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Making Sense of Anything thru Analytics: Employees Provident Fund (EPF)

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Abstract

Employees Provident Fund (EPF) has always been a hot topic, from the previous Government permitted "withdrawals" during the pandemic to the present Government disallowing further withdrawals (afraid it would lead to a financial crisis) and allowing emergency loans through an EPF collateral agreement. The latter used median studies to "contribute" MYR 500 to EPF members with less than RM 10,000 in their accounts. Baffled/bewildered by the current Government's generosity and highlighted in this paper, I used Monte Carlo simulation, a method used by analysts when determining the size of a client's portfolio to support their desired retirement lifestyle, to establish a reference-type table displaying ideal savings when reaching 50. The Government could use the table mentioned above to give more meaningful contributions to EPF members, apart from EPF active and inactive members, knowing where they stand concerning their current EPF savings.

Keywords

Employee Provident Fund (EPF), Median Savings, Dividends, Monte Carlo Simulation

1. Introduction

The purpose of EPF, established in 1951, has been to be a social security organization primarily providing retirement benefits for the private sector and non-pensionable employees in Malaysia. EPF has assets worth nearly MYR 1 trillion and over 10 million subscribers [1].

As I have mentioned, EPF is a hot topic; for example, about EPF announcing 2022 dividends of 5.35% for conventional and 4.75% for Syariah [2]. Before the eagerly anticipated announcement, members had been demanding withdrawals to repay debts and for daily expenses because of "unemployment" (and higher inflation). The previous Government permitted such withdrawals of more than MYR 100 billion during the pandemic lockdowns [3]. Due to the low dividends, some have suggested loosening the "shackles" of EPF investments. For the same reason, EPF plans to separate the investment portfolios for conventional and Syariah so that the latter could give higher dividends [4]. Examples of investment turning bad that EPF and the Government could learn from are Singapore Temasek's investment loss of SGD 377 million in the collapse of the cryptocurrency exchange FTX [5]; and Norway's sovereign wealth fund posted a record loss of USD 164.4 billion for 2022 [6].

Instead of succumbing to the demand from certain quarters and allowing another withdrawal, which the PM says may lead to a financial crisis—similar to the collapse of USA's Silicon Valley Bank and Signature Bank and Switzerland's Credit Suisse [7]—lower dividends, as well as some EPF members not having enough monies when they retire (based on the median savings studies where median savings for Bumiputera, Indian, and Chinese are MYR 4,900, MYR 14,900, and MYR 45,200, respectively, with all of them experiencing significant reduction [8]), the Government gave MYR 500 to EPF members with less than MYR 10,000 in their EPF accounts [9]. Moreover, the Government allowed emergency loans through an EPF collateral agreement, an action which some say will only increase household debt [10].

Since I am still baffled by the Government's contribution of MYR 500, I want to highlight in this paper the establishment of a reference-type table displaying ideal savings when reaching 50 derived from using a Monte Carlo simulation with the following inputs: [i] monthly expenses when reaching the retirement age of 55; [ii] no more contributions/withdrawals from EPF members after 50; [iii] depending solely on yearly dividends after 50. The Government could use the above table to give meaningful contributions to EPF members. Moreover, the above table would benefit EPF active and inactive members by knowing their position/standing concerning their current savings. The above endeavors are similar to using Monte Carlo simulation by analysts in determining the size of a client's portfolio at retirement to support their desired retirement lifestyle and other gifts and bequests.

