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"Entrepreneurship on Global Economics Development in the Era of Society 5.0"

**Transportation Infrastructure and Economic Growth in Central of Java:
Evidence from Panel Data****Novali Panji Nugroho^{1*}, Inda Fresti Puspitasari¹**¹Universitas Muhammadiyah SurakartaJl. A. Yani, Mendungan, Pabelan, Kec. Kartasura,
Kabupaten Sukoharjo, Jawa Tengah 57169, Indonesia**Email:** b300190347@student.ums.ac.id**ABSTRACT**

Infrastructure is an important pillar to increase economic growth. Transportation infrastructure is the one part of the infrastructure that can be an indicator of economic growth. This research aims to determine the effect of transportation infrastructure on economic growth in Central Java province from 2017 to 2020. The variables used in this research is the GDP per capita, length of the road, number of vehicles, and government spending. This research used panel data through the Eviews 9. The best model in this research is the FEM after two tests, namely Chow and Hausman test. The results of testing through analysis tools show that the length of the road with the empirical probability value of 0.1411 (> 0.05) has no significant effect on economic growth, while the number of vehicles and government spending has a significant effect on economic growth with each probability of 0.0000 (< 0.05).

Keywords: Transportation infrastructure, Economic Growth, Panel Data, Central of Java

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INTRODUCTION

One of the most important parts of National Economic Development is economic development in each region, which of the economic development has the aim to improve the welfare of society. Soebagiyo, et al., (2015) defines economic development as a way for the government as the authority to invite its people to manage the wealth of resources that will create jobs as an effort to stimulate economic growth. Economic development can be shown from several important points, namely the increasing ability of people to meet their needs, the creation of an increase in people's sense of self-esteem as a human being, and an increase in people's ability to choose. Kartiasih, (2019); Sholawati, (2020) concluded that the success of economic development can be measured by economic growth indicators.

Wu, et al., (2021), said if in economic theory, the relationship between infrastructure development and economic growth is generally associated with the multiplier effect, which is government investment that depends on strengthening the investment multiplier, which is able to encourage growth in the industrial field, so that it can accelerate the economic growth of a region. Transportation infrastructure development can affect economic growth by the influence of production behavior. Through economic growth created, will also affect the performance of economic development in a region.

Usually the improvement of infrastructure in a region is managed by local governments. Therefore, a good region can be assessed through the performance of local governments in managing and optimizing infrastructure procurement as a locomotive of development (de Almeida, et.al., (2019). Kartiasih, (2019) stated that the economic development of a region can be seen through the high economic growth rate, which is one of the indicators of development of a region. Its function is to evaluate the results of programs that have been implemented by the government, as well as a reference for future development.

To improve and create economic activities that can be a tool to meet the needs of the community, adequate infrastructure is needed. Not only that, the existence of infrastructure is also considered as an optimization of the development process in a region. As the driving force of economic growth, infrastructure is able to become the locomotive of development, both national and regional. Infrastructure is the basic physical structure that is important to facilitate the community in terms of providing the basic framework necessary for economic output (Aisha Tauqir, et al., (2021).

Infrastructure is not only important for the improvement of the quality of human life and its well-being. Moreover, the improvement of this infrastructure can affect the increase in consumption value, labor productivity, and access to job availability (Rahardjo, (2015); Sholawati, 2020). In short, infrastructure can be the main key in the process of accelerating the equitable distribution of development which in turn can reduce the level of poverty and unemployment in a region. Kartiasih, (2019); Duflo, et.al, (2020); Nature, et.al., (2020); Lin, (2020), defines transport infrastructure as key to driving economic growth. This is due to the availability of access to the market as a medium of economic activity. The better the transport infrastructure and the better the accessibility, the economic activity between regions or regions is also growing. Meanwhile, Sholawati, (2020); Mohmand, et al., (2021) assessed that economic growth must be supported by infrastructure development.

