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Author : Aby Sakaria Putra Keliat, and Coki Ahmad Syahwier
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The Influence of Land Transportation Infrastructure on Economic Growth in Medan City

Aby Sakaria Putra Keliat, Coki Ahmad Syahwier

Development Economics Study Program, Faculty of Economics and Business, Universitas Sumatera Utara
Prof. T.M. Hanafiah Street, Medan 20155, Indonesia

keliatabysaka@gmail.com, cokiasyahwier@gmail.com

Abstract

This study aims to evaluate the effect of land transportation infrastructure and the number of motor vehicles on the Economic Growth of Medan City during the period 1993-2022. The method of analysis in this study is using multiple linear regression method with the help of Eviews 12 software, this study analyzes secondary data obtained from the Badan Pusat Statistik (BPS) of North Sumatra Province and Medan City. The results of the analysis show that land transportation infrastructure and the number of motorized vehicles have an insignificant effect on the growth of Medan City. Classical assumption testing was conducted to ensure the validity of the model, including tests of normality, multicollinearity, autocorrelation, and heteroscedasticity. Data transformation was used to qualify the normality test.

Keywords: Land transportation infrastructure; economic growth; number of motor vehicle.

1. Introduction

Medan City, as one of the most populous cities in Indonesia. Land transport infrastructure, such as roads, mobility aids, and access to services, is essential to support the economic growth and development of the city. Land transport infrastructure problems in Medan City include traffic congestion (number of motorised vehicles) and poor road conditions (road quality). In addition, as the economy is supposed to grow rapidly, it slows down due to an increase in demand for transport services, which may put further pressure on the existing transport system.

Table 1. 1 Road Quality Data

Year	Road Quality (km)			
	Tarmac Road	Concrete Road	Gravel Road	Dirt Road
2007	2 676, 45	393,54	-	8,95
2008	2 676, 45	393,54	-	8,96
2009	2 675, 86	254,92	-	147,57
2010	2 676, 45	393,54	-	8,95
2011	2 845,70	287,70	-	58,10
2012	3 340,15	-	-	94,90
2013	3 340,15	-	-	94,90
2014	3 347,71	300,83	-	63,20
2015	3 347,71	300,83	-	63,20
2016	2 671,6	461,8	-	58,10
2017	2 671,6	461,8	-	58,10
2018	2 474,51	802,49	-	0,00
2019	1 289,61	1 763,67	312,28	22,46
2020	1 289,61	1 763,67	312,28	22,46
2021	2 477.02	802.48	-	-

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Source: Statistics Indonesia

Based on table 1.1, the development of the quality of Medan city roads has increased land transport infrastructure in 2007-2015 paved roads have increased along 3,347.71 km followed by roads and concrete also experienced a high increase in 2018-2020 reaching 1,763.67 km replacing paved roads and there are still damaged roads in Medan city using gravel material along 312.28 km.

Table 1.2 Data on the Number of Motorised Vehicles in Medan City

Year	Number of Motorised Vehicles
2007	1.425.943
2008	1.536.365
2009	1.598.672
2010	1.758.943
2011	1.867.832
2012	1.938.832
2013	2.134.768
2014	2.465.663
2015	2.576.443
2016	2.654.621
2017	2.712.726
2018	2.873.712
2019	2.904.865
2020	3.002.734
2021	3.114.774

Source: Statistics Indonesia

Based on table 1.2, the development of the number of motorised vehicles in Medan City has increased from 2007 to 2019 then in 2020 to 2021 it has decreased. Overall modes of transport include buses, trucks, cars, motorbikes. But land transport infrastructure facilities and infrastructure have not been able to provide good service to vehicles in Medan City.

Tabel 1. 3 Data on Gross Domestic Product at Constant Prices by Business Field in Medan City

Year	GRDP (%)
2007	7.78
2008	6.89
2009	6.55
2010	7.16
2011	7.79
2012	7.66
2013	5.36
2014	6.05
2015	5.74
2016	6.27
2017	5.81
2018	5.92
2019	5.93
2020	-1.98
2021	2.62

Source: Statistics Indonesia

Based on table 1.3, the economic growth of Medan city according to GRDP based on constant prices continued to increase from 2007-2012 and in 2013-2019 experienced ups and downs in economic growth followed by 2020-2021 experiencing a drastic decline to minus (%).

Through the problems from the description above, the authors are interested in knowing these problems in the form of thesis research entitled The Influence of Land Transportation Infrastructure on Economic Growth in Medan City.

2. Literature Review

2.1 Economy Growth

According to [1] economic growth is measured by Gross Domestic Product (GDP). To see individual welfare measured by GDP per capita an increase in capital and labour will increase output in the economy. Capital includes public and private sector investments in the economy. The private sector usually builds factories, purchases machinery, and so on. While the public sector builds infrastructure, such as roads, bridges, telecommunication networks and electricity networks.

