Relationship Between Infrastructure And Economic Development Of Surabaya City

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A B S T R A C T

This study aims to identify the impact of infrastructure development on Economic Condition in Surabaya City. The variable used in this study are income per capita, dringking water distribution, sold energi (electricity) and condition of asphalted road. Data used in this paper is secondary data from 1993-2018. Model analysis used is time series regression analysis with selected models Error Correction Model (ECM) according to the econometric procedure. The result show that both dringking water distribution and sold electricity per capita have significant positif impact on per capita income in the long run,but in the short run all infratsructure indicatore no significant impact on development economics in Surabaya City.

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INTRODUCTION

Economic development is one of the important subjects and the attention of policy makers, both central and local governments. This is because economic development is closely related to the improvement of living standards which are not only in the form of increasing income but also expanding employment opportunities, improving the quality of public facilities, education and improving other sectors related to human welfare. The indicators commonly used to measure the success of development are changes in the value of Gross Domestic Product (GDP) or called economic growth as well as changes in per capita income.

The increase in the value of gross domestic product is influenced by an increase in aggregate output in economic activity. Future increases in output and income are influenced by capital accumulation, population growth and technology. Capital accumulation consists of investments in both physical and human capital. For physical capital, the investment made is through productive investment in infrastructure. This investment in infrastructure will facilitate and integrate existing economic activities (Todaro and Smith, 2011)

Khan et al (2020) mention that infrastructure in addition to increasing economic development is also able to reduce poverty through several ways, through convenience in the production process, increasing competitiveness due to ease of trade, reducing transportation costs, increasing trade and creating new workers. In short, it can be stated that improving the provision of infrastructure creates competitiveness, efficiency, and productivity.

Basic physical infrastructure such as transportation infrastructure, clean water and sanitation, telecommunications and energy infrastructure is a public infrastructure that can create great benefits considering the very large number of users, almost everyone needs it. Public infrastructure improvements like this will benefit not only business development but also households.

Physical infrastructure development is usually easier to develop in urban areas than in rural areas. This condition is influenced by the availability of funds and the needs of households and businesses. One of the areas in East Java that is interesting to analyze is the city of Surabaya. The city is the second largest city in Indonesia, the capital of East Java Province which is a business and education center with a fairly high population density. Infrastructure development is absolutely necessary to support the business and investment climate.

Research on the relationship between infrastructure and the economy has been carried out in India by Sahoo & Dash (2014), Kumari & Sharma (2017). In Indonesia, Maryaningsih et al. (2014), Atmaja and Mahalli (2015) have done the analysis. The results of the analysis show different results depending on the object of each research. With this background and previous research, researchers want to know how the impact of infrastructure development on the economy in the city of Surabaya.

The theory of economic growth that explains the role of investment and saving on economic growth is Solow's neoclassical growth theory. This growth model is a modification of the Harrod-Dommar growth model, but in the Solow model it allows for substitution between capital and labor and assumes that there is an additional diminishing return in the use of these inputs.

The Solow equation shows the capital-labour growth ratio, k (referred to as capital deepening). The equation also shows that the growth of k depends on physical savings sf(k), after taking into account the amount of capital required

154

for depreciation k and after capital expansion. The expansion of capital in question is the provision of the amount of existing capital per worker to net new workers who enter the workforce of NK. In the Solow growth model, an increase in savings will increase the growth of equilibrium output per capita which of course makes a very valuable contribution to development. The success of development is very dependent on the use of savings for investment, especially for technologicalprogress (Todaro and Smith, 2011).