The relationship between infrastructure development and economic growth is generally associated with a multiplier effect, that is, government spending used as

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investment through infrastructure development (Zu, et.al., 2022). The existence of investment from government spending is considered to be able to accelerate economic growth in a region (Wu, et al., 2021); (Batool & Goldman, 2021).

Pradhan, (2019) summarizes three ways that can prove the relationship between transportation infrastructure and economic growth. First, the infrastructure of this type of Transport has a share in the production process as a direct input, and in various cases the transport infrastructure acts as an unpaid factor of production. Second, transportation infrastructure can be a trigger for the creation of inputs in other fields, so that they become more productive. Third, the existence of transportation infrastructure is able to become a magnet for economic growth in a region by agglomeration.

Transportation infrastructure is a type of infrastructure development that can be an important factor, affecting income inequality, which is effectively able to promote regional economic growth and affect regional income distribution through the flow of goods, labor, and various resources (Zhang, et al., 2021); (Cho & Choi, 2021). Not only that, investment in transportation infrastructure development has a broad impact on economic activity, as revealed in the agricultural, manufacturing, and tourism sectors, even the development of this transportation infrastructure contributes to economic growth (Chen, et al., 2021); (Apury & Uzma, 2021).

In his research, Pradhan & Bagchi, (2012) concluded that good transportation infrastructure can expand the productivity capacity of a country, both through increased mobilization of existing resources and by increasing the productivity of its resources. The influence exerted by transport infrastructure on economic growth by changing aggregate demand. An example is the development of transportation infrastructure that can generate input from other sectors so that it can be a multiplier effect stimulus in economic activity.

The development of Transportation-based service infrastructure intended for modes such as cars, buses, trucks, motorcycles, to planes, and ships leads to job creation and is considered to be able to shape the development of the logistics sector that will increase the income of a region (Antoni, et al., 2019); (Alam, et al., 2021).

In trend, the percentage of economic growth in Central Java during 2017 to 2020 tends to decrease, especially in 2020 which experienced a significant decline due to the Covid-19 pandemic. Three years before the pandemic, the percentage of economic growth in Central Java was fluctuating, where in 2019 it had increased from the previous year. However, economic growth in Central Java can be said to have not experienced a significant increase in the vulnerable time. Then, in 2022, economic growth in Central Java increased after adapting to the pandemic. However, the increase is predominantly due to the infrastructure and agriculture sectors. However, the increase is still far from the government's Work Plan (RKP).

When compared to other provinces in Indonesia, based on data from the deputy for Regional development of the Ministry of PPN/Bappenas, economic growth in Central Java province became the lowest of several provinces on the island of Java in 2018 to 2020. Central Java province in percentage terms is at the bottom of the other provinces of Java island. Meanwhile, in 2019, Central Java province experienced an increase by having a better percentage of economic growth than West Java and Banten provinces, but still under DKI Jakarta, Yogyakarta, and East Java provinces.

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Furthermore, in 2020 where there was a pandemic that attacked Indonesia as a whole, including in aspects of economic growth, each province experienced a minus record in economic growth. Central Java province is only better than the province of Yogyakarta and Banten province in percentage terms of economic growth. While Central Java province is under three other provinces, namely DKI Jakarta Province, West Java Province, and East Java province.

The minus record that occurs in various provinces on the island of Java in economic growth is caused by the absence of routine economic activities, such as distribution and logistics work that uses transportation infrastructure as access to smooth economic activities. There is an outbreak that requires all activities, including economic activities, to be resettled and transferred to digital, so that economic activities, distribution, and logistics activities cannot be carried out optimally. Chen, (2021) quoted in Adam Smith's the Wealth of Nations, said if transportation infrastructure supports the mobility of production factors and is able to connect people with jobs, education, and health services, that could ultimately affect a region's economic growth. The proposition of economic growth driven by Transportation shows that transportation infrastructure is elastic with emerging investment output, so there is a correlation between transportation infrastructure investment and economic growth.

