Volume 13 No. 2 (2024)
JURNAL EKONOMI PEMBANGUNAN (JEP)
http://jurnal.feb.unila.ac.id/index.php/jep
ISSN Cetak: 2302-9595 ISSN Online: 2721-6071

The Role of Human Capital, and Demographic Bonus on The Economic Growth of Jawa Barat Province: a Solow-Swan Theory Approach

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Article Information

Submitted: 19 May 2024
Revision: 18 June 2024
Accepted: 6 August 2024

Keywords:
Human capital; Demographic bonus; Economic growth; Solow-Swan theory.

Abstract

This study uses the Solow-Swan theory as a framework to analyze the role of human capital and demographic bonuses on economic growth in Jawa Barat Province. This study uses a panel data regression approach, specifically generalized least squares (GLS) regression with a fixed-effects model, to analyze data from several districts and cities in Jawa Barat Province. Human capital is measured through average years of schooling and life expectancy, whereas demographic bonus is proxied by the proportion of the productive age population (15-64 years). The results show that average years of schooling have no significant effect on economic growth, indicating that increased education does not always directly impact economic performance, possibly because of a mismatch between educational outcomes and labor market needs. In contrast, life expectancy has a positive and significant relationship with economic growth, supporting the Solow-Swan model, which emphasizes health as an important component of human capital that can increase productivity. Demographic bonuses, represented by the productive-age population, average a positive and significant effect on economic growth, suggesting that a larger proportion of productive-age individuals contribute to increased output and economic expansion through the demographic bonus. There is a need for policies that focus on improving the quality of education and suitability to the labor market to maximize the potential of human capital and demographic bonuses in supporting sustainable development in Jawa Barat.

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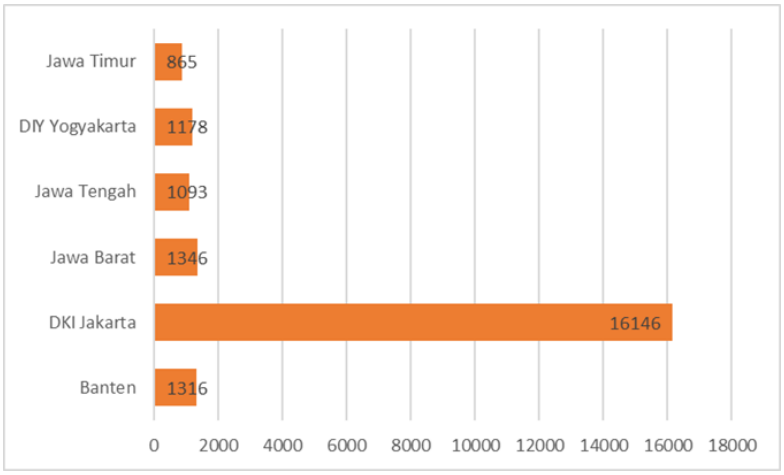
DOI: doi.org/10.23960/jep.v13i2.3522

INTRODUCTION

One of Indonesia's most populous provinces, Jawa Barat Province, is now witnessing demographic bonus phenomena predicted to considerably accelerate regional economic growth. Andriani & Yustini (2021) defined demographic bonus as a phenomenon that arises when the proportion of the population between the ages of 15 and 64 who are in the productive age group as opposed to the non-productive age group, which includes children aged 0–14 and the elderly aged 65 and above, is higher. Effectively managing the demographic bonus through the development of human capital and supportive government policies may enable Jawa Barat Province to capitalize on its population in the productive age category, thereby fostering economic growth. This perspective aligns with the assertions of Sockin & Sockin (2019), who argue that optimizing the working-age population and enhancing human capital specifically by improving educational standards and ensuring the health of this demographic can significantly contribute to increased economic growth rates.

