

Analysis of The Effect of Infrastructure Investment on Economic Growth in Indonesia: Linear Regression Model Approach

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ABSTRACT

This study investigates the relationship between infrastructure investment and economic growth in Indonesia, given the economic challenges posed by the COVID-19 pandemic. With the country's focus on a 20-year development plan, emphasizing human capital and global competitiveness, the research aims to provide insights for policymakers to formulate effective economic strategies. Using a quantitative approach and linear regression analysis, the study examines data spanning 2017-2022 sourced from official government platforms. Infrastructure investment, economic growth, and control variables such as inflation, government spending, and population growth are analyzed. The findings underscore the importance of stable inflation, efficient government spending, and controlled population growth for sustained economic development. In conclusion, this research provides valuable insights for policymakers, suggesting a need to prioritize infrastructure projects to stimulate economic growth. However, the study encourages further research to identify specific infrastructure initiatives that yield the most significant impact on economic development.

Keywords:

Infrastructure
Investment; Economic
Growth; Inflation;
Government
Expenditure;
Population Growth

INTRODUCTION

According to the World Bank, Indonesia, as the largest economy in Southeast Asia, has faced challenges due to the impact of the COVID-19 pandemic. The country's economy was downgraded from upper-middle income to lower-middle income status as of July 2021, and the pandemic partially reversed recent progress in poverty reduction. Despite these challenges, Indonesia has made significant gains in poverty reduction, cutting the poverty rate to under 10 percent in 2019 before the pandemic hit. The country's economic planning follows a 20-year development plan, with the current medium-term development plan aiming to strengthen Indonesia's economy by improving human capital and competitiveness in the global market. The economy is projected to moderate to 4.9 percent in 2023 and stay broadly flat in the medium term, with real GDP growth slowing to 4.7% in 2023 and then reaching 5.1% in 2024. Indonesia's economic freedom score is 63.5, making its economy the 60th freest in the 2023 Index, and the country has undertaken wide-ranging reforms to address various structural weaknesses in the economy and improve competitiveness. The economy of Indonesia is estimated to be the 16th largest in the world by nominal GDP and the 7th largest in terms of GDP (PPP).

Investment is widely recognized as a crucial factor for economic growth. Several studies have highlighted the significance of investment in driving economic development. For instance, a study on the impact of savings on economic growth in a developing country emphasized that investment contributes to aggregate growth and is essential for sustainable economic development (Poku et al., 2022). Additionally, research has shown that foreign direct investment (FDI) plays a vital role in economic growth, especially in the long run, particularly for emerging and developing countries (Huifang, 2006). Furthermore, the Organization for Economic Co-operation and Development (OECD) has emphasized that economic growth is ultimately about

investment in capital and labor, and improving the productivity of these factors through innovation. Investment not only contributes to economic growth but also has a positive impact on poverty reduction, inequality, human development, and job creation. Strong economic growth can lead to the emergence of a strong and growing group of entrepreneurs, which generates pressure for improved governance and advances human development, thereby promoting further economic growth.

This research attempts to answer the question "What is the quantitative relationship between infrastructure investment and economic growth in Indonesia, and how do various components of infrastructure investment contribute to overall economic development". Thus, this research, apart from being complementary and able to enrich the body of research on this topic, can also help policy makers to formulate better economic policies, more effective resource allocation, more appropriate investment decisions, and more mature economic planning.

Literature Review

a. Infrastructure Investment

Infrastructure can be defined in a number of ways depending on the policy discussion; in general, however, the term refers to longer-lived, capital-intensive systems and facilities, such as roads, bridges, and water treatment facilities. Investments in core infrastructure, defined as roads, railways, airports, and utilities, are expected to produce larger gains in economic output than investments in some broader types of infrastructure, such as hospitals, schools, and other public buildings (Munnell, 1992). Infrastructure investment can have both short and long term economic and employment impacts. A report by the Economic Policy Institute examines three possible scenarios for infrastructure investment and estimates their likely impact on overall economic activity, productivity, and the number and types of jobs, depending on how the investments are financed. The impact of infrastructure investments on the overall level of economic activity depends on the degree of productive slack in the economy, the stance of monetary policy, and how the investments are financed. However, the report suggests that the impact of infrastructure investments on the composition of labor demand can be reliably projected (Pérez, 2020). A study in China shows that new infrastructure investment elevates economic growth quality by enhancing innovation capacity (Gnych et al., 2020). Investments in infrastructure allow goods and services to be transported more quickly and at lower costs, resulting in both lower prices for consumers and increased profitability for firms. Infrastructure investment can also create jobs and stimulate economic growth (Tallontire & Nelson, 2013).

