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Household Income Differences between Residential Distance from the Toll Road in Indonesian Suburban Areas

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Abstract

Toll roads play a significant role in regional development. Moreover, toll roads affect the behavioral patterns of the people who reside in the surrounding areas and the region's development. Toll roads improve accessibility to resources that lead to higher productivity and ultimately foster economic growth. This paper aims to examine the difference in household income levels between suburban areas before the construction of Bakauheni–Terbanggi Besar toll road in 2014 and after the toll road construction in 2017. Toll road construction is associated with society's income; the areas closer to the toll road are inclined to have higher income levels. Furthermore, the construction of a toll road creates socio-economic opportunities and improves accessibility for society. This research used an income effect model to develop transformational household changes using the Ordinary Least Square (OLS) Regression. It is discovered that there is a behavioral correlation both in and between the households that leads to shifts in the work sector, income level, health, and education. This research showed that households' income is significantly increased after toll construction. Residential distance from toll also has a strong correlation with income, which households residing closer to the toll road have earned more income than those residing farther.

Keywords: access; household income; infrastructure; toll road

1. Introduction

According to Law No. 38 of 2004 about Roads, A toll road is a public road part of the national road network that requires drivers to pay for its use. It plays a significant role in regional development. The construction of toll roads affects the behavioral patterns of the surrounding society and the region's economic development (Gunasekera, Anderson, & Lakshmanan, 2006). Toll roads improve accessibility to resources that lead to higher productivity and ultimately foster economic growth. Toll roads are also part of the infrastructure development to support agriculture and plantations development and the rural economy in general.

Moreover, toll roads affect the behavioral patterns of the people who reside in the surrounding areas and the region's development. The latter statement agrees with the study of Gunasekera et al. (2006), stating that toll roads contribute to changes in the behavioral patterns of society by improving people's access to resources that foster productivity and economic growth in general. Accordingly, the recent enormous infrastructure project of Trans Sumatera Highway is believed to have a significant impact economically and socially. It will increase the connectivity across Sumatera island as well as connected to Java as the economic center.

This paper aimed to develop the study of Gunasekera et al. (2006) to probe further the changes in the behavioral pattern of society and the difference in household income level between sub-urban areas as the result of toll road construction in Indonesia. Specifically, the purpose of this study is to investigate the

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difference in household income levels in Sumatra. One of the toll roads that will be the main focus of this study is the Bakauheni–Terbanggi Besar toll road, designed as the gateway to Sumatra island. It will connect Java island and the provinces in Sumatra. The construction of the 140.9 km toll road is considered paramount as it is expected to build key connectivity to Sumatra's development. Thus, this study analyzes the relationship between the construction of the Bakauheni–Terbanggi Besar toll road and the household income levels in 2014 and 2017.

Previous studies have explained that the construction of toll roads can bring transformational changes. Such transformation is essential to improve the behavioral patterns of the society, such as job sectors and income, health and education, and residency (Gunasekera et al., 2006). The transformation becomes more apparent as land-use shifts, such as agricultural land converted to residential land or interregional or village transportation routes converted to toll roads. Moreover, the behavioral patterns of society are affected (Tuyen, 2015). In addition, previous studies emphasize that the behavior of the society may vary, depending on the distance between one's residential location and the toll road. Punt et al. (2003) found that people living close to toll roads have better access to public service and information. The latter is also associated with changing behavioral consumption patterns of society. This paper will further investigate the correlation between household income levels and toll road construction. To date, Indonesian studies focusing on factors affecting household income before and after infrastructure development are limited.

According to the analysis of households in 2014 and 2017, it was found that household income levels in Lampung Province increased by 15.6% in that period. Comparing distances, the income of households living close to toll roads (less than 10 km from the road) was relatively higher than that of households living further than 10 km from the road. In terms of job sectors, in 2017 (after the construction of toll roads), the income of people working in the agricultural sector is lower than that of people working in the non-agricultural sector.

