitate civil servants' documentation before retirement.

From the legal perspective, the Retirement Fund Incorporated (KWAP) manages the civil servant pension fund. It is a statutory body governed by the Ministry of Finance to manage Malaysia's civil employees' pension scheme. On top of that, KWAP is the fund manager of the Malaysian public sector pension fund. Its role includes managing the Government's pension, future assets and liability. It also administers the payment of pensions to the public sector retirees.

Since KWAP has operated for more than 12 years, the total fund size has gradually increased. In 2007, the total fund was recorded at RM47.42 billion, and the fund was the highest, amounting to RM141 billion in 2017 before declining to RM137 billion in 2018. In 2018, the Malaysian Financial Reporting Standards (MFRS) 9 was fully adopted, replacing the existing MFRS 139 (KWAP, 2018).

In general, each retiree will receive two types of payment. The first is the monthly pension payment, and the second is the one-off gratuity upon retirement. Table 1 shows the annual growth rate of 7.6% and 14.5% for pension and gratuity payments over the last 20 years. The table shows an annual 8% increase in the Federal Government's financial obligation over pension and gratuity payments.

**Table 1: Pension Payment by the Malaysian Government from 2001-2020**

| Component | Pension Payment | Gratuity Payment | Total Benefit Paid |
|---|---|---|---|
| Average Annual Growth Rate 2001-2020 | 7.60% | 14.51% | 8.03% |

Source: Economic Unit Report, Prime Minister Department 2001–2020

Besides the government pension scheme, two prominent pension schemes in Malaysia are the Employee Provident Fund (EPF) and the Armed Forces Fund Board (LTAT). EPF manages a defined pension scheme contribution for private-sector employees. At the same time, LTAT oversees compulsory and voluntary pension contributions for non-pensionable and pensionable armed forces specific to industries. However, this study does not discuss these pension schemes

[3] http://www.jpapencen.gov.my/english/2012budget.html, accessed on 1 July 2021.

under EPF and LTAT. The private retirement scheme and the basic state scheme are also not discussed.

### 1.1 Defined-Benefit (DB) Plan

In the Defined-Benefit (DB) plan, the annuity provider must pay a specified annuity to the retirees. Benefit amounts are guaranteed regardless the retiree's DB plan is underfunded. In other words, the benefit to be paid becomes the employer's obligation irrespective of its financial condition or capacity.

Hence, the financial sustainability of the DB plan scheme refers to the annuity provider's capacity to fulfil the short-term and long-term commitments in paying pensions. The short-term commitment refers to the ability to finance the current debt to pay current pensioners by considering the current assets and liabilities. Long-term obligations, also known as implicit debt, refer to the ability to finance future pension that considers future expenditures and revenues (Barr & Diamond, 2009; Holzmann et al., 2004)

Despite the rising pension costs, the Malaysia Federal Constitution safeguards the pension system and guarantees solvency (the assets must equal liabilities) (Lee, 1997). When the pension deficit becomes too large and persists, the pension scheme becomes unsustainable, requiring reviewing and changing pension parameters to ensure sustainability. Hence, Barr & Diamond (2009) argue that any pension expenditure shall be compatible with one country's ability to finance retirees' consumption, investment return from the pension assets, and the fund manager's ability to raise revenues.

The revenues must be sufficient to cover the liabilities to ensure financial sustainability in the long run. The ability to finance future expenditures shall depend on the fund contribution, the interest earned on the assets, and the pension promises to the current and future retirees (Barr & Diamond, 2006). A pension deficit means the contribution collection and returns do not match the payments to pensions.

When a pension deficit occurs, the pension scheme becomes financially unsustainable. It thus creates a pension debt that the Government needs to finance through its revenue or by raising taxes. Some governments have responded to underfunded pensions with a wave of pension reforms that seek to limit benefits for current employees and alter the benefit structure for future employees.

Malaysia's long-term sustainability pension relies on the KWAP pension fund's ability to generate a return in paying out pensions to the present and future retirees. Nevertheless, without the employee contribution, the Government would encounter problems accumulating financial reserves for investing and getting the required returns for ongoing payments (Lee, 1997).

Currently, the public employee pension is funded by the State and Federal governments' annual contribution to KWAP. There is an ongoing issue that the pension cost has increased over many years. The retirement cost in the 2019 Federal Budget stood at 27.06 billion of the operating expenditure (OPEX)[4]. What is the ideal contribution rate from the government agencies KWAP? In addition, what is the required return from the investment undertaken by the Federal

[4] https://www.mof.gov.my/arkib/revenue/2020/section3.pdf

Government to ensure the pension fund sustainability in the long term? These questions remain unaddressed in the literature.

This next part of the paper is organised as follows. Section 2 highlights the literature, followed by the data and methodology in Section 3. Section 4 discusses the results, while the last section concludes this study.

## 2.0 LITERATURE REVIEW

### 2.1 Basic Model of Work-Leisure Choice

Economists have studied retirement patterns and trends to discover and quantify the factors influencing the retirement model for older employees. This section delves into the economic retirement models that have emerged over the last few decades.

According to traditional or neoclassical economics, individuals make choices that optimise their self-perceived well-being in light of available options. (Leonesio, 1996). Hence, individuals will attempt to make the best decision for themselves in any situation. In the face of limited resources, economics focuses on how individuals make choices to achieve their highest level of well-being.

One important set of financial decisions is how people allocate their time to work, retirement, and leisure. Time allocation is a basic understanding of economic fundamentals. Determining the financial impact includes determining what opportunities are lost when a specific course of action is taken and determining the value assigned to the best alternative that must be forsaken. The central idea behind retirement models is based on the work-leisure choice framework that could explain retirement patterns and trends (Leonesio, 1996). This model is the most basic retirement model, a straightforward application of a single-period retirement.

This idea has been discussed and addressed by developing the work-leisure choices theory to determine unique labour supply functions that best explain the work patterns discovered in the economy using statistical approaches in the fundamental empirical analysis of work behaviour.

Haworth & Lewis (2005) and Warr (1987) found that both work and leisure are essential for the well-being of an individual. They use the work-leisure model to examine the economic factors incentivising individuals to work. Financial aspects have shown a correlation to affect retirement and work choices consistently. However, these factors are sometimes overshadowed by non-economic factors such as age and health. (Leonesio, 1996)

Based on the model, the economic decision is concerned with how an individual could best allocate total available time (T) between two competing uses, the amount of time given to market work (H) and the amount of time devoted to leisure activities (L). Hence, the equation of the model as:

$$\boldsymbol{TIme\ (T) = Work\ (H) + Leisures\ (L)}$$

Hence, the person's satisfaction or well-being depends on the consumption of goods (X). A unit of (X) can be purchased at a price of (P) and the amount of leisure the person can be enjoyed; hence if the income is a dollar per hour times with time allocated to work (WH) plus for any nonwage income (V). Therefore, the budget constraint limits the individual's attainable well-being, an expression that summarises the relationship between time and income.

$$\boldsymbol{XP \leq w\,(T - L) + V}$$

Given the wage rate, the amount of money that can be spent on X could vary from a minimum of V (that is, no hours are worked) to a maximum of wT + V, the situation in which assumed leisure to be used (100% of time allocated to work). The cost of an hour of leisure is always w, the number of foregone earnings.

Hence, Leonesio (1996) explained the solution on how much time an individual can work compared to the time to leisure. The worker's labour supply function gives the key to the problem:

$$\boldsymbol{H = H(P, w, V)}$$

It explained that the number of hours to work depends on the price of consumption goods, the wage rate, and the amount of nonwage income available. The individual may choose not to work where the value of H is zero. This individual compares the real wage rate (w/P) offered by a prospective employer as less than the subjective value (w*) that the individual places on an hour of leisure. If the real wage rate exceeds the value of an hour of leisure, then well-being is improved through labour-force participation and H > 0.

With the assumption that everyone is working, a typical analysis of labour supply is more concerned with how many hours of work an individual would change in response to changes in financial circumstances and, in particular, to changes in the wage rate or income. Economic theory suggests that the increase in wage rate and probability of people working is positive. At the same time, the effect on the number of hours is still unclear. The ambiguous direction is arising because there are two opposing incentives to consider.

First, a higher wage increases the cost of consuming leisure time hours (not work). Hence increasing the substitution effect provides an incentive to work more and consume less leisure. Second, with the new income, the original number of work hours yields a higher income, enabling the individual to afford more consumption and leisure. Thus, the higher income could finance a reduction in work hours through the income effect. Whether workers' labour supply undergoes a net increase or decrease depends on which of these two opposing incentives dominates – a question that can only be answered empirically.