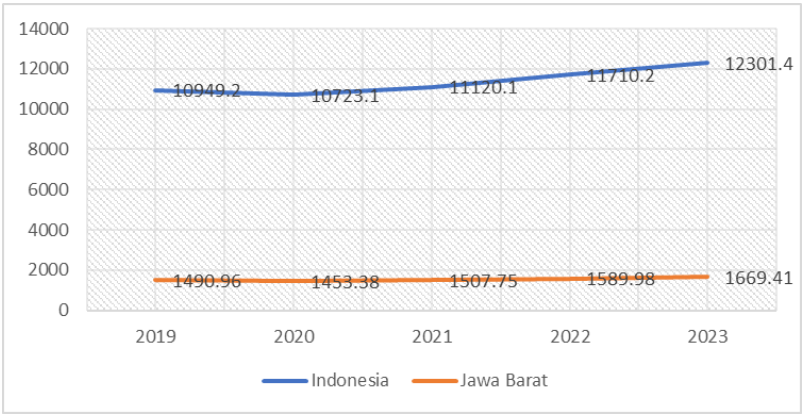
Based on population density data in Jawa Island, Jawa Barat Province exhibits a density of 1,346 people/km^2, indicating that each 1 km^2 of its area is inhabited by an average of 1,346 individuals. While lower than DKI Jakarta on 16.146 people/km^2, this figure underscores Jawa Barat's status as one of the most densely populated provinces. Its demographic composition is distinct, characterized by a mix of urban and rural areas with substantial economic growth potential. Unlike DKI Jakarta, which is predominantly urban, Jawa Barat faces more complex challenges in achieving equitable development, infrastructure, and demographic dividend management. Wu & Hsu (2022) argue that capital provinces benefit from advantages such as streamlined access to infrastructure and investment, which bolster their economic growth. Conversely, non-capital provinces like Jawa Barat, with hybrid urban-rural landscapes, can enhance economic growth by optimizing workforce utilization and addressing demographic challenges through integrated policy interventions.



Source: Central Bureau of Statistics, Process Data

Figure 1. Comparison of Population Density of Provinces in Java Island in 2023 (People/Km^2)

An advanced level of education equips individuals with enhanced skills, allowing the working-age population to contribute more effectively to economic growth. Furthermore, maintaining good health among individuals can boost productivity and diminish expenses related to illness and physical disabilities (Sockin & Sockin, 2019). Faturahman (2019) elucidated that life expectancy serves as a key indicator reflecting the health quality of a population within a specific area. Elevated life expectancy has the potential to act as a favorable indicator for regional economic enhancement.

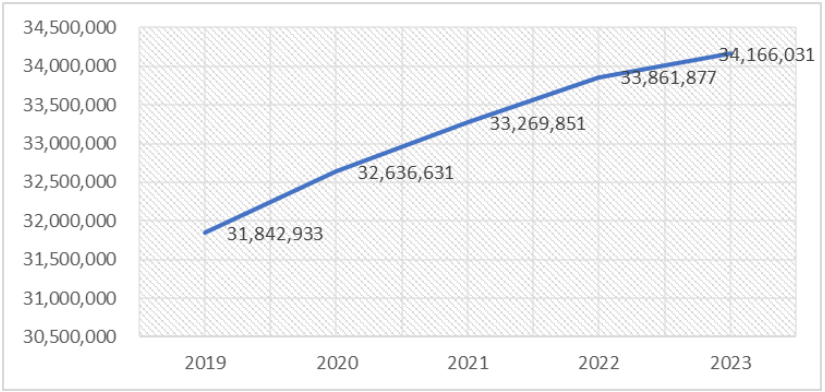


Source: Central Bureau of Statistics of Jawa Barat Province, Process Data

Figure 2. Comparison of Gross Domestic Product of Indonesia and Gross Regional Domestic Product of Jawa Barat Province at Constant Prices (2010=100) for 2019-2023 (Trillion Rupiah)

According to Figure 2, the trend of Indonesia's Gross Domestic Product (GDP) and the Gross Regional Domestic Product (GRDP) of Jawa Barat Province, measured at constant 2010 prices where 2010=100, reveals significant changes between 2019 and 2023. Notably, in 2020, both Indonesia's GDP and Jawa Barat's GRDP saw a downturn attributable to the repercussions of the COVID-19 pandemic. Specifically, Indonesia's GDP experienced a decrease from IDR 10,949.2 trillion in 2019 to IDR 10,723.1 trillion in 2020. In parallel, Jawa Barat's GRDP declined from IDR 1,490.96 trillion in 2019 to IDR 1,453.38 trillion in 2020 (Badan Pusat Statistik, 2021).

Following the decline in 2020, both Indonesia's GDP and Jawa Barat's GRDP have exhibited a steady recovery each year. In 2021, Indonesia's GDP rose to 11,120.1 trillion rupiah, an increase from the previous year, while Jawa Barat's GRDP experienced growth, reaching 1,507.75 trillion rupiah. This upward trend persisted through 2023, with Indonesia's GDP projected to attain 12,301.4 trillion rupiah compared to 2022. Concurrently, Jawa Barat's GRDP is expected to continue its ascent, reaching 1,669.41 trillion rupiah in 2023. This persistent growth pattern underscores that, following the downturn prompted by COVID-19 in 2020, both Indonesia's GDP and the GRDP of Jawa Barat Province have exhibited a consistent year-over-year increase (Badan Pusat Statistik, 2024).



