EFFECTS OF GDP PER CAPITA, FDI, AND EXPORTS ON LIFE EXPECTANCY: A PANEL REGRESSION ANALYSIS

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ABSTRAK

Angka harapan hidup adalah indikator fundamental kesehatan masyarakat dan kesejahteraan ekonomi yang mencerminkan kualitas hidup suatu negara secara keseluruhan. Seiring dengan perkembangan suatu negara, pertumbuhan ekonomi biasanya meningkatkan layanan kesehatan, gizi, pendidikan, dan standar hidup, sehingga meningkatkan angka harapan hidup. Penelitian ini menguji pengaruh PDB per kapita, Penanaman Modal Asing (PMA), dan Ekspor terhadap angka harapan hidup dengan menggunakan regresi data panel di beberapa negara. Analisis ini menggunakan Random Effects Model (REM) dengan kesalahan standar yang kuat untuk memperhitungkan heterogenitas dan memastikan kesimpulan yang dapat diandalkan. Temuan kami menunjukkan bahwa PDB per kapita yang lebih tinggi dan peningkatan aktivitas ekspor sangat terkait dengan peningkatan angka harapan hidup, yang menunjukkan bahwa sumber daya ekonomi yang lebih besar dan integrasi pasar meningkatkan akses terhadap layanan kesehatan yang berkualitas. Sebaliknya, FDI menunjukkan efek yang beragam terhadap angka harapan hidup, menyiratkan bahwa manfaat modal asing bergantung pada faktor-faktor spesifik negara. Secara keseluruhan, hasil-hasil ini menyoroti pentingnya kebijakan ekonomi dalam meningkatkan kesehatan masyarakat dan pembangunan.

***Kata kunci**: harapan hidup, pdb per kapita, penanaman modal, ekspor, regresi data panel*
Klasifikasi JEL: O15, I15, F21, F14, C33

ABSTRACT

Life expectancy is a fundamental indicator of public health and economic well-being that reflects a country's overall quality of life. As nations develop, economic growth typically improves healthcare, nutrition, education, and living standards, thereby increasing life expectancy. This study examines the influence of GDP per capita, Foreign Direct Investment (FDI), and Exports on life expectancy using panel data regression across multiple countries. The analysis employs a Random Effects Model (REM) with robust standard errors to account for heterogeneity and ensure reliable inference. Our findings indicate that higher GDP per capita and increased export activity are strongly associated with improved life expectancy, suggesting that greater economic resources and market integration enhance access to quality health services. In contrast, FDI shows mixed effects on life expectancy, implying that the benefits of foreign capital depend on country-specific factors. Overall, these results highlight the importance of economic policies in promoting public health and development.

***Keywords**: life expectancy, gdp per capita, foreign direct invesment, exports, panel data regression*
Klasifikasi JEL: O15, I15, F21, F14, C33

INTRODUCTION

Economic development plays a crucial role in improving the quality of life and overall well-being of a country's population. One of the key indicators of societal welfare is Life Expectancy (LE), which reflects the average number of years an individual is expected to live based on current mortality rates (Ngangue & Manfred, 2015). Life expectancy at birth is defined as the average number of years a newborn baby is expected to live under current mortality conditions, which serves as a broad indicator of population health (Herzer, 2015). It is widely used to assess the overall quality of a country's health care system and social welfare (Nagel et al., 2015). Higher life expectancy is usually associated with improved access to medical care, better nutrition, and better living conditions (Beşe & Kalayci, 2021). Moreover, empirical research suggests that sustained economic growth and increased foreign investment contribute to higher life expectancy in developing countries (Burns et al., 2017).