b. Economic Growth

Economic growth explains or measures the achievements of the development of an economy. In actual economic activity, economic growth means the fiscal development of the production of goods and services that applies in a country, such as the increase and number of production of industrial goods, development of infrastructure, increase in the number of schools, increase in the production of services deposits and increase in the production of capital goods (Khurriah & Istifadah, 2019). According to the views of classical economists, there are four factors that influence economic growth, namely: population, stock of capital goods, land area and natural resources, and the technology used. This theory emphasizes the importance of production factors in increasing national income and realizing growth (Peterson, 2017).

Investment in infrastructure is considered to be an important factor for economic growth. According to a study on the relationship between infrastructure and economic growth in Indonesia, infrastructure has a long-run relationship to economic growth, albeit of the asymmetric behavior found between both variables (Impact et al., 2022). Investment by the government in infrastructure can inject income into the economy by creating business opportunities, employment, and demand, and reversing the effects of the aforementioned imbalance (World Economic Forum (WEF) et al., 2018).

c. Conceptual Framework

From reviews of previous existing literature, a conceptual framework can be created that explains the hypothesis of the relationship between infrastructure investment and economic growth as well as several literatures that support this hypothesis.

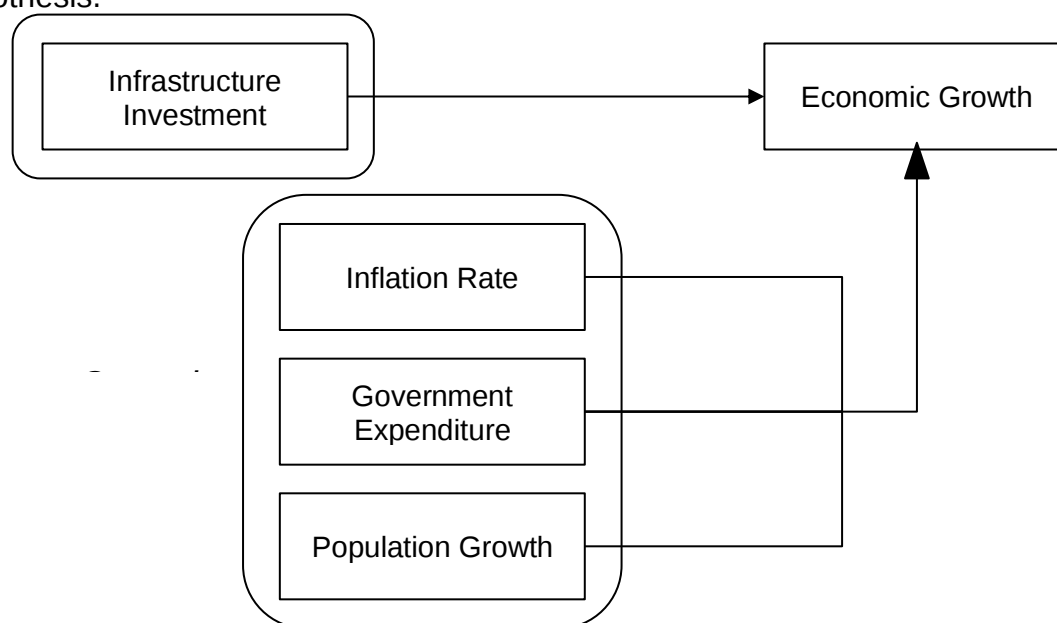


Figure 1. Conceptual Framework
Source: Literature Review, 2023

METHOD

a. Design

This research uses a quantitative approach as is generally the case with research in other fields of economics. A quantitative approach allows for the analysis of large sets of data related to infrastructure investment and economic growth in Indonesia. This approach can help in identifying patterns, correlations, and trends in the data, providing valuable insights into the relationship between infrastructure investment and economic growth (Poku et al., 2022). By employing statistical techniques such as linear regression, the quantitative approach can also help in establishing a mathematical relationship between infrastructure investment and economic growth. This can provide a clear understanding of how changes in infrastructure investment may impact economic growth in Indonesia (Curristine et al., 2018). Quantitative analysis also provides objective insights into the effect of infrastructure investment on economic growth, helping to minimize bias and subjectivity in the research findings. This is crucial for ensuring the credibility and reliability of this study.

b. Variables and Data Collection

This research uses three different types of variables, namely independent variables, dependent variables and control variables. The independent variable in this research is infrastructure investment which is represented by infrastructure budget data compiled by the Ministry of Finance of the Republic of Indonesia. The dependent variable in this research is none other than economic growth itself, which is represented by the percentage of Indonesia's annual GDP growth. Meanwhile, control variables are also used in this research, using three variables, namely inflation rate, government spending and population growth. The use of control variables is important because it helps to isolate the effects of the independent variable on the dependent variable, while holding other variables constant (Bernierth & Aguinis, 2016).

These three variables were chosen as control variables because they have the definite ability to influence economic growth based on existing literature. Some economists believe that stable, low, and controlled inflation can help drive economic growth by keeping businesses profitable and preventing consumers from waiting for lower prices before making purchases. Meanwhile, government spending variables also have an impact on economic growth (Poku et al., 2022; H. Rahman, 2007). Controlled population growth is also one of the variables that influences economic growth, referring to research conducted by (STRAUSS, 1963).

