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Research article

Public Infrastructure and Economic Growth in the Local Region

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Abstract: This study aims to analyze the effect of public infrastructure on economic growth in Lampung Province. The data used are time series and cross sections for the period 2012-2018 and 14 districts/cities. The method applied is the panel data model with the random effect model method. The results showed that Infrastructure, Irrigation Infrastructure, Health Infrastructure, Investment, Labor, and Gini Growth had a significant and positive effect on economic growth, while capital expenditures insignificant effect on economic growth. The implications of these findings indicate that public sector investments such as road infrastructure, bridges and other infrastructure facilities are important.

Keywords: public infrastructure, economic growth, health, labor

JEL Classification: H50, H54

Abstrak: Penelitian ini bertujuan untuk menganalisis pengaruh infrastruktur publik terhadap pertumbuhan ekonomi di Provinsi Lampung. Data yang digunakan adalah time series dan cross section selama periode 2012-2018 dan 14 kabupaten/kota. Metode yang diterapkan adalah model panel data dengan metode random effect model. Hasil penelitian menunjukkan bahwa Infrastruktur, Infrastruktur Irigasi, Infrastruktur Kesehatan, Investasi, Tenaga Kerja, dan Pertumbuhan Gini memiliki pengaruh signifikan dan positif terhadap pertumbuhan ekonomi, sedangkan belanja modal tidak memiliki pengaruh signifikan terhadap pertumbuhan ekonomi. Implikasi dari hasil temuan ini mengindikasikan bahwa investasi sektor publik seperti infrastruktur jalan, jembatan dan sarana infrastruktur lainnya adalah penting.

Kata Kunci: infrastruktur publik, pertumbuhan ekonomi, kesehatan, tenaga kerja

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1. INTRODUCTION

The economic development is very much needed by every country to improve the standard of living and welfare of society (Wulandari, 2015). Generally, the country's goal is to achieve economic stability, economic growth that is reflected in an increase in Gross Domestic Product (GDP) and low unemployment. The need for infrastructure is even stronger and could double in the next few years. One of the economic indicators used to evaluate the development outcomes of a country is the Gross Domestic Product.

Investment is the first step in production. Capital can be in the form of investment, infrastructure, and machinery or equipment for the production process. Investors in investing consider whether their business can run and develop by paying attention to the available infrastructure. Infrastructure is considered important because it supports economic activity in the

production process to produce output to the mobility of the population and the flow of goods and services. Another production factor besides capital is labor. Improving the quality of the workforce can be done by increasing the ability and health of the workforce. The economic growth rate of districts/cities in Lampung Province during the last seven years has decreased, although not significantly. Bandar Lampung city shows the highest average economic growth rate for 2012-2018 compared to other districts/cities. Meanwhile, the lowest average economic growth rate was shown in East Lampung District during the seven years of the study. From this figure it can also be seen that the average economic growth rate of Lampung Province is 5.50 percent (Central Statistics Agency of Lampung Province, 2019).

One of the supporters of the mobility of goods and services or a person from one area to another is by providing good roads. The existence of a road network also makes it easier for areas that are difficult to reach to become accessible by the construction of road facilities. Road infrastructure as one of the transportation infrastructure plays a role in stimulating economic growth, because the availability of roads will minimize capital so that the production, distribution and service processes will be more effective and efficient. Road infrastructure development will provide access to underdeveloped areas in districts/cities in Lampung. Based on the average period of 2012 to 2018, the availability of roads in good and moderate condition in Bandar Lampung city and Metro city has the largest percentage value compared to other districts in Lampung Province. The lowest percentage occurred in West Lampung District at 38.04 percent during the research year. This proves that the remaining roads in West Lampung District are still in bad condition and damaged (Central Statistics Agency of Lampung Province, 2019). Maqin (2011) states that road infrastructure is the lifeblood of the economy that connects economic activities between regions so that the distribution of goods and services can move smoothly.

Social infrastructure also plays a role in encouraging economic growth by improving the quality of human resources. Health is a prerequisite for increased productivity, and successful education also depends on adequate health. Development in the health sector aims so that all levels of society can obtain health services evenly with good services and at affordable costs. The number of health facilities in the form of hospitals and puskesmas are available in each district/city in Lampung Province. Health facilities, namely puskesmas and hospitals, include the number of private and government-owned hospitals available in each district/city. From the picture above, there are most health facilities in Bandar Lampung City and also in Central Lampung district. On the other hand, other districts, such as Mesuji, Tulang Bawang Barat, Pringsewu, and Pesawaran, were still among the districts with low health facilities.

