Journal of Social Economics Research
2023 Vol. 10, No. 3, pp. 124-133
ISSN(e): 2312-6264
ISSN(p): 2312-6329
DOI: 10.18488/35.v10i3.3474

Impact of inflation severity on retirement savings: A simulation analysis of projected accumulation and de-accumulation

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Article History
Received: 4 April 2023
Revised: 7 August 2023
Accepted: 25 August 2023
Published: 14 September 2023

Keywords
Accumulation
De-accumulation
Inflation
Retirement savings
Retirement wealth.

JEL Classification:
G51; I30; J26.

ABSTRACT

Statistics have shown that by the age of 60, Malaysian life expectancy for males and females is expected to be 17.5 and 20.1 years, respectively. Thus, if not properly addressed by the authorities, the ageing population would contribute to a serious problem for the public by having an inadequacy of retirement wealth to sustain their lives. Considering all of these issues, the present study seeks to comprehensively examine the extent to which inflation adversely affects retirement savings. This investigation holds the potential to yield valuable insights into the accumulation of retirement wealth, thereby addressing the issue of insufficient retirement income, particularly among members of the Employees Provident Fund. Using a mathematical iteration formulation approach, the accumulation and de-accumulation of retirement wealth subject to inflation are formulated to examine the severe impact of this economic factor. Ironically, the disruptive effect of inflation on retirement savings is not severe. It is the power of compounding returns generated by dividend profits that absorbs the real impact. Despite the fact that this is a useful insight, people must plan well for their retirement savings to avoid having them eaten up by inflation. The results showed that inflation disruptions of varying degrees can negatively impact retirement funds. In order to effectively mitigate the potentially detrimental impact of inflation on retirement savings, it becomes imperative to adopt a strategic approach that encompasses various measures, like the exploration of investment opportunities that possess the potential to generate returns surpassing the prevailing inflation rate.

Contribution/Originality: The research delves deeply into the consequences of inflation and its magnitude on retirement savings, which contributes to an insight that could aid in projecting the total accumulation of retirement wealth to prevent insufficient retirement income, particularly for EPF members.

1. INTRODUCTION

Global issues are emerging related to the ageing population. It is a result of decreased birth rates and rising life expectancy rates among individuals all across the world. According to projections, the demographic composition of the global population is expected to undergo a significant shift by the year 2050. Specifically, it is anticipated that the proportion of individuals aged 60 years and older would see a twofold increase in comparison to the overall population (Cacchione, 2022). Malaysia, being a developing nation, is not exempt from the phenomenon of an ageing population,

hence giving rise to the associated concern of longevity risk. According to statistical data, it has been demonstrated that individuals in Malaysia, upon reaching the age of 60, may anticipate a remaining life expectancy of around 17.5 years for males and 20.1 years for females.

Thus, if not properly addressed by the authorities, the ageing population would contribute to a serious problem for the public by having an inadequacy of retirement wealth to sustain their lives after retirement age and contributing towards deteriorating the fiscal balance of economic growth at a macro-level (Bengtsson & Scott, 2010). Furthermore, recent research focused on financial distress as an important element affecting the quality of life among elderly people (Huang, Ghose, & Tang, 2020).

In this regard, having adequate retirement savings is essential to guaranteeing financial security during the prime earning years. In fact, Folk, Beh, and Baranovich (2012) research showed that low- and middle-income earners in Malaysia had major issues with the sufficiency of their retirement and savings resources. According to Ja'afar and Daly (2016), a major contributing factor to the inadequacy of retirement income is that Malaysians are still unaware of the importance of planning ahead for their retirement. Employees Provident Fund (EPF) has proposed the ideal basic saving, which is thought to be consumable within 20 years in accordance with life expectancy, in order to address the challenges of inadequate retirement wealth and a lack of financial preparedness among Malaysians for retirement.

