

POPULATION AGING, ECONOMIC GROWTH, AND HEALTH FINANCING SUSTAINABILITY: EVIDENCE FROM ASEAN-5 COUNTRIES

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Abstract

This study examines the impact of population aging, economic growth, and investment on public health expenditure within the framework of health financing sustainability in ASEAN-5 countries (Indonesia, Malaysia, Thailand, the Philippines, and Singapore). Using a quantitative approach with panel data from 2009–2023, the analysis employs the Fixed Effects Model (FEM) to control for unobserved heterogeneity across countries. Population aging is proxied by the old-age dependency ratio, economic growth by GDP per capita growth, investment by gross capital formation, and public health expenditure by domestic general government health expenditure. The empirical findings indicate that population aging exerts a positive and statistically significant effect on public health expenditure, underscoring the role of demographic transition as a key driver of increasing healthcare costs in the region. In contrast, economic growth and investment are found to be statistically insignificant, suggesting that macroeconomic expansion and capital accumulation do not automatically translate into higher public health spending. These results emphasize the predominance of demographic pressures over macroeconomic factors in shaping health financing dynamics in developing economies. This study contributes to the existing literature by providing robust empirical evidence from ASEAN-5 and offers policy-relevant insights for the design of sustainable and demographically responsive health financing systems.

Keywords: Population Aging, Public Health Expenditure, Economic Growth, Investment

INTRODUCTION

The global demographic transformation, characterized by a rising proportion of older persons (*population aging*), has emerged as a strategic issue in sustainable economic development. This phenomenon is driven by simultaneous increases in life expectancy and declines in fertility rates across many countries (Heintz & Folbre, 2022; Yang et al., 2025; Yue et al., 2025). The Asia Pacific region, including ASEAN, is experiencing a particularly rapid acceleration in the aging process. Projections indicate that the share of the population aged 65 and above in low and lower middle income countries and territories in Asia Pacific will nearly double, from approximately 6% in 2023 to around 13% by 2050 (OECD, 2025). Declining mortality and fertility rates have led to significant structural demographic shifts worldwide, affecting development dynamics particularly in the health sector and fiscal sustainability (Lee et al., 2017; Osareme et al., 2024). This trend underscores that population aging is no longer merely a long-term concern but has become an immediate demographic reality requiring timely and responsive policy interventions.

The ASEAN region is facing increasingly pronounced and complex dynamics of population aging. In 2023, approximately 8.1% of ASEAN's population equivalent to around 55.9 million people were aged 65 and above, and this figure is projected to rise to 128.7 million, or about 16.3% of the total population, by 2050 (ASEAN Secretariat, 2025). Moreover, all ASEAN member states are

expected to enter the categories of aging, aged, or super-aged societies within the coming decades. This trend indicates that ASEAN is undergoing a rapid demographic transition, often described as “aging before becoming rich,” where many countries experience population aging prior to achieving high-income status (ASEAN Secretariat, 2023). This presents a serious challenge, as fiscal capacity and social protection systems in developing countries are generally still limited (Murshed et al., 2022).

More specifically, the ASEAN-5 countries (Indonesia, Malaysia, Thailand, the Philippines, and Singapore) exhibit a high degree of heterogeneity in the context of population aging, particularly in terms of the pace of demographic transition and the readiness of their health systems. Singapore and Thailand have already entered the phase of an aged society, while Malaysia is approaching the threshold of an aging society. In contrast, Indonesia and the Philippines remain in the transitional stage, albeit with rapidly accelerating aging trends. As the most populous country in the region, Indonesia contributes significantly to the total number of older persons in ASEAN, accounting for nearly 37% of the region’s elderly population (ASEAN Secretariat, 2023). Furthermore, population aging has become a major concern due to its wide-ranging implications for multiple aspects of life, including health, economic performance, and social welfare (Ogura & Jakovljevic, 2018).