Several macroeconomic factors play a crucial role in shaping and determining life expectancy across different populations (Dafirino Hardjono & Putu Wiwin Setyari, 2022). A strong and stable economy often leads to better healthcare infrastructure, improved living standards, and enhanced public health initiatives, all of which contribute to increased life expectancy (Kurniawan & Managi, 2018). Countries with a higher GDP per Capita (GDPPK) leads to better living standards, improved healthcare facilities, and increased public investment in medical services, all of which contribute to higher life expectancy (Kencana, 2019). As individuals experience higher income levels, they tend to have better access to nutritious food, clean water, and quality medical care, thereby reducing mortality rates (Miladinov, 2020).

GDP per capita is defined as a country's gross domestic product divided by the total population, reflecting the average economic output per person (Bazán Navarro & Álvarez-Quiroz, 2022). It serves as a leading indicator of living standards and overall economic performance (Oladipo, 2013). Empirical evidence shows that higher GDP per capita is often associated with better health outcomes and quality of life (Herzer, 2015). Research from various contexts confirms that strong economic performance measured by GDP per capita can enhance social and infrastructure development (Ling et al., 2017).

FDI can be described as an investment made by individuals or companies in one country into business interests located in another country, usually characterized by acquiring a lasting management interest (typically 10% or more of the voting shares) (Lipsey & Sjöholm, 2011). It is usually expressed as a percentage of GDP to indicate the extent of a country's integration into the global economy (Balisacan et al., 2003). Research has shown that FDI encourages technology transfer and increases productivity in the host country (Idrees et al., 2019). Moreover, FDI plays an important role in promoting economic growth and improving overall living standards in developing countries (Nugraha, 2013).

Similarly, Foreign Direct Investment as a percentage of GDP (FDIG) is often associated with economic growth, job creation, and technology transfer (Liang et al., 2021). FDIG can indirectly improve life expectancy by enhancing healthcare infrastructure, increasing employment opportunities, and fostering innovation in medical technology (Maichal et al., 2023). However, the impact of FDIG on public health is not always positive, as foreign investment may also introduce environmental risks, industrial pollution, and labor exploitation, which could adversely affect public health outcomes (Jugurnath & Emrith, 2018). Meanwhile, Export (EXP) plays a vital role in economic expansion by generating income and increasing revenues. A strong export sector allows countries to invest more in public health and social services, which can enhance life expectancy (Chiwira et al., 2023). However, the relationship between trade and health outcomes is complex; while increased exports can improve economic conditions, they may also expose countries to external economic shocks, affecting healthcare funding and accessibility (Rodrik, 2018).

Exports refer to domestically produced goods and services sold to foreign markets, which play an important role in a country's economic engagement with the world (Herzer, 2015). Trade openness is usually measured as the ratio of exports (or the combined value of exports and imports) to GDP, reflecting the extent to which an economy is integrated into the global market (Ling et al., 2017). Increased export activity is associated with increased economic growth as it opens up larger markets and encourages technology diffusion (Bazán Navarro & Álvarez-Quiroz, 2022). In addition, higher levels of trade openness can indirectly improve health outcomes by raising income levels and encouraging innovation (Beşe & Kalayci, 2021).

Despite these theoretical linkages, empirical studies provide mixed findings regarding the impact of economic growth, foreign direct investment, and trade on life expectancy. The role of FDIG also remains debated, as the benefits of foreign investment may vary depending on institutional quality, governance, and policy frameworks. Additionally, trade liberalization has been linked to both positive and negative health outcomes, depending on how export revenues are allocated to public health services (Fazaalloh, 2019).

To address these gaps in the literature, this study employs a panel data regression model to analyze the impact of GDPPK, FDIG, and EXP on Life Expectancy (LE) across multiple countries. The study aims to provide new insights into how macroeconomic factors shape health outcomes and longevity, offering valuable policy recommendations for governments and international organizations (Felice et al., 2016).

