

Implications of an Aging Population on Government Expenditure in Malaysia

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DOI: <https://doi.org/10.30880/jstard.2024.06.01.007>

Article Info

Received: 2 February 2024

Accepted: 12 June 2024

Available online: 30 June 2024

Keywords

Aging population, government expenditure, FMOLS

Abstract

This study investigates the implications of an aging population on government spending in Malaysia using the Fully Modified Ordinary Least Squares (FMOLS) method. Employing data spanning from 1992 to 2022, the study examines the relationship between the dependent variable, Government Expenditure, and the independent variable, Aging Population, while controlling for Gross Domestic Product and Unemployment as additional factors. The results reveal a positive connection between the aging population and government expenditure. As Malaysia experiences demographic shifts characterized by increased life expectancy and declining fertility rates, the findings suggest that addressing the needs of an aging population contributes to higher government spending. This study underscores the importance of recognizing and addressing the fiscal implications of demographic changes, providing valuable insights for policymakers in formulating strategies to navigate the challenges posed by an aging society in Malaysia.

1. Introduction

Over the past few decades, there has been a remarkable and transformative change in global demographics, marked by a significant surge in the aging population. The term "aging population" conventionally encompasses individuals aged 65 and above, and this demographic segment is currently undergoing an unparalleled expansion worldwide. The multifaceted nature of this demographic shift can be attributed to a complex interplay of various factors. Key among these are advancements in healthcare, which have led to increased life expectancy and improved overall well-being among individuals. Additionally, elevated living standards and improved socio-economic conditions have played a crucial role in contributing to this demographic phenomenon. Furthermore, a concomitant factor influencing this shift is the decline in birth rates observed in many regions across the globe. Together, these interconnected elements have synergistically contributed to the remarkable growth of the aging population, reshaping the global demographic landscape in unprecedented ways.

This issue is important to look profoundly at as it is reported by United Nations (UN) in 2019 that on a global scale, the year 2019 saw a population of 703 million individuals aged 65 or older. The largest concentration of this elderly demographic, totaling 260 million, was situated in Eastern and South-Eastern Asia, surpassing other regions. Europe and Northern America closely followed, hosting an elderly population exceeding 200 million. In the coming three decades, there is a projected global surge in the number of elderly individuals, expected to more than double and reach a staggering 1.5 billion by the year 2050. Across all regions, there is an anticipated growth

in the size of the elderly population between 2019 and 2050. Notably, Eastern and South-Eastern Asia are poised to experience the most significant increase, with projections indicating a rise from 261 million in 2019 to a substantial 573 million individuals aged 65 years or older by 2050, marking an unprecedented growth of 312 million persons in this demographic segment. As Malaysia as one of the countries listed in South-Eastern Asia, an empirical study is reasonably important to revisit this issue even though the issue has been studied by other researchers but in different views.

The significance of a nation's economy lies in its endeavor to foster growth through diverse avenues of profitable investment, in addition to the contributions made by its citizens through taxation. However, the presence of an aging population, characterized by a growing number of elderly individuals, poses a challenge to this overarching economic objective. The limitation arises from the fact that the elderly demographic, due to factors such as retirement and potentially reduced income, may find themselves unable to actively contribute to the economic landscape through traditional tax-based means. This demographic shift introduces a nuanced dimension to economic planning, prompting the exploration of alternative strategies and policies to sustain and enhance economic growth in the face of an aging population. As societies grapple with this demographic transition, innovative approaches are essential to optimize the economic potential and well-being of both the elderly and the broader population, ensuring a balanced and resilient economic trajectory.

Focus on Malaysia, there are several notifications by medias that Malaysia will be one of the countries that have the abundance of aging populations such as Harian Metro in 25th April 2023, Berita Harian 24th June 2015 and many others. Moreover, Berita Harian 29th September 2023 had unveiled that Malaysia is not ready for entangling the abundance of aging population. Figure 1 below shows the current trends as provided by Department of Statistic Malaysia (DOSM).