This research highlights the impact of infrastructure investment on economic growth over five years, namely from 2017 to 2022. All necessary data was obtained and accessed from official government websites such as the Ministry of Finance of the Republic of Indonesia, the Central Statistics Agency, and the World Bank so that it is guaranteed its validity. According to documentation, the collection is carried out so that it can then be analyzed using a linear regression approach.

c. Data Analysis

Linear regression is suitable for this research because it allows for the examination of the relationship between infrastructure investment and economic growth through statistical modeling. This method is particularly useful when analyzing the impact of one or more independent variables, such as infrastructure investment, on a dependent variable, in this case, economic growth. By using linear regression, the researchers can quantify the impact of infrastructure investment on economic growth, taking into account other relevant factors. This approach is valuable in providing empirical evidence and insights into the relationship between infrastructure investment and economic activity in Indonesia (Bank Indonesia, 2023). Additionally, linear regression allows for the identification of potential trends and patterns in the data, which can help in understanding the magnitude and direction of the effect of infrastructure investment on economic growth in Indonesia (Ansar et al., 2016).

RESULTS AND DISCUSSION

Result

Classic Assumption Test

a. Normality Test

Table 1. displays the results of the normality test conducted using the SPSS software, indicating whether or not the sample data comes from normally distributed populations. The purpose of the normality test is to determine if the residual or confounding variables in the regression model have a normal distribution (Sekaran & Bougie, 2016).

Table 1. Normality Test Result

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistics	df	Sig	Statistics	df	Sig
Economic Growth	0,343	6	0,260	0,640	6	0,100
Infrastructure Investment	0,330	6	0,390	0,767	6	0,290
Inflation	0,195	6	0,200	0,910	6	0,435
Government Expenditure	0,250	6	0,200	0,854	6	0,170
Population Growth	0,123	6	0,200	0,981	6	0,955

Source: Data Analysis Result, 2023

The null hypothesis can be rejected if the p-value is less than or equal to 0.05, which suggests that the data do not follow a normal distribution. However, a p-value larger than 0.05 indicates that the data are compatible with a normal distribution and that there is insufficient evidence to reject the null hypothesis. The data obtained has a normal distribution with a p value >0.05, as Table 1 illustrates.

b. Heteroscedasticity Test

As per Ghazali (2018), the heteroscedasticity test is employed to assess the presence of variance similarity in the regression model, which is the residual between two observations. Heteroscedasticity occurs when the variance of the residual varies from one observation to the next but remains constant in the first case. By measuring the variation in residual variance for each observation in the regression model, the test is used to see if there are any deviations from the traditional assumption of heteroscedasticity. As per Ghazali (2018), the outcome of the heteroscedasticity test is visible in the P value table (on the sig. column) of the SPSS output for every independent variable. In case the P-value is less than the significance level, which is typically 0.05, the alternative hypothesis of heteroscedasticity is accepted and the null hypothesis of homoscedasticity is rejected. Table 2 below shows that all independent variables in this study have p values greater than 0.05, indicating that heteroscedasticity is not present in the data and allowing for further investigation.