Based on the theory developed by Tobler (1970), "Everything is related to everything else." The maxim emerged as the basic concept of the relationship between infrastructure development and the development of the surrounding areas. Tobler (1970) noted the correlation between social dependency and spatial autocorrelation on distance weighting. Accessibility is the "main" product of the transportation system. It determines the competitive advantage of some areas over others in terms of location factors (districts and cities) over other regions. One of the indicators of accessibility is the benefits received by households and enterprises located close to the transportation infrastructure. The substantial role of transportation infrastructure in spatial development is manifested by providing better access for regions to the market and input material so that productivity and competitive advantages will be obtained, thus enabling these regions to develop more than the remote regions (Vulevic, 2016).

The relationship between transportation infrastructure development and spatial development is hardly verified empirically. Some researchers explain that there seems to be a positive correlation between transportation infrastructure and the traversed regions and the level of economic indicators, such as income per capita (Vickerman, 1996). Vulevic (2016) stated that investment in transportation is less beneficial for developed countries or regions where transportation infrastructure is already adequate. There is uncertainty about the magnitude of the impact of transportation infrastructure on regional development depending on the current level of development. Some analysts argue that regional development policies on the impact of infrastructure developments have not successfully reduced regional disparities. Increased accessibility enables previously isolated regions to connect, encouraging increased specialization and reorganization of the labor force. Developing countries will have the same effect in the short term (albeit on a smaller scale). Nevertheless, in the long run, short-term effects can be a catalyst for structural changes in the socio-economic system, such as changes in job sectors, improvement in education, and so forth.

In summary, it can be argued that the income level of households and the distance between their residential areas and toll roads are correlated; that is, household residences close to the toll roads will have different income levels compared with households whose residences are far from the toll roads. This means that distance becomes a variable of interest that is correlated with income. Furthermore, households living in areas with greater access are generally more prosperous than households in areas with less access (Punt et al., 2003). Consequently, according to the rational choice theory developed by Becker (1993), the public responds to economic opportunities to maximize their utility as incentives to earn more income arises. Assuming economic opportunities, they explore and choose alternatives to increase utility, such as household income.

Household income based on Statistics Indonesia (*Badan Pusat Statistik*/BPS) is defined as the total income earned by the household, comprising income earned by the head of the household and by other members of the household. Household income can be generated from employees' compensation (wage and salary, profit, bonus), capital return (interest, profit sharing), and income received from other parties (transfer)[2]. Household income is the combined income of all household members, including the head of the household and other adults in the household. For most people, household income is the most crucial determinant of economic welfare. It provides a measure of resources for consumption and saving, although income is not the only economic resource available. Household income is generally the preferred

[2] Indonesia Statistics accessed from https://www.bps.go.id/istilah/index.html?Istilah%5Bberawalan%5D=P&Istilah_page=7

measure for analyzing people's economic well-being rather than personal income. When considering economic welfare, the household is the preferred unit for analyzing income because it is the aggregate level of individual income assumed to have the most reasonable level of income sharing[3].

Based on the definition mentioned above, it can be concluded that household income consists of all family members (individuals in the family) working in a particular type of work, either formal or informal. Becker (1993), in his first book about labor capital theory, explained his "Human Capital" theories. He explained the effect of labor-capital on income. Furthermore, income and education have a solid relationship. According to Wolla and Sullivan (2017), education is an investment in human capital. Someone who invests in human capital shares a similar purpose to investing in financial assets to make money. Therefore, in general, those who are better educated will obtain higher incomes. Other than education, it is stated in human capital theory that gender correlates with income. Becker (1993) affirms the importance of human capital to describe the gender wage gap. Traditionally, women spend more time part-time than men, as they usually prefer to quit the labor market after childbirth. Consequently, they have less incentive to invest in education and training, which is paramount to increasing earnings and work skills.