The optimum baseline savings amount has, however, occasionally been amended due to the inflation rate, which climbed from RM228,000 in 2017 to RM240,000 in 2019 and beyond (Employees Provident Fund, 2019). According to Foziah, Ghazali, Alias, Sukono, and Bon (2021), retirement expenses will become more expensive for retirees in the future due to the rising trend of the ideal basic savings amount. The effect of the time value of money is to blame. Since retirement generally takes a long time to achieve, national inflation and interest gains may have a considerable impact on the overall amount of basic savings (Afthanorhan, Mamun, Zainol, Foziah, & Awang, 2020). However, the fundamental savings were sadly overlooked and merely subjected to the present minimum monthly income.

Therefore, it would be preferable if the government and the relevant agencies had developed the new fundamental savings by integrating those extra components. It's critical to get a deeper understanding of the fundamental savings, which will serve as a guide for Malaysia's future retirees. Given the aforementioned challenges, the objective of this study is to focus on the impact of inflation on retirement savings, with the potential to provide a significant increase in the accumulation of retirement wealth. This research intends to address the issue of insufficient retirement income, specifically among members of the Employees Provident Fund (EPF).

2. LITERATURE REVIEW

As the development of the new viable pension plan leads towards consumption and savings, it is mostly suited to refer to the Life Cycle model, developed by Modigliani and Brumberg (1954), as the underpinning theory in this study. The Life Cycle Hypothesis Theory, or simply known as the Life Cycle Model, was pioneered by Modigliani and Brumberg (1954) in the early 1950s and further developed by Ando and Modigliani (1963). The Life Cycle model basically an economic model that strives for individual consumption patterns behavior. It was previously introduced by Modigliani and Brumberg (1954) when they wanted to observe people's behavior in making decisions to consume the available resources over their lifetime. According to the model, individual utility depends on his or her intentional bequest. While the resources to achieve the said bequest are in the mode of increasing function based on the age group of individual average resources. Therefore, the model asserts that individuals have struggled to maintain a living standard by managing their consumption and savings over their lives.

The Life Cycle model further implied consumption as a function of disposable wage income and non-wage income. By using marginal utility analysis in their study, Modigliani and Brumberg (1954) revealed the importance of information in regards to individual savings behavior. Their empirical study used net-worth assets instead of liquid assets, as depicted by many researchers in their era. They found that assets and consumption have a positive correlation, as people with more assets would also consume more in their lives. Furthermore, the life span of an

individual would have a great influence on savings behavior. Therefore, according to the Life Cycle model, for individuals who are expected to live for another T years at retirement age with an initial wealth of W and an annual income of Y that they earn for R years during working periods, the consumption function can be written as:

$$C = \frac{W + RY}{T}$$

The above function can be depicted if the person might equally divide the resources, which consist of W and the lifetime earnings of R, by multiples of Y over the T years. This function comes with the assumption of a zero interest rate.

However, the drawback of the Life Cycle model was that there was no uncertainty as regards the rate of return, the effect of inflation, or the people's deaths (Sambo, 2012). This had been raised by Yaari (1964), when the author extended the Life Cycle model with a demonstration of annuitization calculation based on uncertain lifetimes of people. Yaari (1964) believed that the uncertainty of such an unexpected healthcare expenditure in old age would have a significant impact on the original findings of the model. Interestingly, even though the uncertainty made the theory more complex, the findings were still relevant to the original theory. In this regard, in order to have a better prediction of an individual's wealth, it would be better for the study to include the elements of salary growth pertaining to the overall income growth and also inflation factors in extending the calculation of rate of return in the consumption function of Life Cycle model.

Based on the subtle impact of inflation on retirement wealth, Bajtelsmit and Rappaport (2018) emphasized in their research using Monte Carlo simulation that the impact of inflation on medical costs during retirement would significantly increase. Investigating the most common mistake pointed out by wealth managers, Laster, Suri, and Vrdoljak (2013) addressed the fact that inflation risk and longevity would ruin the retirement plan. Alias and Foziah (2022) added that, other than the many factors that affect the inadequacy of retirement savings, inflation would be among the most influential factors that need to be considered in achieving the retirement savings target.

Unexpected risks can come as a surprise to retirees. Inflation could wreak havoc on a retirement plan, especially for those enjoying a long retirement. Using Continuous Work History Sample (CWHS) data from the past 50 years, Gorodnichenko, Song, and Stolyarov (2013) revealed that inflation can also lead to the erosion of real wages, thereby encouraging workers to retire earlier than they otherwise would. Merton and Muralidhar (2020), who were looking for a good way to improve retirement security, pointed out that inflation-adjustment became important when doing basic compounding calculations to build up and spend down retirement wealth.

