IDENTIFICATION THE ROLE OF INFRASTRUCTURE TO ACCELERATE ECONOMIC GROWTH AND INTER-REGIONAL CONNECTIVITY IN SUMATRA ISLAND

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ABSTRACT

Infrastructure development, both economic and social, is one of the major determinants of economic growth and development, particularly in developing countries. Infrastructure is the capital stock that provides public goods and services. It produces various effects, including those on production activities and quality of life for the households, which thus permeate the entire society. Economic development in Indonesia create infrastructure as the foundation in the development and carried out in order to foster inter-regional connectivity. This research examine the linkage between infrastructure and economic growth for ten provinces in Sumatera island for the 2009-2013 period. This research utilizes a panel data technique and connectivity index to analyze the potential strength of the interaction between the regions. Overall, the result reveal that electricity and road infrastructure have played an important role in economic growth for ten provinces in Sumatera island, while water infrastructure has positive effect but does not affect economic growth. Connectivity index shows there is potential for interaction between regions on Sumatera island, this means that the higher the index value, the more the road network linking cities or regions. In relation to the regional developing planning, connectivity index can be used as an indicator and consideration for planning the construction of road infrastructure and other transportation facilities. Result from the empirical analysis show that the provision of good infrastructure are proven to positively affect economic growth, so that expected economic development will become even better in each region with the support of adequate infrastructure. This paper suggests that government should give great attention to infrastructure as a fundamental factor behind economic growth.

Keywords : connectivity index, economic growth, infrastructure, panel data,

INTRODUCTION

Infrastructure is an important input to the production activities and can affect economic activity in a variety of ways, both directly and indirectly. The existence of infrastructure will also affect the efficiency and smooth running of economic activity in other sectors . Infrastructure as physical facilities developed or required by public agencies for the

functions of government in the provision of water, electricity, sewage, transportation, and other services to facilitate the objectives of economic and social (Pranessy, 2009) .
Infrastructure is a drive wheel of economic growth, infrastructure that hampered would make economic growth stunted. Kuznets (2009), states that the development of infrastructure in the public service obligation, which is something that should be the obligation of the government because the infrastructure is the most primary of public infrastructure in support of economic activities of a country. The availability of infrastructure also determines the level of efficiency and effectiveness of economic activity and is a prerequisite for the wheels of the economy can run well. Various opinions on the effect of infrastructure on economic growth based on research respectively. The first opinion says that the impact of infrastructure on economic growth is positive (Ratner, (1983), Aschauer (1989), Lynde (1992), Lau and Smith (1997), and Sanchez-Robles (1998)). The second opinion which says that the effect of infrastructure on economic growth is not significant or even negative (TOM (1991) and Holtz-Eakin (1994)).
Infrastructure development is basically divided into two, economic infrastructure and social infrastructur . Economic infrastructure that is both physical infrastructure that is used in the production process as well as those used by the public, which includes all public utilities like electricity, telecommunication, irrigation, transportation, clean water, and sanitary and waste disposal. Social infrastructure such as education and health . Infrastructure is very important in the economy as a driver of productivity increase output and mobility to carry out economic activities. Based on the view that economic growth and distribution of growth associated with the infrastructure , developing the idea that Indonesia is lagging in the provision of infrastructure so that economic growth did not achieve the desired goals (Silalahi, 2014).

Table 1. Conditions Infrastructure in Indonesia Year 2009-2011

Year	Electricity Sold (thousand MWh)	Length of road By Level of Authority (km)	Clean Water (million m3)
2009	134.581,99	476.373	2.313
2010	147.300,49	487.314	2.439

2011	157.992,67	496.607	2.499

Source: Statistik Indonesia, 2012

Table 1 represents the condition of infrastructure Indonesia Year period 2009-2011 consisting of electricity sold, the length of provincial roads, and water services provided. Less than optimal infrastructure in Indonesia, also experienced in the provinces of Sumatera. With the potential of natural resources owned Sumatera island such as geothermal, oil, gas, coal, and others it is expected that the infrastructure can be developed rapidly. In addition, a large area of Sumatera island and with a population that is reasonably expected infrastructure development will go well . Support the availability of adequate infrastructure expected economic development in Sumatera will increase, and will be able to make a major contribution to the GDP in Indonesia .

In addition to physical capital , labor factor is the key factor in increasing the GDP . Labor as an input that is running all the factors of production . With the increase in the workforce is expected to increase the GDP and positive effect on economic growth in a region. According to Todaro (2006) population growth and labor force growth is traditionally regarded as one of the positive factors that spur economic growth. Each production activities that will be implemented will certainly require manpower. Labor factors of production are the factors of production are important and need to be factored in the production process (J. Simanjuntak, 1995).

One factor that supports the strength and intensity of the interaction between the regions is the condition of transportation infrastructure that connects a region with other regions in the vicinity. The number and quality of road infrastructure , good roads, air, or sea , will accelerate the rate and distribution of the movement of people, goods , and services between regions . The level of complexity of the network linking the different areas is one indication of the current strength of the interaction .

