Modeling Low Income Vehicle Ownership in Cibadak District

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ABSTRACT

The number and growth of vehicles is a separate problem related to the problem of sustainable transportation. In 2019, the number of motorized vehicles in Indonesia was recorded at more than 448 vehicles per 1,000 people. And specifically for motorcycles, it reaches 365 vehicles per 1,000 people. The growth of motor vehicles is significantly influenced by economic growth as measured by Gross Regional Domestic Product. When compared with the growth of motorized vehicles, it can be concluded temporarily that the high growth rate of motorized vehicles at the end of this decade has an impact on traffic problems on the highway. To see the trend between economic growth represented by regional gross domestic product and motorcycle growth, a model is needed to be useful for policymakers who handle the road in making decisions. The results showed that the growth model of motorcycles in Sukabumi can be approached with a linear regression equation. With the sample from the Cibadak sub-district, the area is classified as a low-income area.

1. Introduction

The increasing level of motorized vehicle ownership is a big challenge for developing countries in terms of the sustainability of urban transportation [1] [2] [3]. The availability of motorized vehicles significantly influences several individual decisions regarding transportation, such as housing location, number of daily trips, purpose of travel and of course the use of the vehicle itself [4] [5]. This usually implies that, as the number of motorized vehicles increases, the number and distance of motorized trips will increase as well [6].

The previous author asserts that this increase will result in major transport-related impacts, such as congestion, pollution and road accidents and other effects, car ownership is mostly concentrated in middle to high income households, which indicates that infrastructure investment to reduce congestion can be a social inequality [7] [8]. The previous researchers provide a perspective on urban transport that in developing countries, including a specific analysis of the impact of fast-rising motorization [9].

The increase in motorized vehicle ownership will certainly affect economic growth [2] [10]. In terms of economic growth in Indonesia between the years 2000-2004, economic recovery occurred with an average regional gross domestic product (RGDP) growth of 4.6% per year [11]. After that, RGDP growth accelerated (with the exception of 2009 when, due to global financial shocks and uncertainty, Indonesia's RGDP growth fell to 4.6%, a still impressive figure) and peaked at 6.5% in 2011 [11]. However, after 2011 Indonesia's economic expansion began to slow down considerably.

Between 2011 and 2015 Indonesia's economic growth decelerated quite sharply [12]. When compared with the growth of motorized vehicles, it can be concluded temporarily that the high growth rate of motorized vehicles at the end of this decade actually resulted in a decline in RGDP.

2. Research Method

2.1 Research Design

By taking into account the background of the very rapid development of motorized vehicles and the possible impacts that may arise as a result, it is necessary to examine the extent of the influence of motorized vehicle ownership (especially motorcycles) on the economic growth of a region or vice versa. Several previous studies have attempted to build a model to predict the growth of motorized vehicles, the results of which can be used as a planning reference.

Modeling for prediction of vehicle ownership has begun to be developed by The previous researchers [13] [14]. The previous authors have collected and analyzed the growth of motor vehicles from various countries, especially developing countries, and concluded that it follows the S-Curve pattern [15]. The other authors have studied several models of motorized vehicle growth related to independent socio-economic variables and other variables such as vehicle type, demand-supply and others [16].

In some areas of Sukabumi district, there is a rapid growth in vehicle modes in some areas, where these areas have low income but have very many vehicle modes, especially motorbikes or 2-wheeled vehicles.

The objectives to be achieved from the research are: to analyze whether the population, number of motorized vehicles and GRDP affect motor vehicle tax revenues in the Cibadak District.

2.2 Basic Theory

The current development of road transportation facilities in the Sukabumi area with a density indicator, namely the volume of vehicles compared to road capacity (V/C ratio) at certain times approaches number 1. by policy makers, for example to increase the length of roads or limit the ownership of motorized vehicles.

In this journal the author uses linear regression analysis which is a technique used in mathematical equations that express functional relationships between variables [17] [18]. Linear regression analysis or straight line regression is used for:

1. Determine the functional relationship between the dependent and independent variables. This functional relationship can be referred to as a linear regression equation.