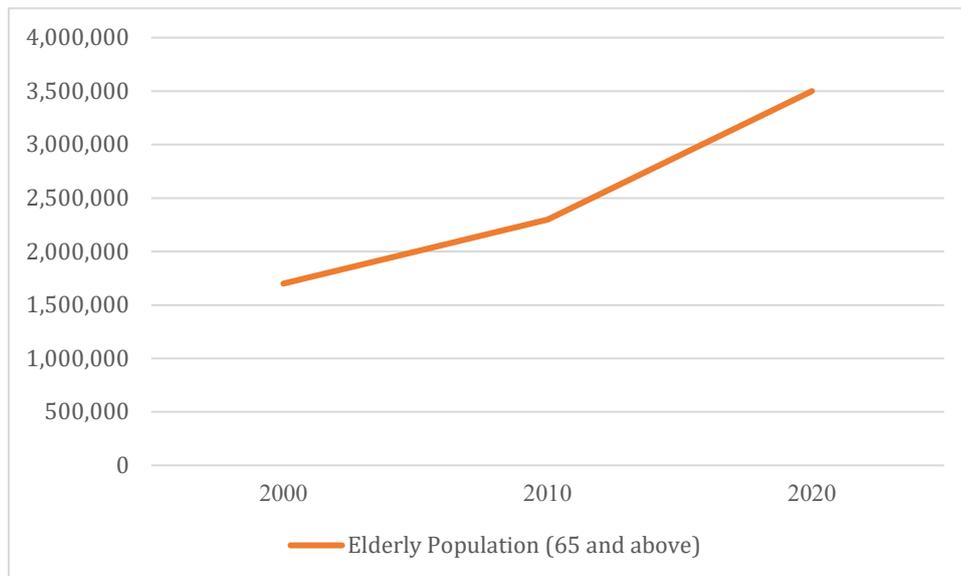


Fig. 1 Malaysia's aging population trends
Data from Department of Statistics Malaysia

Figure 1 clearly illustrates a consistent upward trend in the aging population every decade. This demographic shift is a global concern, impacting government revenues negatively and necessitating substantial expenditures on social security, as emphasized by the research conducted by Vlad and Mădălina in their study encompassing Brazil, China, Germany, Japan, and the United States in 2012. As a country grappling with a deficit budget, it becomes imperative to conduct a study that delves into the current aging population scenario in Malaysia, assessing the nation's readiness for the future. Consequently, this research specifically aims to scrutinize the repercussions of an aging population on government expenditure in Malaysia. Moreover, the budget deficit issue in Malaysia is not a new issue as Malaysia are grappling with budget deficit for decades as the expenditure in Malaysia is raising faster than the revenue (Hashemi-Nabi, Zakaria, & Jamil, 2021).

2. Literature Review

The Keynesian theory posits that government expenditure is essential as it serves to stimulate the economy. Therefore, achieving a sustainable economy involves judiciously allocating funds to the right areas to offset government spending. The issue of overspending arises when it is considered not entirely avoidable but

nevertheless crucial for the greater economic good (Zulkifli, Effendi, & Shafai, 2022). Hence, it is important to revisit the issue of what are the triggers to government spending.

Gross Domestic Product is important in determining the capability of the nation to draft the budget and expenditures (Rahman, Nath, Siddiqui, & Hossain, 2023). Therefore, many researchers are keen in examining the relationship between GDP and government expenditure. Came into the same conclusion is P.Srinivasan (2013) in examining the causality between economic growth and expenditure in India. The analysis carried out between 1973-2012 data which then went through final analysis using Vector Error Correction Model (VECM) unveil the direction exist between GDP and government spending. Hence, it is testified to the positive connection between these variables. A study had been conducted by Sanz and Velázquez (2002) over OECD countries for the data span 1970-1997 had adopted several variables. Some of the variables are GDP, institutional factors and population density had found the positive connection for all variables on government expenditure. This finding is parallel to the later study made by P.Srinivasan (2013) and Zulkifli et al.(2022).

However, these finding is different to the study done by Haliru (2023) using ARDL method as the variables are adopted consist of inflation, population, GDP and trade openness that found the insignificant results between GDP and government expenditure in Nigeria. However, population and inflation have remained positive significant to the government expenditure. Nevertheless, the earlier study on the government expenditure in Nigeria had been conducted in 2019 by Jibir and Aluthge (2019) brought different views as adopted GDP, population, Trade Openness, oil prices, taxation and inflation for the study and analyzed through ARDL. The conclusion revealed that all the variables are significant in the study. Specifically, GDP, population and Inflation are positively influenced the growth of government expenditure. The later study by Ilugbusi et al. (2021) revisit the issue which triggers the government expenditure in Nigeria which then consistently revealed the role of GDP in positively influence the government expenditure. Obviously, based on the literature provided, not much study was found on the determinants of government expenditure in Malaysia. Moreover, the researchers tend to investigate the impact of government expenditure on other things in Malaysia. Therefore, the study is aimed to create a bridge for the literature gap. Meanwhile, there are the concerns of other researchers that aging populations are able to be detrimental factors to government revenue such as Temsumrit (2023). Therefore, the quest of unveil the impact of aging population on government expenditure specially is Malaysia is possible. The variables used are based on past studies by other researchers.