This research uses correlation analysis that employs dependent and independent variables. The purpose of this research is to investigate the difference in household income levels between those living close to the toll road and those living far away, plus other factors affecting household income. We begin with government investments in infrastructure development, i.e., the Bakauheni–Terbanggi Besar toll road in Lampung Province. It was argued that toll road construction in a relatively remote area would generate transformational changes (for instance, land clearing). Such transformation would induce a new socio-economic market with new opportunities, especially for those living around the construction area. The behavioral patterns within and between households would absorb the changes in job sectors, income, health, and education (Gunasekera et al., 2006).

Previous studies have examined the impacts of toll road construction on the surrounding areas in the context of developing countries, including Indonesia. A correlation between toll road construction and the incomes of the surrounding population was found. The people who reside close to toll roads most likely earn higher incomes than those who reside further away (Gunasekera et al., 2006; Sengupta, Coondoo, & Rout, 2016). Another characteristic that significantly affected incomes was the availability of essential infrastructures, such as roads. This was because roads provide access for people in the surrounding areas to conduct their economic activities. Access to the market and the availability of roads indicate a positive correlation with increasing household income (Tuyen, 2015). It is argued that regions located close to toll roads acquire more income than those located farther away. The latter sentence indicates a distinct income distribution associated with the distance to toll roads. It is because toll roads provide more comprehensive access and connectivity that increase mobility and economic activities. However, no study has addressed the direct impact of road infrastructure construction on household income (Gunasekera et al., 2006). This paper aims to examine the difference in household income levels between suburban areas before the Bakauheni–Terbanggi Besar toll road in 2014 and after the toll road construction in 2017.

2. Research Methods

2.1 Data and Sample

This research extracted the data of Lampung Province from the National Socioeconomic Survey (SUSENAS) in 2014 and 2017. The data used is cross-sectional, in which responses are obtained from different households at different points in time. The samples encompassed all households registered in Lampung Province, based on a household survey code.[4] The total samples used are 16.216 households. Information covered by the National Socioeconomic Survey comprised monthly household spending (estimation of monthly household income), job sectors, educational level of the head of the household, gender of the head of the household, and the number of working family members.

The effect of toll road construction on household income is examined by comparing the 2017 income (after the road construction) with the 2014 household income (before the road construction) across the districts in Lampung Province.[5] This research used a cross-sectional analysis from 2017 and 2014 since although the households used as samples are different, they are located in similar regions.

The map illustrates the construction of the toll road (Figure 1). The districts within a 10 km radius are South Lampung, Bandar Lampung, Metro, Central Lampung, Pesawaran, and East Lampung. Therefore, this study will compare districts located 10 km from the road with the other districts. The districts mentioned above are chosen as they are close to the toll road and Bandar Lampung, the city center. Thus, the mobilization of people and goods in these districts is relatively high.

Consequently, observations at the household level, combined with the location of residences based on their distances to the toll road, are possible to create limits and estimate the model (Gunasekera et al., 2006). Dependent variables of the model measure the change in household income, whereas the

[3] Canberra Group, *Handbook on Household Income Statistics*. (2011), 193.

[4] Household survey code is the data for household surveyed created by the National Socioeconomic Survey based on province code, district code, sub-district code, village code, and sample code.

[5] We opted for a 10 km radius from the toll road after conducting several trials and errors. When we conducted the estimation using a 5 km radius, the estimation value is almost similar to 10 km; therefore, at the end, we decided to use 10 km and >10 km parameter.

independent variables measure the location of household residences—those living within 10 km from the toll roads and those who do not—furthermore, job sectors, education, gender, and family members working as the control variables.

