Analysis of the Effect of Pre-Retirement Withdrawals: VBA Simulation

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Abstract — **Malaysia's trajectory towards becoming an aging nation, coupled with the current healthy life expectancy (HALE) and overall life expectancy, has caused the population to face a higher risk of inadequate retirement income. Private sector workers are obligated to save through the Employees Provident Fund (EPF). However, recent pre-retirement withdrawal policies during the COVID-19 pandemic have raised concerns about future retirement income adequacy. This study simulated accumulated EPF values for SPM and Degree holders, analysed withdrawal effects, determined the income adequacy ratio using replacement rates, and identified poverty status among retirees using VBA Excel. While Degree holders demonstrated the highest savings and expected retirement income, SPM holders had higher replacement rates. Pre-retirement withdrawals had a greater impact on SPM holders due to their lower accumulated value at retirement. According to the scenarios simulated, the highest reduction is 26.76 percent for SPM and 20.85 percent for Degree. Even though none of the analysed scenarios resulted in income during retirement being lower than the poverty line income, they may have a high chance of facing insufficient income for a comfortable retirement year. Hence, policymakers should carefully monitor, control, and plan available and future pre-retirement withdrawal policies, as increased withdrawals can shift retirees' situations from adequate to inadequate retirement income.**

Keywords — **Employees Provident Fund (EPF); Pre-retirement withdrawals; COVID-19 Withdrawals; Retirement Income; Replacement Rates; Simulation**

I. INTRODUCTION

The first case of COVID-19 was discovered in Wuhan, China, on 31st December 2019 (WHO, 2020), and medical experts around the world initially called it 'pneumonia of unknown cause'. According to the World Health Organization, pneumonia is a quick-developing respiratory infection that affects the lungs (WHO, 2023). This virus, which originated from Wuhan, has spread all over the world, including Malaysia, and it has caused concern in every country as COVID-19 is a deadly disease, and there is still no cure. In response to the

deadly pandemic, the Malaysian government enforced three phases of Movement Control Order (MCO) to contain its spread. The first phase was implemented from 18th March to 3rd May 2020, the second phase was implemented from 13th January to 4th March 2021, and the third phase was implemented from 1st June to 14th June 2021 (DOSM, 2021b).

The Movement Control Order has had a huge impact on the Malaysian and global economy. Businesses are forced to shut down and people are obligated to stay at home according to the government ruling. Thus, demand for goods and services decreases, resulting in lower production and employment. It

also has a negative impact on trade. The volume of trade is declining as countries close their borders and restrict travelling. Hence, it is difficult for businesses to receive goods and services they need from other countries.

The Malaysia National Bank reported that Malaysia's gross domestic product (GDP) contracted by 5.6 percent in 2020, the worst performance since 1998 (BNM, 2021). Companies recorded a large drop in profits, while the labor market weakened due to high unemployment rates and low-income levels. Losing a job at a critical moment and for an extended period of time can lead to insufficient savings to cover the cost of living. During COVID-19, some Malaysians, especially those from the B40 and M40 groups, faced financial difficulties. As proven, 20 percent or about 600,000 Malaysian households were pushed out of the M40 group into the B40 group due to the pandemic (DOSM, 2021a).

According to the Employees Provident Fund Act 1991, employers and employees are required to make forced savings by contributing a fixed percentage of their monthly salaries to the Employees Provident Fund (EPF). The purpose of these savings is to serve Malaysian workers a safety net during their later years. Therefore, it is not surprising that every working person who faces financial hardship during the pandemic or has run out of savings to live sees EPF withdrawals as a last resort to survive.

EPF members are allowed to withdraw their savings for several reasons, such as housing, education, medical expenses, and Hajj (Mohd Jaafar et al., 2021). However, withdrawal for other purposes is not allowed during employment. EPF is a vital source of income for many workers in their old age. Although some withdrawals are allowed, they indirectly affect the accumulated amount in the fund, thus resulting in a lower retirement income in the future. Even more new pre-retirement withdrawals are allowed during the pandemic. Thus, this study focuses on investigating the effect of pre-retirement withdrawals, including the withdrawals allowed during the pandemic.

Malaysia is now on a trajectory to become one of the ageing countries in the world, such as the United States and Japan. The elderly population in Malaysia is expected to grow from 7 percent of the total population in 2020 to over 20 percent in 2056 (The World Bank, 2020). Long life expectancy is often associated with post-retirement income sufficiency, as it is crucial to maintain a decent quality of life during later years. This is particularly true as older people typically require additional care and expenses for their health (Md Yusuf et al., 2014). Elderly people are more susceptible to illness than young people due to their low immune systems. As a result, due to their weakened immune systems, elderly individuals often need to allocate more funds towards maintaining a healthy diet and covering the costs associated with medical treatment if they become ill.

Hence, retirement savings are crucial for individuals, especially in an ageing nation where older people require additional healthcare and financial support. During the Movement Control Order (MCO), due to the COVID-19 pandemic, the Malaysian government introduced several EPF withdrawal programs, including i-Sinar, i-Lestari, and i-Citra. These programs are provided to Malaysians with the opportunity to withdraw funds from their EPF accounts without any penalty. The maximum amount of withdrawals allowed for i-Sinar, i-Lestari, and i-Citra is RM60,000, RM6,000 and RM5,000 respectively. These measures were established to alleviate the financial burden of affected families and stimulate the economy. Without these programs, families from low and middle-income backgrounds would have suffered, as many had lost their sources of income.