The Monte Carlo simulation has numerous applications in finance and other fields. Zhijian He [11] studied Conditional value at risk (CVar) sensitivity estimation using Randomized Quasi-Monte Carlo (RQMC) simulation and showed that the RQMC-based estimator is strongly consistent under mild conditions. Tsviliuk *et al.* [12] developed a fast Monte Carlo-type procedure for analyzing complex systems such as those occurring in financial markets. The above "procedure" involves combining the "fast" Monte-Carlo method for one-dimensional jump-diffusion processes and the generation of correlated multidimensional variates. Acworth *et al.* [13] compared the performance of ordinary Monte Carlo and Quasi-Monte Carlo Methods in valuing moderate- and high-dimensional options. They found the Quasi-Monte Carlo Methods outperform "ordinary" Monte

Carlo, the Brownian bridge construction generally outperforms the standard "construction", and the principal components construction generally "outperforms" the Brownian bridge construction and is more widely applicable. Boyle *et al.* [14] discussed some recent applications of the Monte Carlo method to security pricing problems, emphasizing efficiency improvements. In addition, they reviewed some "useful" variance reduction methods in finance, described the use of deterministic low discrepancy sequences for the valuation of complex derivative securities, and summarized the recent applications of the Monte Carlo method to estimate risk sensitivities in the valuation of American options. Broadie *et al.* [15] proposed a hybrid valuation technique that bridges Monte Carlo simulation and lattice methods where they simulate the whole price trees. The tree emanating from each point assesses the option continuation values for the date and stock prices. In addition, the authors offered a variety of techniques to increase efficiency.

2. Monte Carlo Simulation

Monte Carlo simulation, also known as the Monte Carlo Method or a multiple probability simulation, is a mathematical technique used to estimate an uncertain event's possible outcomes. Monte Carlo techniques involve three basic steps: [i] set up the predictive model, identifying the dependent variable to be predicted and the independent variables (also known as the input, risk, or predictor variables) that drive the prediction. [ii] Specify probability distributions of the independent variables. Use historical data and/or the analyst's subjective judgment to define possible values and assign probability weights for each. [iii] Run simulations repeatedly, generating random values of the independent variables. Do this until enough results are gathered to make up a representative sample of the (near) infinite number of possible combinations.

The following assumptions were used in the Monte Carlo simulation: [i] at the retirement age of 55 with an average life expectancy of 75 [16], EPF members with MYR 240,000 worth of savings would be able to withdraw MYR 1,000 to pay monthly expenses for the next 20 years; [ii] statistically normally distributed with mean and standard deviation equal to 6.02 and 0.52, respectively, for EPF conventional dividends data [17] (the Kolmogorov-Smirnov test was used on the thirteen data points to test the normality [18]); [iii] no contributions (or withdrawals) being expected after the age of 50 (due, for example, to "unemployment"), relying (or depending) entirely on the EPF dividends until the age of 55; and [iv] most companies incorporate dividends per stock (or share), and I assume EPF is one of them. So, if you have an "x" number of "stocks" by the end of 2023 and, based on the company's 2023 financial performance, it's giving MYR "y" as a dividend for 2023, you'll get an amount represented by MYR "z", equal to MYR "y" multiplied by "x". If no spending is done on MYR "z", MYR "z" is converted into stocks (represented by "w"), you'll have "x" plus "w" "stocks" for 2024, and the calculation continues. Other companies, for example, Malaysia's Tabung Haji (pilgrimage fund) have a trickier or more complex "calculation" (because of paying "zakat" or tithe on behalf of its members). Regarding EPF conventional dividends model used in the Monte Carlo simulation, I recommend "updating" the model, especially if the future dividends behaviour differs from the current model (for example, bear markets, recessions, or any other financial crisis), because it will significantly influence the Monte Carlo simulation outcome.

One thousand simulated data were generated (representing all possible outcomes for the next five years) using the following formulas:

$$
\begin{aligned}
&s_i = \left(s_0 \Big/ \prod_{j=1}^{5}\left(1+d_{i,j}\right)\right) = i\text{-}th \text{ EPF savings generated,} \\
&i = 1,2,\cdots,1000, \\
&s_0 = MYR\ 240{,}000, \\
&d_{i,j} \sim N\left(6.02,(0.52)^2\right) = (i,\ j)\text{-}th \text{ EPF dividends generated from normally} \\
&\text{distributed with average and standard deviation equal to 6.02 and 0.52,} \\
&\text{respectively. Note that the dividends given here are in the form of percentages}
\end{aligned}
\tag{1}
$$