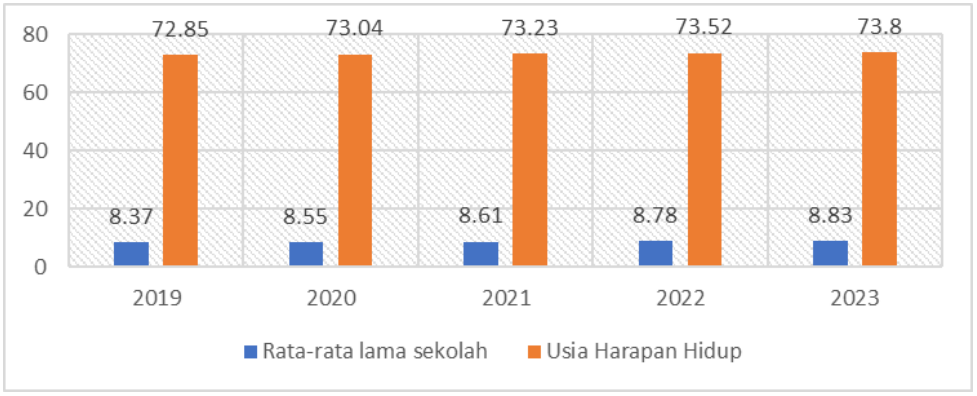
Source: Central Bureau of Statistics of Jawa Barat Province, Process Data

Figure 3. Total Population of Productive Age 15-64 Years of Jawa Barat Province 2019-2023 (Population)

The economic growth observed from 2021 to 2023 can be attributed primarily to the performance of a burgeoning productive-age population, alongside enhancements in education and health standards. A larger productive-age demographic plays a crucial role in augmenting productivity and bolstering economic competitiveness. Concurrently,

advancements in education and health contribute to the improved quality of human resources, which subsequently stimulates economic growth. According to Figure 3, the productive-age population in Jawa Barat Province has experienced an annual increase from 2019 through 2023. Notably, in 2020, the number of individuals within the productive age bracket rose to 32,636,631, reflecting an increase of over 31,842,933 individuals compared to 2019. However, it is pertinent to note that Jawa Barat's economic growth in 2020 contracted by 1,453.38 trillion rupiahs, down from 1,490.96 trillion rupiahs in 2019 (Badan Pusat Statistik, 2021).

According to the Solow-Swan theory on Angelika et al. (2022), the demographic bonus, represented by the working-age population, is expected to facilitate economic output growth. However, the year 2020 demonstrated significant external constraints, such as the COVID-19 pandemic, which resulted in economic contraction. This observation suggests that additional factors, particularly the enhancement of human resources through human capital, are vital for economic growth, beyond merely the size of the working-age population. Dohtani & Matsuyama (2023) assert that, as per the Solow-Swan theory, labor specifically the working-age population as an indicator of the demographic bonus is not the sole determinant of economic growth. Instead, a synthesis of capital accumulation derived from human resources, especially through technological innovation and the cultivation of individual skills, is essential for fostering economic development.



Source: Central Bureau of Statistics Jawa Barat Province, Process Data

Figure 4. Comparison of Average Years of Schooling and Life Expectancy of Jawa Barat Province 2019-2023

Figure 4 illustrates the rise in both average years of schooling and life expectancy in Jawa Barat Province from 2019 to 2023. In 2019, the average years of schooling were 8.37 years, and life expectancy was 72.85 years. Both metrics exhibited a consistent upward trajectory over the observed period. By 2020, the average years of schooling had increased to 8.55 years, accompanied by a rise in life expectancy to 73.04 years. This positive trend continued through 2023, with average years of schooling reaching 8.83 years and life expectancy reaching 73.8 years. These developments reflect enhancements in educational access and the overall quality of life for residents of Jawa Barat in the past five years (Badan Pusat Statistik, 2024).