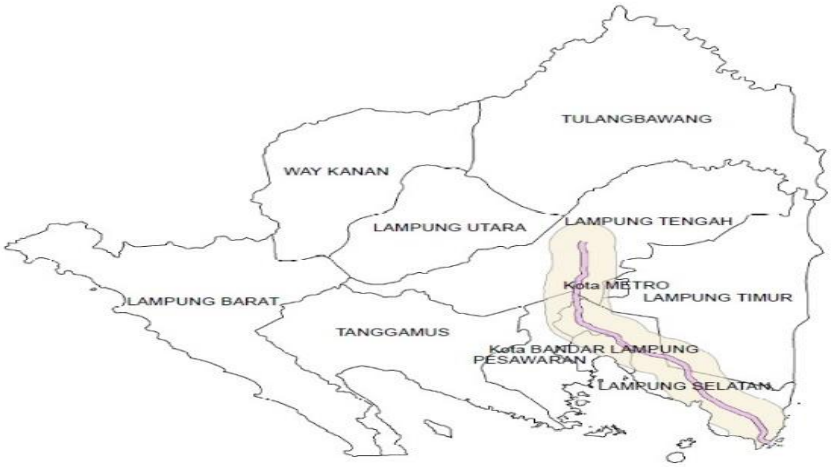

Figure 1. The Map of Lampung Province and the Bakauheuni–Terbanggi Besar Toll Road within 10km

The distance variable shows the ease of access to the toll road used by Gunasekera et al. (2006) and Sengupta et al. (2016). The job sector variable is employed to observe regional economic changes (for instance, shifting economic activities from agricultural-based to non-agricultural-based). This variable is measured in dummy variables in which number 1 represents the head of the household working in the agricultural sector, and 0 represents the head of the household working in other sectors. Based on questionnaires and data from Statistics Indonesia (BPS), rice farming and secondary crops, horticulture, plantations, fisheries, livestock, forestry, and other agriculture included in the agricultural sector. The non-agricultural sectors are mining and quarrying, processing industry, electricity and gas, construction/building, trade, hotel and restaurant, transportation and warehousing, information and communication, finance and insurance, education services, health services, services society, government, and individuals. The same variables were used by Gunasekera et al. (2006).

Another independent variable is the number of family members working. The latter is defined as people who reside in the same house, aged ten years and above, who have worked in the last 3 months.[6] The variable is subsequently transformed into a natural logarithm, as Gunasekera et al. (2006) and Noor et al. (2012) in the previous study. The last independent variables used as controls are the demographic characteristics of the household comprising education and gender. Both represent the demographic characteristics of the head of the household. The education of the head of the household is described in dummy variables, 1 for the head of the household who graduated from at least junior high school and 0 for those who did not graduate junior high school. This variable is referred from Becker (1964), Gunasekera et al. (2006), and Sengupta et al. (2016), who discovered its correlation with household income. Other than that, the gender of the head of the household, which is another control variable, is also described as a dummy variable: 1 for a man and 0 for a woman, as used by Becker (1964); Gunasekera et al. (2006); and Sengupta et al. (2016).; Control variables were necessary to acquire insight into whether there was a statistically significant relationship between skill level and gender and household income.

2.2 Empirical Model

This research aims to probe the difference in household income level resulting from toll road construction in Indonesia so that it uses correlation analysis that employs dependent and independent variables. The purpose of this research is to examine the difference in household income levels between those living close to the toll road and those living far from the toll road and other factors affecting household income. The dependent variable is household income. Other variables considered necessary in this study comprise distance, described as the distance between the residence and the toll road and social characteristics of the households. Some variables are described in dummy variables. They are dummies for the time variable, which is 1 for 2017 and 0 for 2014. The dummy for the distance variable is 1 for households living within 10 km from the toll road and 0 for households living beyond 10 km from the toll road. The dummy for the job sector variable is 1 if the head of the household works in the agricultural sector and 0 if the head of the household works in a non-agricultural sector. In addition, we employed interaction variables to extend the depth of the research, namely, the interaction between time and

[6] Indonesia Statistics accessed from https://www.bps.go.id/subject/5/konsumsi-dan-pengeluaran.html

distance variables and the interaction between distance variables and job sector variables. Therefore, the household income model employed in this research is illustrated in equation (1).

$$\begin{aligned}\text{Ln } I = {} & \alpha_0 + \alpha_1 D(time) + \alpha_2 D(distance) + \alpha_3 D(time) * D(distance) + \alpha_4 D(job\ sectors) \\ & + \alpha_5 D(job\ sectors) * D(distance) + \alpha_6 D(education) + \alpha_7 D(gender) \\ & + \alpha_8 \ln working\ members + \varepsilon\end{aligned} \quad (1)$$