The physical investment in question can be in the form of investment in infrastructure, both physical and social infrastructure. Fourie (2006) in Palei (2015) argues that infrastructure consists of two elements, namely capitalness and publicness. The point is that infrastructure development requires capital intensity but also has social impacts. The classification of the level of capital intensity and its social impact is presented in the table below:

Table 1
Classification of infrastructure properties

Publicity (Social Impact)	Capital (Capital)	
	Tall	Low
Tall	Roads, railways, airports, electricity, water and sanitation, telecommunications	Schools, hospitals, parks, fields, museums, libraries, universities
Low	Industrial infrastructure	Fountains, statues

Source: Fourie in Palei, 2015

In many literatures, the role of infrastructure is evaluated through the services provided by the built physical infrastructure. Infrastructure services such as energy, transportation, telecommunications, clean water supply, sanitation are fundamental needs for all kinds of household and economic activities. This infrastructure is therefore long term, has limitations, is capital intensive with cycles and returns on investment often associated with market failures.

Shantz et al. (2011) mentions that there are three very important economic benefits from infrastructure improvements, namely changes in productivity. This means the ability to produce output that is greater than the previous level of output with the same amount of input. Second, changes in economic output as measured by changes in total output, value added and income per capita. The third is a change in the number of people working the effect of a change in the amount of output. Economic benefits derived from infrastructure improvements can reallocate economic activity. The point is that with the new infrastructure it is possible to attract new economic activity so that it has a positive effect on the surrounding area where this will encourage the construction of new infrastructure.

Electricity is one of the expensive and long-term infrastructures so that its planning and development requires input from a combination of several stakeholders. Electrical energy is even referred to as the "golden thread" (The Golden Thread) that links economic growth, increasing social equity, and creating conditions for a rapidly developing world (Lee et al., 2020)

Road infrastructure development can affect the economy in several ways, almost entirely related to increased mobility. Improved road access will make it easier for producers to reach their markets at lower costs, thus indirectly expanding their market area. In addition, producers are also more flexible in determining input suppliers. The

connection with the lower costs in reaching the output and input markets can increase the speed of producers in carrying out production. Meanwhile for workers, good road access will make it easier for them to make decisions whether to live in a location far from their work area (Shantz et al., 2011).

Research on infrastructure development and economic growth was conducted by Sahoo & Dash (2014). The object of this research is India during the period 1970-2006. The analysis is built using a composite index to measure the availability of infrastructure. The results of the analysis show that infrastructure development has a positive contribution to economic growth in India both through public and private investment.

Kumari & Sharma (2017) conducted a study on the relationship between infrastructure (physical & social) and economic development in India. The period used is 1995-2013 with the Vector Auto Regression (VAR) analysis method. The social infrastructure used is expenditure on education and health, while the physical infrastructure is air transportation, electricity consumption per capita, energy use, telephone networks, and railroads. Meanwhile, to measure economic development using the GDP per capita proxy. The results of the analysis show that there is a reciprocal relationship between social infrastructure and economic development, while physical infrastructure only has a one-way relationship, namely the development of physical infrastructure affects economic development.

In Indonesia itself, research on the influence of infrastructure on economic growth has been carried out by Maryaningsih et al. (2014). By using α-covergence and β-convergence the author wants to know whether there is a decrease in disparity between regions (divided by economic corridor) and whether there is an effect of chasing regions with low growth rates on regions with high growth rates. The results of the analysis show that there is no real distribution of income per capita between provinces in Indonesia. However, there is a catch-up effect that provinces with lower incomes grow higher than regions with already high incomes. The condition of road and electricity infrastructure has a significant impact on per capita income growth, but this is not the case for ports.

Atmaja and Mahalli (2015) conducted a study on the influence of infrastructure on economic growth in Sibolga City. The data used is time series data for the period 1989-2013 with four variables used to represent infrastructure, namely roads, electricity, water and telephones. The results of the analysis show that only water infrastructure is significant and has a positive coefficient, while the other variables are not significant.

Kharisma and Nuraeiny (2018) the purpose of this study is to determine the effect of infrastructure which includes roads, electricity, clean water and ports on per capita output. This study uses a static and dynamic panel data model in 33 provinces in Indonesia during the period 2010-2015. The results of this study indicate that road and port infrastructure has a positive and significant influence on per capita output, while electricity and clean water infrastructure have a positive but insignificant influence. In this regard, the government can take a policy of increasing and building road infrastructure and improving service performance in the form of port loading and unloading productivity.