According to Yunker (2024), who examined the potential causal relationship between differences in population growth and economic growth in China and India from 1980 to 2020, there exists a significant relationship between China's stringent population control policies and its economic growth when compared to India. This suggests that

simulations of economic growth models indicate that China's higher per capita income growth can be attributed to more effective population control measures relative to those employed in India. Additionally, Falah & Syafri (2023) contributes to this discourse by identifying determinants that affect economic growth in Indonesia, revealing that population density exerts a positive and significant impact on the country's economic growth. This indicates that high population density is likely to produce a substantial labor supply, which can improve productivity and stimulate economic growth. The state of the labor market in Indonesia, particularly within labor-intensive industries such as agriculture, manufacturing, and trade, further amplifies this beneficial effect, especially as Indonesia is currently experiencing a demographic bonus characterized by a significant proportion of the working-age population.

Onogiese et al. (2024) reported the results of their present a contrasting view, showing that population growth has an adverse effect on economic growth which is statistically significant This implies that the growth in population does not always result into beneficial impact on per capita economic empowerment. Conversely, unbalanced growth in economic productivity, education and infrastructure can make rapid population aldeterent by inhibiting per capita economic development. This is a time to highlight the importance of policies which should not only focus on increasing population but also on enhancing human resources and economic infrastructure for sustainable aggregate economic growth.

Bawazir & Nor (2023) focused on the long-term and short-term relationships between demographic structure and human capital on economic growth in Turkey. Their results indicate that the proportion of the population in the working-age group has a significant positive effect on economic growth in both the short and long term, meaning that more productive individuals can contribute to the economy, thereby increasing overall economic output. Additionally, human capital also has a positive impact on economic growth in the short term.

Rasnino et al. (2022) looked at how household spending, average years of education, and life expectancy affected economic growth in the regencies and cities of Lampung Province. The study's findings demonstrated that while average years of education had a positive and substantial influence on economic growth, life expectancy had a favorable but not statistically significant effect. This is consistent with research by Putriana & Aji (2022), who found that average years of education had a major impact on Sleman Regency's economic growth. This indicates that raising educational standards benefits the region's economic development. The workforce's knowledge and skills are improved via higher education, which raises worker productivity and contributes to economic growth.

According to Tchamyou et al. (2019), lifelong learning has a positive impact on economic growth. This means that education at all levels, including primary, secondary, and tertiary, provides individuals with the knowledge needed to contribute to the economy. On the contrary, Arman et al. (2020) present a different viewpoint. Their research suggests that the increase in the number of universities in Indonesia has not led to economic growth. This is because the expansion of universities has not been accompanied by an increase in qualified teaching staff. As a result, these institutions are unable to provide the high-quality education necessary to develop a skilled workforce, and thus are not able to significantly drive economic growth.

Xu et al. (2020) investigated the mutually enhancing interactions between higher education, economic growth and innovation capacity and how they interact in the context of sustainable development in Jiangsu Province, China. The analysis shows that higher

education contributes significantly to economic growth through various mechanisms such as innovation and knowledge transfer. The presence of higher education will foster innovation and ultimately increase the capacity of the regional economy, thus leading to sustainable growth and development. According to Nasyri et al. (2024), Life Expectancy has a positive and partially significant effect on economic growth in Nusa Tenggara Barat. This means that an increase in life expectancy as a measure of public health will increase productivity, which has a positive impact on economic growth in Nusa Tenggara Barat.

A different view is found by Octaviyani & Endang (2024) in the analysis of gender disparities in Indonesia's economic growth to compare the gap between gender inequality that occurs and expenditure and its effect on economic growth in Indonesia. The results of the analysis state that the life expectancy of women and men has a positive and insignificant effect on economic growth. This condition indicates that the allocation of the health sector in Indonesia is still not effective and efficient. The population is dense but access to health facilities is still limited.

Sethi et al. (2020) analyzed the impact of geographic distribution of health facilities on health outcomes in remote and rural areas of South Asian countries by looking at the causal relationship to economic growth. The analysis showed that there is a bidirectional causality between economic growth and individual Health status, indicating that any shocks to the economy that cause a decline in GDP growth rate can have a detrimental impact on Health status and vice versa. An increase in the population's level of health will accelerate the recovery from a decline in GDP, thanks to a healthier and more productive workforce.

Comparison with previous studies found several differences. First, most of the previous studies focus on countries or provinces whose economic and demographic characteristics differ significantly from those of Jawa Barat Province. Second, although there are studies related to the effect of demographic components such as average years of schooling and life expectancy on economic growth in other parts of Indonesia, none have specifically assessed the role of demographic bonuses and human capital on economic growth in Jawa Barat Province. Therefore, this study aims to fill this gap by analyzing the relationship using panel data regression covering several Kabupaten/Kota in Jawa Barat Province. The demographic bonus in this paper is proxied by the number of people of productive age, namely 15 years to 64 years, and human capital is proxied by the average years of schooling and life expectancy.