Notes= $\text{Ln } I$= natural log of household income in the specific distance; $D(time)$= time frame of the survey (D=1 if 2017 and D=0 if 2014); $D(distance)$= Distance between household residence and the toll road, (D=1, if it is located in 10 km, D=0 if it is located farther than 10 km); $\alpha_3 D(time) * D(distance)$= interaction between time survey and specific distance of the household; $D(job\ sectors)$= Dummy for job sectors in which the head of the household works (D=1 for work in agricultural sector, D=0 for work in other sectors); $\alpha_5 D(jon\ sectors) * D(distance)$= interaction between job sectors of the head of the household and specific distance; $D(education)$= Dummy for educational level of the head of the household (D=1 if at least graduated from junior high school, D=0 for others); $D(gender)$= Dummy for gender of the head of the household (D=1 for a man, D=0 for others); $\text{Ln } working\ members$= Number of family members working; ε = error

To conduct a descriptive analysis, we conducted a mid-value analysis using t-statistics. In the subsequent step, we used a regression model, namely, ordinary least square (OLS), to address research questions. As cross-sectional data was harnessed in this study, OLS was considered a suitable method to investigate the relationship between the dependent and independent variables. This model can provide evidence for the changes in household income and other factors affecting their potential income. The OLS regression model must fulfill classical assumptions, including multicollinearity and heteroscedastic tests, to obtain a good estimation model.

3. Result and Discussion

3.1 Descriptive Statistic

The construction of the Trans-Sumatra toll road began in 2015. The Bakauheuni–Terbanggi Besar toll road is one of the networks of roads. The toll length is 140.9 km and is worth 16.795T of investment value. The Bakauheuni–Terbanggi Besar toll road traverses three districts: South Lampung, Pesawaran, and Central Lampung. In total, 11 toll gates have been built to support its operation. Based on data from Statistics Indonesia (BPS), more than 50% of the population remains reliant on the agricultural sector. In contrast, the rest work in non-agricultural sectors, such as commerce, service, and others. In terms of income, people working in the agricultural sector typically obtain lower income compared with those working in the non-agricultural sector (Figure 2).

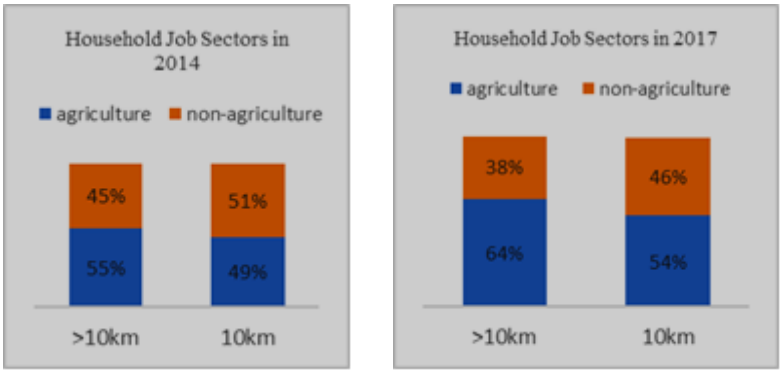

Figure 2. Percentage of Job Sectors Based on Residential Location in 2014 and 2017
(Source: Central Bureau of Statistics Indonesia 2014; 2017, author's calculation)

In 2015, the Trans-Sumatra construction project began. It started with land clearing and, subsequently, the construction process. The project finished in 2017. The construction of the Trans-Sumatra toll road, particularly Bakauheni–Terbanggi Besar, is associated with a change in the people living in the surrounding area. The behavioral changes within and between households have affected the job sectors, economic opportunities, and incomes of society.