11 According to Waluyo (2009), government spending has a positive impact on economic growth. Regional development financing for infrastructure is usually referred to as capital expenditure. Capital expenditure is expenditure related to investment activities carried out by the government to achieve development targets. Capital spending will result in the provision of facilities and infrastructure needed to increase economic growth. In addition to infrastructure that affects the economic growth of a region, according to Waluyo (2009) investment also plays an important role in development theory, so it is often referred to as the engine of growth. This investment is a direct investment that will have an impact on employment so that in the end it will increase national output. This opinion was also conveyed by Sahoo (2010) in his paper which states that investment and infrastructure can create production facilities and stimulate economic growth, reduce transaction costs and increase competitiveness in trade and provide job opportunities for the poor.

Yanti et al. (2019), Maryaningsih et al. (2014), and Nuritasari (2013) state that improving road infrastructure will encourage an increase in economic growth. Iriyena et al. (2019), Dianaputra & Aswitari (2017), Kusumasari (2020) and Sumadisa et al. (2016) state that road infrastructure has a positive but insignificant effect on economic growth. This shows that infrastructure is an interesting topic to be researched in the process of increasing economic growth. Pane et al. (2020) and Yuhendri et al. (2013) state that good health infrastructure has an impact on high health levels so that it will encourage an increase in the economic growth of a region. Neo-Classical growth theory looks from a supply point of view. According to this theory, which was developed by Solow (1987), economic growth depends on the development of the factors of production. In equations, this view can be

expressed by the equation:

$$\Delta Y = f (\Delta K, \Delta L, \Delta T) \tag{1}$$

Where, ΔY is the rate of economic growth, ΔK is the rate of capital growth., ΔL is the population growth rate, and ΔT is the level of technological development.

Solow's analysis then forms a mathematical formula for the equation and thus proves empirically to show the following conclusions: The most important factors that bring about economic growth are not the increase in capital and the increase in labor. The most important factors are technological progress and the increase in skills and expertise of the workforce. The largest Indonesian dictionary, infrastructure is defined as a public facility and infrastructure. In the World Bank (2018) and the February issue of Priority Outcome No.3 (2003), it is explained that infrastructure is divided into 3 groups, namely:

- (a) Economic infrastructure is a physical asset that provides services and is used in final production and consumption including public utilities (telecommunications, drinking water, sanitation, and gas), public works (roads, dams, and irrigation or drainage channels), and the transportation factor (railroad, port, and airport transportation).
- (b) Social infrastructure is an asset that supports community health and expertise, which includes education (schools and libraries), health (hospitals and health centers), and recreation (parks, museums, and others).
- (c) Administrative/institutional infrastructure includes law enforcement, administrative control, and coordination, and culture.

Several studies have been conducted to examine the effect of infrastructure on economic growth, namely Wulandari (2015), Lestari et al. (2020) and Wahyuni et al., (2014). The results of these studies indicate that infrastructure has a positive and significant effect on economic growth. The development of infrastructure in Lampung is important in increasing economic growth and equitable development for the progress of a province or region and also how much influence the infrastructure has in supporting the development of each district/city in Lampung Province. Therefore, this study is focused investigate the effect road infrastructure, irrigation infrastructure, health infrastructure, capital expenditure, investment, labor, and initial growth affect economic growth in Lampung Province.

2. RESEARCH METHODS

2.1. Data Collection

The data used in this research is secondary data consisting of time series and cross-section data in annual form during the period 2012 to 2018 in fourteen (14) districts/cities in Lampung Province, including Bandar Lampung city, Metro city, West Lampung District, Tanggamus District, South Lampung District, East Lampung District, Central Lampung District, North Lampung District, Way Kanan District, Tulang Bawang District, Pesawaran District, Pringsewu District, Mesuji District, and Tulang Bawang Barat District.