RESEARCH METHODOLOGY

Data Collection

The type of data used is quantitative data, in the form of data in the form of numbers in the form of reports in the research period. The data used is panel data, which is a combination of time series data or data collected based on time sequence with cross-section data taken from 27 Kabupaten/Kota in Jawa Barat Province, namely Kabupaten Bogor, Sukabumi, Cianjur, Bandung, Garut, Tasikmalaya, Ciamis, Kuningan, Cirebon, Majalengka, Sumedang, Indramayu, Subang, Purwakarta, Kawarang, Bekasi, West Bandung, Pangandaran, Bogor City, Sukabumi City, Bandung City, Cirebon City, Bekasi City, Depok City, Cimahi City, Tasikmalaya City, Banjar City. Panel data used in this analysis is sourced from secondary data recorded from the Badan Pusat Statistik Provinsi Jawa Barat starting from 2019 to 2023. Variable explanations and operational definitions can be seen in table 1.

Table 1.
Data Measurement

Variables	Operational Definition	Unit of Measurement	Data Source
Economic Growth (Y)	The total value of goods and services produced by a country in one year. This includes all economic activities carried out by both the public and private sectors.	GDP at constant prices (2010 series) Billion Rupiah	*Central Bureau of Statistics Jawa Barat Province*
Number of Working-Age Population (L)	The population that contributes to the economic production of a region, aged between 15 and 64 years.	Thousand People	*Central Bureau of Statistics Jawa Barat Province*
Average Years of Schooling (EDU)	The number of years spent by individuals in formal education, including primary, secondary, and potential additional higher education.	Years	*Central Bureau of Statistics Jawa Barat Province*
Life Expectancy (H)	The average age expected from a region based on birth and death data, as well as factors affecting individual health and life.	Years	*Central Bureau of Statistics Jawa Barat Province*

Model Spesification

This analysis uses panel data from 27 Kabupaten/Kota in Jawa Barat Province from 2019 to 2023 to analyze the role of demographic bonuses and human capital on economic growth in Jawa Barat Province. Quantitative descriptive analysis techniques are applied using panel regression models. The model used follows the model from the Solow Swan approach following Dykas et al. (2023).

$$Y_t = F(K_{(t)}, E_{(t)}) \quad (1)$$

Where Y denotes output at time t, K refers to capital accumulation, and E to effective labor units. Based on the formula in equation one, it is then transformed by including demographic bonus variables represented by the number of productive age population and human capital represented by average years of schooling and life expectancy.

$$E = L \quad (2)$$

Equation 2 explains that the productive-age population (L) is considered as the labor force because they are 15 years old and above and can participate in economic activities. Then, the average years of schooling (EDU) and life expectancy (H) can be considered as variables representing capital accumulation (K) because EDU indicates investment in formal education and H indicates the quality of life and public health. Therefore, K can be written as follows.

$$K = EDU \quad (3)$$

$$K = H \quad (4)$$

Therefore, equation 1 can be rewritten as equation 5 below.

$$Y_t = F(EDU_{(t)}, H_{(t)}, L_{(t)}) \quad (5)$$

Equation 5 provides an overview of how investment in education, quality of life, and productive-age population affect economic growth. The panel data regression model in log-linear form can be written as follows.

$$lnY_{it} = \beta_0 + \beta_1 \, ln \, EDU_{1it} + \beta_2 \, ln \, H_{2it} + \beta_3 \, ln \, L_{3it} + e_{it} \quad (6)$$

Where β_0 is the intercept, while β_1, β_2 and β_3 in multiple regression are called partial regression coefficients. Then i is the district/city in Jawa Barat Province and t is time. The residuals in Equation 6 follow the assumptions of the OLS method. In this analysis, there are several assumptions that we will use to estimate equation 6, first, the behavior of data between companies is fixed across time better known as Common Effect estimation. Second, assume that the intercept is different between firms, while the slope remains the same between firms better known as the fixed effect regression model. Finally, assume that the disturbance variables may be interconnected across time and individuals better known as the random effect regression model.

Panjawa et al. (2021) highlights the advantages of panel data regression models. These models offer more information, greater variation, reduced collinearity between variables, increased degrees of freedom, and improved efficiency. As a result, certain classic assumption tests in the analysis can be disregarded. Firstly, in the case of a considerable number of observations, such as the 135 used in this analysis, the normality test can be omitted. Generally, the normality test is only vital when the number of observations is below 30, serving to assess whether the error term approximates a normal distribution. With over 30 observations, the sampling distribution of the error term tends to be close to normal, obviating the need for a normality test.