The household income level varies by region, especially in areas close to infrastructures, such as toll roads. This indicates a correlation with several factors, especially the distance from a household's residence to the toll road. Households within a 10 km radius from the toll road have an average income greater than households living farther than 10 km. Figure 2 explains the distribution of average household income by job sector (agricultural and non-agricultural) in both 2014 and 2017, with a total household sample of 16,217 Neighborhood Units (in 2014 = 7889 Neighborhood Units (Rukun Tetangga) and 2017 =

8327 Neighborhood Units (Rukun Tetangga). In addition, Figure 2 presents the average household incomes in 2014 and 2017, based on the residential location. This is to observe if there are changes in average income during the 2-year observation period.

Figure 2 illustrates that most of the Lampung Province population remains reliant on working in the agricultural sector. Based on the National Socioeconomic Survey data, in 2017, the agricultural sector experienced an increase. However, the percentage increment in the agricultural sector was lower in the districts located within 10 km from the toll road compared with the districts farther than 10 km. In other words, job sectors in the closer districts have become more varied and are no longer dominated by agriculture. People have started to shift into non-agricultural sectors, such as service, commerce, and manufacturing. The finding above has been subsequently supported by the data presented in Tables 1 and 2 obtained from households in 16,217 Neighborhood Units (Rukun Tetangga) (7889 Neighborhood Units in 2014 and 8327 Units in 2017). The tables reveal that the household income ratio in 2017 (following the construction of the toll road) is higher than the household income in 2014 (before Bakauheni–Terbanggi Besar was constructed). Using mid-value test analysis, it was discovered that the average income of households living within 10 km from the toll road is higher than those living farther than 10 km.

Table 1 compares average household income in similar districts, yet in two different time frames, before and after the toll road construction (2014 and 2017). It shows an increasing average household income from 2014 to 2017. Based on the distance between the residential areas and the toll road, households that reside within 10 km from Bakauheni–Terbanggi Besar acquire higher increasing income ratios than households that reside farther than 10 km from the toll road. Therefore, it indicates that the construction of the toll road correlates with household income. The emergence of new economic opportunities resulting from toll road construction is associated with behavioral changes leading to increases in household income. The proportional increases in agricultural and non-agricultural sector incomes in 2014 and 2017 will be explained in Tables 1 and 2.

Table 1: Average Household Income Based on Residential Location in Lampung Province in 2014 and 2017

	Adj. Income		**Ratio**
	2014	**2017**	
10km	Rp 2,428,450	Rp 2,954,348	1.22
>10km	Rp 2,051,059	Rp 2,294,384	1.12

Notes: ***p < 0.01, **p < 0.05, *p < 0.1
Source: Central Bureau of Statistics Indonesia (2014; 2017) (author's calculation)

Table 2: Average Income of Household Based on Job Sectors in Lampung Province in 2014 and 2017

	Adj. Income	
	2014	**2017**
Agriculture (A)	Rp 1,755,586	Rp 2,140,721
Non-agriculture (B)	Rp 2,717,690	Rp 3,183,912
rasio (A/B)	0.65	0.67

Notes: ***p < 0.01, **p < 0.05, *p < 0.1
Source: Central Bureau of Statistics Indonesia (2014; 2017) (author's calculation)

Based on the 2017 National Socioeconomic Survey, it was found that 52% of households living within 10 km from the toll road graduated from junior high school (SMP). In contrast, only 48% of households living farther than 10 km from the toll road had graduated from junior high school. As the educational level becomes one of the determinants of job type in the labor market, it certainly affects earning power. In relation to job sectors, districts in which the majority of the population does not graduate from junior high school will be dominated by the agricultural sector. On the other hand, it can be argued that most of the population work as unskilled labor. However, different circumstances are found in the districts located within 10 km of the toll road. It was discovered that 52% of the population graduated from junior high school, and almost 50% of the population worked in the non-agricultural sector and earned higher incomes. The facts mentioned above indicate a correlation between residential proximity and the toll road, educational level, job type, and job and household income. There is a difference between the average income of households living close to the toll road and those living further away.

3.2 Estimation Results

Empirical tests were conducted by estimating several specified models in Table 3.