The rise in population aging carries significant implications for the health sector, particularly in terms of increasing demand for healthcare services (Ogura & Jakovljevic, 2018). Older populations tend to exhibit higher morbidity rates and require more intensive and continuous healthcare services, especially for chronic and degenerative diseases. This condition places growing pressure on healthcare systems and public health financing (Khan et al., 2024; Sun & Li, 2023). From a health economics perspective, an increasing share of elderly individuals is directly associated with higher public health expenditure, driven by greater demand for medical services, long-term care, and the use of more advanced health technologies (Jakovljevic et al., 2023; Shah, 2025). Therefore, public health expenditure constitutes a crucial component in maintaining population well-being while ensuring the sustainability of national healthcare systems. Moreover, it also serves as an important driver of long-term economic productivity through improvements in human capital quality (Guyon et al., 2017).

However, the increase in public health expenditure cannot be separated from a country’s macroeconomic conditions. Economic growth plays a crucial role in enhancing government fiscal capacity through increased state revenues, thereby enabling greater budget allocations to the health sector (Rana et al., 2020; Velenyi, 2016). Several studies indicate a positive relationship between economic growth and health expenditure, where rising national income tends to be followed by an increase in public health spending (Behera & Dash, 2017; Erçelik, 2018). In addition, investment contributes to strengthening the healthcare system through infrastructure development, improvements in service efficiency, and the adoption of medical technologies (Olaniyan et al., 2021; Visconti & Quirici, 2020). Therefore, the interplay between population aging, economic growth, and investment becomes a key determinant in shaping the sustainability of health financing systems.

In the context of sustainable development, this issue has become increasingly relevant as it is directly linked to efforts to balance economic growth and social welfare. Population aging not only leads to rising health expenditures but also has the potential to reduce labor productivity and narrow the tax base due to a declining share of the working-age population (Harper, 2014). This condition may generate a dual fiscal pressure: on the one hand, it increases the demand for health-related spending, while on the other, it can reduce government revenue capacity. Therefore, without appropriate policy strategies, this phenomenon may threaten fiscal sustainability and long-term economic stability (Nyce & Schieber, 2005).

Furthermore, within the framework of sustainable economics and growth policies, public health expenditure is not merely viewed as a fiscal burden but also as a form of social investment that can enhance human capital quality and support long-term economic growth (Dyakova, 2017).

A sustainable health financing system is therefore essential to ensure that the rising demand for healthcare services driven by population aging can be met without compromising fiscal stability (Hassan & Islam, 2026; Shah, 2025; Wu et al., 2023). In this context, a comprehensive understanding of the determinants of public health expenditure becomes critically important, particularly in identifying the relative roles of demographic, economic, and investment-related factors.

Empirical studies examining the effects of population aging, economic growth, and investment on public health expenditure remain limited, particularly in the context of developing countries such as the ASEAN-5. Most existing research has tended to focus on advanced economies. However, the heterogeneous characteristics of ASEAN-5 countries in terms of economic development levels, demographic structures, and healthcare system capacity offer an opportunity to generate more comprehensive insights through a comparative approach. Studies conducted in several countries have found that population aging has a positive and significant effect on increasing health expenditure (De Meijer et al., 2013; Mohapatra et al., 2024). Nevertheless, empirical evidence from developing countries presents more diverse and often inconsistent findings, particularly regarding the role of investment in influencing health expenditure.

Based on this gap, the present study aims to analyze the effects of population aging, economic growth, and investment on public health expenditure in the ASEAN-5 countries using a panel data approach. The scope of this study covers five ASEAN member states over a recent observation period and employs internationally comparable indicators, namely the old-age dependency ratio, GDP per capita growth, gross capital formation, and domestic general government health expenditure.