3. Results

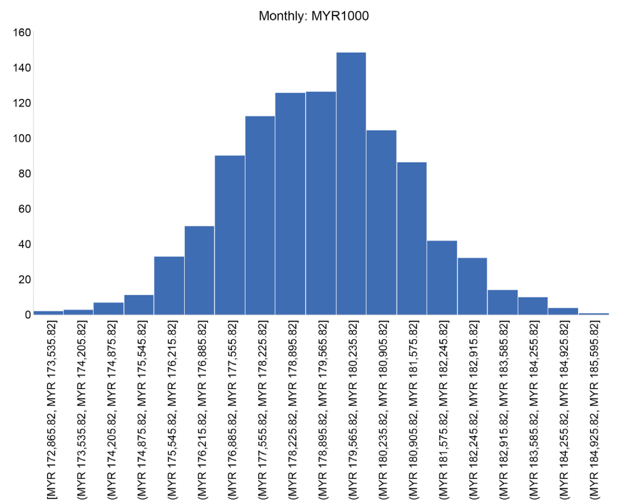
The Monte Carlo simulation results are displayed in **Figure 1(a)**, and their summary statistics are in **Table 1**'s (2nd) column titled "MYR 1,000 (MYR 240,000)". The table mentioned above shows the ideal savings for EPF members by age 50 are in the range of MYR 173K to MYR 185K, near (or equal to) the average of MYR 179K (with a standard deviation of 1,916), where the occurrences (the frequencies represented by the y-axis in **Figure 1(a)**) are high. For example, there's a better "chance" for EPF members to achieve MYR 240,000 depending solely on dividends by age 55 if savings at 50 are MYR 179K. Note that the simulated data are tested "normal" using Kolmogorov-Smirnov test, and one of the "normal" essential/important properties is that average is the same as the median and mode. Since the simulated data is proven "normal", the better "chance" mentioned above refers to "probability" equal to 0.5. If one chooses a maximum or minimum value, the probability of the maximum is equal to 0.0013 and the minimum equal to 0.00045. Hence the chances for the said choices are considered "slim".

The same assumptions and argument (as well as Equation (1) by replacing the value of s_0) are relevant and used for monthly MYR 2000 (MYR 480,000), MYR 3000 (MYR 720,000), MYR 4,000 (MYR 960,000), and MYR 5,000 (MYR 1.2 million) as well, as depicted in **Figure 1** ((b), (c), (d), and (e)) and **Table 1** (3rd, 4th, 5th, and 6th columns). As highlighted in the news articles, a single adult by age 55 would require MYR 2700 to pay monthly expenses; a couple without children would require MYR 4500; and a couple with two children would need MYR 6500 [19]. Hence, the above news articles could be used as a guideline when choosing histograms and summary statistics in **Figure 1** and **Table 1**, respectively.

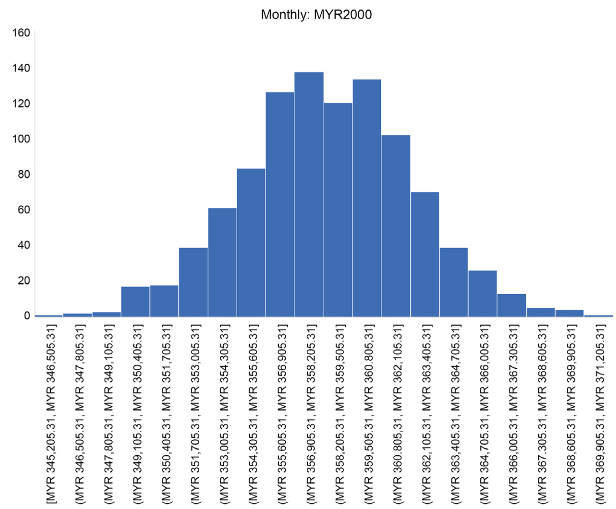
Table 1. Monte Carlo simulation result's summary statistics for MYR 1000, MYR 2000, MYR 3000, MYR 4000 and MYR 5000.