3. Methodology

In examining the impacts of the aging population on government expenditure, a comprehensive methodological approach was adopted, leveraging data spanning the years 1992 to 2022 sourced from the World Bank database. The analysis commenced with descriptive statistics to provide an overview of key trends and patterns in both aging demographics and government expenditure over the specified period. Subsequently, unit root tests were applied to assess the stationarity of the variables, ensuring the robustness of the time series data. The investigation then proceeded with the Johansen co-integration test, a pivotal step in exploring the long-term relationships between variables. This test not only evaluated the existence of co-integration but also shed light on the dynamic interactions among aging demographics and government expenditure. Finally, to capture the intricate nuances of this relationship, time series estimation was performed using fully modified ordinary least squares (FMOLS), a technique well-suited for addressing endogeneity concerns and providing reliable parameter estimates.

3.1 Variables Descriptions

Table 1 presents the details of variables which consist of three categories of variables consist of dependent variable, independent variable and control variables.

Table 1 Variable description

Types of Variables	Variables	Description	Symbol
Dependent Variable	Government Expenditure	Total national spending (in current US dollars)	GE
Independent Variable	Aging Population	Percentage of the total population comprising individuals aged 65 and older	AP

Control Variable	Gross Domestic Product	Gross Domestic Product measured in current US dollars	GDP
	Unemployment	Unemployment rate	UNE

3.2 Model Estimation

Equation 1 outlines the fundamental function to investigate the correlation between individual variables and public debt, while equation (2) delineates the empirical model structure in the following manner:

$$GE = f(AP, GDP, UNE) \tag{1}$$

Where:

GE= Level of government expenditure in Malaysia

AP= total of aging population in Malaysia

GDP= Gross Domestic Product in Malaysia

UNE= Unemployment rate in Malaysia

f = functional relationship between dependent and independent variables

$$GE = \alpha + \beta_1 AP + \beta_2 GDP + \beta_3 UNE + \varepsilon \tag{2}$$

Where:

GE	This is the dependent variable, representing the total amount of money spent by the government.
α (Intercept)	This is the constant term or intercept of the equation, representing the baseline level of government expenditure when all independent variables (AP, GDP, POP) are zero.
β_1 (Coefficient of AP)	This represents the change in government expenditure for a one-unit change in autonomous spending (AP), holding other variables constant. It indicates the sensitivity of government expenditure to changes in autonomous spending.
β_2 (Coefficient of GDP)	This signifies the change in government expenditure for a one-unit change in gross domestic product (GDP), while keeping other variables constant. It reflects the sensitivity of government expenditure to changes in economic output.
β_3 (Coefficient of UNE)	This coefficient signifies the change in government expenditure for a one-unit change in unemployment (UNE), holding other variables constant. It reflects the sensitivity of government expenditure to changes in unemployment levels.
ε (Error Term)	This term represents the unobserved factors or influences that affect government expenditure but are not explicitly accounted for in the model. It captures the discrepancy between the observed government expenditure and the values predicted by the model.

4. Estimation Procedures

4.1 Descriptive Statistic

Descriptive statistics serve as a crucial initial step in the analysis of data by providing a concise and informative summary of key characteristics. The primary purpose of employing descriptive statistics is to organize and present data in a meaningful way, offering insights into the central tendency, dispersion, and shape of a distribution. Measures such as the mean, median, and mode convey the typical or central value, while standard deviation and range illuminate the spread or variability of the data. Descriptive statistics offer a comprehensive overview, facilitating the identification of patterns, trends, and potential outliers within the dataset. This

preliminary exploration not only aids in understanding the inherent structure of the data but also guides subsequent analytical steps, contributing to a more informed and targeted research or decision-making process.