Also, the Okeke and Nwafor (2022) study on the economic effects of inflation and interest rates on the life annuity sector found that inflation and interest rates had a big effect on the growth of life annuities as a part of retirement. In order to benefit life annuity policyholders and the investment returns of life insurance firms that will not be reduced by inflationary effects, the study proposed that the authorities, such as the government, develop monetary policy objectives targeted at combatting growing inflation rates. Additionally, Park, Wong, and Yan (2023) have taken inflation-linked index bonds and stocks into consideration while building a strong consumption-investment strategy for retirement purposes. They have prepared a thorough setup of ambiguity in return, volatility, and correlation factors in their study.

Interestingly, Cardoso et al. (2022) have identified the three main pathways through which inflation influences wealth disparity. This study quantified the effects of three channels on wealth redistribution due to inflation: the traditional Fisher channel, which involves the transfer of wealth from lenders to borrowers; the nominal labor income channel, which lowers the real value of wages and benefits; and the relative consumption channel, which has different effects on people depending on their consumption patterns due to varying price increases across different goods. It was discovered that the relative consumption channel shrank by an order of magnitude while the Fisher and labor income channels grew. While people in their middle years were largely unaffected by inflation, older people were most affected by its effects. Therefore, the study on the extent of inflation's impact on retirement savings is considered

essential since it can offer a major estimate of building up retirement wealth, thereby addressing the problem of inadequate retirement income, particularly for EPF members. The stakeholders can then develop and put into action focused measures that protect retirement assets from inflation's corrosive impacts, ensuring a more secure and financially sound future for retirees inside the EPF system.

3. METHODOLOGY

In realizing the objectives of the study, the model of annuity accumulation and de-accumulation of retirement wealth will be simulated. In the first phase, the first model, or general annuity accumulation, will be generated through the mathematical iteration method that will be discussed in this section. Furthermore, the element of inflation will be embedded in the formula to project the output of accumulation of retirement wealth for the second model. In this regard, the impact of inflation disruption on retirement wealth can be measured by refining both models. As a commencement, the details of general information about an EPF member's profile will be considered the lower income earner's main target in this study. The study used the minimum wage for private sector in Peninsular Malaysia of RM1, 500. The highest participation rate of active members in the EPF scheme is above 25 years old. In order to include more individuals at a younger working age, the study evaluated the maximum age of 25. The details are listed in Table 1.

Table 1. The general profile of EPF member.

No.	Items	Value
1.	Working period: 25 – 55 years old	30 years
2.	Monthly salary	Ringgit Malaysia (RM) 1,500
3.	EPF contribution rate, employee and employer (11% + 13%)	24%
4.	Expected profit rate	6.11%, according to the average EPF dividend rate for the past 10 years from 2011 to 2020
5.	Expected inflation rate	2.10%, according to the average core inflation rate between 2011 and 2021

The detailed information in Table 1 is very important to start the simulation processes in the first and second models of the study, both for the general accumulation of retirement wealth and the adjustment-inflation component. In order to generate the simulation results for the accumulation for the general model of annuity, the elements in the Table 2 should be considered in the simulation process.

Table 2. Elements in simulation for general model of annuity for accumulating retirement wealth.

AA1	AA2	AA3	AA4	AA5	AA6
Age	Year	Annual salary	Contribution amount	Profit gains	Accumulated funds

Where:-

AA1 = Age of the participant.
AA2 = Number of working periods.
AA3 = Monthly salary x 12 months, RM.
AA4 = Annual Contribution, RM.
AA5 = The profit gains are based on the annual profit calculation, RM.
AA6 = Total accumulated retirement funds for each year, RM.

The mathematical formulations of elements AA4 to AA6 for the conventional annuity are derived as in the Table 3. Next, in order to enhance the comprehensiveness of the simulation analysis, the second model of simulation will take into account the element inflation rate. The entire set of elements used to realize the simulation can be referred to in Table 4.