The theory of work-leisure choice is the basis for most labour supply research, and considerable supportive evidence has been found. In the empirical analysis of work behaviour, economists try to determine specific labour supply functions through statistical procedures that could explain the work patterns in the economy. As Haworth & Lewis (2005) mentioned, it is crucial to recognise the complexity of the relationship between well-being and social structures and cultures. Significant issues such as the relationship between paid work and the rest of life require global, national, and local perspectives in creating arrangements for satisfactory work and leisure in an agreed economic framework. Greenhaus & Parasuraman (1999) indicate that while work and family can conflict, having adverse effects on each other, they can also be integrated, having reciprocal positive effects.

Hence, a statistical labour supply function can be formulated by introducing the stochastic (that is, random) element of $\varepsilon$ into the hours of work equation discussed by Leonesio (1996). A rudimentary statistical labour supply function can thus be written as:

$$H = H(P, w, V, Z, \varepsilon)$$

Z is a set of personal attributes that could influence one's decision to work, such as age, health, or marital status.

Driffill (1980) explained that in utility-maximising models, the individual might balance gains in earnings and thus consumption obtained through training and work against the loss of leisure entailed. Again, there is a diminishing marginal rate of substitution between human capital production and earnings, obtained by various choices of the division of the market time between training and work, holding the fraction of the day devoted to leisure.

**2.2 Investment Policy**

The nature of pension funds is to decide on the best investment policy and implement those policies. Any risk taken is a cost to the fund management. Ambachtsheer (1994) has explained two implementations of choices. One is to take the lowest-risk-cost path with due diligence and prudence. In contrast, another takes the additional bundle of risks and costs, expecting that the economic payoff (additional fund return) shall be sufficient to justify the additional cost and risk assumed.

So, pension fund management involves creating one of these two relationships conceptually over time as follows:

$$\boldsymbol{Policy\ Return\ = f(policy\ risk - cost)}$$

or;

$$\boldsymbol{Policy\ Return + Additional\ Return = f(policy\ risk - cost, Additional\ Risk)}$$

The idea of investment choices is to maximise return. However, a pension fund cannot just maximise its returns using the traditional method. Chernoff (2003) explained that one way to manage a pension fund is by matching pension assets against pension liabilities. Besides providing pension liabilities to the pensioners, (Rudolf & Ziemba, 2004) argues that pension fund sponsors have the secondary goal of achieving an "earning spread" to reduce future liabilities.

For example, the Malaysia pension funds have been studied by Jidwin et al. (2012) regarding the fund selection, performance, and perception survey. The results reveal that members' experiences of investment performances and risk-taking are mixed. It is challenging for pension fund managers to fulfil a guaranteed minimum return to the contributors as they have to consider the performance return and risk perception aspects.

## 2.3 Funding Pension

There are two prominent employer-sponsored retirement plans; defined benefit (DB) and defined contribution (DC). The DB plan is the pension benefit in which the Malaysian Government guarantees pension benefits to the employee upon retirement based on the employee's final salary scale.

For the DB plan, Government as the annuity provider, shall pay a specified annuity to the retirees. The benefit amounts are guaranteed regardless the retiree's plan is underfunded. The benefit amounts are the employer's obligation, irrespective of its financial condition or capacity.

Funding pension plans means putting aside financial assets dedicated to fulfilling the promised payments in the future. The amount of money that pension and annuity providers shall allocate each year is determined by how much expenses are allocated by actuaries each year. Hence, establishing and maintaining a high level of assets relative to liabilities require fiscal discipline and many years of planning.

Martell et al. (2013) demonstrate a reciprocal relationship between the public pension fund and states' finances. Thus, any government's financial health is inextricably linked to the funding status of its DB-sponsored plans and other post-employment benefit programmes.

The funding ratio is associated with three characteristics of the plan; the time the programme is commenced, plan size, and the generosity of benefits. When the plan has started, older plans tend to have promised benefits over a more extended period without setting aside funds to fulfil the promises, which would lead to significant unfunded liability. Therefore, the older the plan, the lower the expected funded ratio.

Two funding issues have been raised: first, the stock market's collapse reduces the equity value held by the state and local plans, thus undermining the funded status of all stated and local plans. Second, many baby boomers are about to retire, which means that benefits are slated to increase sharply (Munnell et al., 2011).

One of the key concerns is how long the state and local plans can keep up with their promises. In other words, are the plans going to run out of cash? If so, when would it happen? Indeed, a retirement plan's assets to liabilities ratio illustrate how many years the plan can keep paying benefits in the event of no other investment returns, no additional contribution, and no growth in the scheme benefits. Sponsors of the plan shall continue to contribute, notwithstanding the basic ratio, to reflect the changes over time. As the baby boomers retire, there is an expectation that the plan will generate returns on assets, and the benefit payout will increase.

## 2.4 Economic Cycles and Investment Return

Since most governments, including the ones in Malaysia, participate in the DB plan, the financial conditions of the pension scheme are crucial for its long-term health. Pension fund assets and their corresponding liabilities are pro-cyclical. The scheme shall report significant positive returns when the financial market or economy demonstrates a bullish trend. During this period, the Government also can meet the required contributions.

However, most pension plans reported losses exacerbated by aggressive investment strategies during the recession. Martell et al. (2013) mentioned that the health of a pension scheme is also affected by actuarial assumptions, including the assumed investment rate of return and the extent to which gains or losses are smoothed into asset values. An actuarial analysis of the ability of the employer to pay the retirees will determine the number of funds for the state and local plans to put aside each year.

### 2.5 Asset Allocation

An asset class is a group of assets with similar investment characteristics, subject to the same regulations. Each asset class shall carry risk factors such as equity market risk, interest rates, inflation, or currency risk. Thus, portfolio weighting for an asset class helps manage the portfolio's risk exposure. Asset allocation influences the return to the retirement fund.

An optimal asset allocation is when the pension plan sponsor does the portfolio weighting dynamically. Strategic Asset Allocation (SAA) is the highest decision-making level in the investment process. Hence, Alestalo and Puttonen (2006) discuss pension fund portfolio management in two steps.

The first is when the sponsoring company identifies how broad asset classes to invest in, known as strategic asset allocation, which shall heavily affect a pension fund's performance. The asset classes include but are not limited to fixed income, equity, money market instruments, real estate, private equity, or even commodities.

The second is asset allocation implementation via internal or external fund managers. The role of fund managers is critical in selecting the right investment strategies or security processes. The sponsor shall consider the fund manager with a higher information ratio, indicating additional spread or alpha over additional unit risk.

The literature highlighted two extreme views on optimal asset allocation. From one perspective, bonds are the sole option to align assets with liabilities. At the same time, another advises that the assets shall have equity exposure. The potential asset classes include fixed income, equity, money market, and alternative investments such as real estate, private equity, and commodities. Traditionally, equity and fixed income are the main asset classes for pension funds, whereas alternative investments are growing in demand.

For example, OECD (2020) report shows that OECD pension funds are primarily invested in equities and fixed-income asset classes. 16 of 36 OECD countries have more than 75% of their pension portfolios in equities and bonds. However, Papke (1991) found that the asset allocation of the US private pension funds in terms of fixed income and equities depends on the type of employers. Single-employer plans tend to have about 60% fixed-income and 20% equity securities. The smaller single employers invest 50% and 20% in fixed-income and equity securities. They found that the equity allocation increased its share from 48% in 1991 to 57% in 2001. Blake et al. (1999) found that 300 UK pension funds have a higher equity allocation than fixed-income securities. However, this study concentrates on pension performance rather than asset allocation.

.

## 3.0 METHODOLOGY

This study uses a few assumptions from the Malaysian Public Service Department Post-Service Division to project the retirement fund. The goal is to produce a retirement fund cash flow for pensioners of Malaysia's civil servants under a few scenarios. The objective is to estimate the required return needed to sustain the retirement fund for Malaysia's civil servants.

### 3.1 Monthly Pension Payment

First, understanding the type of pension benefits offered by the Malaysian Government. The Malaysia pensionable officer who retires or is asked to retire from government service is eligible for the following pension benefits (JPA, 2021).

For a typically defined benefit pension plan, the Malaysian Government pledges a monthly pension payment according to the employee's final salary and years of service using a specific formula as follows:

$$\boldsymbol{Pension\ Payment\ (Monthly) = \frac{1}{600} \times Last\ Drawn\ Salary \times Service\ Months}$$

The formula, however, is limited to a pension of three-fifths of the last basic salary (after 30 years or 360 months of the recognised service period). In other words, the maximum number of months recognised is limited to 360 months (30 years of service). A pensionable officer who works for more than 30 years is not eligible for additional months of service in the pension calculation.