The urgency of this study is further reinforced within the context of sustainable development, where the sustainability of health financing systems constitutes a key prerequisite for achieving societal well-being (Liaropoulos & Goranitis, 2015). Without proper management, rising health expenditures driven by population aging may generate significant fiscal pressure and threaten long-term economic stability (Osareme et al., 2024). Therefore, this study offers not only academic contributions but also strong policy relevance, particularly in supporting the achievement of the Sustainable Development Goals (SDGs), especially SDG 3 (*Good Health and Well-being*) and SDG 8 (*Decent Work and Economic Growth*). The contributions of this research are multidimensional. Theoretically, it enriches the health economics literature by integrating demographic and economic factors within the framework of sustainable economics. Empirically, it provides up-to-date evidence based on panel data from the ASEAN-5 region, which exhibits heterogeneous characteristics. Practically, the findings are expected to serve as a basis for policymakers in formulating sustainable and adaptive health financing policies in response to demographic changes.

The novelty of this study lies in its integrative approach, which links demographic factors (population aging), macroeconomic factors (economic growth), and investment factors in explaining the dynamics of public health expenditure in developing countries, particularly the ASEAN-5. In contrast to previous studies that tend to be partial in scope or focused on advanced economies, this research emphasizes a regional context characterized by high heterogeneity and connects it to the concept of health financing sustainability within the framework of sustainable economics. The policy implications of this study are expected to provide concrete recommendations, including: (1) the need to strengthen fiscal capacity through inclusive economic growth; (2) the optimization of investment, particularly in the health sector and supporting infrastructure; and (3) the development of adaptive health financing strategies in response to the rising old-age dependency ratio. Thus, this study not only contributes to the academic literature but also holds practical relevance in supporting the sustainability of healthcare systems and long-term economic development in the ASEAN-5 region.

LITERATURE REVIEW AND HYPOTHESIS FORMULATION

From an economic perspective, the relationship between demographic structure and health expenditure can be explained through the Life-Cycle Hypothesis developed by Modigliani and Brumberg. This theory posits that individual consumption patterns change over the life cycle, with older age groups tending to increase consumption, particularly in the healthcare sector (Halliday et al., 2019; Tung, 2011). This is consistent with empirical findings showing that older individuals have higher demand for healthcare services due to an increased risk of chronic and degenerative diseases (Jakovljevic et al., 2023). In addition, the health economics theory proposed by Grossman conceptualizes health as a form of human capital with economic value. Within this framework, health expenditure is viewed as an investment aimed at enhancing individual productivity (Grossman, 1972; Koka et al., 2014). Therefore, increased public health expenditure not only improves overall well-being but also contributes to long-term economic growth (Jakovljevic et al., 2023).

The relationship between economic growth and government expenditure is explained by Wagner's Law, which posits that increases in per capita income lead to higher government spending, including in the health sector (Lamartina & Zaghini, 2011; Olayiwola et al., 2021). In this context, healthcare expenditure is considered a normal good, for which demand rises as income increases (Bustamante & Shimoga, 2017). Meanwhile, the role of investment in the economy is explained by the Endogenous Growth Theory, which emphasizes that capital accumulation, innovation, and investment in infrastructure can drive sustainable economic growth (Carlsson et al., 2013). Investment in the health sector, both directly and indirectly, can enhance the efficiency of healthcare services and reduce long-term costs (Wang & Wang, 2021). From the perspective of fiscal sustainability, Fiscal Sustainability Theory highlights the importance of maintaining a balance between government revenues and expenditures (Alshaib et al., 2023). Population aging has the potential to increase fiscal burdens through rising healthcare expenditures, thereby necessitating sustainable financing strategies to ensure long-term economic stability (Lee et al., 2017).

This study employs internationally comparable indicators, namely: population aging measured by the old-age dependency ratio (OADR), economic growth proxied by GDP per capita growth, investment measured through gross capital formation (GCF), and public health expenditure represented by domestic general government health expenditure. Research on the relationship between population aging and public health expenditure has been widely conducted, particularly in developed countries. Studies by Shah (2025) and Jakovljevic et al. (2023) show that an increase in the proportion of the elderly population significantly raises public health expenditure. Similar findings are reported by Felder (2013) and De Meijer et al. (2013), indicating that demographic factors constitute one of the primary determinants of rising health spending.