To analyze the potential strength of the interaction between the regions in terms of the structure of the road network as transport infrastructure , K.J. Kansky develop Graph Theory by comparing the number of cities or areas that have a lot of these roads as a means of connecting those cities . According Kansky , the strength of the interaction is determined by the Connectivity Index . The higher the index value , the more the road

network linking cities or regions being studied . This is certainly affect the potential movement of people , goods , and services for the road infrastructure is very smooth mobility rates among regions.

In relation to regional development planning , analysis connectivity index can be used as an indicator and considerations for planning the construction of roads and other transportation facilities . With connectivity index analysis can increase the relationship of a region with other regions , and facilitate the flow of movement of people , goods , and services that can ultimately improve the welfare of the community .

The objectives of this study are to analyze the effect of electrical infrastructure, road infrastructure, water infrastucture and labor to the GDP provinces in Sumatera Island and its contribution. Another goal of this study is to analyze the potential strength of the interaction between the regions using connectivity index.

DATA AND ESTIMATION METHOD

The data used is secondary data and the scope of the data is data period (time series) of the year 2009-2013 and the latitude series data (cross section) of ten provinces in Sumatera Island. The data used come from , the Central sources both journals, papers, internet and other scientific papers related to the study.

Mathematical function of this study as follows :

$$Y = f\,(LTK, JLN, AIR, TK)$$

The model in this research is modified from the research model Maqin (2011) :

$$\ln Y_{i,t} = \beta_0 + \beta_1 \ln LTK_{i,t} + \beta_2 \ln JLN_{i,t} + \beta_3 \ln AIR_{i,t} + \beta_4 \ln TK_{i,t} + \varepsilon_{i,t}$$

Information :

Y	= PDRB province i on year t
β_0	= Constanta
$\beta_1 - \beta_4$	= Coefficient of regression
LTK	= Electricity infrastucture
JLN	= Road infrastructure
AIR	= Water infrastructure

TK = Labor
ln = Natural logarithm
ε = *Error term*
i,t = i for each province and t for the year

This study uses panel data , panel data is a data set that contains the sample data of individual (province) at a specific time period. Data panel is a combination of time series data (time series) and data -sectional slice (cross section) . In the method the data panel there are three methods were used that common effect , fixed effect and random effect . To find out which model is the best in the study to test the suitability of the model . Chow test is done to see whether common effect or fixed effect better . Test Chow is done by looking at the probability (p - value) , if the probability is smaller than the significance level (alpha) , the fixed effect model is more precise , and vice versa if the probability value (p - value) is greater than the significance level (alpha) , the model the right is a common effect . Chow test is done by using software tools program Eviews 9

Table 2 . Hausman Tes Result

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	14,100324	4	0,0070

Source : data processed, 2016

Based on Hausman test shown, the p -value obtained Hausman between the fixed effect model and random effect at the 5% significance level is at 0.0070 . Because p-value less than the 5% significance level (0.05) so that it can be concluded that the fixed effect is more appropriate to analyze the research model .

Here is the conclusion of the election results from testing the model in the study :

Table.3 Conclusion Model Selection

	Prob.	**Conclusion**	
Chow test	0,0000	Reject Ho	FEM better

Hausman test	0,0070	Reject Ho	FEM better

Source : data processed, 2016

From the estimation , panel data regression equation as follows :

$$\ln Y_{i,t} = 4{,}296999 + 0{,}291961 \ln LTK_{i,t} + 0{,}611093 \ln JLN_{i,t} + 0{,}009319 \ln AIR_{i,t} + 0{,}097887 \ln TK_{i,t}$$

The estimation results in this study indicate coefficients for each independent variable and the effect on the dependent variable. Constant value (C) of 4,296999. This shows that the influence of the independent variables, the value changes in the GDP will occur in the amount of 4,296999%. Assuming other variables are constant, then any increase in value of the electric variable (LTK) of 1%, it will cause an increase in the value of GDP amounted to 0,291961%. If there is a change in the value of the variable path length (JLN) of 1%, it will cause a change in the value of GDP amounted to 0,611093%. The capital increase, in this case is the infrastructure will affect the increased productivity of the workers, because the number of access to utilize existing infrastructure. Infrastructure that can be accessed easily prove to be easier for workers to carry out economic activity, thereby increasing the productivity of workers will increase in aggregate output (GDP) in the economy.

EMPERICAL RESULT

Based on the results of the regression calculation, the regression of electricity infrastructure coefficient is 0,291961 with a confidence level of 99%. This means that any increase in electricity sold amounted to 1%, it will increase the GDP province in Sumatera Island of 0,291% ceteris paribus. This is consistent with the hypothesis that electricity infrastructure studies positive effect on the GDP in the province of Sumatera Island. The results are consistent with research conducted by Vibiz Regional Research (2008) which states that a variable electrical infrastructure represented by the electricity produced to give positive and significant impact on economic growth in Eastern Indonesia. Good electrical infrastructure will streamline the production process.