#### 3.1.2 Service Gratuity Payment

The formula is as follows:

$$\boldsymbol{Gratuity\ Payment\ =\ Last\ Drawn\ Salary \times months\ of\ reckonable\ service \times 7.5\%}$$

This one lump sum payment by the Malaysian Government to the new retirees is an appreciation for their services to the Government.

#### 3.1.3 Cash Award in place of Leave

The Malaysian Government provides for the Cash Award in place of Leave (GCR) for public service officers, resulting from the unused Leave due to service necessity, and is accumulated following the terms under pension regulations.

The provision for Cash Award in place of the Accumulated Leave came into effect on 1 January 1974 under Service Circular No. 1/1974 and is granted to the public service personnel who start to retire on or after 1 January 1974 (JPA, 2021). The formula is as follows:

$$\boldsymbol{Cash\ Award\ = \frac{1}{30} \times (Last\ Drawn\ Salary + allowances) \times Number\ of\ Leave}$$

The maximum number of days that are claimable is 120 days. However, the Malaysian Government can scrutinise and amend any mistakes in the officer leave record when approving the claim.

### 3.2 Pension-funded Ratio

The funding ratio refers to the assets to liabilities ratio. The funded pension ratio is related to the Government's fiscal health. Munnell et al. (2011) state that the funded ratio is derived as the value of pension assets divided by their liabilities. The liabilities refer to the current and future pension benefits to be paid out. Thus, the funded ratio reflects a pension fund's current financial position, expressing the balance between available assets and liabilities. In other words, if the pension fund holds enough reserves to pay out pension benefits to its current and future members, it shall have a higher pension-funded ratio and require less liability hedging (Rudolf & Ziemba, 2004).

### 3.3 Scenario Analysis

Scenario analysis is one of the methods to assess portfolio value changes in response to certain conditions. The idea is to study how the scenarios such as unfortunate events and worst-case scenarios (tail risk) influence the portfolio value. Hence, scenario analysis is proposed using the pension formula to find the required return for the civil service pension fund under a few scenarios and assumptions.

This study estimates the average investment return throughout the defined benefits period to cover future obligations under various scenarios. Figure 1 shows how the required returns are generated using different assumptions and constraints. This study has made assumptions about the input of the variables. Table 2 summarises the input range for four variables in generating the scenario-based analysis.

**Table 2: Input Range for the Variables Used in the Required Return Simulation**

| Variable | Unit | Description | Range |
|---|---|---|---|
| Contribution Rate (ContRate) | Percentage | Defined benefit contribution by the Malaysian Government based on salary per month | 5–13% |
| Average Year of Service (Length) | Years | Length of service in government sector | 10, 20, 30 and 40 years |
| Retirement Age (RetiAge) | Years | Compulsory retirement age | 55, 60 and 65 years old |
| Life Expectancy (LifeExp) | Years | The average period a person may expect to live | 75, 80, 85, 90, 95 and 100 years |

The rationale of the scenario-based assumptions:

**i. Inflation Assumption**

The inflation assumption is that every pensioner is eligible for the 2% increment for each year (JPA, 2021)

**ii. Salary Increment**

The Malaysian Government has provided a salary increment of 3% for each year starting from 2013 (JPA, 2021).

**iii. Mortality Rate**

This study ignores the table of mortality probability that projects how long civil servants will live after retirement. Life expectancy shall be considered one of the possibilities when calculating future liabilities

**iv. Optional Retirement Age**

Malaysia's pension scheme offers an optional retirement age for those who have fulfilled the criteria. However, this study may ignore the optional retirement in the calculation.

**v. Leave Claim**

This study assumes that civil servants can claim a maximum leave of 150 days.

**vi. Dependent Pension and Spouse Pension**

The pension scheme in Malaysia also extends pension benefits to deceased officer's dependants who passed away while still in the service or upon retirement. The extension benefit is known as a derivative gratuity or derivative pension. However, this study may ignore the derivative gratuity in the retirement fund calculation.

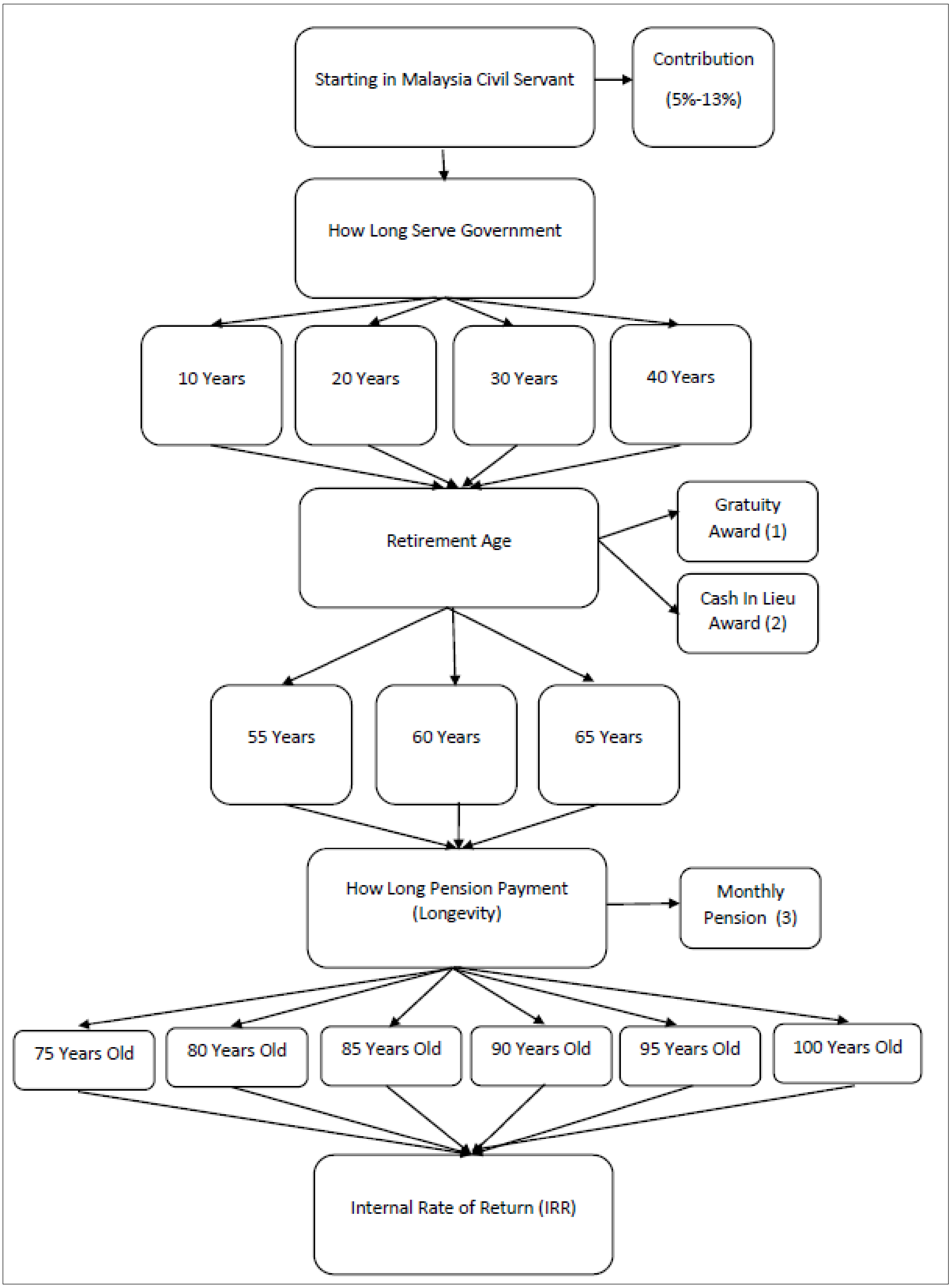


**Figure 1: Workflow of the Scenario Analysis**

Source: Authors' sketch

### 3.4 Internal Rate of Return (IRR)

This study defines the required return via the internal rate of return (IRR). IRR is a financial analysis metric to estimate a potential investment's profitability. In a discounted cash flow analysis, IRR is a discount rate that makes all cash flows' net present value (NPV) equal to zero. IRR relies on the same formula as NPV does.

Keep in mind that IRR is not the actual dollar value of the project. It is the annual return that makes NPV equal to zero. IRR is calculated using the same concept as NPV, except it sets NPV equal to zero. IRR is ideal for capital budgeting analysis to understand and compare the potential annual rate of return over time.

$$NPV = \sum_{t=1}^{T} \frac{C_t}{(1 + IRR)^t}$$

To find the right amount of return and liabilities, NPV must be equal to zero.

$$0 = \sum_{t=1}^{T} \frac{C_t}{(1 + IRR)^t}$$

Where $C_t$ denotes the cash flow at that time, t.