4.2 Unit Root Test

A unit root test is a vital analytical tool used in time series analysis to assess the stationarity of a dataset, particularly investigating whether a variable exhibits a unit root, which implies a stochastic or non-stationary behavior. Stationarity is essential for reliable time series analysis as it ensures that the statistical properties of a variable remain constant over time. The unit root test, often employed with statistical methods like the Augmented Dickey-Fuller (ADF) test, examines whether a variable's characteristic equation has a unit root, indicating a lack of stationarity. If the test rejects the presence of a unit root, it suggests that the variable is stationary, and its statistical properties do not change over time. A stationary time series is crucial for accurate modeling and forecasting, making unit root tests a foundational step in understanding the dynamics of time-dependent data.

$$\Delta Y_t = \alpha_0 + \alpha_1 Y_{t-1} \sum_{j=1}^k d_j \Delta Y_{t-j} + \varepsilon_t \quad (3)$$

Where:

ΔY_t = the difference operator

Y_t = a time series

α_0 = the constant

k = the optimal number of lags for dependent variable

ε_t = the error term

4.3 Johansen Co-integration Test

The Johansen co-integration test is a statistical method utilized to assess the presence and nature of long-term relationships among multiple time series variables. Its primary purpose is to determine whether a set of variables move together over time and share a common stochastic trend. Co-integration implies a stable, linear combination of non-stationary variables, indicating a lasting relationship between them. The Johansen test, based on the likelihood ratio statistic, not only identifies co-integration but also estimates the number of co-integrating relationships in a given system. This test is particularly valuable in economic and financial analyses where it helps unveil the underlying equilibrium relationships among variables, providing insights into the dynamics of interconnected time series data. The identification of co-integration is fundamental for building reliable and accurate long-term models, enhancing the understanding of the interdependencies among variables in a dynamic system.

4.4 Fully Modified Ordinary Least Square

Fully Modified Ordinary Least Squares (FM-OLS) is a sophisticated econometric technique specifically designed for addressing endogeneity concerns in time series analysis. Unlike traditional Ordinary Least Squares (OLS), FM-OLS adjusts for potential biases arising from endogeneity issues, such as simultaneous correlation between independent variables and error terms. This method incorporates lagged values of both dependent and independent variables, along with instruments, to enhance the efficiency and consistency of parameter estimates. FM-OLS is particularly useful in capturing dynamic relationships within time-dependent data, providing robust estimates that account for potential endogeneity problems. By mitigating bias and improving the reliability of parameter estimates, FM-OLS contributes to more accurate and insightful analyses, making it a valuable tool in the field of time series econometrics.

5. Findings

5.1 Descriptive Test Results

Table 2 presents descriptive statistics for the variables Government Expenditure (GE), Aging Population (AP), Gross Domestic Product (GDP), and UNE (unemployment). The mean and median values provide a sense of central tendency, with GE averaging 25.74 and AP having a mean of 1.60. The range is depicted by the maximum and minimum values, showcasing the variability in the dataset. Standard deviations quantify the dispersion around the means, and skewness and kurtosis offer insights into the data distribution's shape. Jarque-Bera tests, with associated p-values, suggest that the variables may conform to a normal distribution.

Table 2 Descriptive statistic results

	GE	AP	GDP	UNE
Mean	25.7416	1.5994	25.8699	1.2110
Median	25.7673	1.5621	25.9888	1.2208
Maximum	26.6570	2.0152	26.7322	1.5129
Minimum	24.7539	1.3298	24.8036	0.8961
Std. Dev.	0.6503	0.2117	0.6376	0.1253
Skewness	-0.0350	0.4637	-0.1586	-0.2723
Kurtosis	1.4423	1.9817	1.4556	4.0674
Jarque-Bera	3.1404	2.4503	3.2109	1.8547
Probability	0.2080	0.2937	0.2008	0.3956
Sum	797.9894	49.5812	801.9683	37.5420
Sum Sq. Dev.	12.6851	1.3450	12.1956	0.4709
Observations	31	31	31	31

5.2 Unit Root Test

The unit root test results in Table 3 indicate that, without trends, government expenditure (GE), gross domestic product (GDP), and unemployment (UNE) become stationary in their first differences, while aging population (AP) exhibits stationarity. When trends are considered, all variables, including GE, AP, GDP, and UNE, demonstrate stationarity both in levels and first differences. The unit root test results suggest that the data is eligible for the next test.