Table 2. Heteroscedasticity Test Result

Model		Sig
1	Infrastructure Investment	0,205
	Inflation	0,200
	Government Expenditure	0,334
	Population Growth	0,528

Source: Data Analysis Result, 2023

c. Multicollinearity Test

As to Gozali (2018), the multicollinearity test can be carried out by the analysis of the independent variable correlation matrix or by utilizing SPSS to compute the values of Variance Inflation Factor (VIF) and Tolerance. According to Ghazali (2018), the VIF value < 10.00 and the Tolerance value > 0.10 are the parameters used to indicate the presence of multicollinearity symptoms. Table 3 demonstrates that the data is free of multicollinearity.

Table 3. Multicollinearity Test Result

Model		Collinearity Statistics	
		Tolerance	VIF
1	Infrastructure Investment	0,553	2,555
	Inflation	0,212	2,836
	Government Expenditure	0,346	3,623
	Population Growth	0,582	2,816

Source: Data Analysis Result, 2023

d. Autocorrelation Test

According to (Sugiyono, 2015), one of the most used statistical tests for identifying autocorrelation is the Durbin-Watson test. The conclusion is upheld if $du < d < 4 - du$, indicating the absence of either positive or negative autocorrelation (Ghozali, 2018). The Watson Durbin value of 2.876 from the model is displayed in Table 4 below.

Table 3. Multicollinearity Test Result

Model	Durbin Watson Value
1	2,876

Source: Data Analysis Result, 2023

Coefficient Determination

The degree to which the independent variable can account for the variance in the dependent variable is expressed by the coefficient of determination (R^2) (Taber, 2018). The coefficient of determination ranges from 0 to 1, where 1 denotes a 100% price connection and the model's suitability for use in future projections and 0 indicates that prices are not a function of dependent on the index. When the independent variable can explain nearly all of the information required to explain the change in the dependent variable, the R^2 value is big or close to one (Ghozali, 2013).

Table 5. R Square

	R Square	R Square Adjusted
Economic Growth	0,913	0,833

Source: Data Analysis Result, 2023

Table 5 above shows that the dependent variable, or economic growth, can be described by this model by 83,3%, with the remaining 16,7% being explained by factors not included in the study. This indicates that the R Square value mentioned is 0.833. The explanation (Hair et al., 2010) states that this figure falls into the strong group because its value is near to 1.

Hypothesis Test

This analysis aims to test existing hypotheses based on the conceptual framework depicted in Figure 1 previously. There are five hypotheses divided into two categories. 4 hypotheses explain partial influences which will be answered based on the information in table 6. Meanwhile 1 hypothesis explains simultaneous influences which will be answered based on the information in table 7 below.

Table 6. Hypothesis Test Result

Model		Unstandardized Coefficients		Standardized Coefficient Beta	t	Sig
		B	Std. Error			
1	(Constant)	1,572	0,381		2,680	0,003
	Infrastructure Investment	0,475	0,247	0,299	1,276	0,000
	Inflation	0,328	0,249	0,300	1,221	0,000
	Government Expenditure	0,528	0,319	0,327	1,223	0,000
	Population Growth	0,245	0,292	0,299	2,987	0,001

Source: Data Analysis Result, 2023

Table 7. Hypothesis Test Result

Model		Sum Of Squares	df	Mean Square	F	Sig
1	Regression	34,720	4	8,680	1,250	0,049
	Residual	6,945	1	6,945		
	Total	41,665	5			

Source: Data Analysis Result, 2023

Based on the information in table 6, information is obtained that all partial hypotheses can be accepted, which means that there is a significant influence between Infrastructure Investment Inflation, Government Expenditure, and Population Growth (as a control variable) on economic growth, indicated by the significance value in below 0.05.