Munawaroh and Haryanto (2021) the purpose of this study is determine the effect of infrastructure development on economic growth in Papua Province. This study uses panel data regression with the Random Effect Model. Infrastructure data used this study are road infrastructure, educational infrastructure, health

156

infrastructure from 29 districts / cities period 2011-2018. The results are road infrastructure and educational infrastructure have a positive and significant influence on economic growth, while health infrastructure has a positive but not significant effect on economic growth in Papua Province. The regional government must increase the quantity and quality of teaching staff, services and health facilities at isolated regions.

METHODOLOGY

The object of research in the study is the city of Surabaya with the data used in the form of time series data during the 1993-2018 period. The type of data used is secondary data sourced from the publications of the Central Bureau of Statistics of the City of Surabaya in various years. The data processing tool used is STATA 13. The variables used are divided into two, namely the dependent and independent variables which are summarized in detail in the table below:

Table 2
Categories and Detailed Information on Research Variables

CATEGORY	VARIABLE	SYMBOL	UNIT
Dependen	Real Gross Regional Domestic Product per Capita (ADHK=2010)	pdrbpc	Rupiah
Independen	The condition of the electricity infrastructure is calculated from the amount of electrical energy sold for all customer groups divided by the total population	energipc	MWH
	The Condition of water infrastructure calculated from distribution of drinking water for all customer groups divided by population	airpc	Meter cubic (m3)
	The condition of road infrastructure is calculated from the total length of roads with good and moderate condition divided by the number of residents	jalanpc	Meter (m)

Source: Peneliti, 2020

Because the data used is stationary at the 1st difference level, the analytical method used is the Error Correction Model (ECM). This technique is used to correct short-term imbalances. ECM is a regression technique that relates the first difference to the dependent variable and the first difference to all independent variables in the model. The ECM model was selected based on the results of the stationarity and cointegration tests. The form of the equation of the ECM model used in this study is:

$$\Delta LnPDRBPC_t = \alpha_0 + \beta_1 \Delta energipc + \beta_2 \Delta airpc + \beta_3 \Delta jalanpc + \mu t_{-1} + \mu t$$

where μt_{-1} is called the Error Correction Term (ECT) which is the value of the lag error of the previous period. The ECT value indicates how quickly the short-term imbalance will return to its equilibrium state. The ECT coefficient number is always expected to be negative (Gujarati and Porter, 2012). A valid requirement for using this ECM model is that the ECT value is significantly negative and there is long-term cointegration. Meanwhile, to assess the long-term model using an estimation technique using the Ordinary Least Square (OLS) model.

RESULT AND DISCUSSION

Data Stationarity Test

The first step that needs to be done on time series data is to perform a data stationarity test or what is known as a unit root test. Unit root testing is important to avoid spurious regression, i.e. results that appear to be good when in fact they are not related. Stationarity testing in this study used the Augmented Dickey Fuller Test (ADF Test). Unit root tests are applied to all variables used in the model.

Stationarity test is done by comparing the value of t-statistics with the critical value of MacKinnon or by comparing the value of p-value with alpha (level of significant). If there is one variable that is not stationary at the level, the next step is to perform a unit root test at the first difference level, with the same decision-making conditions. The results of the unit root/stationarity test of this study are presented in the table below:

Table 3
Unit Root Test Results

Variabel	ADF test (level)		ADF test (first difference)	
	t-statistics	p-value	t-statistics	p-value
lnpdrbpc	0,051	0,9625	-3,975	0,0015***
energipc	-1,928	0,3190	-7,698	0,0000***
Airpc	-2,415	0,1376	-7,635	0,0000***
jalanpc	-3,693	0,0042***	-6,166	0,0000***

Note: all variables are stationary at the 1st difference level with 1 percent level of significant

Cointegration Test

Cointegration test is a form of testing in a dynamic model that aims to determine whether or not there is a long-term relationship between the linear combinations of the variables used. If it is proven to be cointegrated, the ECM method is appropriate to use. The cointegration test used in this study is the Eagle Granger Test where the test is carried out on the residual model. If the result shows that it is stationary at the level, it means that the model is cointegrated.