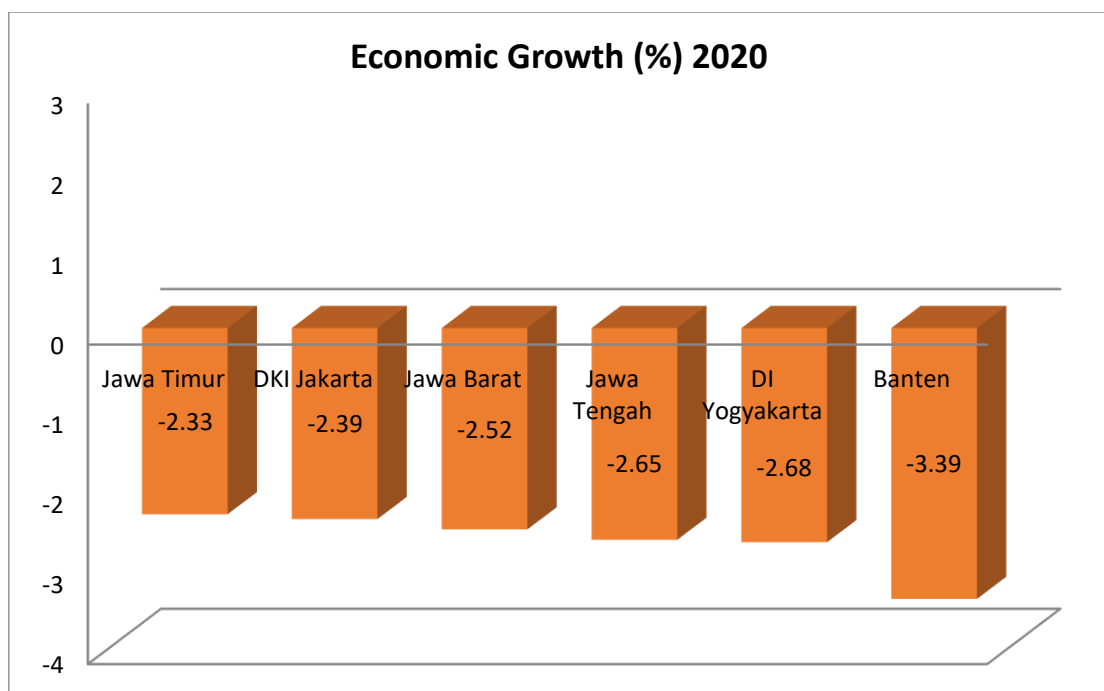


Figure 1. Graph of Economic Growth Per province on the Island of Java in 2020

Source: Deputy for Regional Development Ministry of PPN / Bappenas, processed

If we looking at the plan of the Ministry of Public Works and public housing (PUPR), the development of transportation infrastructure has not been so intensified. Practically, the focus is to build the Semarang-Demak toll road. Then, the distribution of development on roads, both toll and non-toll access, has not been evenly distributed in each Regency/city in Central Java province. In the PUPR Ministry's plan for infrastructure development in Central Java, only the road to the Borobudur tourism area will be built. It can be said that the

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expenditure of the Central Java provincial government on the transportation infrastructure sector has not been the focus of development.

In some districts / cities between the length (condition) of the road with the number of vehicles is also not comparable. This causes congestion, damaged roads, and access difficulties. The minus factor in such transportation infrastructure that ultimately causes problems with the equitable distribution of welfare, both socially and economically in Central Java province.

Launching the Strategic Plan report of the Central Java provincial Transportation Office for 2018-2023, the land transportation sector itself has 269 AKDP route networks served by 3,125 fleets and 902 AKAP route networks served by 917 fleets. The number of terminals itself has 24 type B terminals, but there are still 3 of the 24 terminals that do not meet the minimum operational requirements of the terminal and physically the main facility is damaged. Among them are the Suronegaran and Nampurejo terminals in Purworeko Regency, as well as the DRS Terminal. Prayitno Magelang Regency. For terminal type A in Central Java province as many as 17 terminals, fewer than terminal type B.