Secondly, when employing the generalized least squares (GLS) approach in panel data regression models, the heteroscedasticity test can be disregarded. This is due to the efficacy of the GLS approach in addressing heteroskedasticity, allowing for the assumption that the model is devoid of heteroscedasticity symptoms. Furthermore, the GLS approach in panel data regression models works to mitigate autocorrelation between confounding errors in the current and preceding periods in the estimated regression equation. As a result, the autocorrelation test is more pertinent to time series data regression models, as panel data regression predominantly prioritizes cross-section data over time series data.

RESULTS AND DISCUSSION

This study aims to identify the impact of the number of working-age population, average years of schooling, and life expectancy on the economic growth of 27 regencies/cities in West Java. In panel data regression analysis, three primary estimation techniques are commonly employed: the Ordinary Least Squares (OLS) or common effect model, the Fixed Effect Model (FEM), and the Random Effect Model (REM). However, the challenge lies in selecting the most appropriate estimation approach. To determine the optimal model, two diagnostic tests were conducted. The first test, the Chow test, yielded a cross-section probability chi-square value of 0.0000, which is lower than the 5% significance level ($\alpha = 0.05$). This result indicates that the Fixed Effect Model (FEM) is more appropriate than the Common Effect Model. Subsequently, the Hausman test was employed to compare the Random Effect Model (REM) and the Fixed Effect Model (FEM). As presented in Table 2, the cross-section random probability value is 0.0427, which is lower than the 0.05 significance level, leading to the selection of the Fixed Effect Model (FEM) as the most suitable estimation approach for this study.

Table 2.
Best Model Used

Test	Effect Test	Probability	Description
Chow test	Cross-section Chi-Square	0.0000	Selecting a Fixed Effect Model
Hausman test	Cross-section Random	0.0427	Selecting a Fixed Effect Model

Source: Authors calculations

Table 3.
Estimation Result of Fixed Effect Model Approach

Dependent Variable: Y				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-30.15827***	5.131940	-5.876583	0.0000
LOG(EDU)	0.212518	0.256032	0.830046	0.4084
LOG(H)	7.859108***	1.610168	4.880924	0.0000
LOG(L)	0.473935**	0.216287	2.191233	0.0306
	Effects Specification			
Cross-section fixed (dummy variables)				
R-squared	0.998744	Mean dependent var		10.48768
Adjusted R-squared	0.998397	S.D. dependent var		0.973186
F-statistic	2879.679			
Prob(F-statistic)	0.000000			

Note:***, **,and * indicate significance levelat 1%, 5%, and 10%
Source: Authors calculations

Table 3 presents the estimation results obtained through the fixed effect model approach. To derive the equation from Table 3, it is necessary to assume that Equation 6 controls for all differences between districts/cities in Jawa Barat Province, while maintaining the intercept at a constant level over time. This indicates that the regression coefficient (slope) is constant across districts/cities in Jawa Barat Province and over time. Therefore, the hypothesis is deemed to be unbiased, as the discrepancies or distinctive attributes have been eliminated. Subsequently, equation 6 can be rewritten as equation 7 below

$$lnY = -30.15 + 0.21lnEDU + 7.85lnH + 0.47\ lnL + e_t \quad (7)$$

The estimation results in Table 3 show that equation 8 has an F value > F table, namely 2879.679 > 2.60 at α = 5%. These results indicate that the independent variables exert an effect on the dependent variable and that the variables of average years of schooling (EDU), life expectancy (H), and population of productive age (L) can be used to predict economic growth in kabupaten/kota of Jawa Barat Province.

To ascertain the extent of the relationship between the independent and dependent variables, it is necessary to determine the coefficient of determination (R^2). The R2 value for equation 8, based on the estimation results with the fixed effect model approach, is 0.9987, or 99.87%. This figure indicates that 99.87% of the variation in economic growth in Jawa Barat Province can be explained by the average length of schooling, life expectancy, and the number of productive age population. The remaining 0.13% is explained by other variables outside the model.