Table 3. Calculation for the elements aa4 to aa6 in general model of annuity.

Element	Formula
$AA4_{AA2}$	$AA3_{AA2} \times Total\ contribution\ rate\ from\ employee\ and\ employer$
$AA5_{AA2}$	$Expected\ profit\ rate \times (\sum_{i=1}^{AA2-1} AA4_i + \sum_{i=1}^{AA2-1} AA5_i)$
$AA6_{AA2}$	$\sum_{i=1}^{AA2} AA4_i + \sum_{i=1}^{AA2} AA5_i$

Table 4. Elements in simulation for inflation adjustment model of annuity for accumulating retirement wealth.

AB1	AB2	AB3	AB4	AB5	AB6	AB7
Age	Working period	Annual salary	Contribution amount	Profit	Inflation	Accumulated funds

Where:-

AB1 = Age of participant: EPF member.
AB2 = Number of working periods.
AB3 = Monthly salary x 12 months, RM.
AB4 = Annual contribution, RM.
AB5 = The profit gains are based on annual profit calculation, RM.
AB6 = The inflation rate, which refers to the core inflation, RM.
AB7 = Total accumulated retirement funds for each year, RM.

The mathematical formulations of elements AB4 to AB7 can be derived as in Table 5.

Table 5. Calculation for the elements AB4 to AB7 in inflation adjustment model of annuity.

Element	Formula
AB4	$AB3 \times Total\ contribution\ from\ employee\ and\ employer$
AB5	$Expected\ profit\ rate \times (\sum_{i=1}^{AB2-1} AB4_i + \sum_{i=1}^{AB2-1} AB5_i)$
AB6	$Core\ inflation\ rate \times (\sum_{i=1}^{AB2-1} AB4_i + \sum_{i=1}^{AB2-1} AB5_i)$
AB7	$\sum_{i=1}^{AB2} AB4_i + \sum_{i=1}^{AB2} AB5_i - \sum_{i=1}^{AB2} AB6_i$

4. RESULT AND DISCUSSION

4.1. General Simulation of Accumulation of Retirement Wealth

By using the detailed information from Table 1, the general simulation results of accumulated retirement wealth output for the first model can be summarized as in Table 6.

As shown in Tables 6, the total accumulated retirement funds for a 30-years period for the annuity model can be accumulated up to RM 361,395.39.

4.2. Inflation Adjustment Simulation of Accumulation of Retirement Wealth

Using the same information from Table 1, the adjustment inflation simulation results of the accumulated retirement wealth of the second model can be summarized as in Table 7.

Table 6. General simulation results of accumulation retirement wealth for the first model.

AA1	AA2	AA3	AA4	AA5	AA6
25	1	18.000	4.320	-	4.320
26	2	18.000	4.320	273	8.913
27	3	18.000	4.320	563	13.796
28	4	18.000	4.320	872	18.988
29	5	18.000	4.320	1.200	24.508
30	6	18000	4320	1549	30377
31	7	18000	4320	1920	36617
32	8	18000	4320	2314	43251
33	9	18000	4320	2733	50305
34	10	18000	4320	3179	57804
35	11	18000	4320	3653	65777
36	12	18000	4320	4157	74254
37	13	18000	4320	4693	83267
38	14	18000	4320	5262	92850
39	15	18000	4320	5868	103038
40	16	18000	4320	6512	113870
41	17	18000	4320	7197	125386
42	18	18000	4320	7924	137631
43	19	18000	4320	8698	150649
44	20	18000	4320	9521	164490
45	21	18000	4320	10396	179206
46	22	18000	4320	11326	194852
47	23	18000	4320	12315	211486
48	24	18000	4320	13366	229172
49	25	18000	4320	14484	247976
50	26	18.000	4.320	15.672	267.968
51	27	18.000	4.320	16.936	289.224
52	28	18.000	4.320	18.279	311.823
53	29	18.000	4.320	19.707	335.850
54	30	18.000	4.320	21.226	361.395

Table 7. Inflation adjustment simulation results of accumulation retirement wealth for the second model.