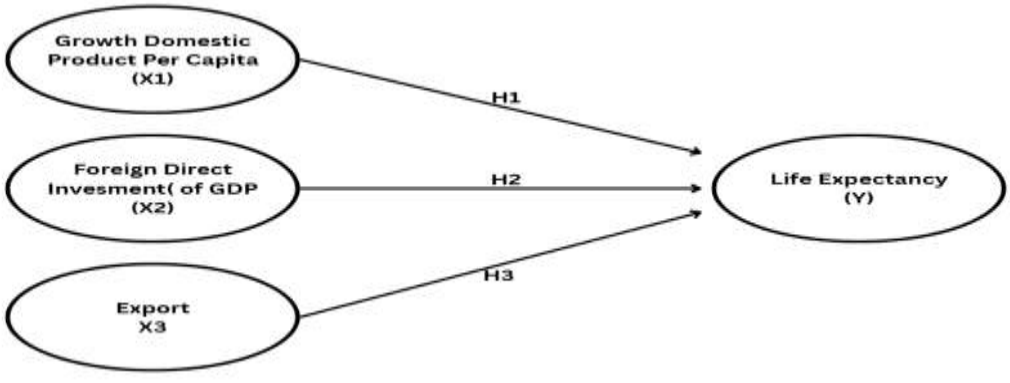
Based on existing phenomena and research gaps, researchers are interested in further examining the influence of Gross Domestic Product Per Capita, Foreign Direct Invesment of GDP, Export on Life Expectancy. The following are the hypotheses formulated in this study:

H_1 : Growth Domestic Product Per Capita has a positive impact on Life Expectancy

H_2 : Foreign Direct Invesment of GDP has a positive impact on Life Expectancy

H_3 : Export has a positive impact on Life Expectancy

Gambar 1: Kerangka Konseptual



Source: Data Diolah, 2025

Economic growth plays a significant role in improving public health outcomes, particularly life expectancy. GDP per capita (GDPPK) is a critical factor influencing life expectancy since higher income levels allow better access to healthcare, nutrition, and improved living conditions (Miladinov, 2020). Countries with higher GDP per capita typically invest more in medical infrastructure, education, and sanitation, which directly contribute to increased longevity (Shafi & Fatima, 2019). Additionally, individuals with higher income levels tend to afford better medical treatment, leading to reduced mortality rates (Herzer, 2015). Empirical studies confirm a strong positive correlation between economic performance and public health, emphasizing that GDP per capita significantly enhances quality of life (Herzer, 2015). Thus, GDP per capita is hypothesized to have a positive effect on life expectancy.

H_1 : Growth Domestic Product Per Capita has a positive impact on Life Expectancy

The relationship between Foreign Direct Investment (FDI) and life expectancy remains mixed, with studies presenting both positive and negative outcomes (Chiappini et al., 2022). On the one hand, FDI can improve public health through technology transfer, increased employment opportunities, and better access to medical innovations (Idrees et al., 2019). When foreign investments target healthcare and essential industries, they can enhance medical services and living standards (Herzer & Nunnenkamp, 2012). However, in some cases, FDI is concentrated in sectors such as manufacturing and resource extraction, which do not directly contribute to public health improvements (Herzer & Nunnenkamp, 2012). Moreover, environmental concerns, labor exploitation, and industrial pollution associated with FDI may negatively affect population health (Chiappini et al., 2022). Several studies suggest that FDI does not always translate into better life expectancy and that its benefits depend on the regulatory environment of the host country (Jugurnath & Emrith, 2018). Therefore, the impact of FDI on life expectancy is expected to be ambiguous, depending on country-specific factors.

H_2 : Foreign Direct Invesment of GDP has a positive impact on Life Expectancy

Exports (EXP) play a crucial role in shaping economic stability and public health by increasing government revenues that can be allocated to social welfare and healthcare (Kojo Ayesu et al., 2022). Countries with strong export performance tend to experience higher economic growth, allowing greater public investment in medical facilities, education, and health

programs (Byaro et al., 2021). Furthermore, trade liberalization encourages innovation in healthcare services and medical technologies, leading to better health outcomes (McNamara, 2018). Studies indicate that nations with a high volume of exports generally exhibit longer life expectancy due to increased national income, which allows for expanded healthcare coverage and improved living standards (Byaro et al., 2021). Thus, it is hypothesized that increased export activity has a positive impact on life expectancy.