Multicollinearity Detection

Table 4.
The Correlation Coefficient Between Average Years of Schooling (EDU), Life Expectancy (H), Number of Working-Age Population (L)

	LOG(EDU)	LOG(H)	LOG(L)
LOG(EDU)	1.000000	0.742146	-0.220344
LOG(H)	0.742146	1.000000	0.089685
LOG(L)	-0.220344	0.089685	1.000000

Source: Authors calculations

Table 4 illustrates the findings of the multicollinearity detection analysis, which indicates that the correlation coefficient between the independent variables < 0.95. This suggests that there is no evidence of multicollinearity in each independent variable, specifically between the average years of schooling (EDU), life expectancy (H), and the number of working-age pupolation (L).

Partial Test (t-Statistic)

Table 5.
Partial Test (t-Statistic) Equation 7

Variable	t-statistic	t-tabel	Prob.
LOG(EDU)	0.830046	1.645	0.4084
LOG(H)	4.880924	1.645	0.0000
LOG(L)	2.191233	1.645	0.0306

Source: Authors calculations

The variables that have a partially significant effect on economic growth (Y) in Jawa Barat Province as illustrated by Table 5 are the life expectancy variable (H) with a t-statistic > t-table or 4.880924 > 1.645 at the α = 5% significance level, and the number of working-age population variable (L) with a t-statistic > t-table or 2.191233 > 1.645 at the α = 5% significance level. While the average years of schooling variable (EDU) does not have a partially significant effect on economic growth (Y) in the kabupaten/kota of Jawa Barat Province because it has a t-statistic < t-table, namely 0.830046 < 1.645 with a significance level of α = 5%.

Discussion

The results of the estimation of the effect of average years of schooling on economic growth in Jawa Barat Province indicate that there is no significant relationship between the two variables. Using a significance level of α = 5%, the probability of the export variable is 0.4084. In addition, the t-statistic is greater than its critical value at the α = 5% significance level.

The findings indicate that the relationship between human capital, as proxied by average years of schooling, and economic growth does not align with the predictions of the Solow-Swan theory. It is anticipated that individuals with higher education levels will be able to secure more advantageous employment opportunities, thereby generating higher incomes and a higher quality of life. Equation 5 illustrates that an increase in the average years of schooling, typically defined as a population with a more advanced level of education, enhances the productivity of an individual, subsequently contributing to economic growth.

The correlation between education level and economic growth in Jawa Barat Province corroborates the findings of Arman et al. (2020), who asserted that there is no correlation between education and economic growth. This is due to the high number of tertiary institutions that are not supported by the number of educators in lower-quality universities. Consequently, universities are not effective in developing human resources, which ultimately means that the contribution of education to economic growth is inconsequential.

However, Bawazir and Nor (2023), Rasnino et al. (2022), Putriana & Aji (2022), and Tchamyou et al. (2019) presented an alternative perspective. He posits that a high level of education in an area will undoubtedly lead to an increase in the knowledge, technology, and skills of individuals of productive age. Such that their productivity can be enhanced and, thereby, contribute to the regional economy. The

lack of a correlation between educational level and economic growth in Jawa Barat Province can be attributed to the relatively low Gross Participation Rate (APK) in the region. The APK is an indicator used to compare the number of individuals pursuing education at a specific level with the total population of individuals in the appropriate age group, expressed as a percentage. As reported by the Badan Pusat Statistik (2024), the APK value at each education level decreased relative to the lowest education level. In 2022, the APK for elementary education in Jawa Barat was 104.55, for junior high school was 93.46, for senior high school was 78.86, and for higher education was 22.11. This indicates that only 21.11% of the Jawa Barat population has engaged in tertiary education. Conversely, the 12-year learning obligation for the school-age population is only 78.86% participation. This indicates that there are individuals who are eligible for the highest level of education but are not engaged in it. Therefore, the skills, innovation, and technology expected to be present in all individuals in Jawa Barat Province are inadequate to contribute to the regional economy.

Consequently, based on the significance level α = 5%, a coefficient of 7.85 with a probability of 0.0000, it can be concluded that the life expectancy variable has a positive and significant effect on economic growth in Jawa Barat Province. This relationship serves to corroborate the Solow-Swan theory, which posits that human capital, proxied by the variable level of health or life expectancy, can exert an influence on the level of economic growth. Higher life expectancy is typically associated with enhanced health and superior nutritional status, leading to increased productivity and economic participation.

This finding is consistent with the results of prior studies by Nasyri et al. (2024) and Sethi et al. (2020). These studies posit that an increase in life expectancy, which serves as a proxy for health levels in this analysis, will lead to enhanced individual productivity, which in turn will bolster regional economic growth. Therefore, enhancing the standard of individual health through the provision of health facilities will facilitate the acceleration of a region's economic growth by creating productive and healthier workforces.