In the context of economic growth, various empirical studies have found a positive relationship between economic growth and health expenditure. Behera & Dash (2017) demonstrate that increases in GDP per capita significantly raise public health expenditure through enhanced government fiscal capacity. Meanwhile, empirical findings on the role of investment in health expenditure remain mixed. Wang & Wang (2021) find that investment contributes to improving the quality and accessibility of healthcare services through infrastructure development. However, other studies suggest that increased investment may enhance the efficiency of healthcare systems, which in the long run could reduce the need for public health expenditure (Brikci et al., 2024). In the context of developing countries, particularly ASEAN, research on this issue remains relatively limited. Some studies indicate that health expenditure in ASEAN is influenced by a combination of demographic and economic factors; however, most existing research remains partial and has not yet integrated all relevant variables within a single analytical framework.

Based on previous studies, it can be identified that the relationship between population aging and health expenditure is relatively consistent, with most research demonstrating a positive and significant effect. This finding aligns with the life-cycle hypothesis and the theory of health demand,

which suggest that the need for healthcare services increases with age. However, the relationship between investment and health expenditure remains inconclusive. Some studies report a positive effect, while others find negative or insignificant relationships. These differences may be attributed to variations in economic structures, the efficiency of healthcare systems, and differences in analytical methods employed. Moreover, the majority of existing studies focus on developed countries, thus providing limited representation of developing economies, which often face fiscal constraints and possess distinct healthcare system characteristics. Studies that simultaneously integrate demographic, economic, and investment factors remain scarce, particularly in the context of ASEAN-5, a region characterized by high heterogeneity. Another limitation lies in the lack of approaches that explicitly link these variables to the concept of health financing sustainability. In the context of sustainable development, it is essential to understand how the interaction among these factors influences the sustainability of healthcare financing systems.

Population aging, measured by the old-age dependency ratio, reflects an increasing demographic burden that drives higher demand for healthcare services; therefore, it is expected to have a positive effect on public health expenditure. Economic growth, proxied by GDP per capita growth, indicates an expansion in government fiscal capacity, enabling greater budget allocation to the health sector. Accordingly, economic growth is expected to exert a positive influence on public health expenditure. Meanwhile, investment, measured by gross capital formation, plays a role in enhancing economic capacity and the efficiency of healthcare systems. However, the effect of investment on health expenditure may be either positive or negative, depending on how such investment influences system efficiency and healthcare financing needs.

Based on these theoretical and empirical arguments, the research hypotheses are formulated as follows:

H1: Population aging has a positive effect on public health expenditure.

H2: Economic growth has a positive effect on public health expenditure.

H3: Investment has a negative effect on public health expenditure.

RESEARCH METHODS

This study employs a quantitative explanatory approach aimed at examining the effects of population aging, economic growth, and investment on public health expenditure within the framework of health financing sustainability. This approach is chosen as it enables theory-driven hypothesis testing through measurable and replicable econometric models. Specifically, the study adopts a panel data design that combines cross-sectional and time-series dimensions. The unit of analysis consists of five ASEAN countries (Indonesia, Malaysia, Thailand, the Philippines, and Singapore) over an annual observation period from 2009 to 2023. The use of panel data offers several advantages, including increased degrees of freedom, improved estimation efficiency, and enhanced ability to control for unobserved heterogeneity across countries (Gujarati & Porter, 2009).

The selection of panel data regression methods is based on several methodological considerations. First, the heterogeneous characteristics of ASEAN-5 countries in terms of economic structure, healthcare systems, and demographic dynamics require an approach capable of accommodating time-invariant differences across units of analysis. Second, the combination of time-series and cross-sectional dimensions allows for a more comprehensive analysis of both short-term and long-term dynamics. Third, this method is widely used in cross-country health economics studies and is considered a robust empirical approach. Furthermore, to mitigate potential estimation bias arising from unobserved variables, this study considers the use of both the fixed effects model (FEM) and the random effects model (REM), with the final model selection determined through appropriate specification tests. The study employs econometric software for data processing and model estimation, specifically EViews.