Many researchers have examined the effect of transportation infrastructure on economic growth in a region. On an international scale, Zhang (2021); Banerjee, et al., (2020) has conducted research like this. They assess if China's transportation infrastructure has a significant impact on inter-regional economic growth. Transportation infrastructure also has an impact on increasing distribution income seen from the flow of goods, labor, and other sources. China has become the country with the largest economic growth in the world. Rapid economic growth in China is influenced by various factors, including infrastructure development, transportation infrastructure, and increased carbon emissions.

Meanwhile, different results were concluded by Magazino & Mele, (2020) who conducted a study using panel data from 28 regions to determine the relationship of the influence of transportation infrastructure on economic growth in China. The study found that transportation infrastructure can affect economic growth on an overall scale, but does not have an effect on the scale of each region.

Although many have examined the effect of transportation infrastructure on economic growth in a region, not many researchers have examined the effect of transportation infrastructure on economic growth in Central Java. In Indonesia itself, several studies have conducted research like this in other Indonesian regions. In his research, Kartiasih (2019) uses similar models and variables to see the effect of transportation infrastructure on economic growth, where the transportation infrastructure used is the length of the road, the number of vehicles, and the flow of aircraft arrivals and the flow of loading and unloading of goods at the port. The results showed that the number of vehicles, the flow of arrivals and the flow of loading and unloading of goods has a significant effect on economic growth, while the length of the road has no significant effect on economic growth.

This is what makes the authors interested in conducting this research in Central of Java, to find out whether transportation infrastructure has an influence on economic growth in Central of Java Province in the period 2017 to 2020.

METHOD

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This research uses a quantitative descriptive method, where the data in this research in the form of numbers or numerical which is then processed and analyzed to obtain conclusions as well as determine the relationship between each variable used in this research. The types of data in this research used secondary data from the Central Bureau of Statistics of Central Java Province, Department of Public Works Binamarga, Cipta Karya of Central Java Province, and the deputy of Regional development of the Ministry of PPN within a certain period of time.

In this research, the data used is panel data that combines the time series and cross section. Data analysis will be done by finding the best test model using the Fixed Effect Model (FEM) method in the Eviews Program.

The variables used in this research are the dependent variable and the independent variable. With details, the independent variables include data on road length, number of vehicles, and government spending. While for the dependent variable using data on Gross Regional Domestic Expenditure (GRDP) per capita of Central Java province.

The analysis performed is a regression analysis of panel data by determining the best model in accordance with the estimated results. The panel data regression formula as follows:

Economic Growth:

$$Y_{it} = \beta_0 + \beta_1 LR_{it} + \beta_2 NV_{it} + \beta_3 G_{it} + e_{it}$$

Y=GDP per capita; LR=length of road; NV=number of vehicles; G=government spending

In determining the best panel data, there are three models that can be selected, namely Common Effect Model (CEM), Fixed Effect Model (FEM), and Random Effect Model (REM). To find out which model is the best of the three, in this research conducted two tests, namely Chow test and Hausman test. In the Chow test, if the p-value is less than alpha, then H_0 is rejected, so the model called Fixed Effect Model is better than the Common Effect Model. Likewise with the Hausman test, if the p-value is not greater than alpha, then the results reject H_0 so that the Fixed Effect Model is better than the Random Effect Model.