IRR indicates the annualised rate of return for a given investment, no matter how far into the future, and the projected future cash flow. In this study, IRR is the annual growth rate that an investment is likely to generate to ensure the fund can pay the liabilities in the future.

### 3.5 THE BEST, NORMAL, AND WORST-CASE SCENARIOS

Table 3 shows three situations that portray the best, average, and worst-case scenarios.

Table 3: Three Scenarios to be Tested

| Variables | Worst Case | Normal Case | Best Case |
|---|---|---|---|
| Contribution Rate (%) | 5% | 11% | 13% |
| Years of Service (Years) | 20 | 30 | 40 |
| Retirement Age (Years Old) | 55 | 60 | 65 |
| Longevity (Years Old) | 90 | 85 | 80 |

Consider a pension plan under three best, average, and worst-case scenarios. First, the average case is defined by assuming the contribution rate of 11% (similar to the defined contribution of EPF), 30 years of service with the Government, retirement age of 60 years, and living up to 85 years old.

The worst-case scenario represents a lower contribution rate, shorter services, earlier retirement, and higher life expectancy. However, a better scenario is anticipated with a lower required return, higher contribution rate, long years of service, and a shorter post-retirement period.

### 3.6 Regression

Besides the scenario analysis, this study attempts to model and investigate the factors influencing the retirement fund required to return in Malaysia using the ordinary least square (OLS) over 648 scenarios. A conceptual framework examines the retirement plan rate of return to fund sufficient pension liabilities in the future.

This study intends to determine the rate of return the Malaysian Government shall maintain to sustain the pension fund in the long run, as discussed in the Methodology Section.

Accordingly, the formula used is as follows:

$$\textbf{Required Return}(\textbf{IRR}) = \textbf{f}\ (\textbf{ContRate}, \textbf{LifeExp}, \textbf{Length}, \textbf{RetiAge})$$

Where:

ContRate denotes the contribution rate when the Malaysian Government puts aside a fund for the retirement fund;

LifeExp represents life expectancy for the post-retirement period;

Length means the years of service of a civil servant; and

RetiAge indicates the retirement age.

**Hypothesis:**

Based on the discussion of the model, this study aims to investigate the impact of the independent variables on the required rate of return (RRR) of the Malaysian pension fund investment. Overall, contribution rate, length of service, and retirement age shall negatively affect the required rate of return needed by the fund. However, higher life expectancy shall lead to a higher required rate of return. The hypothesis is as below:

***H1: Contribution Rate is negatively associated with the required rate of return***

***H2: Life Expectancy is positively associated with the required rate of return***

***H3: Length of Service is negatively associated with the required rate of return***

***H4: Retirement Age is negatively associated with the required rate of return***

When the contribution rate, length of service, and retirement age increase, the required return generated from the KWAP pension fund shall be lower. Hence, these three variables are expected to be negatively associated with the required rate of return (H1, H3, and H4). On the other hand, the longer the retiree's life expectancy, the required rate of return generated by the KWAP pension fund shall be higher (H2)

# 4.0 FINDINGS AND RESULTS

## 4.1 Scenario Analysis Findings

The findings of RRR are summarised in Table 4, indicating the descriptive statistics based on the simulation of the 648 scenarios. The simulation shows the required rate of return that the Malaysian pension fund needs to achieve based on the parameters set up in this study.

Table 4: Descriptive Statistics of Simulation-Based on 648 Scenarios

| Required Return | |
|---|---|
| Mean | 0.29 |
| Standard Error | 0.01 |
| Median | 0.23 |
| Mode | 0.57 |
| Standard Deviation | 0.14 |
| Sample Variance | 0.02 |
| Kurtosis | -0.59 |
| Skewness | 0.93 |
| Range | 0.46 |
| Minimum | 0.14 |
| Maximum | 0.60 |
| Sum | 186 |
| Count | 648 |

The maximum required return is 60% of the investment return throughout the policymaking. However, it is possible to generate as low as 13.75% of the required return to ensure the retirement plan sustainability. Out of the 648 scenarios, the mean of the required return is 28.70%, with a standard error of 0.55%. Based on the kurtosis and skewness, the actual return distribution is not expected since the mean, median, and mode values differ. This distribution is skewed to the left as the mode exceeds the median and mean.

Table 5, Table 6, and Table 7 show 483 scenarios that use different investment return.

Table 5: Required RRR at the Retirement Age of 55 Years

| Length of Services (Years) | Life Expectancy (Years) | Contribution Rate by the Government | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 5% | 6% | 7% | 8% | 9% | 10% | 11% | 12% | 13% |
| 10 | 75 | 59.9198% | 56.9996% | 54.5653% | 52.4824% | 50.6648% | 49.0546% | 47.6108% | 46.3034% | 45.1097% |
| | 80 | 59.9203% | 57.0002% | 54.5661% | 52.4835% | 50.6662% | 49.0564% | 47.6130% | 46.3060% | 45.1127% |
| | 85 | 59.9203% | 57.0002% | 54.5663% | 52.4836% | 50.6664% | 49.0566% | 47.6133% | 46.3064% | 45.1133% |
| | 90 | 59.9203% | 57.0002% | 54.5663% | 52.4836% | 50.6664% | 49.0567% | 47.6134% | 46.3065% | 45.1133% |
| | 95 | 59.9203% | 57.0002% | 54.5663% | 52.4836% | 50.6664% | 49.0567% | 47.6134% | 46.3065% | 45.1134% |
| | 100 | 59.9203% | 57.0002% | 54.5663% | 52.4836% | 50.6664% | 49.0567% | 47.6134% | 46.3065% | 45.1134% |
| 20 | 75 | 31.3712% | 30.1344% | 29.0959% | 28.2015% | 27.4165% | 26.7176% | 26.0878% | 25.5150% | 24.9899% |
| | 80 | 31.3840% | 30.1499% | 29.1141% | 28.2223% | 27.4400% | 26.7437% | 26.1166% | 25.5465% | 25.0240% |
| | 85 | 31.3876% | 30.1545% | 29.1196% | 28.2289% | 27.4477% | 26.7525% | 26.1265% | 25.5575% | 25.0362% |
| | 90 | 31.3887% | 30.1559% | 29.1213% | 28.2310% | 27.4502% | 26.7554% | 26.1299% | 25.5614% | 25.0406% |
| | 95 | 31.3889% | 30.1562% | 29.1218% | 28.2317% | 27.4510% | 26.7564% | 26.1311% | 25.5628% | 25.0422% |
| | 100 | 31.3890% | 30.1564% | 29.1220% | 28.2319% | 27.4513% | 26.7568% | 26.1315% | 25.5633% | 25.0427% |
| 30 | 75 | 22.2919% | 21.5154% | 20.8610% | 20.2956% | 19.7981% | 19.3539% | 18.9528% | 18.5871% | 18.2511% |
| | 80 | 22.3276% | 21.5556% | 20.9055% | 20.3443% | 19.8507% | 19.4103% | 19.0128% | 18.6506% | 18.3180% |
| | 85 | 22.3418% | 21.5721% | 20.9242% | 20.3652% | 19.8737% | 19.4353% | 19.0398% | 18.6796% | 18.3490% |
| | 90 | 22.3475% | 21.5789% | 20.9322% | 20.3742% | 19.8838% | 19.4466% | 19.0522% | 18.6931% | 18.3635% |
| | 95 | 22.3497% | 21.5817% | 20.9355% | 20.3781% | 19.8883% | 19.4516% | 19.0578% | 18.6993% | 18.3704% |
| | 100 | 22.3507% | 21.5829% | 20.9370% | 20.3799% | 19.8903% | 19.4539% | 19.0604% | 18.7022% | 18.3736% |
| 40 | 75 | 17.2406% | 16.6676% | 16.1835% | 15.7643% | 15.3947% | 15.0640% | 14.7649% | 14.4918% | 14.2405% |
| | 80 | 17.2936% | 16.7257% | 16.2463% | 15.8315% | 15.4660% | 15.1393% | 14.8439% | 14.5743% | 14.3264% |
| | 85 | 17.3193% | 16.7545% | 16.2780% | 15.8659% | 15.5030% | 15.1788% | 14.8858% | 14.6185% | 14.3729% |
| | 90 | 17.3319% | 16.7689% | 16.2941% | 15.8837% | 15.5225% | 15.1998% | 14.9083% | 14.6426% | 14.3984% |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 95 | 17.3380% | 16.7761% | 16.3024% | 15.8931% | 15.5328% | 15.2111% | 14.9206% | 14.6558% | 14.4125% |
| | 100 | 17.3411% | 16.7798% | 16.3067% | 15.8979% | 15.5383% | 15.2172% | 14.9273% | 14.6631% | 14.4204% |