3.2.1 Relationships Between the Construction of the Toll Road and the Distance from the Toll Road to the Residential Area and How They Relate to Household Income

The above estimations show that the average household income in 2017 (after Bakauheni–Terbanggi Besar toll road is constructed) is higher than households' average income in 2014 (before the construction of Bakauheni–Terbanggi Besar). Construction of the toll road is positively correlated with household income in Lampung Province. The latter implies that the development of infrastructure, e.g., Bakauheni–Terbanggi Besar, induces new economic opportunities and increases household income. Based on the distance variable, estimation results reveal that the average income of households in districts within 10 km

from the toll road is 0.163% greater than the average income of households in districts located within more than 10 km from the toll road. Moreover, households living within 10 km from the toll road in 2017 earned a higher income than those living farther than 10 km from the toll road, both in 2017 and 2014. These findings correspond to Tobler (1970), which stated that everything is related to everything else. Therefore, it is true that toll road construction affects the surrounding society, especially their incomes.

Empirical studies in several developing countries, such as Sri Lanka and India, reveal the relationship between the area traversed by the toll road and household income. The existence of the toll road provides indirect results to households, as argued by Gunasekera et al. (2007). In his research, it is indicated that there have been no studies to date arguing that infrastructure development affects household income. Still, it changes household behavior as land function shifts, access to the surrounding areas improves, new economic opportunities emerge, and job sectors change. Other facts show that household incomes for those living close to toll roads are relatively higher because the areas possess more significant value-added, including land prices, rent, access to education, and ease of access. Therefore, the value-added becomes an incentive for people to move into districts close to the toll road. Consequently, stratification levels or agglomeration of households that earn higher incomes emerge in those districts (Sengupta, Coondoo and Rout, 2016; Gunasekera et al., 2007).

Table 3: Estimation Results of Average Income in 2014 and 2017

Variables	(1)	(2)	(3)
D(time)	0. 252***	0.271***	0.309***
	(0. 010)	(0.010)	(0.010)
D(distance)	0. 090***	0.186***	0.163***
	0.013	(0.016)	(0.015)
D(time)*D(distance)	0.098***	0.103***	0.107***
	(0.018)	(0.017)	(0.016)
D(job sectors)		-0.225***	-0.247***
		(0.011)	(0.010)
D(job sectors)*D(distance)		-0.225***	-0.207
		(0.018)	(0.017)
D(gender)			0.156***
			(0.012)
D(education)			0.209***
			(0.008)
Ln (number of family members working)			0.329***
			(0.015)
Constant	14.495	14.620	14.209
Adj. R^2	0.076	0.158	0.253
Observation	16,216	16,216	16,216

Notes: Independent variable: Ln_household income
***p < 0.01, **p < 0.05, *p < 0.1
Source: Central Bureau of Statistics Indonesia (2014; 2017) (author's calculation)

The estimation results correspond with the research conducted by Punt et al. (2003) that households in areas with transportation access have more significant economic opportunities so that increasing household income becomes possible. In other words, those households are more prosperous compared with households in other regions. People who live in areas with higher accessibility have a higher level of mobility to increase income for work and business purposes (Gunasekera et al., 2006). Research in Indonesia has investigated districts close to the toll road. According to Unun Udia (2018), new business opportunities have emerged from the construction, such as commerce, increasing household incomes. This fact is enhanced by research on the impacts of the Bakauheni–Terbanggi Besar toll road on the population living near the toll gates. Regions located close to the road and infrastructure development provide access to the city center that increases accessibility and the flow of goods and services between regions so that the economy of the society and households can bloom (Jaya, 2018).

3.2.2 Education, Gender, and Number of Working Family Members

Other variables included in the model, such as education, gender, and the number of working family members, are classified as control variables. Education and gender are the characteristics of the head of the household. From the estimation results, it can be deduced that both variables are positively correlated with household income in Lampung Province.