H_3 : Export has a positive impact on Life Expectancy

RESEARCH METHOD

This research uses data from five ASEAN countries which are Indonesia, Thailand, Singapore, Malaysia and Brunei Darussalam from the year 2003-2023. The selection of Indonesia, Thailand, Singapore, Malaysia, and Brunei Darussalam for this study is based on their relatively high GDP per capita within the ASEAN region (Setyadi et al., 2022). In 2023, the data shows that Singapore leads with a GDP per capita of $84,734, followed by Brunei at $33,431, Malaysia at $11,649, Thailand at $7,172, and Indonesia at $4,941. Focusing on these countries allows for an in-depth analysis of how higher income levels influence life expectancy, providing valuable insights into the relationship between economic prosperity and public health outcomes in the ASEAN context.

The dataset used in this study consists of panel data collected from multiple countries over a specified period. The data sources include the World Bank Database, from which we obtained Gross Domestic Product per capita, Foreign Direct Investment as a percentage of GDP, and Export. Additionally, data on Life Expectancy were retrieved from the World Health Organization (WHO). These variables were selected to analyze their relationships and potential impacts within the scope of the study. The sample includes a set of developing and developed countries, ensuring a broad perspective on the relationship between economic indicators and health outcomes. Countries with incomplete data were excluded to maintain the robustness of the analysis.

This study employs a panel data regression model to examine the relationship between Life Expectancy and three key macroeconomic variables which is GDP per capita, Foreign Direct Investment as a percentage of GDP, and Export. Life Expectancy serves as the dependent

variable, representing overall public health and living standards. GDP per capita, expressed in logarithmic form, reflects a country's economic well-being and is expected to have a positive impact on life expectancy, as suggested by Lovrincevic et al. (2013). Foreign Direct Investment as a percentage of GDP, also in logarithmic form, captures the role of foreign capital in economic growth and its potential influence on public health, following the perspective of Linsi (2018). Export, measured in logarithmic form, represents trade openness and its contribution to national income, which can affect health infrastructure and public services, as highlighted by Sahoo and Sahoo (2017). Initially, Import was included as an independent variable; however, after conducting a preliminary regression analysis, it was removed due to its multicollinearity problem (VIF>10; 104.89>10) on the model. The empirical analysis is based on the following panel data regression model:

$$\mathbf{lnLE = \alpha + \beta_1 lnGDPPK + \beta_2 lnFDIG + \beta_3 lnEXP + \varepsilon}$$

In this study, LE refers to Life Expectancy, GDPPK denotes GDP per Capita, FDIG represents Foreign Direct Investment as a percentage of GDP, and EXP signifies Export. Additionally, α denotes the constant term, while ε represents the error term. To ensure consistency and improve the interpretability of the results, all variables in this study are transformed into their natural logarithmic form.

RESULTS AND DISCUSSION

To ensure the validity of the model, a series of robustness checks and diagnostic tests were conducted. The Chow Test indicated that the Fixed Effects Model (FEM) is superior to the Common Effects Model (CEM) (p-value < 0.05). Furthermore, the Hausman Test revealed that the Random Effects Model (REM) is more appropriate than FEM (p-value > 0.05). The Lagrange Multiplier Breusch Godfrey (LM-BG) Test further validated REM as the best model for this study.