Tabel 1. Operational Definitions of Variables

Variables	Factor	Sign	Variables	Unit	Source
Dependent Variable	Public Health Expenditure	PHE	Domestic general government health expenditure	%	World Bank
Independent Variables	Population Aging	OADR	Old-age dependency ratio	%	World Bank
	Economic Growth	GDP	GDP per capita growth	%	World Bank
	Investment	GCF	Gross capital formation (% of GDP)	%	World Bank

Source: Data processed, 2026

The dependent variable in this study is public health expenditure, measured by domestic general government health expenditure (% of GDP). The independent variables include population aging, proxied by the old-age dependency ratio (% of the working-age population); economic growth, measured by GDP per capita growth; and investment, represented by gross capital formation (% of GDP). The regression model employed in this study is specified as follows:

$$PHE_{it} = \alpha + \beta_1 OADR_{it} + \beta_2 GDP_{it} + \beta_3 GCF_{it} + \mu_i + \lambda_t + \varepsilon_{it} \dots\dots\dots (1)$$

Where *PHE* denotes public health expenditure, *OADR* represents population aging, *GDP* refers to economic growth, and *GCF* indicates investment. The subscript *i* denotes the cross-sectional units, namely the 5 ASEAN countries, while *t* represents the time period, covering 2009 to 2023.

In panel data regression, there are three approaches, namely the Fixed Effect, Random Effect, and Common Effect models. The determination of the most appropriate model to be used in the study is conducted using the Chow test, Hausman test, and Lagrange Multiplier test. After the best model is obtained, the next step is to perform statistical tests including the coefficient of determination test, F-test, and t-test.

RESULTS AND DISCUSSION

The study's findings were obtained using panel data regression analysis with the Fixed Effect Model (FEM) approach method. The selected model is one that passes the classical assumption test, which includes heteroscedasticity and multicollinearity tests. In this study, the regression results are as follows:

Tabel 2. Fixed Effect Model Estimation Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.074627	0.513516	0.145325	0.8849
OADR	0.181236	0.019915	9.100346	0.0000
GDP	-0.013115	0.011367	-1.153800	0.2527
GCF	0.000241	0.016970	0.014202	0.9887
Prob(F-Statistic)	0.000000			
R-Square	0.829597			

Source: Data processed, 2026

Based on the results in Table 2, it is necessary to test the coefficient of determination. The purpose of the coefficient of determination test itself is to determine how comprehensive the independent variables are to the dependent variables. In the fixed effect model estimation results, it is known that R-square estimates is 0.829597, which means that the independent variables, which include population aging, economic growth, and investment affect public health expenditure by 82.95%, while the remaining 17.05% is influenced by other factors outside the model. Then, an F-test was conducted to determine the overall effect of the independent variables on the dependent variable. In Table 2, the F-statistic probability produced a value of 0.0000, which is smaller than alpha 5% ($0.0000 < 0.05$), meaning that the independent variables in the study, namely population aging, economic growth, and investment, influence public health expenditure simultaneously.

Table 2 also present the estimates from the t-test, which determines the individual effect of each independent variable on the dependent variable. The significance level chosen for this study is 5%. Based on the table 2 above, which shows the results of the equation model estimation, the effect of each independent variable partially on the dependent variable can be seen as follows:

- (1) The population aging variable on public health expenditure has a probability value of 0.0000, which is smaller than the significance level $\alpha = 0.05$ with a positive relationship direction, meaning that there is a positive and significant influence between population aging and public health expenditure.
- (2) The economic growth variable on public health expenditure has a probability value of 0.2527, which is greater than the significance level of $\alpha = 0.05$, meaning that there is no significant influence between economic growth and public health expenditure.
- (3) The investment variable on public health expenditure has a probability value of 0.9887, which is greater than the significance level of $\alpha = 0.05$, meaning that there is no significant influence between investment and public health expenditure.