Table 1. Data Descriptions

Variable	Measurement	Period	Data source
Economic Growth (PE)	Percent	Annual	Central Bureau of Statistics
Road Infrastructure (IJ)	Percent	Annual	Transportation Statistics
Irrigation Infrastructure (IR)	Percent	Annual	Agricultural Statistics
Health Infrastructure (IK)	Unit	Annual	Central Bureau of Statistics
Capital Expenditures (BM)	Percent	Annual	Financial Statistics
Investment (IN)	Percent	Annual	BKPM
Labor (TK)	Percent	Annual	Central Bureau of Statistics
Initial Growth (IG)	Percent	Annual	Central Bureau of Statistics

2.2. The Model Specification

This study uses an analysis with the economic model of Levine & Renelt (1992), which is referred to from Ma'ruf & Wihastuti (2008), namely:

$$Y = \beta_i I + \beta_m M + \beta_z Z + \mu \quad (2)$$

Where: Y is economic growth, I is growth function variables, M is researcher's Interest Variable, Z is supporting variables on researcher's interest variables, μ is error term, and $\beta_i, \beta_m,$ and β_z is regression coefficient of each variable. The model is transformed into a panel data regression equation model present as follows:

$$PE_{it} = \beta_0 + \beta_1 IJ_{it} + \beta_2 IR_{it} + \beta_3 IK_{it} + \beta_4 BM_{it} + \beta_5 IN_{it} + \beta_6 TK_{it} + \beta_7 IG_{t-1it} + \mu_{it} \quad (3)$$

Where: PE is economic growth (%), IJ is road infrastructure (%), IR is irrigation infrastructure (%), IK is health infrastructure (Unit), BM is capital expenditure (%), IN is investment (%), TK is labor (%), IG is initial growth (%), β_0 is intercept coefficient, $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7$ is regression coefficient; and μ is error term.

Estimates using panel data generally use one of three calculation methods, namely common effect model approach is the simplest technique for estimating panel data is to only combine time series data and cross-section. By simply combining these data regardless of the differences between time and individuals, we can use the OLS method to estimate the panel data model. Furthermore, the fixed effect model is a model that assumes that there are different intercepts in the equation is known as the Fixed Effect regression model.

The fixed-effect model technique is a technique of estimating panel data using dummy variables to capture the difference in the intercept. The definition of Fixed Effect is based on differences in intercept, but the intercept is the same between times. Furthermore, the random effect model is inclusion of dummy variables in the fixed effects model is intended to represent ignorance of the actual model. However, this also has consequences with reduced degrees of freedom which in turn reduces the efficiency of the parameters. This problem can be solved by using error terms known as the random effect method.

According to Widarjono (2018) there are three tests to perform panel data estimation techniques, namely: Chow test is a test conducted to determine whether the model used is the Common Effect or Fixed Effect. Furthermore, Hausman test is used to choose between a fixed effect or random effect, the Hausman test is obtained through the command *E-views* found in the panel directory. Furthermore, Lagrange multiplier (LM) test was used to determine the significance of the Random Effect technique. The Lagrange multiplier (LM) test is used to choose between OLS (Common Effect) without dummy variables or Random Effects. Several test conducted namely: Normality testing, multicollinearity, heteroscedasticity and autocorrelation test.

3. RESULTS AND DISCUSSION

This study presents descriptive statistics in Table 1 include mean, median, maximum, minimum, standard deviation, skewness, kurtosis, JB-test and matrix correlation. The correlation results show that the correlation between independent variables is relatively diverse, but none has a strong correlation. This indicates that statistically there is no multicollinierity between the independent variables. While the overall normality test shows that the data used are normally distributed.

The unit root test results presented in Table 2 show that statistically at the Level all variables contain unit roots, while the first difference indicates that all variables do not contain unit roots, this indicates that the model estimation can be continued.

Table 1. Descriptive Statistics

Descriptive	PE	IJ	IR	IK	BM	IN	TK	IG
Mean	5,474	59,301	57,042	25,036	22,823	23,988	48,558	5,570
Median	5,420	57,400	63,400	21,000	22,250	23,900	47,100	5,500
Maximum	7,050	99,700	98,800	57,000	86,900	27,800	86,600	7,050
Minimum	2,870	28,100	0,800	9,000	7,200	22,400	40,500	2,870
Std. Dev.	0,614	17,364	23,726	11,831	8,814	0,874	7,350	0,629
Skewness	-0,558	0,303	-0,248	0,846	3,520	1,165	3,656	-0,628
Kurtosis	5,833	2,183	2,280	2,729	26,281	5,879	17,665	5,425
JB-test	43,257	4,834	3,564	13,701	2761,922	64,045	1253,087	34,792
Prob.	0,000	0,089	0,168	0,001	0,000	0,000	0,000	0,000
Observations	112	112	112	112	112	112	112	112
Correlation matrix								
IJ		1,000	0,024	0,264	-0,204	0,019	-0,277	0,262
IR		0,024	1,000	-0,087	0,040	0,030	0,008	0,033
IK		0,264	-0,087	1,000	-0,459	0,265	-0,184	0,093
BM		-0,204	0,040	-0,459	1,000	-0,099	0,246	0,021
IN		0,019	0,030	0,266	-0,099	1,000	-0,011	0,053
TK		-0,277	0,008	-0,184	0,246	-0,011	1,000	-0,046
IG		0,262	0,033	0,093	0,021	0,053	-0,046	1,000

Source: Processed Eviews 9.