Tabel 1: UJI FEM, CEM, REM

Variable	FEM	CEM	REM
GDPPK	0,039*** 7,55 0,000	0,049*** 20,21 0,000	0,041*** 10,52 0,000
FDIG	-0,000*** -2,02 0,046	-0,007*** -2,00 0,049	-0,000** -1,96 0,050
EXP	0,015*** 3,10 0,003	0,017*** 12,24 0,000	0,014*** 4,13 0,000
Const	3,567 42,27 0,000	3,402 63,20 0,000	3,574 54,05 0,000
Adjusted R-Squared	0,817	0,917	0,817
CHOW Test	54,09 (0,000)		
Hausman Test	0,858 (0,000)		
LM-BG Test	372,72 (0,000)		

Source: Data Diolah, 2025

Table 1 shows the results of data analysis using the CEM, FEM and REM approaches. The results of the analysis in the three models show consistent results, where the H_1 : GDPPK variable in the three models has a positive and significant influence on LE. The results of data analysis also found that the H_2: FDIG variable also statistically had a negative and significant influence on LE. Likewise with the H_3: EXP variable, where the results of data analysis show that EXP has a positive and significant influence on LE.

Since the Random Effects Model (REM) was selected, classical assumption tests such as normality and multicollinearity tests are not necessary. However, to ensure robustness, we conduct Heteroskedasticity Test and Autocorrelation Test which is confirmed the presence of heteroskedasticity in the data ($p < 0.05$), while the Autocorrelation Test (Wooldridge Test) detected autocorrelation in lag residuals ($p < 0.05$). To address these issues, Generalized Least Squares (GLS) estimation with heteroskedasticity-robust standard errors and AR(1) correction,

along with REM robust standard error was applied, ensuring reliable and unbiased coefficient estimates.

Tabel 2: GLS Panel Heteroskedasticity Robust Standard Errors and AR(1)

Variable	REM Robust Standard Error	GLS Heteroskedasticity - AR (1)
GDPPK	0,041*** 4,99 0,000	0,040*** 19,32 0,000
FDIG	-0,000 -1,06 0,289	0,000 0,02 0,984
EXP	0,014*** 3,54 0,000	0,012*** 8,37 0,000
CONST	3,574 49,92 0,000	3,635 85,82 0,000

Source: Data Diolah, 2025

Based on the robustness test shown in the Table 2 above, the results show that the t value of FDIG is -1.06, which means that only FDIG has a non-significant negative effect on Life Expectancy (LE) in the estimation results with REM robust standard error. The results from GLS Panels Heteroskedasticity AR(1) shows different results, where the t value of FDIG is 0.02, which shows that FDIG has an non-significant positive influence on LE. Even though these two models have different results on the regression coefficient of the FDIG variable, the statistical results show a significance value that is both insignificant. Meanwhile, in both models, GDPPK and EXP have a significant positive influence on LE.

The increase in GDPPK has a positive and significant relationship with LE because the higher a country's per capita income, the greater the allocation of resources for healthcare services, education, and infrastructure that support public well-being (Shafi & Fatima, 2019). With higher income levels, people can access better healthcare services, including vaccinations, quality medical care, and improved nutrition, which directly contribute to increased life expectancy. Furthermore, economic growth, as measured by rising GDPPK, helps reduce poverty

levels and enhances overall quality of life, ultimately leading to longer life spans (Samputra & Munandar, 2019).

The results of this research is also supported by Hitam & Borhan (2012) that also find the increase in FDIG has a non-significant relationship with LE. In some cases, foreign investment may be concentrated in industries such as manufacturing or natural resource extraction, which do not directly contribute to improvements in health services or living conditions (Herzer & Nunnenkamp, 2012). Additionally, environmental degradation or labor exploitation associated with certain FDI projects might offset any potential economic benefits (Chiappini et al., 2022). However, the weak magnitude of the effect implies that other variables may moderate the impact of FDIG on LE (OECD, 1999).

The increase of EXP leads to an increase in LE. This relationship is confirming the notion that economies with a strong export sector tend to experience higher living standards (Keller, 2020). A higher volume of exports contributes to economic growth by increasing national income, which in turn allows governments to invest more in public goods such as healthcare, education, and social welfare (Kojo Ayesu et al., 2022). Trade liberalization can also enhance technological advancements and efficiency in healthcare services, indirectly contributing to an increase in LE, which can enhance medical service efficiency and extend people's lifespan (Byaro et al., 2021).