However, the findings of Rasnino et al. (2022) and Octaviyani & Endang (2024) indicate that there is no correlation between life expectancy and economic growth. The rationale is that to enhance economic growth through the health sector, prioritizing the development of health facilities is imperative. The findings indicate that the allocation of health care resources is still less effective and efficient. It is therefore evident that an expansion of healthcare facilities is required in order to ensure the safety of an increasing population, which will undoubtedly provide a demographic dividend, and to facilitate their contribution to economic growth.

Equation 7 shows that the demographic bonus variable proxied by the number of productive age population (15-64 years) has a positive and significant influence on economic growth in Jawa Barat. The study indicates the finding with a coefficient of 0.47, a probability of 0.0306, and a significance level of α = 5%. This finding confirms the Solow-Swan statement that an increase in the number of workers will increase economic output through increased productivity and production capabilities. The number of productive-age populations can trigger a demographic dividend where the proportion of the productive-age population increases and that of the young and old population decreases. Thus, increasing the number of productive workers will increase economic output and strengthen economic growth.

These findings are consistent with those of Yunker (2024), Falah & Syafri

(2023), and Bawazir & Nor (2023), who asserted that effective control of the productive age population and investment in human capital are crucial for promoting economic growth in a region. A favorable demographic structure, such as a high productive-age population, in conjunction with appropriate population control policies can serve as a catalyst for increased productivity and economic growth at the regional level. Furthermore, high population density, when effectively managed, can serve as a valuable economic asset, particularly in the context of a dynamic labor market and labor-intensive sectors. Therefore, regions must carefully consider demographic and human capital policies as integral components of economic development strategies.

The findings of Onogiese et al. (2024) present an alternative perspective on the relationship between population growth and economic growth, indicating that population growth does not invariably have a positive and significant impact on the economy. This finding highlights the potential negative consequences of population growth that are not accompanied by corresponding improvements in economic productivity, education, and infrastructure. Such economic growth can impose a burden on the economy, ultimately leading to economic decline. Rapid population growth in the absence of adequate policy support for education, infrastructure, and productivity improvement can exert considerable pressure on economic resources. Population growth is not sufficient for economic growth.

CONCLUSIONS

This research seeks to establish the connection between human capital, Demographic bonus, and economic growth of Jawa Barat Province in the period of 2019-2023. These relationships were examined using a panel data analysis method together with a fixed-effects model. The observable characteristics comprise; an average Years of Schooling, life expectancy, and the total population within a productive age group of 15-64 years as indicators of human capital and demographic bonus. The purpose of this study is to analyze the impacts of these factors on economic development.

It is depicted from the research analysis that average years of schooling had a statistically negligible impact on the economic growth in Jawa Barat Province. Lifting in levels of education does not have an impact on a country's total economic growth. This may be due to low quality education or a mismatch of skills learned in the classroom to that required in a job market. On the other hand, life expectancy was seen as enhancing the level of economic growth hence supporting the Solow-Swan theory of health as a determinant of human capital that can boost the productivity of labor and thus the level of economic growth.

In addition, the demographic bonus explained by the number of people in the reproductive age group also has a positive significant t effect on economic growth in Jawa Barat Province. By implying that an increase in the proportion of those within the productive working ages leads to a bolstering of a country's demographic dividend leading to increased productivity and production capacities one can only agree with this proposition.

But in the same respect, this study also established that population growth that is not defined by corresponding improved productivity, education, and infrastructure can force economic mal-effects. The reforms of demographic policies and human capital investments should therefore be taken as a part of sustainable economic development of Jawa Barat Province. The policy objective should embrace all aspects of the population that will add to the quality of education, health, and physical infrastructure so that demographic dividends can effectively support the agenda of sustainable economic growth in the country.

From this analysis, it can be deduced that average years of schooling do not bear any correlation with economic growth in Jawa Barat Province. So, it would be advisable for further research to advance the analysis of educational quality with the number of educators, the enhancement of the educational infrastructures, the infrastructures to enhance the labor skills, besides, the quantity or duration of education. Finally, this will go quite a long way in proving useful for Jawa Barat since the number of people within the productive age is significantly large. As a result, governments should include such components as regulation of population growth, improvement of population quality, and supporting physical investment and infrastructure. This involves ensuring that people of all statuses in the Jawa Barat Region receive equal access to education and health enhancing all sectors of the population to contribute to the economy and take advantage of the demographic bonus to boost economic development.

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