Table 6: Required RRR at the Retirement Age of 60 Years

| Length of Services (Years) | Life Expectancy (Years) | Contribution Rate | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 5% | 6% | 7% | 8% | 9% | 10% | 11% | 12% | 13% |
| 10 | 75 | 59.9160% | 56.9944% | 54.5587% | 52.4742% | 50.6549% | 49.0429% | 47.5972% | 46.2878% | 45.0919% |
| | 80 | 59.9198% | 56.9996% | 54.5653% | 52.4824% | 50.6648% | 47.6108% | 47.6108% | 46.3034% | 45.1097% |
| | 85 | 59.9203% | 57.0002% | 54.5661% | 52.4835% | 50.6662% | 49.0564% | 47.6130% | 46.3060% | 45.1127% |
| | 90 | 59.9203% | 57.0002% | 54.5663% | 52.4836% | 50.6664% | 49.0566% | 47.6133% | 46.3064% | 45.1133% |
| | 95 | 59.9203% | 57.0002% | 54.5663% | 52.4836% | 50.6664% | 49.0567% | 47.6134% | 46.3065% | 45.1133% |
| | 100 | 59.9203% | 57.0002% | 54.5663% | 52.4836% | 50.6664% | 49.0567% | 47.6134% | 46.3065% | 45.1134% |
| 20 | 75 | 31.3212% | 30.0796% | 29.0359% | 28.1349% | 27.3437% | 26.6385% | 26.0027% | 25.4240% | 24.8930% |
| | 80 | 31.3712% | 30.1299% | 29.0959% | 28.2015% | 27.4165% | 26.0878% | 26.0878% | 25.5150% | 24.9899% |
| | 85 | 31.3840% | 30.1499% | 29.1141% | 28.2223% | 27.4400% | 26.7437% | 26.1166% | 25.5465% | 25.0240% |
| | 90 | 31.3876% | 30.1545% | 29.1196% | 28.2289% | 27.4477% | 26.7525% | 26.1265% | 25.5575% | 25.0362% |
| | 95 | 31.3887% | 30.1559% | 29.1213% | 28.2310% | 27.4502% | 26.7554% | 26.1299% | 25.5614% | 25.0406% |
| | 100 | 31.3889% | 30.1562% | 29.1218% | 28.2317% | 27.4510% | 26.7564% | 26.1311% | 25.5628% | 25.0422% |
| 30 | 75 | 22.2008% | 21.4154% | 20.7528% | 20.1799% | 19.6753% | 19.2244% | 18.8168% | 18.4450% | 18.1031% |
| | 80 | 22.2919% | 21.5153% | 20.8610% | 20.2956% | 19.7981% | 18.9528% | 18.9528% | 18.5871% | 18.2511% |
| | 85 | 22.3276% | 21.5556% | 20.9055% | 20.3443% | 19.8507% | 19.4103% | 19.0128% | 18.6506% | 18.3180% |
| | 90 | 22.3418% | 21.5721% | 20.9242% | 20.3652% | 19.8737% | 19.4353% | 19.0398% | 18.6796% | 18.3490% |
| | 95 | 22.3475% | 21.5789% | 20.9322% | 20.3742% | 19.8838% | 19.4466% | 19.0522% | 18.6931% | 18.3635% |
| | 100 | 22.3497% | 21.5817% | 20.9355% | 20.3781% | 19.8883% | 19.4516% | 19.0578% | 18.6993% | 18.3704% |
| 40 | 75 | 17.1291% | 16.5477% | 16.0561% | 15.6300% | 15.2539% | 14.9173% | 14.6125% | 14.3339% | 14.0775% |
| | 80 | 17.2406% | 16.6676% | 16.1835% | 15.7643% | 15.3947% | 14.7649% | 14.7649% | 14.4918% | 14.2405% |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 85 | 17.2936% | 16.7257% | 16.2463% | 15.8315% | 15.4660% | 15.1393% | 14.8439% | 14.5743% | 14.3264% |
| | 90 | 17.3193% | 16.7545% | 16.2780% | 15.8659% | 15.5030% | 15.1788% | 14.8858% | 14.6185% | 14.3729% |
| | 95 | 17.3319% | 16.7689% | 16.2941% | 15.8837% | 15.5225% | 15.1998% | 14.9083% | 14.6426% | 14.3984% |
| | 100 | 17.3380% | 16.7761% | 16.3024% | 15.8931% | 15.5328% | 15.2111% | 14.9206% | 14.6558% | 14.4125% |

Table 7: Required RRR at the Retirement Age of 65 Years

| Length of Service (Years) | Life Expectancy (Years) | Contribution Rate | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 5% | 6% | 7% | 8% | 9% | 10% | 11% | 12% | 13% |
| 10 | 75 | 59.8791% | 56.9494% | 54.5055% | 52.4126% | 50.5848% | 48.9643% | 47.5099% | 46.1918% | 44.9871% |
| | 80 | 59.9160% | 56.9944% | 54.5587% | 52.4742% | 50.6549% | 49.0429% | 47.5972% | 46.2878% | 45.0919% |
| | 85 | 59.9198% | 56.9996% | 54.5653% | 52.4824% | 50.6648% | 49.0546% | 47.6108% | 46.3034% | 45.1097% |
| | 90 | 59.9203% | 57.0002% | 54.5661% | 52.4835% | 50.6662% | 49.0564% | 47.6130% | 46.3060% | 45.1127% |
| | 95 | 59.9203% | 57.0002% | 54.5663% | 52.4836% | 50.6664% | 49.0566% | 47.6133% | 46.3064% | 45.1133% |
| | 100 | 59.9203% | 57.0002% | 54.5663% | 52.4836% | 50.6664% | 49.0567% | 47.6134% | 46.3065% | 45.1133% |
| 20 | 75 | 31.1557% | 29.8947% | 28.8331% | 27.9169% | 27.1112% | 26.3923% | 25.7433% | 25.1520% | 24.6089% |
| | 80 | 31.3250% | 30.0812% | 29.0359% | 28.1349% | 27.3437% | 26.6385% | 26.0027% | 25.4240% | 24.8930% |
| | 85 | 31.3712% | 30.1344% | 29.0959% | 28.2015% | 27.4165% | 26.7176% | 26.0878% | 25.5150% | 24.9899% |
| | 90 | 31.3840% | 30.1499% | 29.1141% | 28.2223% | 27.4400% | 26.7437% | 26.1166% | 25.5465% | 25.0240% |
| | 95 | 31.3876% | 30.1545% | 29.1196% | 28.2289% | 27.4477% | 26.7525% | 26.1265% | 25.5575% | 25.0362% |
| | 100 | 31.3887% | 30.1559% | 29.1213% | 28.2310% | 27.4502% | 26.7554% | 26.1299% | 25.5614% | 25.0406% |
| 30 | 75 | 21.9596% | 21.1579% | 20.4806% | 19.8942% | 19.3770% | 18.9143% | 18.4958% | 18.1135% | 17.7617% |
| | 80 | 22.2008% | 21.4154% | 20.7528% | 20.1799% | 19.6753% | 19.2244% | 18.8168% | 18.4450% | 18.1031% |
| | 85 | 22.2919% | 21.5154% | 20.8610% | 20.2956% | 19.7981% | 19.3539% | 18.9528% | 18.5871% | 18.2511% |
| | 90 | 22.3276% | 21.5556% | 20.9055% | 20.3443% | 19.8507% | 19.4103% | 19.0128% | 18.6506% | 18.3180% |
| | 95 | 22.3418% | 21.5721% | 20.9242% | 20.3652% | 19.8737% | 19.4353% | 19.0398% | 18.6796% | 18.3490% |
| | 100 | 22.3475% | 21.5789% | 20.9322% | 20.3742% | 19.8838% | 19.4466% | 19.0522% | 18.6931% | 18.3635% |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 75 | 16.8852% | 16.2908% | 15.7874% | 15.3506% | 14.9647% | 14.6188% | 14.3054% | 14.0187% | 13.7545% |
| | 80 | 17.1291% | 16.5477% | 16.0561% | 15.6300% | 15.2539% | 14.9173% | 14.6125% | 14.3339% | 14.0775% |
| 40 | 85 | 17.2406% | 16.6676% | 16.1835% | 15.7643% | 15.3947% | 15.0640% | 14.7649% | 14.4918% | 14.2405% |
| | 90 | 17.2936% | 16.7257% | 16.2463% | 15.8315% | 15.4660% | 15.1393% | 14.8439% | 14.5743% | 14.3264% |
| | 95 | 17.3193% | 16.7545% | 16.2780% | 15.8659% | 15.5030% | 15.1788% | 14.8858% | 14.6185% | 14.3729% |
| | 100 | 17.3319% | 16.7689% | 16.2941% | 15.8837% | 15.5224% | 15.1998% | 14.9083% | 14.6426% | 14.3984% |