Based on previous research before COVID-19 hit, it is also reported that 68.2 percent and 18.2 percent of female and male respondents aged 60 and above are poor (Masud & Zainalaludin, 2018). Thus, the COVID-19 pandemic has exacerbated the already worrisome problem of inadequate retirement savings in Malaysia. According to EPF Corporate Affairs Department (2021), it is reported that the amount of savings that are released during the pandemic has resulted in a total of 6.1 million members now having less than RM10,000 in their accounts. On another report, This is a serious concern as COVID-19 EPF withdrawals provided short-term financial relief. Frequent and large withdrawals can hinder the long-term accumulation process and jeopardize the retirement income later. This is because saving is a crucial component of securing financial sufficiency and sustainability beyond one's working years (Mohd Jaafar et al., 2021). Therefore, significant and frequent withdrawals should be avoided as they undermine the objective of EPF.

Even though many are aware of the issue that early EPF withdrawals would lead to insufficient retirement income, are they aware of how much reduction has resulted after all withdrawals made before and during the pandemic? Do retirees fall into poverty during retirement years after withdrawals are made? Hence, the purpose of this study is to simulate the accumulated value and the effect of withdrawals towards EPF funds using VBA specifically for SPM and Degree qualifications, to determine the replacement rates (RR) for all scenarios, and to identify the poverty status among retirees in Malaysia.

II. LITERATURE REVIEW

A. Employees Provident Fund (EPF)

In Malaysia, The Employees Provident Fund (EPF) is an institution dedicated to safeguarding employees' financial well-being by offering retirement benefits, savings programs, and financial security. This organization was established in 1951 and is currently known as the 12th largest pension fund in the world (EPF, 2021). The EPF Board is in charge of managing funds in EPF under the direction of the Ministry of Finance (MOF). EPF functions by gathering a specific portion of an employee's monthly salary, contributed jointly by both the employee and the employer.

EPF is compulsory for all employees in Malaysia from the private sector and non-pensionable public sector. As a result, EPF has 15,217,902 members in total and 7,691,973 members are active members that contribute monthly salary to the fund (EPF, 2021). The current contribution rate for members under the age of 60, earning less than RM5,000, is 11 percent for employees and 13 percent for employers. On the other hand, the contribution rate for members under the age of 60, earning more than RM5,000, is 11 percent for employees and 12 percent for employers (EPF, 2023b). Employees and employers have the freedom to go beyond the required contributions to the EPF if they wish, as long as they meet

certain criteria. This means they can voluntarily contribute more towards their savings, giving them the opportunity to have an even stronger financial foundation for their future.

According to EPF (2023), the funds collected by the EPF are credited to an individual employee's EPF account. Hence, it will be divided into two accounts: Account One and Account Two. Seventy percent of the monthly contribution is credited to Account One, while thirty percent of the monthly contribution is credited to Account Two. These funds accumulate over the employee's working life and generate interest based on yearly declared dividends. EPF strives to at least give its members a 2.5 percent nominal dividend on a yearly basis. In 2022, EPF declared that they managed to give a 4.75 percent shariah dividend rate and a 5.35 percent conventional dividend rate (EPF, 2023a).

Even though EPF is an organization that forces Malaysians to save money for their retirement lives, it also allows its members to withdraw funds from Account Two for several reasons. For instance, withdrawals for purposes such as housing, hajj, health, and education are allowed. However, EPF members are not allowed to withdraw money from Account One before the age of 55. Account One is specifically designed for retirement saving; hence, it is not supposed to be used for other purposes as it can jeopardize the accumulation process.

B. Pre-Retirement Withdrawals

Pre-retirement withdrawals, also known as early withdrawals, are an important aspect of retirement planning that varies across countries around the world. These withdrawals allow individuals to access some portion of their retirement savings before reaching the age of retirement.

In some countries, pre-retirement withdrawals are heavily regulated and restricted. For example, in the United States, individuals under the age of 59.5 who want to withdraw funds from Individual Retirement Accounts (IRA) or retirement plans must pay an additional 10 percent early withdrawal tax unless an exception applies (Internal Revenue Service, 2022). Buying a first house and education are one of the exceptions. The aim is to discourage early access to retirement funds and ensure long-term viability.

According to Toronto-Dominion Bank (2023), in Canada, the Registered Retirement Savings Plan (RRSP) allows individuals to withdraw money tax-deferred under the Home Buyers' Plan (HBP) and Lifelong Learning Plan (LLP). For HBP, individuals can withdraw up to $35,000, and the repayment of the withdrawal begins two years after the withdrawal with a maximum repayment term of fifteen years. Besides, if eligibility criteria are met, individuals have the option to withdraw up to $10,0000 per year under LLP, with a maximum total lifetime withdrawal of $20,000.

In comparison to the United States and Canada, Thailand's system has stricter withdrawal regulations. It only allows withdrawals for two specific reasons which are termination of employment and retirement (Sobieszczyk et al., 2003). The ability to withdraw retirement savings after being terminated from employment can be a lifeline for those who are struggling to make ends meet.