Table 4
Cointegration Test Results

Variable	ADF Test		Information
	t-statistics	p-value	
Error	-3,158	0,0225*	Terkointegrasi

Description: * significant at 10 percent alpha

Estimation Results of Short and Long-Term Models

The short-term model estimation is the result of the Error Correction Model (ECM) while the long-term estimate is the result of the Ordinary Least Square Model (OLS). The ECM estimation results show how the data behaves in the short term, where the estimation results show the ECT value which reflects how quickly it takes to return to the equilibrium point.

The estimation results show that in the short term, all infrastructure variables do not significantly affect economic development as proxied by real per capita income. This condition is reasonable because investment in infrastructure is a long-term investment so that the visible results will be much longer than other real investments. The ECT value is negative and significant (-0.1550), meaning that it has met the prerequisites for using a valid ECM. The ECT figure can be interpreted as the time needed to make short-term

adjustments to equilibrium, which is 1 year and 8 months. In simple words, the impact of infrastructure development will not directly impact on economic development but has a certain time lag.

Error Correction Model estimation results

Error Correction Model estimation results

F-Stat = 1,05		R-Square= 0,1740	
Prob. F= 0,4049		Adjusted R-Square= 0,0089	
Variabel	**Koefisien**	**t-stat**	**Prob.**
konstanta	0,0435	3,42	0,003
denergipc	0,0297	1,15	0,263
dairpc	0,0001	0,18	0,856
djalanpc	0,8745	0,56	0,579
ect	-0,1550	-1,79	0,088*

Ordinary Least Square estimation results

F-Stat = 27,70		R-Square= 0,7907	
Prob. F= 0,0000		Adjusted R-Square= 0,7621	
Variabel	**Koefisien**	**t-stat**	**Prob.**
konstanta	17,2077	65,39	0,000***
energipc	0,3234	5,18	0,000***
airpc	0,0035	1,76	0,092*
jalanpc	-1,9711	-0,58	0,565

Description: *significant with alpha 10%, ***significant with alpha 1%

The long-term estimation results show that the energy and water variables have a positive significance, meaning that if the energy and water infrastructure improves, per capita income will also increase in the long term. The impact of improvements to electricity infrastructure is seen to be greater than that of water, which is indicated by a larger coefficient value of 0.3234. This means that every increase in electrical energy per capita sold by 1 unit will increase per capita income by 0.3232 percent, assuming other variables are constant. Improvements in electricity infrastructure have a greater impact on economic development because they are related as inputs in the production process that facilitate the development of other economic sectors such as manufacturing, cottage industries, health, education and others.

The coefficient of the water infrastructure variable also shows a positive and significant number of 0.0035. If it is interpreted, every increase in the condition of water infrastructure (as proxied by the distribution of drinking water per capita) by 1 unit, per capita income will increase by 0.0035 percent, assuming other variables remain constant. Talking about water resources, the policy approach can be separated into two, namely based on social and economic objectives. The social approach in question is how to provide water for community needs based on social humanitarian and health reasons. Meanwhile, the economic approach is aimed at providing water supply for fishing and encouraging economic activity towards improving the quality of life. Both of these

approaches require intensive investment.

In contrast to the two variables described above, in the long term the road infrastructure variable proxied by the length of the road in good and moderate condition is not significant and even has a negative value. This is possible because the investment in improving road infrastructure is higher than the increase in income This condition can also occur because the benefits of investing in roads have a longer time to increase per capita income than investments in other infrastructure.

CONCLUSION

The results of the analysis show that infrastructure development has an indirect impact but the effect will be seen in the long term. Infrastructure development in the city of Surabaya that needs attention is the development of electricity and water infrastructure due to its positive effect on increasing per capita income. The government can intervene in policy by facilitating the involvement of the private sector in infrastructure development. Second, use the budget wisely by focusing more on budget items that support capital accumulation. Third, improve infrastructure by taking into account geographical aspects and regional needs.

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