Monthly (Monthly × 12 months × 20 years)	MYR 1000 (MYR 240,000)	MYR 2000 (MYR 480,000)	MYR 3000 (MYR 720,000)
Minimum	MYR172865.82	MYR345205.31	MYR515861.04
Average	MYR179229.31	MYR358378.28	MYR537501.01
Standard Deviation	1915.79	3801.29149	5956.217256
Maximum	MYR185003.92	MYR370502.87	MYR555877.95

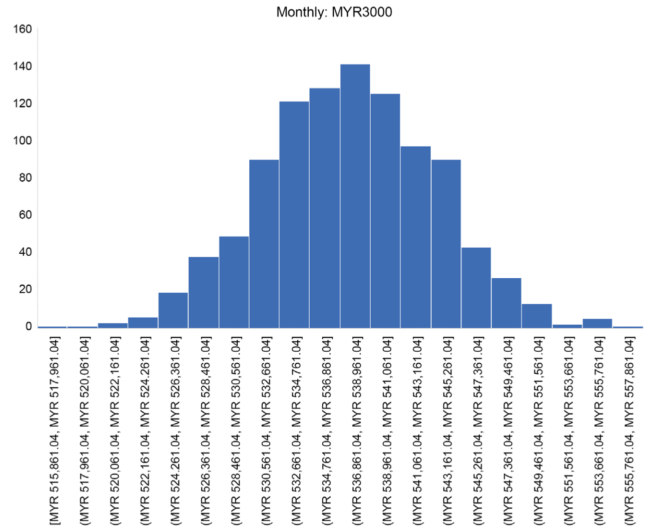
Monthly (Monthly × 12 months × 20 years)	MYR 4,000 (MYR 960,000)	MYR 5,000 (MYR 1,200, 000)
Minimum	MYR692933.28	MYR863574.44
Average	MYR716678.69	MYR895891.02
Standard Deviation	7819.020349	9340.655878
Maximum	MYR740705.60	MYR925722.64



(a)



(b)



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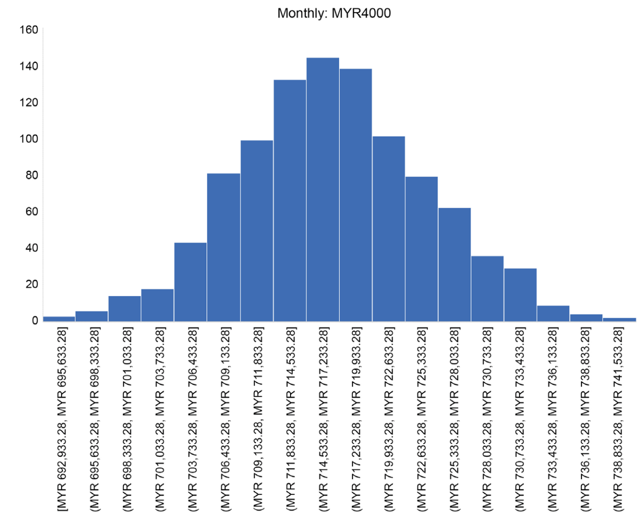

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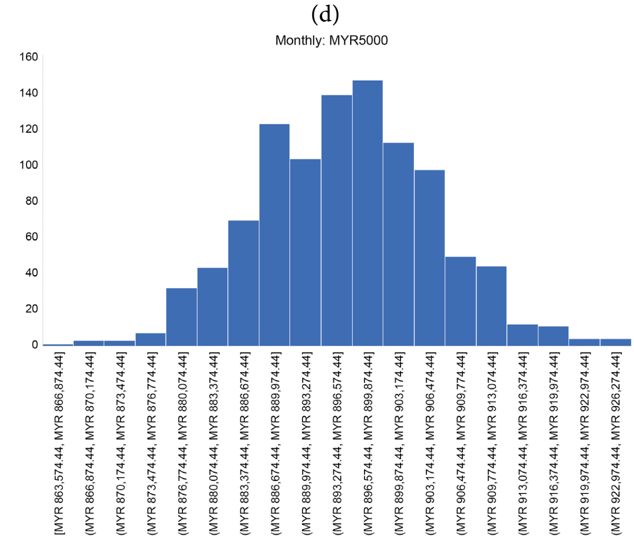

(e)

Figure 1. Monte Carlo simulation result's histograms for (a) MYR 1000, (b) MYR 2000, (c) MYR 3000, (d) MYR 4000 and (e) MYR 5000.