In this research, the overall data variable has do transformation. This is because the units of each variable are different, so the data transformation is carried out to change the variable units into the same form, namely percent. So the regression equation becomes as follows:

Economic Growth:

$$\ln Y_{it} = \beta_0 + \beta_1 \ln LR_{it} + \beta_2 \ln NV_{it} + \beta_3 \ln G_{it} + e_{it}$$

Y=GDP per capita; LR=length of road; NV=number of vehicles; G=government spending

RESULT AND DISCUSSION

This research was concluded using the method of Fixed Effect Model after two tests, namely Chow test and Hausman test. The following are the results of the Chow Test and Hausman test using the Eviews Program:

Table 1. Uji Chow

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Effects Test	Statistic	d.f.	Prob.
Cross-section F	448.611333	(34,102)	0.0000
Cross-section Chi-square	701.989349	34	0.0000

In the test results using the Eviews Program, The Chi-square cross-section probability value is 0.0000, making it smaller than alpha 0.05. H_0 is rejected and the Fixed Effect Model is better than the Common Effect Model.

Table 2. Uji Hausman

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	35.072118	3	0.0000

Then, in the second Test to determine the best Fixed Effect Model or Random Effect Model, the Hausman test was performed. By using the Eviews Program, the probability value of random cross-section is 0.0000, which means that the p-value is less than the significance of 0.05, thus rejecting H_0 . Thus, the Fixed Effect Model Method is the best model in research using this panel data.

After finding the best testing model, regression through Eviews program estimates and classical assumption tests, which include normality tests, multicollinearity tests, heteroskedasticity tests, and autocorrelation tests. From the results of the estimation and test of classical assumptions obtained the following results:

Table 3. Estimation Results and Classical Assumption Test

Variable	Koef	Std. Error	t-Statistic	Prob.
LR	-0.000591	0.000398	-1.483248	0.1411
NV	0.002088	0.000283	7.370362	0.0000
G	0.014165	0.002856	4.958807	0.0000
C	2.497592	0.061528	40.59261	0.0000
<i>Diagnosis</i>				
R-squared			0.997399	
Adjusted R-squared			0.996455	
Durbin-Watson			1.636450	
F-statistic			1057.083 (0.000000)	
Corelation			1.000000 (0.156357)	
Breusch-Pagan-Godfrey			1.102829 (0.350318)	
Normality Jarque-Berra			5.392349 (0.067463)	
White			1.102829 (0.350318)	

Source: Author's compilation

From the regression results using the Fixed Effect Model, the variable NV (number of vehicles) and G (government spending) has a significant positive effect on economic growth with each probability value is 0.0000 and 0.0000, smaller than the value of alpha 0.05 thus rejecting H_0 . Meanwhile, only the variable LR or length of the road that has no significant effect on economic growth in Central Java province. This is because the empirical probability value of 0.1411 is greater than alpha 0.05 and H_0 is accepted Model estimator calculation of this research as follows:

$$\ln Y_{it} = \beta_0 + \beta_1 \ln LR_{it} + \beta_2 \ln NV_{it} + \beta_3 \ln G_{it} + e_{it}$$

$$\ln Y_{it} = 2,497592 - 0,000591 \ln LR_{it} + 0,002088 \ln NV_{it} + 0,014165 \ln G_{it} + e_{it}$$

$$\ln Y_{it} = 2,513254$$

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Based on the results of panel data regression in the equation above, the regression coefficient of each variable can be described in detail, if all variables value is 0, then the average economic growth is equal to 2.49%. If the number of vehicles increases by 1%, then economic growth will increase by 0.20%, and if government spending increases by 1%, then economic growth will increase by 1.4%. While the variable length of the road does not have a significant effect on economic growth in Central of Java Province.

This research also shows the value of R-squared of 0.997399, meaning that the variation of variable Y (GDP per capita) can be explained by the change of variables LR (road length), NV (number of vehicles), and G (government spending) of 99%. The remaining 1% can be explained by other variables that are not in the model.

In the F-stat test, simultaneously the three independent variables affect the dependent variable, because H_0 is rejected with the probability value of F-stat is 0.000000 so it is smaller than alpha 0.05.