According to [2] explaining the link between infrastructure and economic development, infrastructure includes the physical and financial aspects embodied in roads, railways, seaports and other forms of transport and communication plus clean water, electricity and water supply. According to the views of classical economists, Adam Smith, David Ricardo, Thomas Robert Malthus and John Staurt Mill, as well as neo-classical economists, Robert Solow and Trevor Swan, suggest that there are basically four factors that affect economic growth, namely population, the amount of capital stock, land area and natural resources, and the level of technology used [3].

The theory of economic growth according to the Harrod - Domar theory was developed separately in the same period by E.S Domar and R.F Harrod. Both see the importance of investment to economic growth, because investment will increase the stock of capital goods, which allows an increase in output. The source of domestic funds for investment purposes comes from the share of production (national income) that is saved.

2.2 Relationship between Transport Infrastructure and Economic Growth

Economic growth and infrastructure have a very close relationship and cannot be separated anymore. One of the influences of economic growth is infrastructure such as adequate roads, proper transport and good services that are sufficient with the aim of improving the welfare of a better society. In this case, the role of the government should be very important to regulate, supervise and support economic activities. Economic growth is one of the indicators to see the results and determinants of development that has been carried out as well as useful for the future.

From the results of research conducted by [4] that infrastructure affects economic growth if it is seen from the basic needs of infrastructure has decreased, economic growth will also decrease. Transport infrastructure has a significant relationship with economic growth, land transport infrastructure contributes positively and significantly to the economic growth of a region:

1. Investments in transport infrastructure create economic growth through various channels, including increased market access, productivity, balanced regional economic development, job creation, and community connectivity.
2. Efficient transport infrastructure provides economic and social benefits, and ensures balanced regional economic development, job creation, promotion of mobility.
3. Transport infrastructure can stimulate economic growth, increase long-term productivity, improve climate resilience, and reduce inflationary pressures.

2.3 Infrastructure

Infrastructure can be defined as public facilities and infrastructure. Infrastructures are generally known as public facilities such as hospitals, roads, bridges, sanitation, telephones, and so on. Furthermore, in economics infrastructure is a form of public capital that is formed from investments made by the government.

Infrastructure can be divided into 2 groups, namely infrastructure based on its function and designation. According to [5] explains that infrastructure can be divided into economic and social infrastructure. Economic infrastructure plays an important role in driving the performance of economic growth in various countries. Economic infrastructure includes public utilities such as electricity, telecommunications, water supply, sanitation and sewerage and gas. It also includes publicworks, such as roads, canals, dams, irrigation and drainage as well as transport projects such as railways, urban transport, waterways and airports. Social infrastructure can be divided into education and health infrastructure.

According to [6] state that infrastructure has externality properties. Various infrastructures such as roads, education, health, etc. have positive externality properties. provides support that the facilities provided by various infrastructures are positive externalities that can increase the productivity of all inputs in the production process. The positive externality on infrastructure is in the form of spillover effect in the form of increased production of firms and the agricultural sector without having to increase capital and labour input or increase the level of technology. With the construction of infrastructure, the productivity level of firms and the agricultural sector will increase.

2.4 Transportation

Transport is a means that plays a role in human life, both the continuity of interaction between humans and as a tool to facilitate humans in moving goods from one place to another. The existence of these community activities requires adequate supporting tools or facilities, such as transport. According to [7], Transportation is defined as the transfer of goods and people from the place of origin to the destination. The transport process is a movement from the place of origin, where the transport activity begins, to the destination, where the transport activity is ended.

According to [8] states that the effect of the number of motorised vehicles on economic growth has a significant negative effect because the number of vehicles has a positive and negative impact on economic growth. The negative impact of motorised vehicles on economic growth is that the increasing number of motorised vehicles will cause congestion. The number of motorised vehicles that tends to increase from year to year is an indicator of the higher public demand for adequate transportation facilities in line with the higher mobility of the population. However, the increasing number of motorised vehicles will have an impact on traffic congestion. Traffic congestion is a situation where traffic is stalled or even stopped due to exceeding capacity.

Transportation is not only an effort in the form of movement of people and goods from one place to another with static movement but transportation will experience development and progress from time to time both facilities and infrastructure in accordance with the development of science and technology. Transportation is one of the facilities for an area to progress and develop and transportation can increase the accessibility or relationship of an area because accessibility is often associated with the region.

3. Research Method

This research is a form of quantitative research using an associative approach. In this study, data measurements of each variable will be made so that the relationship of each variable can be explained statistically. This quantitative approach will test the hypothesis of the Effect of Land Transportation Infrastructure on Economic Growth in Medan City.