EPF in Malaysia has a less strict control over the pre-retirement withdrawals. Malaysians are allowed to withdraw their EPF funds in Account Two for the 11 purposes that have been set. Housing, health, education, and hajj are some

permitted purposes by the EPF. This gives more flexibility to Malaysians, especially during unexpected situations such as the COVID-19 pandemic, where they need urgent funds to cover medical expenses if an unfortunate incident happens or when they lose their source of income but need to pay their home loan.

1) COVID-19 EPF Withdrawals: The COVID-19 pandemic has disrupted lives and economies worldwide, leaving many individuals and families struggling with financial challenges. Governments around the world, such as New Zealand, Australia, Mexico, and Peru, including Malaysia, have implemented policies that permit their citizens to withdraw funds from their personal retirement accounts (OECD, 2020). Previous studies have shown that economic disturbances could significantly influence the choice of families to access their retirement funds (Argento et al., 2013).

Firstly, the Ministry of Finance (MOF) introduced the i-Lestari withdrawal facility on the 1st April 2020 for EPF members who require financing for the purposes of sustainable living during the COVID-19 crisis (EPF, 2021). i-Lestari is only applicable to EPF members aged under 55 years old. This withdrawal facility utilizes funds from each individual Account Two. Thus, applicants are required to have some savings in that account. Payment for i-Lestari withdrawals is issued on a monthly basis, with the amount ranging from a minimum of RM50 to a maximum of RM500 per month based on the amount requested by the member. However, if the amount requested exceeds the balance savings in Account Two, the amount of the withdrawal for the month will be based on the available balance in Account Two. The last monthly payment for i-Lestari was in March 2021. Therefore, if the first payment starts in April 2020, members will receive a total of 12 monthly payments. On the other hand, if the first payment takes place in September 2020, the numbers of monthly payments are limited to 7 months. Due to this withdrawal allowance, it is reported that a total amount of RM20.81 billion was withdrawn from i-Lestari in the year 2020 and 2021 (EPF, 2020, 2021).

During the i-Lestari withdrawal period, on 1st January 2021, MOF introduced another EPF withdrawal facility which is called i-Sinar (EPF, 2021a). The objective of the i-Sinar facility is to provide financial assistance to EPF members who need funding to boost their income in order to cope with the challenges posed by COVID-19 and ensure their survival. Unlike i-Lestari, which withdraws savings from Account Two, i-Sinar allows EPF members to withdraw from their Account One. In the beginning, there were only 2 categories of members who were eligible for this facility. However, according to EPF (2021b), Minister of Finance, Tengku Datuk Seri Zafrul Tengku Abdul Aziz removed the i-Sinar facility criteria in order to help more members with financial relief. i-Sinar withdrawals are limited to 6 times, and the amount of withdrawals depends on the members' savings in their Account One. For members with RM100,000 and below in Account One, they are allowed to withdraw at a maximum of RM 30,000 with the first payment up to RM5,000. Furthermore, members who have above RM100,000 in Account One are allowed to withdraw a maximum of RM60,000. This facility was open for application from 1st January until 30th June 2021. As reported by the EPF (2021a), the number of i-Sinar applications reached

6.57 million, with an amount disbursed of RM58.69 billion in 2021.

After the end of the i-Sinar facility period, to cater to the needs of members impacted by the MCO and assist them in meeting their essential survival requirements, another financial facility named i-Citra was introduced. This facility was open for application from 12th July 2021 until 30th September 2021 to EPF members aged 55 and below who have a minimum savings amount of RM150. Members can withdraw up to RM5,000 under this facility with 5 monthly payments. The maximum amount allowed to withdraw per month is RM1000, while the minimum amount is RM50. i-Citra is unique as withdrawals utilized funds in Account Two. Funds in Account One will only be used if the amount in Account 2 is insufficient. According to EPF (2021a), the number of i-Citra applications reached 5.15 million, with an amount released of RM21.29 billion.

Moreover, EPF members are allowed to apply for all three facilities, which are i-Lestari, i-Sinar, and i-Citra if they are eligible. There is no obstacle to apply for all three facilities as long as the members have sufficient funds in their EPF account. However, members need to maintain a balance of at least RM100 in their Account One to continue enjoying the benefits of being an EPF member. However, with only RM100 left in the fund, would it result in an adequate retirement income?

C. Measurement of Adequacy for Retirement Income

One crucial aspect of retirement planning is determining the adequacy of income to sustain a comfortable lifestyle. Assessing retirement income adequacy involves examining various factors such as living expenses and healthcare costs. Elderly people usually spend more on buying nutritious food to maintain their health. Healthy life expectancy (HALE) in Malaysia shows an increasing trend from 64 in 2000 to 65.7 in 2019 (WHO, 2020). However, the recent life expectancy reported by DOSM (2022) is 73.4. Thus, Malaysians are expected to live another 7.7 years in poor health conditions. Throughout life in poor health, elderly people have to pay for medicine and treatment, which costs a lot of money. Therefore, proper retirement planning is important to make sure retirees have an adequate amount of money to take care of their health during retirement years.