The diagnostic test indicates that the estimated model does not experience any problems violating the classical assumption Test at all. The estimated Model is free from the problem of multicollinearity because the value between the independent variables does not exceed 0.8. Test values of normality, autocorrelation, and heteroskedasticity, each of which is 0,067 ($> 0,05$), 0,35 ($> 0,05$), and 0.35 (> 0.05) concluded that the estimated model has a normal residual distribution, there is no autocorrelation problem, and free from heteroskedasticity problem.

DISCUSSION

Based on the results of the research tested through regression analysis, the number of vehicles has a significant positive influence on economic growth in Central Java province from 2017 to 2020. This significant effect is caused because the vehicle can be used to run economic activities and distribute production results. For example, motor vehicles, both two- and four-wheeled, which are currently not only used as personal needs, but as a tool for work that is assisted by technological advances. So that it further optimizes the allocation of economic resources. The passage of production activities through the availability of transportation can increase the gross regional domestic income of a region. These results also show that the average community in Central Java province has a high purchasing power of the vehicle, so that it is able to improve the level of the region's economy with the economic turnover.

In the variable of government spending also showed results that had a significant positive influence on economic growth in Central Java province in 2017 to 2020. To run the economy well, the government needs to issue and determine the amount of budget each year as part of the government's authority. The existence of government spending indicates that the government cares about improving transportation facilities and infrastructure infrastructure in a region. If the facilities and infrastructure of transportation infrastructure is good then the economic activity in a region will be smooth, so that it can increase economic growth in a region. This research has results that are in line with research previously conducted by Junaidi (2020). In addition, based on The Theory of Rostow and Musgrave, the investment from the government is needed in the development phase as an effort to increase economic growth of a region. In Central Java province, in the vulnerable years of 2017 to 2020, government spending has a significant influence on economic growth,

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so that the efforts and design of transportation infrastructure development carried out by the government are expected to launch the process of economic activities.

From the results of this research, only the effect of road length on economic growth in Central of Java Province in 2017 to 2020 is not significant. This means that the length of roads in 35 districts/cities in Central Java province, with moderate or good road conditions, has no influence on economic growth in Central Java province from 2017 to 2020. The reason is that Central Java province does not only rely on land transportation modes to carry out its economic activities, but also through sea to air modes. In addition, the length of the road is not the only indicator that is able to support the smooth running of economic activities in Indonesia, so that with the availability of road access in developed areas, especially urban areas, it does not require additional road length. However, the need for additional roads in rural areas that still lack access to land transportation. Then, the benefits of the length of the road are long-term if they are associated with an increase in the economy. The point is that the addition of a new road length can be felt its influence in the economic growth of the region in the future, especially when the road has been completed. The results of this research are in accordance with the results of research previously conducted by Kartiasih, (2019) which concluded that long road infrastructure does not have a significant influence on economic growth.

IMPLICATIONS

The significant influence of the number of vehicles on economic growth indicates that the number of vehicles in Central Java province is able to make its economic activities run smoothly. This is because people use transportation as a mode that distributes their products, be it from land, sea, or air.

Then, the absence of a significant influence on economic growth by the length of roads in Central of Java Province in 2017 to 2020 shows that road length is an indicator that can only be used in the long term to see the results. However, the government needs to add roads in the management of government spending budgets and strategic development plans, especially to rural areas that are still difficult to get access to transportation. This is done so that there is equality so that economic activities in each region can run optimally and have an effect on economic growth.

CONCLUSION

The increase in economic growth in Central of Java province is influenced by the availability of transportation infrastructure in the province. The best model used for panel data regression in this research is the Fixed Effect Model. Based on the regression results, it was concluded that together the transportation infrastructure can affect economic growth in Central Java province in 2017 to 2020 significantly with a coefficient of determination or R-squared of 99%. Partially, the number of vehicles and government spending have a significant positive effect on economic growth, while the length of the road does not have a significant effect on economic growth in Central Java province.

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