The education variable has a positive correlation with household income. Regression results in Table 3 describe how the head of the household who managed to graduate from junior high school earns more than those who could not graduate. The latter finding is consistent with Becker (1964), which explains that education has become the paramount factor to earning a higher income. Wolla and Sullivan (2017) argued that education and income are strongly correlated. The higher the degree that someone obtains, the higher the skill that he/she possesses, and the more tasks that he/she can handle. The education variable was also employed by (Gunasekera et al., 2007; Noor et al., 2012) in their research on the impacts of toll road construction on household income. It was stated that regions located close to road infrastructure would experience higher mobility because of cheaper transportation costs, such as access to schools and health

facilities. Therefore, the proportion of the number of children schooling is found to be positively correlated with distance. Observing the educational level of the family, higher educational attainment and higher quality of education lead to improved human capital resources (Noor et al, 2012).

In addition, based on the estimation results, gender variables exhibit a significant correlation with household income. A household with a man earns a higher income than a household where the head is a woman. That means men and women play different roles not only in the agricultural sector and natural resource management but also in economic activities, and even in households and within the society. Following Becker (1993), men and women have distinct priorities and are bestowed with different skill sets that lead to different earning power. Trisnawati (2003) discovered that women perform well in the labor market as they become well educated and adequately skilled. However, as they marry, it becomes harder for them to seize higher career opportunities to earn a higher income. Consequently, women earn less income than men.

Another variable included in the model is the number of working family members. Household income and the number of working family members are positively correlated, meaning that the more family members are working, the higher the household income earned. The last variable employed in the model is interaction, the variable between the distance of residential areas located within 10 km from the toll road and job sectors in which the head of the household works. The estimation results reveal that households living in residential areas within 10 km from the toll road, while the head of the household works in the agricultural sector, and earn lower income by 0.18%.

3. Conclusion

This research revealed that households in Lampung Province earned higher incomes in 2017. Residential distance from the Bakauheni–Terbanggi Besar toll road significantly correlates with the income of the surrounding households. The average income of households living close to the Bakauheuni–Terbanggi Besar toll road is higher than households located farther away. According to income-based from job sectors, households working in the agricultural sector earn a lower income than those working in the non-agricultural sector. In areas close to the Bakauheuni–Terbanggi Besar toll road (within a 10 km radius), almost 50% of the people work in non-agricultural sectors (such as services and commerce), meaning that the work sector has begun to shift to sectors that no longer rely on the land. It seems that, in 2017, the number of students graduating from junior high school in areas close to the toll road is higher than that in relatively more remote areas.

The empirical results reveal that the level of education positively correlates with the average household income of Lampung Province. The study also discovered that the distance of household residence from the Bakauheni–Terbanggi Besar toll road is correlated with household income, in which households living close to the Bakauheni–Terbanggi Besar toll road have higher income levels. Additionally, there is the fact that the level of education of the people living more than 10 km away from the Bakauheni–Terbanggi Besar toll road is less than 50% of the junior high school graduates. In contrast, the level of education is significantly positively correlated with income. Thus, these results imply that the government should continue its infrastructure development. There is evidence that the construction of the Bakauheuni–Terbanggi Besar toll road positively correlates with the society living in the surrounding areas (micro-level). However, the government needs to complement its policies for regions located further away from the toll road. The infrastructure construction can help their economy to bloom as well. One of the alternatives for the latter issue is alternative roads so that the remote areas can have access to those areas with more significant economic opportunities.

However, we admit that some limitations exist in this study. This study can only provide evidence for the correlation between household income and the distance to toll road before and after the Bakauheni–Terbanggi Besar toll road in 2014–2017. It is not convincing enough to capture the real impacts. That is because sample households surveyed in 2014 are different from those surveyed in 2017. Further research is necessary to investigate the long-term impacts.

Additionally, the data harnessed in this study covers only the district level, so that it is not rigorous enough to compare people living close to and far from the toll road. Consequently, if some people are considered as entering into a certain radius, then that one district is considered to have become part of the area. This is because data from SUSENAS cannot be clustered into smaller units, such as urban villages or sub-districts. Lastly, since the available data is not in panel form, we cannot apply a more advanced method of impact evaluation methods, such as DiD (Difference in Difference).

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