Table 3 Panel unit root test

Variables	Without Trends		With Trends	
	ADF		ADF	
	Level	1st Diff	Level	1st Diff
GE	-0.6889	-4.7268***	-1.9175	-4.6354***
	0.8347	0.0007	0.6206	0.0047
AP	0.5756	-0.516398	-2.1090	-5.1946***
	0.9865	0.8731	0.5195	0.0013
GDP	-1.0174	-4.8676***	-1.7719	-4.8004***
	0.734	0.0005	0.6930	0.0032
UNE	-2.8148*	-4.9966***	-2.9727	-5.1103***
	0.0682	0.0004	0.1560	0.0016

(Note: *, **, *** is significant at 10%, 5% and 1%)

5.3 Johansen Co-Integration

The Johansen co-integration test results in table 4 indicated that there are co-integrating relationships among the variables under consideration. The unrestricted cointegration rank test, measured by the Trace statistic, rejects the null hypothesis of no co-integration (None*) at a significance level of 0.05. The Eigenvalues associated with each hypothesis suggest that up to three co-integrating relationships exist, as the test statistics for "At most 1*" and "At most 2*" are statistically significant. However, the hypothesis of at most three co-integrating relationships is not rejected. Overall, these findings suggest that there is evidence of co-integration among the variables, emphasizing long-term relationships within the dataset, but the exact number of co-integrating relationships may require further exploration.

Table 4 Johansen co-integration test results

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.6088	54.6476	47.8561	0.0101
At most 1	0.5509	27.4311	29.7971	0.0915
At most 2	0.0933	4.2138	15.4947	0.8855
At most 3	0.0462	1.3727	3.8415	0.2413
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.6088	27.2165	27.5843	0.0556
At most 1 *	0.5509	23.2173	21.1316	0.0251
At most 2	0.0933	2.8411	14.2646	0.9568
At most 3	0.0462	1.3727	3.8415	0.2413

5.4 Fully Modified Ordinary Least Square (FMOLS)

The Fully Modified Ordinary Least Squares (FMOLS) results in table 5 indicate that aging population (AP) and gross domestic product (GDP) have statistically significant impacts on government expenditure. The coefficient for AP is 0.6623 with a standard error of 0.3641, resulting in a t-statistic of 1.8190 and a p-value of 0.0804, suggesting marginal significance. GDP, on the other hand, exhibits a highly significant positive relationship with government expenditure, as evidenced by a coefficient of 0.7922, a low standard error of 0.1182, a t-statistic of 6.7042, and a p-value of 0.0000. Unemployment (UNE), however, does not show statistical significance with a coefficient of -0.2145, a standard error of 0.2105, a t-statistic of -1.0190, and a p-value of 0.3176. These findings imply that, in this model, aging population and GDP significantly influence government expenditure, while unemployment does not exhibit a significant impact.

Table 5 Fully modified ordinary least square

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AP	0.6623	0.3641	1.8190	0.0804
GDP	0.7922	0.1182	6.7042	0.0000
UNE	-0.2145	0.2105	-1.0190	0.3176

(Note: *, **, *** is significant at 10%, 5% and 1%)

6. Discussion

The results from the Fully Modified Ordinary Least Square (FMOLS) regression analysis reveal several key insights into the relationship between economic variables and government expenditure in Malaysia. While the coefficient for the aging population suggests a positive impact on spending, its lack of statistical significance implies the need for further investigation into its long-term implications. Based on the results for the aging population and government expenditure, it is a warning sign for the nation to overcome this issue in several ways. One of the

possible methods is through the empowerment of retirement planning so that the burden of the expenditure could be reduced. This kind of strategy has been practicing in Singapore. However, the highly significant positive relationship between GDP and government expenditure underscores the importance of economic growth in driving fiscal policies. Despite the non-significant relationship between unemployment and spending, policymakers should remain vigilant of demographic trends, particularly the aging population, and devise proactive strategies to address future fiscal challenges while leveraging economic growth to sustainably finance public spending priorities.

7. Conclusion

In conclusion, the examination of the implications of an aging population on government spending in Malaysia reveals a discernible positive connection between the two variables. As the demographic landscape shifts towards an older population, characterized by increased life expectancy and declining fertility rates, the demand for healthcare, pension, and social welfare services is expected to surge. This phenomenon poses a considerable fiscal challenge for the Malaysian government, necessitating proactive policy measures to address the escalating expenditure associated with aging. To mitigate the economic impact, policymakers should consider implementing comprehensive healthcare reforms, encouraging longer workforce participation through skill development initiatives, and exploring innovative financing mechanisms for pension and social welfare programs. Additionally, fostering public-private partnerships in eldercare services and enhancing the efficiency of existing social safety nets could contribute to a sustainable fiscal framework. These recommendations align with the imperative of adapting Malaysia's fiscal policies to the evolving demographic dynamics and ensuring the long-term fiscal sustainability amid the challenges posed by an aging population.

Acknowledgement

We would like to thank the journal's editor and the anonymous reviewers for their positive feedback and suggestions for the improvement of this article.

Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

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