### 4.2 Retirement Age Factor

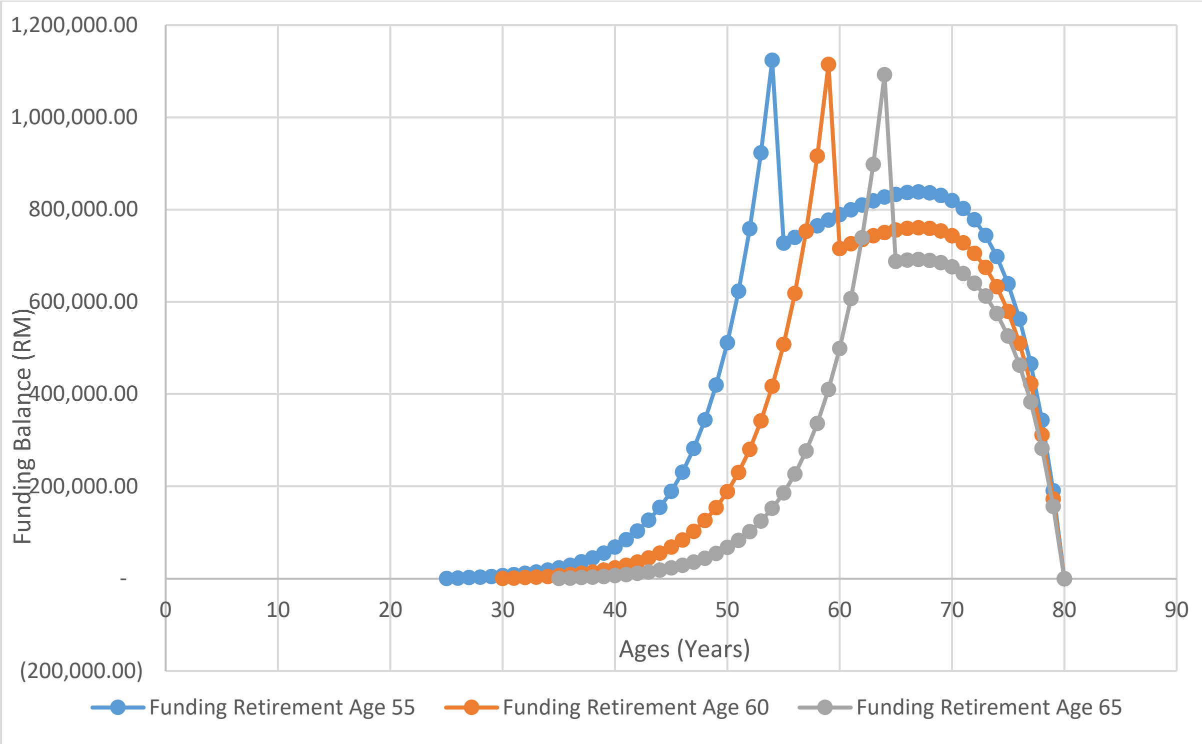


**Figure 2: Retirement Fund Balance according to the Retirement Age**

Constant Parameters: Life Expectancy – 80 Years; Contribution Rate – 5%; and Length of Service – 30 Years
Source: Author's computation

Figure 2 shows the retirement fund balance according to the retirement age. Funding at the retirement age of 55 requires a higher return rate of 21.5556%. A higher return is due to sustaining a more extended post-retirement period of 25 years compared to the retirement age of 60 years (21.5154%) and 65 years (21.4154%).

Figure 3 shows the retirement fund balance according to the contribution rate throughout the Government contribution to the retirement fund. Based on the figure, only 9% and 10% contribution is sustainable for funding a pensioner that retired at 60 years old and will die at 80 years old. However, the return is too optimistic about having 20% of the average rate of return. Hence, the study computed a few scenarios under different return rates presented below:

**Table 8: Minimum Contribution Rate according to Required Rate of Return**

| Required Return (%) | Minimum Contribution Rate (%) |
|---|---|
| 20% | 8.580% |
| 15% | 28.324% |
| 10% | 94.487% |
| 5.40% | 287.988% |

Source: Author's computation

Based on Table 8, assuming a 20% rate of return throughout the period, the minimum breakeven to cover this scenario is 8.58% of the contribution rate. The higher RRR will need a higher contribution rate. On average of 5.40%, RRR by KWAP needed the Government to contribute about 288% of the salary of civil servants for an average pensioner up to 80 years old.

### 4.3 Contribution Rate Factor

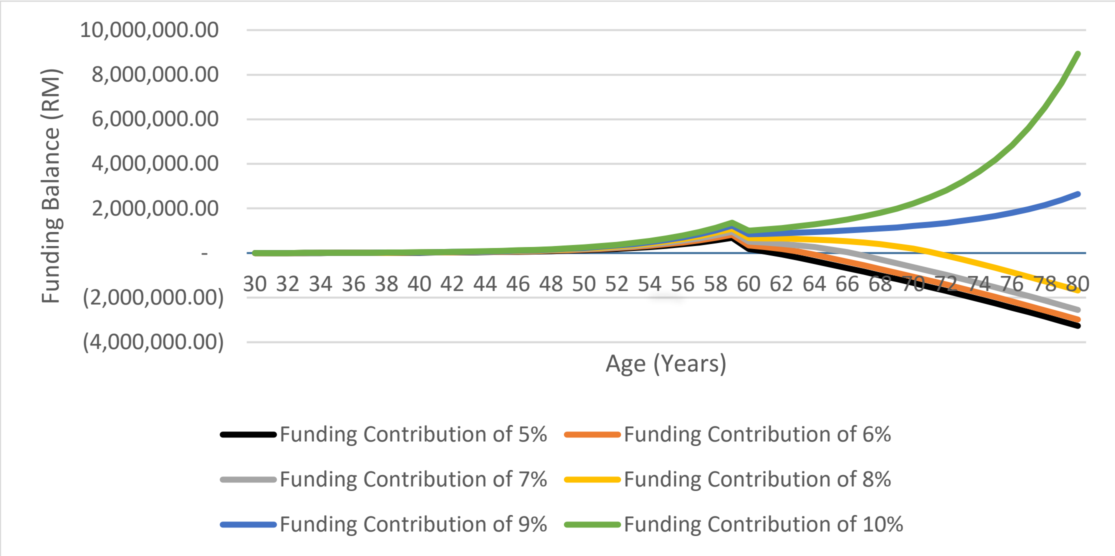


**Figure 3: Retirement Fund Balance according to the Contribution Rate**
Constant Parameters: Life Expectancy s 80 Years; Retirement Age – 60 Years; and Length of Service − 30 Years; Fund Rate of Return − 20%
Source: Author's computation

### 4.4 Life Expectancy Factor

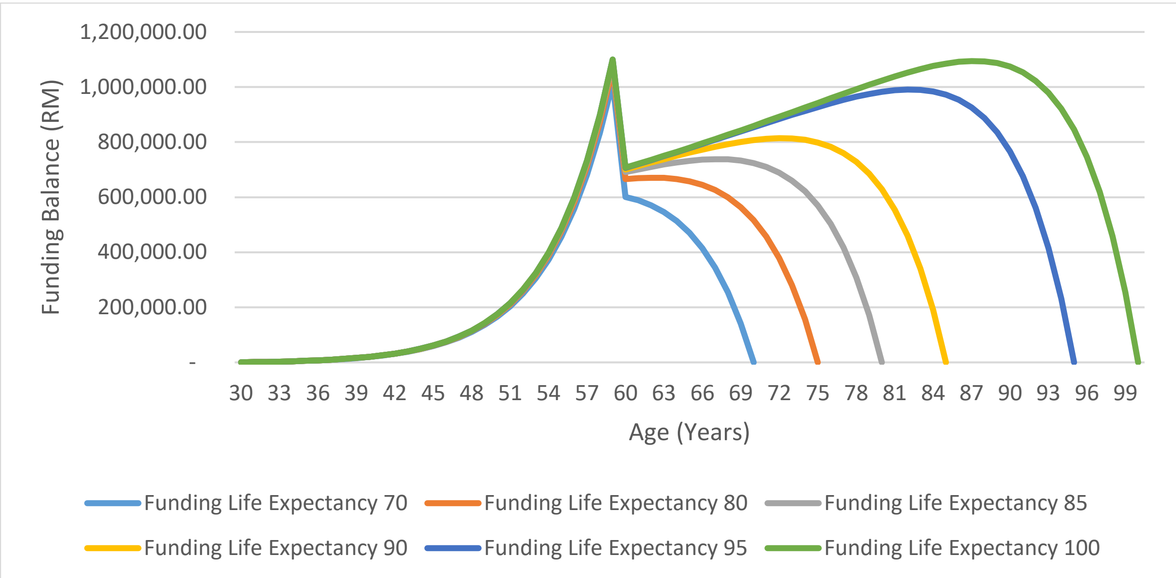


**Figure 4: Retirement Fund Balance according to the Life Expectancy**

Constant Parameters: Contribution Rate − 5%; Retirement Age – 60 Years; and Length of Service −30 Years
Source: Author's computation

Figure 4 shows the retirement fund balance according to the life expectancy throughout the Government contribution to the retirement fund. A higher life expectancy requires a higher rate of return on the fund.