This research collects secondary data from the source of the Badan Pusat Statistik with the dependent variable is the GRDP sector at constant prices by business field, while the independent variables are road quality, and number of motorised vehicles. the data analysis technique uses multiple linear regression analysis, with the regression equation as below:

$$Y = a + \beta 1X1 + \beta 2X2 + Ɛ$$

Description:

Y : GRDP Sector at constant prices by business field
β : Regression coefficient
a : Constanta
X1 : Road quality
X2 : Number of motorised vehicles
Ɛ : Eror term

4. Results and Discussion

4.1 Normality Test

This test aims to test whether the residuals and regression models made are normally distributed or not. A good regression model is to have a normal or near normal residual distribution, if it is not normal then the predictions made with the data will not be good. The normality test in this study uses the Kolmogorov-Smirnov test for normal distribution data if the sig (two sides) is greater than 0.05.

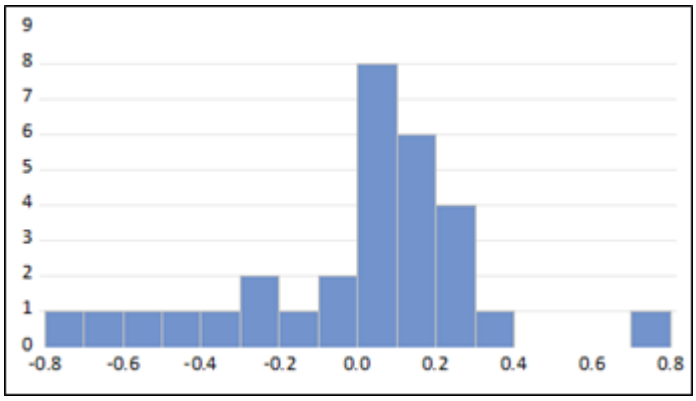

Figure 4. 1 Normality Test
Source: Researcher Processed Data (2024)

Based on Figure 4.1 above, it can be seen that the probability value > 0.05 so it can be concluded that the variable data is normal. From the estimation results, the Probability JB test value is 1.925 (> 0.05), so it can be concluded that the data is normally distributed.

4.2 Multicollinearity Test

Used to determine whether or not there are symptoms of multicollinearity on fellow road quality variables (X1) and the number of motorised vehicles (X2) and the calculation of the variance inflation factor (VIF) value.

The method used to determine whether or not there are symptoms of multicollinearity in the regression model is by looking at the VIF (Variance Inflation Factor) value. If the VIF value in the regression model is < 10, it can be said that the regression model does not have multicollinearity symptoms.

Table 4. 1 Multicollinearity Test

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	2.185	623.569	NA
LOG X1	0.028	473.756	1.184
LOG X2	0.009	555.376	1.184

Source: Researcher Processed Data (2024)

Based on table 4.1, it can be seen that the VIF value of the Independent Variable < 10, it can be concluded that the multi-collinearity test assumptions have been met or there is no multicollinearity problem in the research variables.

4.3 Heteroscedasticity Test

The heteroscedasticity test is conducted to determine whether in a regression model there is an inequality of variance from the residuals of one observation to another. If from one observation to another is fixed, it is called homoscedasticity.

To determine the presence and absence of heteroscedasticity in a model, it can be seen from the Glejser test. If the probability value of each variable > 0.05, it can be concluded that the model does not have heteroscedasticity in the model or the result is data in homoscedasticity conditions. Conversely, if the coefficient < 0.05 then the model occurs heteroscedasticity.

Table 4.2 Heteroscedasticity Test

F-statistic	Obs R-squared	Scaled explained SS	Prob. F
0.563	1.202	1.250	0.575

Source: Researcher Processed Data (2024)

Based on table 4.2, after data transformation, the Obs R-squared value is 1.202 (> 0.05) and the probability value of each variable is greater than > 0.05, so the data can be accepted that there is no heteroscedasticity problem and further testing can be carried out.

4.4 Autocorrelation Test

If there is autocorrelation in the data, the consequence is that the estimator is still inefficient. Therefore the confidence interval will be wide, becoming undeistimateI, which in the end the use of the t test and f test can no longer be used.

Autocorrelation can be known through the Breusch Godfrey Test, where if the prob value < 0.05 then there are symptoms of autocorrelation while if the prob value > 0.05 then there are no symptoms of autocorrelation.

Table 4.3 Autocorrelation Test

F-statistic	Obs R-squared	Prob. F	Prob. Chi-Square
1.942	4.034	0.164	0.133

Source: Researcher Processed Data (2024)

From the results of the autocorrelation test in table 4.3, it can be seen that the prob 0.133 > 0.05, it can be concluded that there is no autocorrelation in the research model.