2. Predicting or estimating the value of one variable in relation to other variables known through the regression line equation.

A. Regression analysis is an analysis that explains the effects and magnitude of the consequences caused by one or more independent variables on a dependent variable [19]. Regression and correlation are part of inferential statistical analysis using parametric models. Regression analysis with correlation analysis is very different, although in regression analysis applying the principles of correlation analysis.

B. Regression analysis is an analysis that measures the influence between the independent variables on the dependent variable [20]. If the measurement of this influence involves one independent variable (X) and the dependent variable (Y) it is called a simple linear regression analysis which is formulated: Y = a + bX [21] [22]. The value of a is a constant and the value of b is the regression coefficient for the variable X [23].

$$b = \frac{n \sum XY - (\sum X)(\sum Y)}{n \sum X^2 - (\sum X)^2} \tag{1}$$

$$a = Y + bX \tag{2}$$

The regression coefficient (b) is the contribution of the magnitude of the change in the value of the independent variable (X), the greater the value of the regression coefficient, the greater the

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contribution of the change and vice versa. The contribution of changes in variable X is also determined by a positive or negative regression coefficient.

3. Regression or correlation is a method used to measure the relationship between two variables or more.

A. Both regression and correlation methods are used to measure the degree of relationship between variables that are correlational or related or dependent. The use of regression is as a measure of the form of the relationship, and correlation is a measure of the closeness of the relationship between variables [24]. The two methods of measuring the relationship have their respective methods of calculation and terms of use. The explanation of the difference between regression and correlation in its use or application lies in Regression is a measure of the relationship between two or more variables which is expressed in the form of a relationship or function. To determine the form of the relationship (regression) requires a clear separation between the independent variable which is often given the symbol X and the dependent variable with the symbol Y. In regression there must be a specified variable and a determining variable or in other words there is a dependence of one variable on another variable and vice versa. The two variables are usually causal or have a cause-and-effect relationship. Thus, regression is a form of a certain function between the dependent variable Y and the independent variable X or it can be stated that the regression is a function Y = f(X). The form of regression depends on the function that supports it or depends on the equation.

B. Regression is a measure of the relationship between two or more variables which is expressed in the form of a relationship or function [25]. To determine the form of the relationship (regression) a firm separation is needed between the independent variable which is often given the symbol X and the dependent variable with the symbol Y. In regression, there must be a specified variable and a determining variable or in other words, the dependence of one variable on the another variable and vice versa. The two variables are usually causal or have a cause-and-effect relationship. Thus, regression is a form of a certain function between the dependent variable Y and the independent variable X or it can be stated that the regression is a function Y = f(X). The form of the regression depends on the function that supports it or depends on its equation.

The following is a curve that shows the form of the relation between 2 variables that it can see on figure 1:
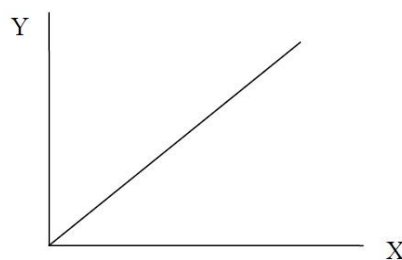

Figure. 1. Positive Relation Curve

Given the importance of predicting the growth of motorized vehicles, this journal will discuss the relationship between the growth of motorized vehicle ownership (dependent variable) and economic progress with the main indicator (independent variable) RGDP.