Moreover, to determine an accurate measure of retirement income adequacy, individuals have to examine their current expenses and lifestyle. This process involves visualizing how one wishes to spend their golden years. One simple question that should come to mind is: will there be travel, hobbies, or new business to pursue? Having a luxurious lifestyle during retirement, which includes activities like extensive travel and engaging in business ventures, typically incurs higher costs compared to a simpler lifestyle, where retirees spend a significant amount of time at home with their family. Therefore, retirees must determine the desired lifestyle they envision during retirement. This determination plays a vital role in assessing the adequacy of their retirement income.

Furthermore, adequate retirement income should also take into consideration the impact of inflation on expenses. Over time, the cost of living increases while retirement income usually stays constant under annuity payment. For instance, 50 years ago in Malaysia, RM1 could buy a complete breakfast meal of nasi lemak, a cup of tea, and cakes. However, the effect of inflation reduces the purchasing power of the Malaysian ringgit, making RM1 today only able to buy a cup of tea. Hence, retirees must plan their finances properly to buy basic needs and pay daily expenses, especially with the continuously increasing life expectancy and cost of living.

D. Replacement Rates

One way to gauge retirement income adequacy is by evaluating the replacement rates (RR), which compares income during the working phase to income during retirement. Income replacement rates are a widely used measure to assess how well-off individuals are in relation to their pre-retirement income after they retire (Knoef et al., 2014).

Based on previous studies, recommended replacement rates change over the years. In the year 2014, The International Labour Organisation (ILO) established a replacement rate of 40 percent of the last drawn salary as a benchmark to maintain one's standard of living after retirement. However, according to Haveman et al. (2007), it is widely recommended to have a retirement income that is equal to or greater than 70 percent of one's previous earnings to maintain pre-retirement consumption patterns.

1) Final Earnings Replacement Rates: The "final earnings replacement rates" have traditionally been the most widely used metric for assessing the sufficiency of retirement savings, with 70 percent often suggested as the recommended target (MacDonald et al. 2016). The final earnings retirement rates calculation is as follows.

$$\text{Final earnings RR} = \frac{\text{Income during retirement}}{\text{Amount of last income before retirement}} \quad (1)$$

2) Average Career Earnings Replacement Rates: According to Knoef et al. (2014), the pension system in the Netherlands aims to achieve 70 percent average career salary replacement rates starting from 2003 and onwards. The formula for average career salary replacement rates is as follows.

$$\text{Average career earnings RR} = \frac{\text{Income during retirement}}{\text{Average income during employment}} \quad (2)$$

3) Living Standards Replacement Rates: MacDonald et al. (2016) also suggested using the Living Standards Replacement Rate (LSRR) as it offers a more precise, comprehensible, and consistent measure to assess the sufficiency of retirement income. LSSR calculation is as follows.

$$\text{LSRR} = \frac{\text{Average annual retirement living standards}}{\text{Average annual working−life living standards}} \quad (3)$$

MacDonald et al. (2016) argued that 70 percent conventional RR is not an accurate measure of retirement income adequacy. Some individuals might need more than 70 percent RR to maintain their desired lifestyle, such as if they plan to travel extensively during retirement. On the other hand, some retirees may only need 40 percent RR if they are content with a more modest lifestyle (MacDonald et al., 2016). Therefore, LSRR is used to determine the amount of retirement income needed for each individual, taking into account their desired lifestyle.

E. Poverty Measurement

1) Line Income: In the realm of development economics, poverty is commonly understood as the struggle to access the necessary resources that are fundamental to achieving a decent standard of living (DOSM, 2022a). Measuring poverty in Malaysia requires a comprehensive approach that considers various indicators and factors. The Malaysian government uses the poverty line income (PLI) to assess poverty levels within the country. As per the data reported by DOSM (2022b), the present Poverty Line Income (PLI) in Malaysia stands at RM2,208 per month for households, while the PLI for the hardcore poor is RM1,169 per month per household. PLI is set differently across countries. Therefore, The World Bank set an international poverty line at $2.15 or approximately RM10 per day (The World Bank, 2023). Additionally, Sabah has the highest percentage of absolute poverty in Malaysia at 25.3 percent, followed by Kelantan with 21.2 percent and Terengganu with 12 percent (DOSM, 2021c).

It is important to note that measuring poverty is an ongoing process that requires regular monitoring and evaluation. The rate of absolute poverty also saw a rise, increasing from 5.6 percent in 2019 to 8.4 percent in 2020 (DOSM, 2021c). As economic and social conditions change, PLI may need to be adjusted to reflect current realities and ensure that efforts to combat poverty remain effective.