CONCLUSION AND RECOMMENDATION

This study examines the impact of GDP per Capita (GDPPK), Foreign Direct Investment as a percentage of GDP (FDIG), and Export (EXP) on Life Expectancy (LE) using panel data regression. The findings indicate that GDP per Capita (GDPPK) has the most significant positive effect on Life Expectancy, emphasizing the role of economic growth in improving public health through better access to healthcare, nutrition, and infrastructure. Export (EXP) also positively influences Life Expectancy, suggesting that countries with higher trade activities benefit from increased government revenues that can be allocated to social services and public health. However, Foreign Direct Investment (FDIG) shows a slight negative effect on Life Expectancy, implying that foreign investments do not always translate into direct public health benefits and should be strategically directed toward sectors that improve overall well-being. The Random Effects Model (REM) was selected as the most appropriate for this analysis, with additional robustness checks confirming

the validity of the results. Despite the presence of heteroskedasticity and autocorrelation, adjustments using Generalized Least Squares (GLS) with robust standard errors and AR(1) correction ensured reliable estimations. These findings highlight important policy implications, including the need for inclusive economic growth, strategic foreign investment allocation, and effective utilization of export revenues to enhance public health outcomes. To maximize life expectancy improvements, governments should prioritize economic policies that foster equitable income distribution, direct foreign investments toward healthcare and education, and reinvest trade revenues into public services. Future research could further explore the role of institutional quality and healthcare advancements in shaping life expectancy trends. Overall, this study underscores the importance of aligning economic growth strategies with public health objectives to ensure sustainable improvements in societal well-being.

Promoting Economic Growth for Public Well-being. Since GDP per Capita has the strongest influence on Life Expectancy, governments should implement policies that promote inclusive economic growth. Expanding healthcare infrastructure, enhancing education systems, and investing in productive sectors that generate employment opportunities are essential strategies for improving public health. Policies that focus on reducing income inequality and increasing access to basic services can significantly enhance life expectancy, particularly in developing nations. Ngangue & Manfred (2015) Enhancing the Effectiveness of Foreign Direct Investment (FDIG). The findings indicate that FDIG does not necessarily lead to improvements in life expectancy. To ensure that foreign investments contribute positively to public well-being, governments must be selective in the types of investments they attract. Encouraging FDI in healthcare, pharmaceutical industries, clean energy, and education sectors could yield better social outcomes. Additionally, implementing regulations to mitigate negative externalities such as pollution, poor labor conditions, and displacement of local industries can help ensure that FDIG benefits the broader population. Jugurnath & Emrith (2018) Leveraging Export Growth for Public Health Improvements. Since exports positively contribute to Life Expectancy, countries should strategically utilize trade revenues to strengthen public services and social welfare programs. McNamara (2018) Governments can implement policies that allocate a portion of export earnings toward building healthcare infrastructure, providing universal healthcare

coverage, and improving public health campaigns. Furthermore, diversifying exports and reducing dependence on a limited number of commodities can enhance economic stability and ensure sustained improvements in living conditions over the long term. Helble & Shepherd (2017) A key limitation of this study is the exclusion of ASEAN countries with lower GDP per capita, such as Cambodia, Myanmar, Laos, and the Philippines. By focusing only on nations with relatively high GDP per capita, the findings may not fully represent the relationship between economic factors and life expectancy in lower-income economies. Countries with lower GDP per capita often face distinct challenges, such as weaker healthcare infrastructure, limited access to quality medical services, and higher income inequality, all of which can significantly impact life expectancy. The absence of these countries in the analysis may result in an incomplete understanding of how GDP per capita, foreign direct investment, and exports influence public health outcomes across different economic conditions within ASEAN. Future research could address this limitation by incorporating a more comprehensive set of countries to provide a broader perspective on the economic determinants of life expectancy in the region.

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