3. Research Flow

The data analysis process consists of nine stages: initial data collection, from the theoretical foundation, to model selection. As for the details, it can be seen at the stages of the research shown in figure 2.
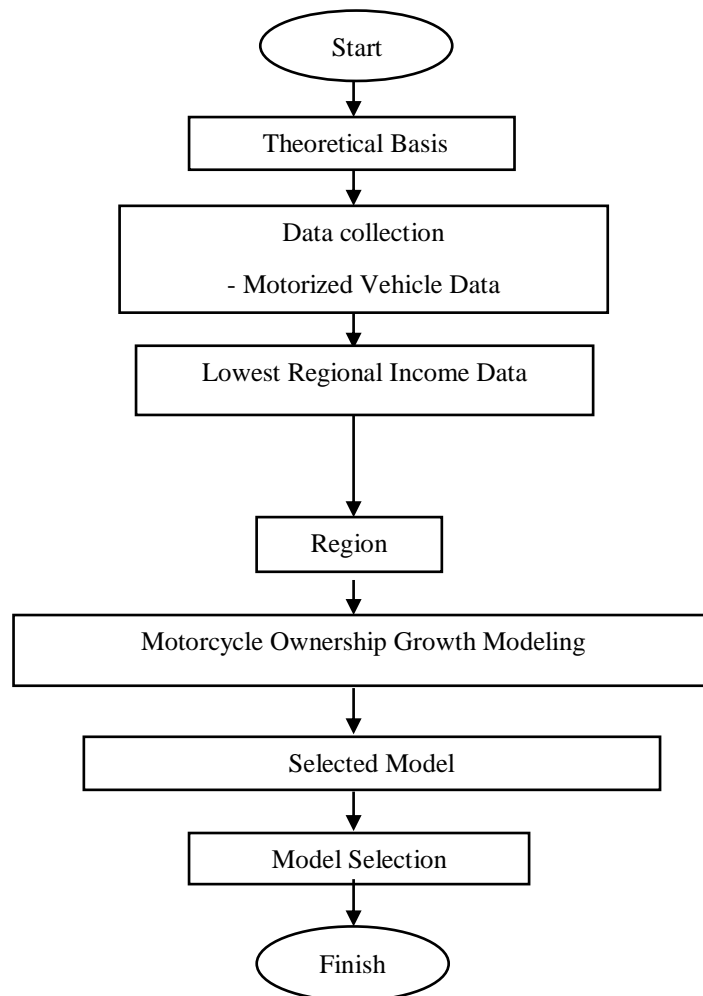
Figure 2. Research Flowchart

4. Research Methodology

To produce a growth model for motorized vehicle ownership (motorcycles) in low-income areas, the authors classify areas in Sukabumi with low incomes. Population income data was obtained from the Sukabumi Central Statistics Agency in 2019, vehicle ownership data was obtained from the West Java Provincial Dispenda in 2019.

After classifying the research area that became the object of research into a low-income area, each area was compiled and a linear regression equation model was made. The data compiled is serial data for the past 5 (five) years.

The chosen model approach is a mathematical model that has the largest R square close to 1 and is significant which can be used as the basis for selecting a motorcycle ownership growth model in Sukabumi Regency.

5. Results and Discussion

In classifying all regions in Sukabumi Regency, there are 3 (three) areas that are included in the low-income classification, including Sukaraja District, Warungkiara District and Parakansalak District. Based on the 2019 World Bank, those classified as low-income areas are RGDP 1,605 US. $. According to the IMF, those who say RGDP is low at 1,751 US$, in Indonesia alone per capita income ranges from 1,500-1600 US. $, with a note that the dollar exchange rate is Rp. 13,700.

The author in classifying low-income areas in Sukabumi ranges from 1,600-1800 US.$. Following are the results of the analysis of all 47 sub-districts, processed according to the lowest classification of the 10 lowest sub-districts and selected again to be the lowest 3 sub-districts as depicting the area with the length of the road in the low-income area that it can see on table 1, as follows:

**Table 1.** Regions in Sukabumi that are into Low Income Classification

No	Region	Road Length (Km)
1	Cibadak	275
2	Warungkiara	132
3	Parakansalak	175

After the research areas with low incomes are determined, the next step is to discuss the modeling of each selected area that is included in the low-income areas, with the following stages of discussion:

5.1 Modeling

In Fig.2. RGDP growth between 2015 and 2017 increased by 4.2%, while in 2017 to 2019 there was a decrease in growth compared to the previous period with RGDP growth of only 2%. The growth in motorcycle ownership in the 2015 to 2017 period was 12%, while in the 2017 to 2019 period there was an increase in growth of 19%, meaning that when there was a decrease in RGDP growth, there was an increase in motorcycle ownership growth. Figure 3 provides the histogram of per capita income and figure 4 shows the growth of motorcycle ownership in cibadak district.