**Table 9: Minimum Required Rate of Return according to the Life Expectancy**

| Life Expectancy (Years) | Minimum Required Return (%) | Minimum Contribution Rate with 20% if the return (%) |
|---|---|---|
| 70 | 21.9596% | 7.8095% |
| 75 | 22.2008% | 8.3430% |
| 80 | 22.2919% | 8.5797% |
| 85 | 22.3276% | 8.6848% |
| 90 | 22.3418% | 8.7314% |
| 95 | 22.3475% | 8.7520% |
| 100 | 22.3497% | 8.7612% |

Source: Author's computation

Table 9 shows that the minimum required rate of return does not increase much in the event life expectancy increases by five years. However, the Government needs to fund the retirement fund from its pocket higher than the minimum rate. This scenario illustrates the best case scenario, where each increase in a variable shall be supported by a higher contribution rate by the Government.

### 4.5 Length of Service Factor

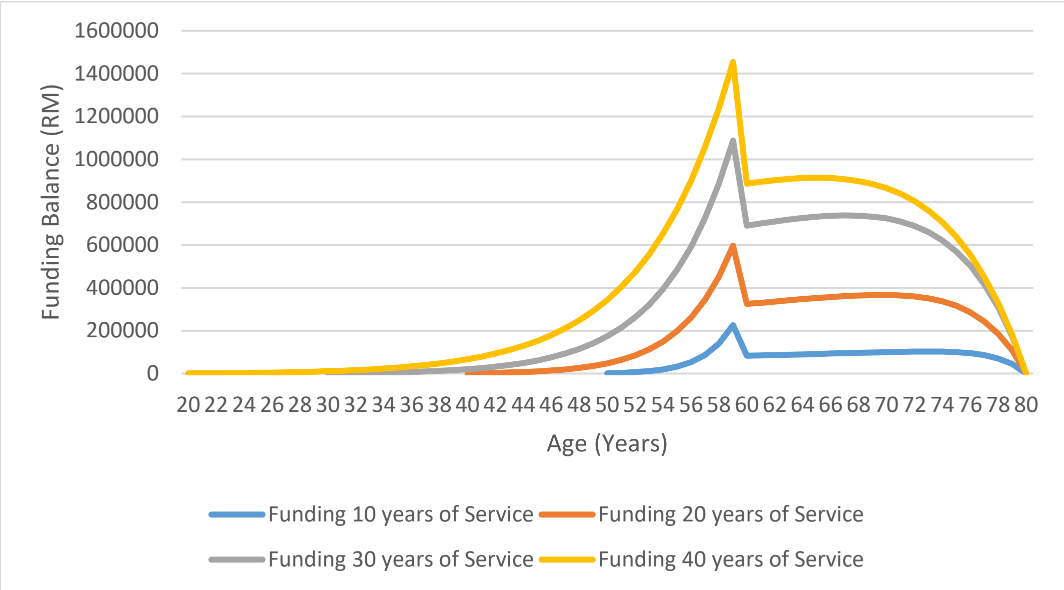


**Figure 5: Retirement Fund Balance according to the Length of Service**

Constant Parameters: Contribution Rate – 5%; Retirement Age – 60; and Life Expectancy – 80 Years
Source: Author's computation

Figure 5 shows that long years of service result in a higher retirement fund balance. A higher fund balance shall require a lower minimum return to generate profit in sustaining the plan for an extended period.

### 4.6 The Best, Normal, and Worst-Case Scenarios

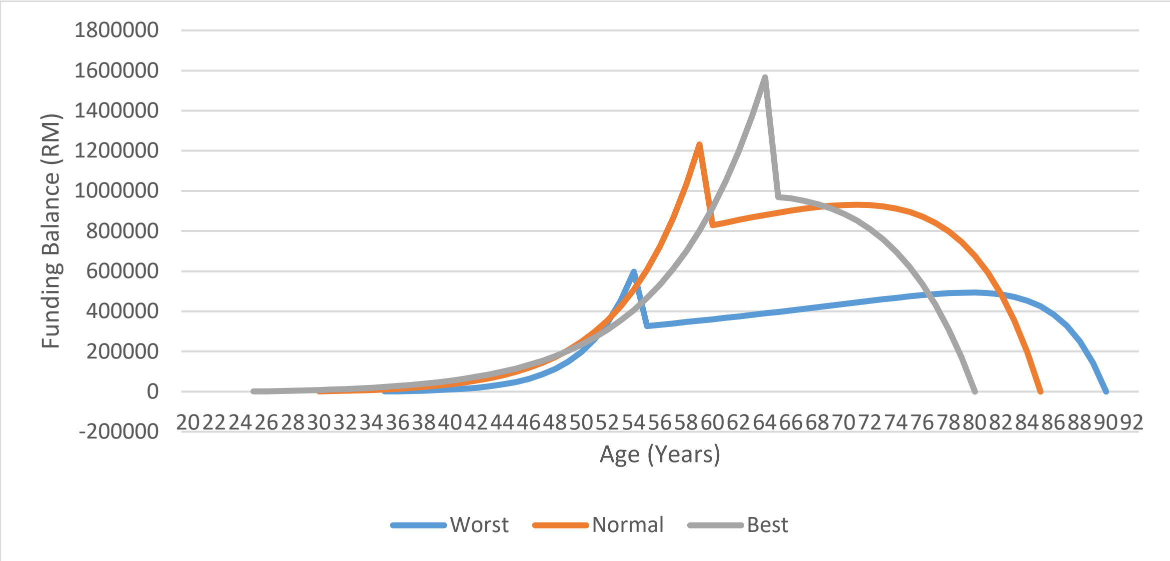


**Figure 6: Retirement Fund Balance according to the Best, Normal, and Worst-Case Scenarios**

Source: Author's computation

**Table 10: Minimum Required Return for Each Scenario**

| Scenario | Minimum Required Return (%) |
|---|---|
| Worst | 31.390% |
| Normal | 19.010% |
| Best | 14.080% |

Source: Author's computation

Figure 6 shows the retirement fund balance with different scenarios mentioned in the methodology section. The best-case scenario requires an extended contribution period (longer years of services) and a shorter post-retirement period (disbursement period). The lowest minimum required rate of return shall be 14.08%, as shown in Table 10. However, the worst-case scenario with a shorter contribution period and more extended post-retirement period will result in a 32.4% required rate of return.

### 4.6 Regression Analysis

Based on 648 scenarios generated, this study has run the regression analysis to model the required rate of return based on the independent variables.

**Table 11: Regression Analysis of the Required Rate of Return**

| Independent Variable | Model: Required Return (Dependent Variable) | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| ContRate (-) | -0.8631<br>(0.21) | -0.8631**<br>(0.00) | -0.8631**<br>(0.00) | -0.8631**<br>(0.00) |
| LifeExp (+) | 0.0001<br>(0.76) | -<br>- | 0.0001<br>(0.76) | -<br>- |
| Length (-) | -0.0115**<br>(0.00) | -0.0115**<br>(0.00) | -0.0115<br>(0.00) | -0.0115**<br>(0.00) |
| RetiAge (-) | 0.0001<br>(0.86) | -0.0001<br>(0.8626) | | -<br>- |
| Constant | 0.6511**<br>(0.00) | 0.6577**<br>(0.00) | 0.6459**<br>(0.00) | 0.6524**<br>(0.00) |
| Adjusted R-squared | 0.8606 | 0.8607 | 0.8608 | 0.8610 |
| F-statistic | 999.44 | 1334.432 | 1334.59 | 2004.65 |
| Observations | 648 | 648 | 648 | 648 |

Notes: Values in parenthesis are the p-value from the 648 scenarios generated.
** and * denote 1% and 5% levels of significance, respectively
Source: Author's computation

Table 11 shows that Model (4) is adequate to explain the required return of the Malaysian Civil Servant Retirement Fund. About 86% variation of the required return can be explained by contribution rate and length of service. The estimated model is as follows:

$$Required\ Return = 0.6524 - 0.8631\ ContRate - 0.115Length$$

**Table 12: Summary of Hypothesis Test**

| Hypothesis | Independent Variable (Expected sign) | Required Return |
|---|---|---|
| *H1* | Contribution Rate (-) | *Supported* |
| *H2* | Life Expectancy (+) | - |
| *H3* | Length of Service (-) | *Supported* |
| *H4* | Retirement Age (-) | - |

Source: Author's computation

As shown in Table 12, H1 and H3 are supported. H1 reiterates that a higher contribution rate from the State and Federal Governments to the KWAP pension fund enables the lower required return to be generated from the fund. H3 reinforces the idea that there is a need for civil servants to work longer before they can enjoy the pension benefits.