III. METHODOLOGY

A. Data Collection

This study depends on secondary data that are retrieved from reliable sources or websites on the internet as a basis to make a few assumptions. These include interest rates from the official website of Bank Negara Malaysia and the EPF dividend rate, employee's as well as employer's contribution rate from the official website of Employees Provident Fund. The VBA simulation uses the average dividend rate between 2011 and 2021 which is at 6.10 percent. The basis for the interest rates assumption is based on the Overnight Policy Rate (OPR) set by Bank Negara Malaysia during the post-COVID-19 era. Although the current OPR has increased to 3 percent, this research adopts a more prudent approach by maintaining the interest rate assumption at 2.75 percent to depict a higher-stress scenario. Note that the interest rate assumption is solely used to calculate the expected monthly retirement income, where the interest rate is directly proportional to the expected retirement income. Moreover, the terms and conditions of each EPF COVID-19 withdrawal are based on the report from EPF Annual Report 2021. The starting working age for SPM and Degree are 18 and 24, respectively. The mean entry-level salary in Malaysia starts at RM2,500 for degree holders (JobStreet, 2022). Individuals who started their job right after Sijil Pelajaran Malaysia (SPM) would expect the statutory minimum wage of RM1,500 per month (Attorney General's Chambers, 2022). This study assumed an annual salary increase of RM100 for SPM holders, aligned with the N19 increment by SPA (SPA, 2023b). For degree holders, it used RM300, exceeding the average SPA increment of RM225, reflecting the private sector is typically higher income compared to government jobs (SPA, 2023a).

B. Data Analysis

This study used Microsoft Visual Basic for Application (VBA) in Microsoft Excel to project the expected accumulated value in EPF. A comparison is made between scenarios with withdrawals as well as zero withdrawals to determine the changes in accumulated value and retirement income RR changes. The term life annuity formula is used in determining the monthly retirement income depending on the total accumulated value. This simulation used Mortality Table M1115 provided by the Life Insurance Association of Malaysia (LIAM, 2018). Next, monthly retirement income is compared to the income during pre-retirement using the replacement rate of 70 percent to determine the adequacy of retirement income. Poverty Line Income is used to determine whether the retirees' income will fall into poverty during retirement days. Random variables for the simulation are the type of withdrawals made, amount of withdrawals, gender, and qualifications of employees.

C. Assumptions

This study makes certain assumptions prior to estimating the projected accumulation of EPF. The assumptions in this simulation are as follows:

TABLE 1. ASSUMPTIONS FOR SIMULATION

Starting Salary	SPM	Degree
	RM1500	RM2500
Annual Salary Increment	RM100	RM300
Mortality Table	M1115	
Interest Rate	2.75%	
EPF Dividend Rate	6.10%	
Employee's Contribution Rate	11%	
Employer's Contribution Rate	13% if salary < RM5,000	12% if salary > RM5,000

The other assumption is that COVID-19 EPF withdrawals are made at the maximum amount allowed or until the EPF account is only left with RM100 in Account One. Lastly, the simulation does not take into account the aspect of taxation.

D. Withdrawals Scenarios

TABLE II. WITHDRAWALS SCENARIOS

Withdrawal A	Maximum housing withdrawal after 10 years of employment.
Withdrawal B	Withdrawal of RM15,000 for education after 23 years of employment.
Withdrawal C	Withdrawal of RM50,000 at the age of 54.
Withdrawal D	Maximum COVID-19 withdrawals starting at age 50.
Scenario 1	No Withdrawal.
Scenario 2	Withdrawal A only.
Scenario 3	Withdrawal A and B.
Scenario 4	Withdrawal A, B and C.
Scenario 5	Withdrawal A, B, C and D.

E. Calculations

1) Calculation of EPF Accumulation: To achieve the first research objective, calculation of EPF calculation is needed. Hence, to calculate the total EPF amount at retirement age, the following formula is applied.

$$\text{EPF AV at the end of the year} = \text{Employee contributions} + \text{Employer contributions} + \text{Yearly dividend} - \text{Withdrawals} \quad (4)$$

Employee and employer contribution rates are based on the assumptions outlined in Table 1. This formula incorporates all components that are available within the EPF system. Instead of calculating the accumulated value on the first day of retirement using a direct approach or a single simplified formula, this research calculates the accumulated value at the end of each year during employment to determine the total funds available in each Account One and Account Two. This method is necessary to determine the maximum amount of withdrawals allowed for each account, depending on the timing of the withdrawals. The formula is applied repeatedly until the person reaches the age of retirement.

2) Calculation of Changes in Accumulated Value: To determine the effect of withdrawals towards the EPF fund from the first research objective, the calculation of changes in accumulated value has to be performed. Hence, the following formula is applied.

$$\text{Changes in accumulated value} = \frac{AV_x - AV_1}{AV_1} \times 100 \quad (5)$$

Where,
AV_x = Accumulated value at time x

3) Calculation of Expected Retirement Income Annuity: The term life annuity formula will be used in this simulation to determine the expected monthly retirement income. This calculation is needed to determine the replacement rate later in section 3.5.4. To calculate the expected retirement income, EPF accumulated value at retirement age from the calculation in section 3.5.1 is used.

$$\text{Retirement Income} = \text{EPF Accumulated Value} \div$$

$$12 \times \left(\sum_{m=0}^{40} \left((1+i)^{-m} \, _m p_{60} \right) - \frac{11}{24} \left(1 - (1+i)^{-40} \times \, _{40} p_{60} \right) \right)$$

$$(6)$$

Where,
i = Interest rate

$_m p_{60}$ = Probability of a person age 60 to survive another m years

4) Calculation of Changes in Retirement Income: To calculate the changes in retirement income between scenarios with withdrawals and scenario 1, the following formula is applied.

$$\text{Changes in Retirement Income} = \frac{R_x - R_1}{R_1} \times 100 \quad (7)$$

where
R_x = Retirement income in scenario x

5) Calculation of Replacement Rates (RR): Final earnings replacement rates are used to calculate the replacement rates. This calculation is performed to achieve the second research objective.