**Figure 3.** Histogram of Per Capita Income
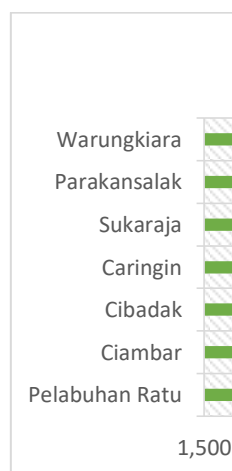
Figure 4. The Ownership in
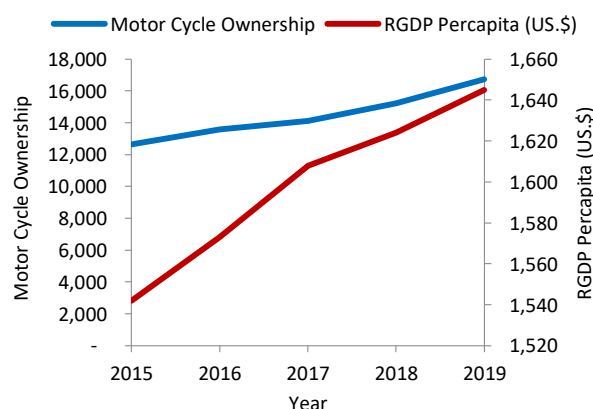
Growth of Motorcycle Cibadak District

In figure 5. The growth model of motorcycle ownership in Cibadak District with the equation model $y = 36.668x-44143$ with $R2 = 0.9101$, meaning that the linearity approach of the relationship between RGDP growth and motorcycle ownership growth is close to the level of confidence that RGDP growth affects motorcycle ownership growth less than 95%, namely by 91%.

Figure 5. Positive Relation Curve

$y = 36.668x - 44143$
$R^2 = 0.9101$

(y-axis: Kepemilikan Sepedah Motor; x-axis: RGDP Percapita (US.$))
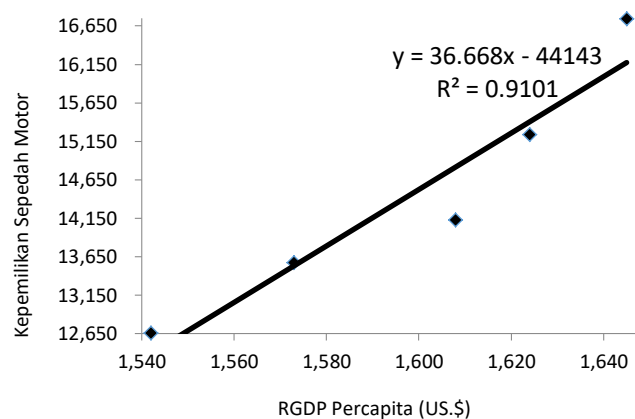
6. Conclusion

In this study, the authors have found a selected model of how to predict motorcycle ownership for the future in low-income areas. In Sukabumi, the area with a motorcycle ownership model which is the result of the author's research is Cibadak District, the results of which can predict 95% of the data. Along with the increase in RGDP growth, there is also an increase in the growth of motorcycle ownership.

The population of WarungKiara Subdistrict with the increasing value of economic growth there is a tendency to have a high desire to be able to own a motorcycle. This high ownership is of course due to the convenience of traveling to work in the WarungKiara sub-district area by motorbike. Most of the population are laborers (low income) with the consideration that using public transportation is ineffective and expensive.

People find it difficult to use public transportation with the assumption of travel time and expensive costs, this of course must be the basis for consideration of policy makers to take policies in regulating traffic. Due to the increasing growth in motorcycle ownership, there will be many impacts, including traffic jams, accidents and social problems. There are several alternative steps that can be taken by policy makers, such as restrictions on vehicle ownership, which have not been implemented in

Indonesia so far. In table 2 provides the result for equation and r-square model to give conclusion in this observation.

Table 2. Equation and R-Square Model

Sub-District	Equation	R^2
Cibadak	y = 36.668x - 44143	0.9101

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Declarations

Author contributions. All authors make an equal contribution to the main contributors to this paper. All authors read and agree to the final paper

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