AB1	AB2	AB3	AB4	AB5	AB6	AB7
25	1	18.000	4.320	-	-	4.320
26	2	18.000	4.320	273	115	8.798
27	3	18.000	4.320	556	234	13.440
28	4	18.000	4.320	849	358	18.252
29	5	18.000	4.320	1.154	486	23.240
30	6	18000	4320	1469	618	28411
31	7	18000	4320	1796	756	33770
32	8	18000	4320	2134	898	39326
33	9	18000	4320	2485	1046	45086
34	10	18000	4320	2849	1199	51056
35	11	18000	4320	3227	1358	57245
36	12	18000	4320	3618	1523	63660
37	13	18000	4320	4023	1693	70310
38	14	18000	4320	4444	1870	77203
39	15	18000	4320	4879	2054	84349
40	16	18000	4320	5331	2244	91756
41	17	18000	4320	5799	2441	99434
42	18	18000	4320	6284	2645	107393
43	19	18000	4320	6787	2857	115644
44	20	18000	4320	7309	3076	124197
45	21	18000	4320	7849	3304	133062
46	22	18000	4320	8410	3539	142252
47	23	18000	4320	8990	3784	151779
48	24	18000	4320	9592	4037	161654
49	25	18000	4320	10217	4300	171890
50	26	18.000	4.320	10.863	4.572	182.501
51	27	18.000	4.320	11.534	4.855	193.501
52	28	18.000	4.320	12.229	5.147	204.903
53	29	18.000	4.320	12.950	5.450	216.723
54	30	18.000	4.320	13.697	5.765	228.975

As shown in Table 7, the total accumulated retirement funds for a 30-year period for the second annuity model can be accumulated up to RM 228,974.66.

From Table 6 and 7, the total accumulated retirement funds for a 30-year period in the general annuity model can accumulate up to RM 361,395.39, while through adjusted inflation in the second model, the total retirement funds would be decreased to RM 228,974.66. The comparison results for the two accumulation retirement models are based on the last total accumulation of retirement wealth over the working period. This can be realized as follows:

$$= \frac{AB6 - AA6}{AB6} \times 100$$

$$= \frac{228{,}974.66 \; - \; 361{,}395.39}{228{,}974.66} \times 100$$

$$= \frac{-132{,}420.73}{228{,}974.66} \times 100$$

$$= -57.83\%$$

When comparing the accumulated retirement wealth with the adjusted inflation element obtained through the general approach, the output resulted in a substantial difference of 57.8% among the accumulated retirement wealth. In this regard, the element of inflation clearly has disruptive effects on retirement savings. Unfortunately, it indicates that the inflation element had a severe impact on more than half of the total existing funds of the retirees.

Due to the fact that inflation gradually diminishes the purchasing power of money, it can have a major effect on retirement savings. The rate at which prices are generally rising is known as inflation, and it has the potential to reduce the value of savings by devaluing the same amount of money over time (Oner, 2010). As a result, it is accurate to say that inflation can significantly affect retirement funds. Due to inflation, a dollar's purchasing power diminishes over time, meaning that the same amount of money will buy fewer products and services in the future than it does now. For retirees who depend on fixed incomes, this might be a particular problem.

Furthermore, inflation can have several impacts on retirement savings beyond just the purchasing power of the money. Some of these impacts include reducing real returns on investments. A study by Yeap and Lean (2017) has found that inflation not only diminishes the purchasing power of economic agents and lowers their standard of living, but it also has the potential to decrease returns on investment assets. In this regard, inflation can reduce the real returns earned on investments, which can affect the growth of retirement savings. For example, if an investment earns a nominal return of 6% but inflation is 2%, the real return is only 4%. This means that the purchasing power of the investment's returns is reduced, which can impact the growth of retirement savings over time. Thus, it may lead to another perspective, which is to change investment strategies, especially for prospective retirees. In this situation, the investors may need to adjust their portfolios to account for changing market conditions. For example, investors may need to invest in assets that are less affected by inflation, such as real estate or commodities, in order to protect the value of their retirement savings.