4.5 Multiple Linear Regression Analysis

Multiple linear regression analysis was conducted to determine the direction and how much influence the independent variable has on the dependent variable. The type of data in this study is time series or data based on time series from 1993 to 2022 (30 years).

Table 4.4 Multiple Linear Regression Analysis Test

Variable	Coefficient	Std. Error
C	4.227	1.478
LOG X1	0.103	0.168
LOG X2	-0.227	0.098

Source: Researcher Processed Data (2024)

Based on the multiple linear regression analysis test that has been carried out as shown in table 4.4, it can be seen that the regression equation formed in this study, the regression equation can be formulated as below:

Log4.2278 =log0.1039X1 + log-0.2278X2, the meaning in this equation is:

1. The constant value obtained is 4.227, it means that if the independent variable increases by one unit on average, the dependent variable will increase by 4.227.
2. The regression coefficient value of variable X1 is positive (+) of 0.103, it means that if variable X1 increases, variable Y will increase by 0.103, and vice versa.

3. The X2 Variable Regression Coefficient value is negative (-) of -2.27, it means that if the X2 Variable increases, the Y Variable will decrease by -2.27, and vice versa.

Table 4.5 t Test

Variable	t-Statistic	Prob.
C	2.859	0.008
LOG X1	0.618	0.541
LOG X2	-2.304	0.029

Source: Researcher Processed Data (2024)

This t test is used to test how influential one variable of road quality and the number of motorised vehicles is to test partially, based on table 4.5, it can be explained that:

The results showed that road quality had an insignificant effect on Gross Regional Domestic Product (GRDP) economic growth in Medan City with a t-Statistic value of 0.6184 and a Prob value of 0.5415 (> 0.05). The research results are not in accordance with the theory and hypothesis which states that road quality has an insignificant effect on economic growth (GRDP) in Medan City. The results of this study are in line with research conducted by Abdul Maqin (2011) which states that infrastructure has an insignificant effect because land transportation infrastructure (Road Quality) in Medan City only contributes a few percent to the economic growth of Medan City where other factors are economic infrastructure such as markets, bridges, airports and social infrastructure such as hospitals, schools, agriculture, trade, industry and services.

The results showed that the number of motorised vehicles had a significant negative effect on the Gross Regional Domestic Product (GRDP) of Medan City with a t-statistic value of -2.3044 and a Prob. (Significance) value of 0.0291 (< 0.05). The results of the study are in accordance with the theory and hypothesis which states that the number of motorised vehicles has a positive effect on economic growth in Medan City. The results of this study are supported by Junaidi's research (2020) which conducted research in East Kalimantan stating that the effect of the number of motorised vehicles on economic growth has a significant negative effect due to the number of vehicles having a positive and negative impact on economic growth. The negative impact of motorised vehicles on economic growth is that the increasing number of motorised vehicles will cause congestion. The number of motorised vehicles that tends to increase from year to year is an indicator of the higher public demand for adequate transportation facilities in line with the higher mobility of the population. However, the increasing number of motorised vehicles will have an impact on traffic congestion. Traffic congestion is a situation of stalled or even stopped traffic caused by many vehicles.

Table 4.6 F test

F-Statistic	Prob.
2.705	0.084

Source: Researcher Processed Data (2024)

Based on table 4.6, it is known that the F-Statistic value is 2.7056 with a Prob. (F-Statistc) value of 0.0849 (< 0.05), it can be concluded that the independent variable (X) has an insignificant effect simultaneously (simultaneously) on the dependent variable (Y).

Table 4.7 Coefficient of Determination

R-squared	Adjusted R-squared
0.166	0.105

Source: Researcher Processed Data (2024)

Based on table 4.7, it is known that adjusted R-square value of 0.1669, it can be interpreted that the contribution of the influence of the independent variables, namely road quality (X1) and the number of motorised vehicles (X2) to the dependent

variable, namely the Gross Regional Domestic Product (GRDP) of Medan City simultaneously (together) by 16% and the remaining 84% is explained or influenced by other variables not included in this research model.

5. Conclusions

Based on the research results, the following conclusions can be drawn: Land transport infrastructure using road quality data partially has an insignificant effect on Gross Regional Domestic Product (GRDP) Economic Growth in Medan City. The number of motorised vehicles partially has a significant negative effect on Gross Regional Domestic Product (GRDP) of Medan City Economic Growth. Land Transportation Infrastructure (road quality) and Number of Motorised Vehicles simultaneously have an insignificant effect on GRDP economic growth in Medan City. The ability of the independent variables, namely land transport infrastructure (road quality) and the number of motorised vehicles in describing the dependent variable, namely economic growth in Medan City, is 16% and the remaining 84% is explained by other variables.

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