The empirical findings indicate that population aging, as measured by the old-age dependency ratio, has a positive and significant effect on public health expenditure in the ASEAN-5 countries. This result directly addresses the main research question and confirms that changes in demographic structure constitute a fundamental determinant in the dynamics of health financing in developing economies. The interpretation of these findings suggests that an increase in the old-age dependency ratio not only raises the demand for healthcare services but also generates fiscal pressure, prompting governments to increase health expenditure in order to maintain access and quality of care. In the ASEAN-5 context, this phenomenon is further reinforced by the limitations of social security systems and the predominance of public financing in the provision of essential healthcare services. Accordingly, population aging functions as a structural cost driver within the healthcare system (De Meijer et al., 2013; Felder, 2013). These findings are consistent with prior studies that highlight a positive relationship between population aging and health expenditure. Cross-country comparative studies show that demographic factors, particularly the rising share of the elderly population, are key determinants of increasing healthcare spending (Wu et al., 2023). This evidence supports the Life-Cycle Hypothesis and health demand theory, while also extending them in the context of developing countries through the dimension of fiscal pressure. In other words, the relationship between population aging and health expenditure is driven not only by age-related healthcare consumption preferences but also by fiscal policy responses aimed at maintaining social stability. Thus, this study proposes an extension of the theoretical framework into a *demographic-fiscal response framework*, in which the old-age dependency ratio triggers increased health spending as an instrument of stabilization and social protection (Harper, 2014).

Furthermore, the results indicate that economic growth has no significant effect on public health expenditure in the ASEAN-5 countries. This finding challenges the assumption derived from Wagner's Law, which posits that increases in income are followed by increases in public

expenditure. Instead, the results suggest that economic growth is not automatically translated into higher public health spending. In the ASEAN-5 context, several mechanisms may explain this outcome: (1) health budget allocation is determined by policy priorities and institutional frameworks, rather than short-term growth fluctuations (Tsofa et al., 2023); (2) sectoral crowding-out, where increased income may be allocated to other sectors such as infrastructure, education, or subsidies in line with development agendas (Landon, 2020); (3) growth driven by specific sectors (e.g., commodities or industry) does not necessarily increase demand for public healthcare services (Lange & Vollmer, 2017); and (4) the role of non-public financing, whereby rising income may stimulate private healthcare consumption, which is not reflected in government expenditure (Behera & Dash, 2017). This finding is consistent with studies showing that the income elasticity of health expenditure is not always significant in developing countries (Jakovljevic et al., 2023). Therefore, the results do not fully support Wagner's Law in the context of public healthcare expenditure in developing economies. This study proposes a refinement by incorporating a *policy mediation channel*, suggesting that the effect of economic growth on health expenditure is mediated by policy priorities, fiscal institutions, and the structure of healthcare financing.

Investment, as measured by gross capital formation, does not have a significant effect on public health expenditure in the ASEAN-5 countries. This finding indicates that investment does not directly translate into increased government health spending. Several factors may explain this result: (1) investment affects the health sector through indirect channels such as productivity, infrastructure, and technology which require time to materialize (Foster et al., 2023; Hu & Yao, 2021); (2) gross capital formation includes non-health investments (e.g., manufacturing, construction, and energy), thereby limiting its direct impact on the health sector (Aberu et al., 2024); and (3) private investment in healthcare may partially substitute for public financing (substitution effect) (Eriksen & Wiese, 2019). Some studies find that investment enhances healthcare service capacity (Wang & Wang, 2021), while others, such as Gupta et al. (2002), report indirect or insignificant effects on public spending due to improved efficiency and increased private sector participation. From a theoretical perspective, these findings contribute to the development of Endogenous Growth Theory by emphasizing that the role of investment in the health sector is context dependent and not necessarily linear. This study therefore suggests that investment should be analyzed based on its sectoral composition and transmission mechanisms, rather than being treated solely as an aggregate variable.