The implications of the research indicate that the degree of inflation disruption has the potential to worsen the consequences for retirement savings, perhaps resulting in a person's retirement with inadequate financial resources. It is advisable for investors, especially those who are planning for retirement, to consider modifying their investing strategy. In the given scenario, it may be necessary for investors to make appropriate modifications to their portfolios in order to accommodate the evolving market conditions. Individuals planning for retirement should consider the impact of inflation and take steps to mitigate its effects, such as investing in assets that can provide a hedge against inflation. To preserve the value of their retirement funds, investors might also think about investing in assets that are less impacted by inflation, such as commodities or real estate. SeLFIES (Standard-of-Living Indexed, Forward-Starting, Income-Only Securities) is a new bond that Merton and Muralidhar (2020) suggest as a workable way to improve retirement security. The SeLFIES bond is an easily understood, low-risk financial product that features compounding, accumulation, decumulation, and inflation adjustments.

Furthermore, from a different perspective, it is worth noting that inflation has the potential to result in elevated interest rates. While the notion may at first appear favourable, it is important to acknowledge that it might potentially exert adverse effects on retirement savings through many means. An illustration of this phenomenon is the impact of elevated interest rates, which can result in heightened borrowing costs and diminished credit accessibility. This circumstance might present challenges for retired individuals in securing the necessary funds to cover their retirement-related expenditures, including healthcare expenses and house maintenance.

Last but not least, inflation might also have increased the cost of living. Indirectly, this can impact the total retirement savings by reducing the amount of money that retirees can afford to spend. This can make it more difficult for retirees to maintain their standard of living, which can impact their quality of life. As suggested by Jayawarsa, Wulandari, Saputra, and Saputri (2021), a high inflation rate will increase the cost of living for the people. An increase in living costs would lead to a reduction in income since higher prices would absorb a significant portion of the earnings. Consequently, a smaller remaining income after deducting the cost of consumption would limit the individual's ability to save more funds for retirement. All in all, the findings of the study have important implications for retirement planning. Individuals who are planning for retirement need to consider the impact of inflation on their savings, as it can significantly reduce the purchasing power of their retirement savings over time.

5. CONCLUSION

In conclusion, accounting for inflation in retirement planning is essential to ensuring that we have enough savings to meet our future needs. It is important for retirees to take inflation into account when planning for their retirement and to adjust their strategies accordingly in order to maintain their purchasing power throughout the retirement years. The difference of 57.8% depicted in the previous result seems to have become a general benchmark that reflects the impact of inflation on retirement savings over time. If retirement savings are not adjusted for inflation, the value of those savings will be eroded by half from total retirement funds, reducing the amount of purchasing power they have when the retiree needs them.

Finally, it is crucial to implement a comprehensive strategy that incorporates many strategies in order to successfully minimise the potentially negative consequences of inflation on retirement funds. An essential factor to contemplate is the examination of investment prospects that exhibit the capacity to yield returns beyond the current inflation rate. The act of diversifying investment paths may involve including equities, which have historically exhibited a tendency to exceed inflation and generate significant long-term growth.

Additionally, investing in real estate may be a viable way to shield retirement funds from the damaging impacts of inflation because real estate prices and rental income have a propensity to hold their value over the long run. Individuals may actively ensure their retirement savings strategy's robustness against the negative impacts of inflation while also adjusting to changing circumstances and demands by periodically and carefully reviewing and revising it. In the end, this strategy gives retirees the security and financial stability that retirement demands. Additionally, one may make sure that it keeps up with inflation and adjusts to changing conditions and needs.

Funding: This research was funded by the Fundamental Research Grant Scheme of the Ministry of Higher Education (Grant number: FRGS/1/2021/SS01/UNISZA/02/1) and the Graduate on Time (GOT) Grant Scheme 2019-1135 of Universiti Sultan Zainal Abidin (Grant number: UniSZA/2019/GOT/01), Malaysia.
Institutional Review Board Statement: The authors declare that they have no competing interests.
Transparency: The authors state that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.
Data Availability Statement: The corresponding author can provide the supporting data of this study upon a reasonable request.
Competing Interests: The authors declare that they have no competing interests.
Authors' Contributions: Wrote the paper, H.F.; analyzed and interpreted the data, A.A.; mathematical formula, P.L.G.; conceived and designed the research, S.A.F.S.T. All authors have read and agreed to the published version of the manuscript.

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