For the final part of this study, a 5-year average gross return on investment (ROI) by KWAP is used, and the trade-offs between the significant independent variables are computed as follows:

**Table 13: 5-year Average Gross Return on Investment (ROI) by KWAP**

| Return on Investment (ROI) (%) / Year | 2014 | 2015 | 2016 | 2017 | 2018 | Average |
|---|---|---|---|---|---|---|
| Net | 4.60 | 3.30 | 4.00 | 7.00 | 0.80 | 3.94 |
| Gross | 6.20 | 5.50 | 5.40 | 5.80 | 4.10 | 5.40 |

Source: Author's computation

**Table 14: Computed Contribution Rate based on Average net and Gross ROI within Five Years: 3.94% (Net ROI) and 5.40% (Gross ROI)**

| Length of Service (Years) | Contribution Rate (%) | |
|---|---|---|
| | Gross ROI | Net ROI |
| 10 | 367.62% | 441.45% |
| 20 | 323.04% | 420.57% |
| 30 | 283.92% | 400.89% |
| 40 | 201.00% | 306.45% |

Source: Author's computation

Table 13 and Table 14 show that the policymakers of the Post-Service Division need to work harder since it is impossible to contribute about 200–300% for each pensioner if the pensioners are expected to live until the age of 80 years old. If someone serves about ten years in the public sector, they are still eligible for the public pension fund. However, the Government needs to contribute about 367% of the fund to the monthly payment payable to this person during his retirement in the future. The current feature is not feasible since the government revenue is lower than the number. The number is generated based on the five-year average return of the KWAP fund between 2014 and 2018.

## 5.0 CONCLUSION

Malaysia's rapidly increasing pension costs raise a severe concern for policymakers and decision-makers. The result shows that the pre-retirement factors, such as contribution rate and length of service, are more crucial in lowering the required rate of return. However, the post-retirement factors, such as retirement age and life expectancy, are insignificant in determining the required rate of return.

The work-leisure model theory discussed the labour supply functions with a factor of leisure and wages that explain how long an individual should work in their career lifetime. Based on the theory, people will work if the wages exceed their needs and leisure. This theory applies to Malaysia's public servant labour supply.

The Malaysian Government needs to fund the public sector retirement scheme higher than the current contribution rate of 5%. The Government has considerable freedom to alter the contribution rate. However, the underlying principles of the amount contribution rate shall depend on the surplus or deficit of the pension fund. The accumulated pension assets must be greater than the projected liabilities. Thus, in a sense, the contribution rate can be reduced during the period of surplus. In contrast, the contribution rate can be increased when the fund is in deficit. The flexibility may be restricted due to certain constraints in the fund.

As a policy suggestion, the Government should introduce a few measures in the future:

First, the Government shall reconsider the pension eligibility based on the minimum years of service for a civil servant to participate in the pension scheme. This study recommends that only those with a minimum of 20 years of service participate in the pension scheme.

The KWAP pension fund needs 20 years before it is fully vested. The State of fully vested occurred when the fund contributed by the State or Federal Government is fully accessible by the pensioner or the beneficiary. Hence, those under 20 years of service shall participate in the Employee Provident Fund (EPF).

According to the analysis of this study, if an officer has only worked for ten years and joined the pension scheme, then KWAP needs to generate a required return of more than 50% to sustain the pension benefits to the officer. On top of that, this study found that extending the retirement age from 55 to 60 years does not reduce the required return significantly (Tables 5 and 6). In addition, the length of service or year of contribution is more important than life expectancy in the post-retirement years.

Second, the Government shall set a minimum contribution rate even if the economy is in deficit. This study recommends a contribution rate of 13% based on the 648 simulated scenarios. The Federal Government's current contribution rate of 5% to KWAP is insufficient. Based on the current literature, there is needed for the Malaysian Government to set a minimum funding ratio for the KWAP pension fund for its long-term sustainability.

## 6.0 REFERENCES


Alestalo, N., & Puttonen, V. (2006). Asset Allocation in Finnish Pension Funds. Journal of Pension Economics and Finance, 5(1), 27-44. https://doi.org/10.1017/S1474747205002295
https://doi.org/10.1017/S1474747205002295

Ambachtsheer, K. P. (1994). The Economics of Pension Fund Management. Financial Analysts Journal, 50(6), 21-31. https://doi.org/10.2469/faj.v50.n6.21
https://doi.org/10.2469/faj.v50.n6.21

Barr, N., & Diamond, P. (2006). The Economics of Pensions. Oxford Review of Economic Policy, 22(1), 15-39. https://doi.org/10.1093/oxrep/grj002
https://doi.org/10.1093/oxrep/grj002

Barr, N., & Diamond, P. (2009). Reforming Pensions: Principles, Analytical Errors and Policy Directions. International Social Security Review, 62(2), 5-29.
https://doi.org/10.1111/j.1468-246X.2009.01327.x
https://doi.org/10.1111/j.1468-246X.2009.01327.x

Blake, D., Lehmann, B. N., & Timmermann, A. (1999). Asset Allocation Dynamics and Pension Fund Performance. Journal of Business, 72(4), 429-461.
https://doi.org/10.1086/209623
https://doi.org/10.1086/209623

Chernoff, J. (2003). Asset Liability Management back with A Twist. Pensions and Investments.

Driffill, E. J. (1980). Life-Cycles with Terminal Retirement. International Economic Review, 45-62.
https://doi.org/10.2307/2526239

Greenhaus, J. H., & Parasuraman, S. (1999). Research on Work, Family, and Gender: Current Status and Future Directions.

Haworth, J., & Lewis, S. (2005). Work, Leisure and Well-being. British Journal of Guidance and Counselling, 33(1), 67-79. https://doi.org/10.1080/03069880412331335902
https://doi.org/10.1080/03069880412331335902

Holzmann, R., Palacios, R., & Zviniene, A. (2004). Implicit pension debt: issues, measurement and scope in international perspective. 0403, 38.
http://documents.worldbank.org/curated/en/947731468762352221/Implicit-pension-debt-issues-measurement-and-scope-in-international-perspective

Jidwin, A. P., Ali, R., & Tuyon, J. (2012). The Malaysian Employees Provident Fund's Members' Investment Scheme: Survey of Fund Selection, Performance and Perceptions. Management, 1(9), 31-43.

JPA. (2021). Malaysia Pension Scheme. Bahagian Pasca Perkhidmatan. http://www.jpapencen.gov.my/english/pension_scheme.html

KWAP. (2018). KWAP Annual Report 2018. KWAP Website, 86(3), 64-65. https://www.kwap.gov.my/EN/UsefulInformation/Publication/Annual Reports/KWAP Annual Report 2018.pdf

Lee, K. C. (1997). The Malaysian Government Pension Scheme. Whither Is Its Future Direction ? Jurnal Ekonomi Malaysia, 31, 87-106.

Leonesio, M. V. (1996). The Economics of Retirement: A Nontechnical Guide. Social Security Bulletin, 59(4), 29-50.

Martell, C. R., Kioko, S. N., & Moldogaziev, T. (2013). Impact of Unfunded Pension Obligations on Credit Quality of State Governments. Public Budgeting and Finance, 33(3), 24-54. https://doi.org/10.1111/j.1540-5850.2013.12013.x https://doi.org/10.1111/j.1540-5850.2013.12013.x

Munnell, A. H., Aubry, J. P., & Quinby, L. (2011). Public Pension Funding in Practice. Journal of Pension Economics and Finance, 10(2), 247-268. https://doi.org/10.1017/S1474747211000126 https://doi.org/10.1017/S1474747211000126

OECD. (2020). Pension Funds in Figures 2020. Oecd, June, 1-5.

Papke, L. E. (1991). The Asset Allocation of Private Pension Plans. https://doi.org/10.3386/w3745

Rudolf, M., & Ziemba, W. T. (2004). Intertemporal Surplus Management. Journal of Economic Dynamics and Control, 28(5), 975-990. https://doi.org/10.1016/S0165-1889(03)00058-7 https://doi.org/10.1016/S0165-1889(03)00058-7

Warr, P. (1987). Work, Unemployment, and Mental Health. Oxford University Press.