Meanwhile, table 7 also explains that the simultaneous hypothesis (h5) can be well accepted because it has a significance value smaller than 0.05, namely 0.049. These results show that there is a significant simultaneous influence between the independent variable, namely infrastructure investment, and the control variable, namely inflation, government spending, and population growth on economic growth as the dependent variable.

Discussion

a. Impact of Infrastructure Investment on Economic Growth

Based on the results of the regression analysis that has been carried out, important information can be drawn, namely that there is a significant influence between infrastructure investment on economic growth in Indonesia. These findings coincide and are in line with several previous findings both in Indonesia and abroad. A study proposed a research hypothesis that new infrastructure investment elevates economic growth quality by enhancing innovation capacity. The study examined the effect of new infrastructure investment on economic growth quality, including its impact on technological innovation, industrial structure, and productivity (Austin & Beck, 2010). Another study, highlighted that in almost all cases, the impact of public capital on private sector output and productivity has been positive and statistically significant. This finding suggests a positive relationship between infrastructure investment and economic growth (Munnell, 1992). A report on the impact of infrastructure investments

on employment and economic activity in the U.S. economy indicated that infrastructure investments can boost private-sector productivity growth. The report suggested that an ambitious effort to increase infrastructure investment could lead to a significant increase in productivity growth (Peterson, 2017).

Infrastructure investment has a significant impact on economic growth in Indonesia. Several studies have analyzed the relationship between infrastructure spending and economic growth in the country. A study found a positive relationship between public capital, especially infrastructure, and economic growth in Indonesia. This suggests that infrastructure investment can lead to increased economic growth in the country (Khurriah & Istifadah, 2019). Another study highlighted the sizable growth impact of higher infrastructure investment in Indonesia. The research emphasized the importance of addressing the country's large infrastructure gap, which includes transport and power, to realize its economic potential (Curristine et al., 2018). Meanwhile, contradictory results were found by (Ansar et al., 2016). According to their findings, a high level of infrastructure investment does not necessarily have a positive impact on economic growth, especially in the Chinese region. They underlined the importance of good and correct management and management of infrastructure projects in order to accelerate and encourage economic growth.

b. Impact of Inflation on Economic Growth

Based on the results of the regression analysis carried out, it was found that there was an influence between inflation and economic growth. This finding is enough to add to the debate regarding whether inflation can encourage economic growth or not. Several previous studies support these findings while many other studies contradict this research. Research conducted by (Shitundu & Luvanda, 2000) shows that there is a significant influence between inflation on economic growth in Indonesia. Another study suggests that maintaining monetary stability, which includes stable inflation, has a positive impact on economic growth in less developed countries, including Indonesia (Mohseni & Jouzaryan, 2016). The same results were also revealed by (Fariz, 2016) in his research which examined the significant impact of inflation and economic growth in Indonesia over a fairly long period of time, namely from 1987 to 2016.

Meanwhile, other studies have found the opposite results. (Robert J Barro, 1995; Sequeira, 2021)'s findings indicate a negative impact from high inflation rates on economic growth. This difference in findings is certainly very natural and understandable. According to (Sequeira, 2021), differences in inflation levels or categories can have an impact on long-term economic growth. Stable and controlled inflation can encourage stable and expected economic growth. This means that the government must be able to get rid of existing thresholds in relation to stabilizing the inflation rate. Meanwhile, high inflation can trigger incompetence and a decrease in people's purchasing power which will result in an economic downturn.

c. Impact of Government Expenditure on Economic Growth

The results of this research show that there is a significant influence between government spending on economic growth. This finding is in line with several previous findings studied by researchers both in Indonesia and abroad. These findings have also been discovered a long time ago and gave birth to theories such as Keynesian theory and so on. A study on the impact of government expenditure on economic growth in SAARC countries found that government spending has a strong positive impact on GDP in these countries. The study also revealed a long-lasting relationship

between government expenditure and economic growth, supporting the Keynesian theory and Wagner's Law (M. A. Rahman, 2023). Another study focused on the influence of government expenditure on economic growth in Ghana using an ARDL approach. The results indicated a positive relationship between government expenditure and economic growth in both the short run and long run (Poku et al., 2022). A study on the impact of government expenditure on economic growth in different states in South Africa found that in lower economic states, government expenditure reduces economic growth by a certain percentage (Buthelezi, 2023). Similar findings were also found by (Nguyen & Bui, 2022) with the additional variable in the form of corruption.