$$\text{Replacement rates} = \frac{\text{Expected salary after retirement}}{\text{Amount of last salary before retirement}}$$

$$(8)$$

6) Calculation of Changes in Replacement Rates (RR): To calculate the changes in RR between scenarios with withdrawals and scenario 1, the following formula is applied.

$$\text{Changes in RR} = \frac{RR_x - RR_1}{RR_1} \times 100 \quad (9)$$

Where,
RR_x = Replacement rates for scenario x

7) Measurement of Poverty During Retirement: From the calculation in section 3.5.3, the expected salary during retirement will be calculated. Then, the expected salary is compared to the poverty line income (PLI) reported by DOSM (2022b) to identify whether the retirees would be at risk of falling into poverty during their retirement years. This will help to accomplish the third research objective. If the expected retirement income is lower than RM2208, then the individual is considered to be living in poverty during retirement years.

$$\text{Expected retirement income} = \begin{cases} R \geq RM2208, & \text{do not live in poverty} \\ R < RM2208, & \text{live in poverty} \end{cases} \quad (10)$$

IV. RESULTS AND DISCUSSIONS

The results in this section were obtained using the methodologies and assumptions made in section 3 above.

A. Withdrawals for Different Scenario

According to Figure 1, without any pre-retirement withdrawal, EPF members from the SPM group could save a total of RM1,466,983.86 through their employment, while Degree holders are able to save RM2,081,186.78. The accumulated amount for males and females is similar as this accumulation calculation method does not involve any calculation of mortality rates. In Figure 1 above, scenario 2 shows the steepest reduction in accumulated value, where the individual withdraws the maximum amount allowed after 10 years of working for housing purposes. The accumulated value of the Degree account drops from RM2,081,186.78 in scenario 1 to RM1,872,451.64 following a withdrawal of RM44,770.88 in scenario 2. Meanwhile, the SPM account's value decreases from RM1,466,983.86 to RM1,313,456.81 after a withdrawal of RM23,083.02 in scenario 2, respectively. From the graph,

compared to other withdrawals in section 3.4 (Withdrawal Scenarios), housing withdrawal after 10 years of working causes the largest reduction in accumulated value.
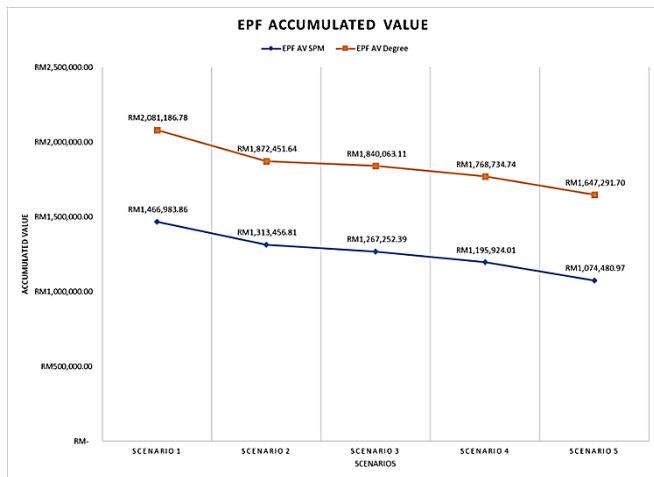

Figure 1. EPF Accumulated Value for SPM & Degree

In scenario 3, an additional withdrawal of RM15,000 is assumed to be made at the age of 41 for SPM and 47 for Degree. Assuming that the average first child is born after 5 years of working, according to a study by Peng (2002), therefore this withdrawal is assumed to be for education purposes when their children reach the age of 18. For SPM, the accumulated value falls from RM1,872,451.64 to RM1,840,063.11, while the Degree accumulated value falls from RM1,313,456.81 to RM1,267,252.39 after withdrawal of RM15,000 is made. Withdrawals under education purposes cause the smallest reduction in accumulated value.

Another withdrawal of RM50,000 at age 54 is added in Scenario 5 for both SPM and Degree groups. This withdrawal is allowed under EPF rules, as members can withdraw all savings in Account 2 between ages 50 and 54. After this withdrawal, the SPM accumulated value reduces from RM1,840,063.11 to RM1,195,924.01, while the Degree accumulated value reduces from RM1,267,252.39 to RM1,768,734.74. Although this withdrawal amount is likely larger than the housing withdrawal, it results in a smaller reduction to the accumulated value as it is made closer to retirement age, leading to a smaller compounding effect.

Scenario 5 added withdrawals allowed during the COVID-19 pandemic, which are i-Lestari, i-Sinar, and i-Citra. It is assumed that the first COVID-19 withdrawal is made at the age of 50, with the maximum withdrawal allowed. After this withdrawal, the SPM accumulated value decreases from RM1,195,924.01 to RM1,074,480.97, while the Degree accumulated value decreases from RM1,768,734.74 to RM1,647,291.70, respectively.

Once the accumulated values are projected, retirement income for both males and females can be calculated using the M1115 Table. Figure 2 shows that overall retirement income for both genders is close. However, females are expected to receive slightly lower individual income compared to males as they may receive more payments due to their longer life expectancy. This is because the total accumulated amount needs to be distributed over a potentially longer lifespan for females, resulting in smaller individual payments as compared to males.