The findings of this study reveal an asymmetry in the roles of demographic and economic factors in shaping the dynamics of public health expenditure in the ASEAN-5 countries. In particular, the dominant influence of population aging, compared to economic growth and investment, indicates that pressures on health financing systems are driven more by structural demographic changes than by short-term economic fluctuations. This condition reflects the characteristics of developing countries undergoing rapid demographic transition, where the increase in the proportion of the elderly population occurs before the achievement of high income status. In such a context, fiscal capacity is not yet fully prepared to accommodate the rising demand for healthcare services. Consequently, increases in public health expenditure tend to be more responsive to demographic needs rather than being proactively driven by economic expansion.

Moreover, the insignificant effect of economic growth suggests that the relationship between macroeconomic variables and health expenditure is not automatic, but rather highly dependent on institutional structures and public policy priorities. This finding underscores that economic growth, in the absence of policy reform, is insufficient to ensure improvements in the quality and accessibility of healthcare services (Saltman, 2018). Meanwhile, the non-significant role of investment indicates that its impact on the health sector is indirect and requires time to materialize. In many cases, investment contributes more to improving system efficiency than to directly increasing public expenditure (Brikci et al., 2024). Therefore, aggregate measures such as gross capital formation may not fully capture the complexity of this relationship.

Overall, the findings of this study highlight the importance of a multidimensional approach in understanding the sustainability of health financing. Demographic, economic, and investment factors do not operate independently; rather, they interact through complex mechanisms. Therefore, public policy needs to be designed in an integrated manner, taking into account long-term dynamics shaped by changes in population structure.

CONCLUSION

This study aims to analyze the effects of population aging, economic growth, and investment on public health expenditure in the ASEAN-5 countries within the framework of health financing sustainability. Based on the panel data analysis, the results show that population aging, as measured by the old-age dependency ratio, has a positive and significant effect on public health expenditure. In contrast, economic growth and investment do not exhibit significant effects. These findings indicate that the increase in health expenditure in ASEAN-5 is driven more by demographic pressures than by economic factors. Consequently, the sustainability of health financing largely depends on the ability of governments to manage the impacts of population aging. Furthermore, the results highlight that economic growth and investment do not automatically lead to higher health expenditure in the absence of effective policy mechanisms.

This study contributes to the health economics literature by demonstrating that the relationship between economic growth and health expenditure is not always linear, particularly in developing countries. In addition, it reinforces the role of population aging as a primary determinant in health financing models and highlights the need to integrate demographic and policy dimensions within the framework of public economics theory. From a practical perspective, the findings offer several policy implications: (1) governments need to prioritize health policies that are responsive to population aging, such as the development of elderly healthcare services and long-term care systems; (2) fiscal mechanisms are required to effectively link economic growth with increased health expenditure; and (3) investment policies should be directed toward sectors that have a direct impact on the efficiency and quality of healthcare services. Furthermore, this study underscores broader policy implications, including the need for reforms in health financing systems to ensure long-term sustainability, the strengthening of national health insurance systems, and the integration of demographic and health policies into development planning.

This study has several limitations that should be acknowledged. First, there are limitations related to variable selection. The study only incorporates the main variables (aging, growth, and investment), and therefore does not account for other potentially relevant factors such as institutional quality, urbanization, health technology, and insurance systems. Second, the investment variable is measured in aggregate terms (gross capital formation), which does not allow for differentiation between investment in the health sector and other sectors. Third, the model employed does not fully capture long-term dynamics or potential lag effects among variables. Fourth, there are limitations in geographical scope, as the study focuses solely on the ASEAN-5 countries; thus, caution is needed when generalizing the findings to other regions.

Based on these limitations, several directions for future research can be proposed. First, subsequent studies may incorporate additional variables such as institutional quality, urbanization, health technology, and health insurance coverage to enrich the analytical model. Second, future research could employ dynamic approaches, such as Dynamic Panel methods (e.g., GMM), to capture long-term effects and address potential endogeneity issues. Finally, expanding the geographical scope for instance, by comparing ASEAN with other regions would provide broader insights and enhance the generalizability of the findings.

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