Likewise in the Indonesian context, several studies show the same results. A study found that government spending has a positive and significant influence on economic growth in Indonesia (Nurlina, 2015). Another study analyzed the effect of real government spending in the physical and social infrastructures on economic growth in Indonesia using panel data from 33 provinces in the period from 2005 to 2018. The results indicated that infrastructure budget realization should be considered as the main variable in analyzing economic growth (Oosterhoff et al., 2018). A paper examining the contribution of government expenditure to economic growth in developing countries, including Indonesia, found that different types of government spending have different effects on a country's growth rates. This implies that the composition and quality of government expenditures, rather than its overall magnitude, may be critical to understanding its influence on growth ("Government Expenditure and Economic Growth," 1989).

d. Impact of Population Growth on Economic Growth

The findings from this analysis indicate that there is a significant influence between population growth and economic growth. Several studies have been conducted to investigate the impact of population growth on economic growth. A study conducted by (Peterson, 2017) suggests that if population growth and per capita GDP growth are completely independent, higher population growth rates would lead to higher economic growth rates. However, a meta-regression analysis of the macroeconomic literature by (Headey & Hodge, 2009) found that the estimated effects of population growth measures on economic growth are not robust.

A study conducted by (Sinding, 2009) identified three broad stages of economic thinking on the relationship between rapid population growth and economic performance. In the first stage, scholars such as (Yao & Liu, 2022) believed that population growth had a positive effect on economic growth through the increase of the labor force and the application of new knowledge and technology. In the second stage, scholars such as (Headey & Hodge, 2009) argued that population growth had no effect on economic growth. In the third and current stage, a new group of development economists decided to look at the impact of reducing population growth rates and changing age structures on economic outcomes.

A study by (Yao & Liu, 2022) holds a moderate view that population growth is complicated by economic development. The study suggests that the effect of population structure on the macro economy is reflected in both supply and demand. Population development affects the quantity and quality of labor force factors, and it influences the capital factors through consumer demand, and finally acts on economic growth. Economic growth influences the population quantity and quality by determining the level of social security, and it influences the population quantity through the real

income, and finally affects the population development. The study found that in the short term, the population growth rate has no significant effect on the economic development level, while the economic development level has a significant effect on the population growth rate. There is a significant negative correlation between population growth rate and economic development level in the long run

The relationship between population growth and economic growth is complex and has been debated by scholars for decades. While some studies suggest a positive relationship between population growth and economic growth, others suggest no relationship or a negative relationship. The impact of population growth on economic growth may depend on various factors, including the structure of the population, the level of economic development, and the time horizon considered.

e. Implication

This research could provide several important implications. Policymakers can use these findings to support and justify the implementation of policies aimed at boosting infrastructure spending. Policymakers may consider placing a greater emphasis on infrastructure projects in their economic development plans. This could involve allocating more financial resources to infrastructure development, implementing targeted policies, and ensuring the efficient execution of such projects. This result also attracts international investors and development partners who are interested in contributing to infrastructure projects in Indonesia. This could lead to increased opportunities for foreign direct investment and international cooperation in infrastructure development.

CONCLUSION

Based on research conducted using linear regression on the effect of infrastructure investment on economic growth with inflation, government expenditure and population growth as control variables, it was found that there was a significant influence both partially from each independent and control variable and simultaneously. Although this research has been able to answer existing research questions, it has not been able to find out which infrastructure projects have the most significant impact on economic growth which can provide more specific direction to policy makers. This makes opportunities for further research very wide open, besides research related to this matter must continue to be updated in line with changes in macroeconomic conditions in Indonesia which really allows for new findings that are different and more insightful.

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