Table 2. The Result of Unit Root test

Variable	Critical value	ADF-test			
		Level	Summary	1 st differences	Summary
ΔPE	1%				
	5%	54,258	not-stationary	61,930	stationary
	10%				
ΔIJ	1%				
	5%	43,410	not-stationary	50,716	stationary
	10%				
ΔIR	1%				
	5%	25,567	not-stationary	33,327	stationary
	10%				
ΔIK	1%				
	5%	18,047	not-stationary	32,857	stationary
	10%				
ΔBM	1%				
	5%	32,903	not-stationary	34,557	stationary
	10%				
ΔIN	1%				
	5%	28,289	not-stationary	17,735	stationary
	10%				
ΔTK	1%				
	5%	43,754	not-stationary	80,531	stationary
	10%				
ΔIG	1%				
	5%	39,492	not-stationary	74,6704	stationary
	10%				

Source: Processed Eviews 9.

3.1. Empirical Result of Panel Data Regression

The choice of the research model was determined using the Chow test and Hausman test. The Chow test is used to compare the common effect method (CEM) method with the fixed effect method (FEM), then followed by the Hausman test by comparing the random effect model (REM) method with the fixed effect method (FEM) method. The random cross-section probability value is

0,000 which is less than (5%), so it can be concluded that the fixed effect method is more precise than the random effect method. The results of the Chow test show that the fixed effect method is better than the common effect method. Then in the Hausman test, it shows that the fixed effect method is better than the random effect method (Table 3).

Table 3. Estimation Results of Fixed-Effect Model

Dependent variable = PE				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
Intercept	6,652	1,653	4,023	0,000
IJ	0,104	0,037	2,799	0,011**
IR	0,009	0,003	2,536	0,013**
IK	0,036	0,018	1,968	0,052*
BM	0,002	0,007	0,270	0,788
IN	0,043	0,023	1,907	0,059*
TK	0,100	0,051	1,972	0,053*
IG	0,186	0,097	1,915	0,059*
Summary: R ² = 0,572; Adjusted R ² : 0,477; F-stat = 6,072***; DW-stat = 2,209				
Selection method: Chow-test = 2,462 (0,007); Hausman test = 26,551 (0,000)				
Diagnostic test	F-stat	Prob.		
Normality	4,973	0,074		
Autocorrelation	1,848	5,990		
Heteroscedasticity	9,072	14,067		

Note: Level of significant at ***1%, **5%, *10%

Source: Author's calculation

Several independent variables have a significant effect on economic growth at the 90 percent and 95 percent confidence levels. The constant coefficient (C) is 6,652, this shows that if all the independent variables used are equal to 0 (zero), then economic growth in fourteen districts/cities in Lampung Province will increase by 6,652 percent. Infrastructure (IJ), Irrigation Infrastructure (IR), health infrastructure (IK), investment (IN), labor (TK), and early growth (IG) have a positive and significant effect at = 5% (0.05). This shows that if there is an increase in all independent variables partially ceteris paribus, then economic growth will increase, while capital expenditure (BM) does not have a significant effect on economic growth.

3.2. Discussions

The coefficient on the road infrastructure variable is the largest coefficient when compared to the coefficient for other independent variables, so this shows that the road length infrastructure variable is in good condition and is having the greatest impact on economic growth in each district/city in Lampung Province for the 2012-2018 period. These results are following the initial hypothesis which states that road length infrastructure is in good condition and moderately has a positive and significant effect on economic growth.

The difference in road conditions in several districts still shows that damaged and heavily damaged roads dominate compared to good road conditions, such as in the districts of West Lampung, Pringsewu, and Tulang Bawang Barat. West Lampung District is a district with a higher proportion of roads in bad condition than good roads. Meanwhile, the proportion of good road conditions in the city of Bandar Lampung is higher than that of bad roads. Differences in natural structure, topography, and also budget are also the cause of the inequality that occurs, including the provision of district/city roads, resulting in high and low accessibility between regions. The greater the ease of reaching between regions connected by good road infrastructure will ensure efficiency, facilitate the movement of goods and services.