Electricity is needed not only as the primary needs that must be met, but as a major factor in economic activity, especially industrial. It is understandable that the economic conditions in the provinces in Sumatera Island are on the rise and thus require adequate electricity to support the production process.

The regression coefficient of road infrastructure amounted to 0,611093 with 99% confidence level . This means that any increase in road length by 1 % will increase the GDP province in Sumatera Island of 0.611 % ceteris paribus . This is consistent with the research hypothesis that the road infrastructure is a positive influence on the GDP in the province of Sumatera Island. The results are consistent with research conducted Prasad et al (2009) which states that the length of the road in Indonesian territory has a positive and significant impact on economic growth in the region of Indonesia. The road has an important role for the factors of production to the distribution of goods and services between regions .

Regression coefficient value of water infrastructure amounted to 0,009319, with t-count equal to 0,755354 and t-table is 2,014 , which means t <t - table shows that the null hypothesis is accepted . This means that the water infrastructure is not a statistically significant effect on the GDP in the province of Sumatera Island. Regression coefficient value of labor is equal to 0,097887 , with a t-count equal to 0,999983 and t-table is 2,014, which means t <t-table shows that the null hypothesis is accepted . This means that the workforce has no effect statistically to PDRB province in Sumatera Island .

Table 4. Fixed Effect Coefficient Values In Each Province in Island Sumatera

	Coefficient	
C	4,296999	
LN_LTK	0,291961	
LN_JLN	0,611093	
LN_AIR	0,009319	
LN_TK	0,097887	
Fixed Effect (Cross)	**Coefficient**	**Individual *Effect***
Aceh	-0.267002	4,029997
Sumatera Utara	0.116303	4,413302
Sumatera Barat	-0.192807	4,104192
Riau	0.604664	4,901663
Jambi	-0.303238	3,993761

Sumatera Selatan	0.211968	4,508967
Bengkulu	-0.646336	3,650663
Lampung	-0.239354	4,057645
Kep. Babel	-0.102004	4,194995
Kep. Riau	0.817806	5,114805

Source : data processed, 2016

Based on the estimation results can be seen that the value of the coefficient intercept the GDP of each region in Sumatera island has a different value . The big difference in the coefficient of the intercept is possible because the area studied had different characteristics from each other . This intercept coefficient values indicate differences in the behavior of each region . Areas that have a positive intercept coefficient indicates that the area has the value of GDP higher than in other regions . Areas that have had a negative coefficient intercept of GDP is lower compared to other regions. Bengkulu Province has the lowest coefficient compared to other provinces at -0.646336 . Riau Province has a coefficient of .604664 , and the province of Riau Islands has a coefficient of 0.817806 . Difference coefficient is negative and positive indicating that the GDP relatively low compared to other provinces Province . Factors affecting that province GRDP relatively low compared to other provinces is still limited infrastructure in each province , and the differences in economic structure in each province in Sumatera Island .`

Table 5. Connectivity Index Provinces in Sumatera Island

No.	Province	Index Connectivity (b=e/v)				
		2009	2010	2011	2012	2013
1	Nangroe Aceh Darussalam	3974.60	4218.00	4491.40	4531.20	4540.80
2	Sumatera Utara	3411.25	4317.50	4506.13	4587.13	4596.75
3	Sumatera Barat	2095.85	2966.14	3147.71	3226.71	3238.43
4	Riau	11579.50	11753.00	11857.00	12271.00	-
5	Kepulauan Riau	661.28	2200.00	2257.00	2390.00	2390.50
6	Jambi	5186.00	5861.00	6218.00	6218.00	0.00
7	Bengkulu	5997.00	7500.00	7766.00	8341.00	8438.00
8	Sumatera Selatan	4101.75	4153.75	4090.50	4107.00	4230.75
9	Bangka Belitung	528.76	673.86	702.29	701.86	701.86
10	Lampung	6578.00	9260.00	9565.50	9719.50	9719.50

Source : departemen perhubungan; direktorat jendral perhubungan darat, data Processed 2016

Connectivity index theory has meaning areas that are connected by complex road network means it has a high spatial interaction patterns. From the Table 5 it can be seen the potential strength of the interaction between cities in the region of Sumatera island where Riau Province has highest connectivity index among the other provinces in relation to regional development planning, analysis connectivity index can be used as an indicator and consideration to plan the development of roads and other transportation facilities. With connectivity index analysis can increase the relationship of a region with other regions, and facilitate the flow of movement of people, goods, and services that can ultimately improve the welfare of the community .

CONCLUSION

Infrastructure electricity, road infrastructure, water infrastucture and labor have positive impact to the GDP province in Sumatera Island although water infrastucture and labor statistically no effect on the GDP in the province of Sumatera Island. Connectivity index shows there is potential for interaction between regions on Sumatera island, this means that the higher the index value, the more the road network linking cities or regions.

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