Figure 2. Expected Retirement Income

Without any pre-retirement withdrawal, a male with an SPM qualification is expected to get a monthly retirement income of RM5,423.03. This amount reduces to RM4,855.49, RM4,684.68, RM4,421.00, and RM3,972.06 in scenarios 2, 3, 4, and 5 respectively. Without any pre-retirement withdrawal, a female with an SPM qualification is expected to get a monthly retirement income of RM5,399.12. This amount reduces to RM4,834.07, RM4,664.02, RM4,401.50, and RM3,954.54 in scenarios 2, 3, 4, and 5 respectively. Retirement income for males is slightly higher compared to males before and after withdrawals are made.

Degree holders consistently receive higher retirement income compared to their SPM counterparts. However, pre-retirement withdrawals significantly impact monthly income for both males and females. Without withdrawals, males with Degree qualifications can expect RM7,693.57 monthly, but scenarios 2 to 5 further reduced this to RM6,921.94, RM6,802.20, RM6,538.52, and RM6,089.58, respectively. Similarly, females who hold Degrees without withdrawals receive RM7,659.64 monthly, but scenarios 2 to 5 bring this down to RM6,891.41, RM6,772.21, RM6,509.69, and RM6,062.73, respectively. From the chart above, it shows that the more number and amount of withdrawals made, the lower the expected retirement income. Besides, the current poverty line in Malaysia is set at RM2,208. From the chart above, it is safe to say that even after the withdrawals are made, SPM and Degree will not live in poverty with given assumptions only.

B. Replacement Rates Analysis

Retirement income achieving a 70 percent replacement rate is generally considered adequate. While Degree holders have higher absolute retirement income, SPM individuals have higher replacement rates both before and after withdrawals. Without any withdrawals, SPM males and females have replacement rates of 96.84 percent and 96.41 percent, respectively. Although over 90 percent replacement rates seem high, it is very unlikely to be achieved, especially for the low earners who tend to withdraw their money to support house financing, medical and education expenses. Low earners are more likely to achieve a higher replacement ratio compared to high earners. This is supported by a report by the OECD (2017)

that a low-income earner in Denmark could expect to receive 123% of their pre-retirement income during retirement.

TABLE IIII. REPLACEMENT RATES

	SPM		Degree	
	Male	**Female**	**Male**	**Female**
Scenario 1	96.84%	96.41%	59.18%	58.92%
Scenario 2	86.71%	86.32%	53.25%	53.01%
Scenario 3	83.66%	83.29%	52.32%	52.09%
Scenario 4	78.95%	78.60%	50.30%	50.07%
Scenario 5	70.93%	70.62%	46.84%	46.64%

Based on the table, these rates decrease in each scenario, but they never fall below the 70 percent adequacy threshold. However, in scenario 5, they come worryingly close, with males at 70.93 percent and females at 70.62 percent. These highlight the need for SPM individuals to be especially mindful of their pre-retirement withdrawals, as even a relatively small additional withdrawal could push their replacement rate below the recommended level.

While Degree holders have higher absolute retirement income, their replacement rates without withdrawals are set at 59.18 percent for males and 58.92 percent for females, falling below the recommended 70 percent threshold for achieving a comfortable retirement lifestyle. These rates further decrease in scenarios 2, 3, 4, and 5, reaching their lowest point in scenario 5 at 46.84 percent and 46.64 percent for males and females, respectively. Replacement rates for males are slightly better than for females as male is expected to receive higher retirement income due to shorter lifespans.

These findings are consistent with those of Md Yusuf et al. (2014), who found that the female replacement rates are slightly lower than male replacement rates, SPM graduates exhibit generally higher replacement rates compared to Degree graduates, and increased withdrawals lead to a proportional decrease in replacement rates.

C. Changes in Accumulated Value, Retirement Income & Replacement Rates

TABLE IIIV. CHANGES IN ACCUMULATED VALUE, RETIREMENT INCOME & REPLACEMENT RATES

	SPM	Degree
Scenario 2	-10.47%	-10.03%
Scenario 3	-13.62%	-11.59%
Scenario 4	-18.48%	-15.01%
Scenario 5	-26.76%	-20.85%

Pre-retirement withdrawals reduce the EPF accumulated value, monthly retirement income, and replacement rates for both males and females with identical percentage reductions. In scenario 2, reductions reach 10.47 percent for SPM and 10.03 percent for Degree. These reductions steadily increase with each additional withdrawal, culminating in the largest impact in scenario 5: 26.76 percent reduction for SPM and 20.85 percent for Degree. Notably, in scenarios 2 to 5, SPM

experiences a larger percentage reduction due to their smaller accumulated value and expected retirement income.

This emphasizes the importance for SPM individuals to be particularly mindful of pre-retirement withdrawals and avoid them whenever possible to minimize their impact on their future financial security.