The results of this study are in line with Sollow's theory which states that roads have a significant effect on economic growth, because Sollow's theory states that there are only various types of capital. Private companies invest in various forms of ordinary capital, while the government

also invests in various forms of public capital, namely road infrastructure, bridges and development channels. This is further strengthened by previous research conducted by Prasetyo (2009); Farah Bonita and Negara (2013); Rohima et al. (2017); and Ma'ruf and Maryaningsih (2014) which suggest that roads have a positive and significant effect on economic growth. If roads have increased, the gross regional domestic product will also increase because roads have a positive and significant effect, meaning that the ups and downs of road infrastructure have a very large effect on the ups and downs of gross regional domestic product. Selection of the variable length of roads in good and moderate condition with the total length of the road will increase accessibility that connects economic activity centers with remote areas so that the distribution of production factors, goods, and services will be more even. The results of the study are similar to research by Arifin & Zulham (2019), which states that the variable road length has a positive and significant effect on economic growth, with the improvement of infrastructure, especially roads, will increase economic growth.

Ngenoh et al. (2015) argues that land area in the irrigation system has a significant (1%) and positive effect on irrigation performance in Kenya. This implies that increasing the size of the land area will increase the maximum possible output of activities in the agricultural sector. In essence, most of the productivity generated in Kenya is driven by the implementation of an agricultural revitalization strategy due to a 10% budget allocation for the agricultural sector in 2003. Kulshreshtha & Paterson (2016) also states that a study conducted with Paterson Earth and Water Consulting Ltd shows that irrigation has a positive impact on many sectors in Alberta, including the improvement of its economy. Study conducted by Prasetyo & Firdaus (2009) shows that health infrastructure has a positive and significant effect on economic growth in Indonesia's land border areas. The government's efforts to maintain the health of its population are by ensuring the availability of health infrastructure so that people both in cities and in rural areas can easily reach facilities. health facility because of the availability of health facilities. With the availability of health facilities, it is hoped that it can increase economic growth.

Warsilan & Noor (2015) said in his research, health infrastructure has a positive and significant effect on economic growth. This is presumably because a large number of hospitals and health centers can be said to be a reflection of the number of people who receive health services at the available health facilities, so the community's need for health is guaranteed. A healthy society will support the productivity of goods/services output, which will then increase economic growth. Rizky et al. (2016) related to capital expenditure and economic growth, it was found that partially capital expenditure had a positive and significant effect on provincial economic growth in Indonesia in 2010-2013. This means that if the value of capital expenditure increases, economic growth will also increase because it has a positive effect. Wahyuni et al., (2014) and Maisaroh & Risyanto (2018) in their respective studies said that investment has a positive and significant effect on economic growth in each of their research objects. The results of research on the classical flow of growth theory, the Harrod-Domar theory of economic growth, which states that investment is the key in the process of economic growth and to fulfill an economy requires investment as additional capital stock.

Levine & Renelt (1992) state that a population that is transformed into labor will always have a positive and significant effect on economic growth in a region. The results of this study agree with research by Priambodo (2015) which states that labor has a positive and significant effect in districts/cities in Central Java Province. Hellen et al., (2018) also found significant influence between labor variables on economic growth, a significance test which showed less than $\alpha = 0,05$, indicating that the large number of labor absorbed and worked was able to encourage or increase economic growth in Malinau District. Konyongian et al. (2019) argue that labor has a positive and significant effect on economic growth in each study. Levine & Renelt (1992), Ma'ruf & Wihastuti (2008), and Oktaviana (2016) state that initial growth has an effect and has a positive impact on economic growth. This shows that a high convergent speed will increase economic growth.

4. CONCLUSIONS

Based on the results of data processing and discussion that has been carried out, it can be concluded that road infrastructure, irrigation infrastructure, health infrastructure, capital expenditures, investment levels, labor, and initial growth have a significant effect on economic growth. In infrastructure development efforts, it is necessary to prioritize and increase the quality of the available infrastructure so that in the long term, the benefits can be felt by the community. To increase and support economic growth, policymakers should be able to allocate a budget for capital expenditure to avoid imbalances and inequalities between regions. If roads have increased, the gross regional domestic product will also increase because roads have a positive and significant effect, meaning that the ups and downs of road infrastructure have a very large effect on the ups and downs. For that, the government needs to improve infrastructure not only in quantity but also in quality. Future studies can use independent variables other than the variables used in this study.

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