4. Conclusion

The above Monte Carlo simulation approach would help EPF members plan for their savings and the Government to close the gap between current and targeted (or ideal) savings. Moreover, the Government and both inactive and active EPF members could project—based on the current savings—to see if the numbers in Table 1 are achievable. For example, at the age of 50, if an EPF member's current savings are MYR "x" less than the ideal savings, the Government could help by giving monies, similar to the MYR 500 provided by them for B40 [20], to close the gap between MYR "x" and the "ideal" savings. Ideal savings here refers to any value between the minimum and maximum, preferably the one that gives the highest frequencies close (or equal) to the average. For this case, if the age of the EPF member is "y", that is, less than 50 years of age where the difference between "y" and 55 is greater than five years, then the above approach or Monte Carlo simulation can be repeated here, provided that the behaviour of the dividends does not stray too far or differ from the model. If not, the model must be updated before repeating the Monte Carlo simulation.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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Appendix

The chapter titled "Results" mentioned the maximum value of **Figure 1(a)** Monthly: MYR 1000 (*i.e.*, MYR 185K) has *low/slim* chance of achieving the target of MYR 240,000 by the age of 55. However, if I were to generate Monthly: MYR 1030 using Equation (1), where S_O is replaced by MYR 247,200, and superimpose its histogram on **Figure 1(a)** Monthly: MYR 1000 as shown in **Figure 2**, the chance of the maximum value of Monthly: MYR 1000 to achieve (new) target MYR 247,200 is *better*. Furthermore, the same approach can be applied to other figures, namely **Figures 1(b)~(e)**.

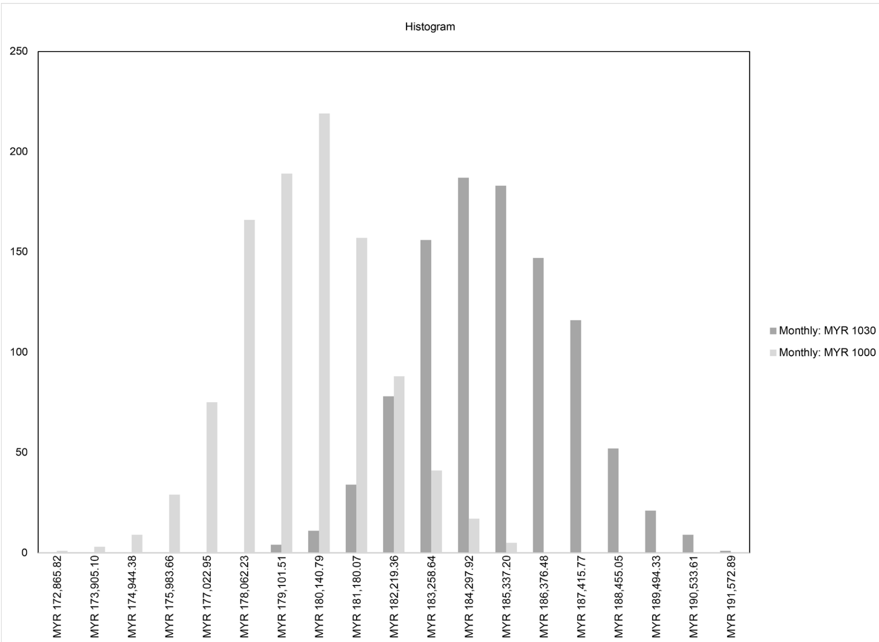

Figure 2. Histogram Monthly: MYR 1000 is superimposed on histogram Monthly: MYR 1030.