Figure 3 below shows that the percentage reduction for SPM for COVID-19 maximum withdrawals depends on the age of the first withdrawals. For ages 19 to 24, the reduction amount increases as the maximum withdrawal amount increases from age 19 to 24. At ages 25 to 32, the maximum withdrawal amount remains constant. Hence, the reduction depends primarily on the timing of withdrawals. Since the dividend rate is assumed to be constant, the earlier the withdrawals are made, the larger the reduction percentage due to compounding effects. As a result, the reduction percentage decreases within this age range. However, at age 33, the maximum withdrawal amount for i-Sinar increases from RM30,000 to RM60,000 as the individual starts to have RM100,00 and above in his Account One, causing a sharp increase in the reduction. Despite the constant maximum amount for ages 33 to 53, the timing of withdrawals within this range still influences the reduction percentage. Interestingly, withdrawing at the age of 33 results in the highest reduction of 22.65 percent, closely followed by age 24, even though the withdrawal amount at 24 is smaller. Moreover, withdrawals at age 53 result in the lowest reduction percentage.
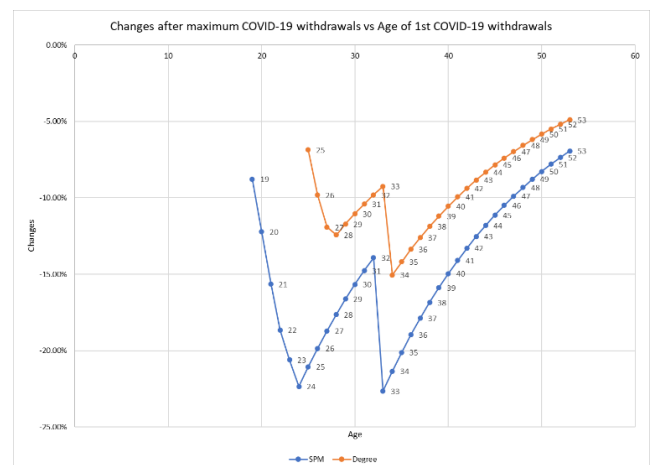

Figure 3. Changes after COVID-19 Maximum Withdrawals

Percentage reduction for Degree for COVID-19 maximum withdrawals also depends on the age of first withdrawals. For ages 25 to 29, the reduction amount increases as the maximum withdrawal amount increases from age 25 to 29. At ages 30 to 33, the maximum withdrawal amount remains constant. Hence, the reduction depends primarily on the timing of withdrawals. Since the dividend rate is assumed to be constant, the earlier the withdrawals are made, the larger the reduction percentage due to compounding effects. As a result, the reduction percentage decreases within this age range. However, at age 34, the maximum withdrawal amount for i-Sinar increases from RM30,000 to RM60,000 as the individual starts to have RM100,00 and above in his Account 1. Despite the constant maximum amount for ages 33 to 53, the timing of withdrawals within this range still influences the reduction percentage. Interestingly, withdrawing at the age of 34 results in the highest

reduction of 15.05 percent. Moreover, withdrawals at age 53 result in the lowest reduction percentage.

V. CONCLUSION

Based on the findings from the simulation, SPM holders have adequate retirement income according to their replacement rates. However, they must be aware of the serious reduction that happens after each withdrawal as it might pull them to be in the inadequate retirement income group. Policymakers also may take responsibility by tightening the terms and conditions on the amount of pre-retirement withdrawals especially for SPM holders.

For Degree qualification, the replacement rates are below the 70 percent level before and after withdrawals are made. They have inadequate retirement income to maintain their standard of living during retirement years. This issue can be solved by increasing the statutory retirement age, hence allowing employees to save more for their retirement days. A previous study from Alaudin et al. (2015) recommended increasing the retirement age in order to increase retirement sufficiency. It is also supported by Md Yusuf's (2012) study that suggested raising the retirement age to 62 years old.

The reduction that happens after maximum COVID-19 withdrawals at a certain age is significant compared to the others. It is hoped that the government could identify the affected groups and provide financial aid or alternatives to encourage them to continue compounding their savings to an adequate level before reaching retirement age. It is also hoped that employees are more aware of the amount of reduction that would later affect their retirement income if they chose to make pre-retirement withdrawals.

Moreover, since this study mostly depends on the assumptions that have been made, it is best to suggest for future studies apply stochastic process into the assumptions for a more precise result. Therefore, the yearly salary increment, interest rate, and dividend rate would depict a closer real-world scenario where the values are not constant each year, and it will give a more accurate and realistic accumulated value, retirement income, and replacement rates.

It is also hoped that future studies will develop effective strategies for affected groups to accumulate their retirement savings to achieve good replacement rates. This could be achieved by encouraging younger participants to be allowed to invest a certain percentage of their Account One funds in higher-risk assets with high upside potential, such as technology stocks, AI-related stocks, or cryptocurrencies such as Bitcoin. Even though Bitcoin is highly speculative and volatile in the short term, it offers a promising long-term investment opportunity that aligns well with retirement planning, particularly given its highest annualized return over the past 10 years compared to other major assets (Blackrock, 2024). Despite its reputation for being misunderstood and having a negative perception, the recent ETF approval adds credibility to the digital asset (SEC, 2024). Furthermore, Bitcoin's Shariah-compliant status is particularly important for Malaysian investors, who prioritize adherence to Islamic principles, ensuring both ethical alignment and potential growth for one's retirement savings (Jabatan Mufti Negeri Selangor, 2021).

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this paper.

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