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The Impact of Trans Sumatra Toll Road on The Retail Industry

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ABSTRACT: The presence of the Trans Sumatra Toll Road (JTTS) in a region can promote economic growth in the region it traverses. By applying the standard difference-in-difference (DiD) method, this study assesses the impact of the Trans Sumatra toll road in 3494 villages from 2006 to 2019. Result indicates on average increasing of 0.30 minimarkets in villages passing by the toll road, even greater 0.90 minimarkets in villages near toll gates. This study's findings remain consistent after controlling with variables conflict and variable topography. Given the empirical evidence indicating a positive effect on the expansion of the retail industry in Sumatra, the Government must pay close attention to the policy of highway infrastructure development by increasing the number of villages served by the Trans Sumatra toll road.

Keywords: DiD, Infrastructure, Trans Sumatra Toll Road, Retail Sector, Transportation

ABSTRAK: *Kehadiran jalan Tol Trans Sumatra (JTTS) pada suatu wilayah dapat mendorong pertumbuhan perekonomian di wilayah sekitar yang dilalui oleh jalan tol. Dengan menggunakan metode standart difference-in-difference (DiD), penelitian ini bertujuan untuk menganalisis pengaruh jalan tol Trans Sumatra terhadap 3494 desa atau kelurahan dalam periode waktu tahun 2006 hingga tahun 2019. Hasil menunjukkan bahwa secara rata-rata terjadi tren peningkatan jumlah kehadiran minimarket di desa atau kelurahan yang dilalui jalan tol sebesar 0.30, bahkan dampak tersebut lebih tinggi 0.90 apabila desa atau kelurahan berada di dekat gerbang pintu tol. Hasil yang didapatkan dalam penelitian ini tetap konsisten apabila ada penambahan variasi variabel kontrol, seperti konflik dan topografi. Berdasarkan temuan empiris yang menunjukkan efek yang menguntungkan bagi pertumbuhan bisnis ritel di Sumatra, Pemerintah perlu memperhatikan kebijkan pembangunan infrastruktur jalan tol dengan memperluas jangkauan desa-desa yang dilalui oleh jalan tol Trans Sumatra.*

Kata Kunci: *DiD, Industri Ritel, Infarstruktur, Jalan Tol Trans Sumatra, Transportasi*

INTRODUCTION

One of the infrastructures that positively affects the economy is the highway (Lin & Wang, 2017; Liu et al., 2022). According to Badan Pengatur Jalan Tol (2022), one of the objectives and benefits of highways is to maximize the mobility of transport in developing regions and to increase economic growth through users or the distribution of goods in the region surrounding the highway. Toll roads could improve economic growth and equality in Indonesia through economic overflow in the regional economy. Currently, constructing Trans Sumatra toll roads is one of the Government's top priorities to achieve equitable development distribution and regional development, particularly in Indonesia's underdeveloped areas (Coordinating Ministry of Economic Affairs, 2022). The mobility of factors in producing goods and services correlates with the impact of toll road infrastructure on other economies. Mobility is producer's ability to move or be moved freely and easily in transportation, allowing them to reach a larger market at a reduced cost (Shatz et al. 2011). Accessibility at the user level and distribution of sales goods will positively effect on consumption and production. Accessibility encompasses the benefits of road conditions devoid of congestion or traffic, thereby reducing vehicle operating costs and logistical expenses (Xu & Nakajima, 2017).

At the local economic level, toll road connectivity may increase locational advantages due to the influx of factors of production of goods and services and trading activities (Redding & Turner, 2014). Expanding location-based commerce will benefit employment opportunities, household income, and the government's tax revenue (Abidhadjaev & Davletov, 2022; Junwook Chi et al., 2017; Terry Clower & Weinstein, 2005). Trans Sumatra, the interconnectedness of toll roads, might also attract investment and promote consumer goods, which would positively benefit the manufacturing, SMEs and retail sectors in locations where toll roads pass (Kim & Han, 2016; Natalia et al., 2021).

A sector of urban economic activity that generates local tax money, creates employment opportunities for the surrounding community, and represents the purchasing power of the surrounding community (Erkip & Ozuduru, 2015). The area traversed by this toll road will encourage the construction of traditional and modern shopping centers, so enticing inhabitants of other areas to relocate closer to the toll road; this population shift will result in the presence of retailers that complement one another. Intense competition between retailers in terms of price and service followed the development of this retail presence. According to Aprindo (2019), Indonesian retail industry proliferated in the early 1990s following the government's policy of welcoming foreign and domestic capital investment. Urban demand for minimarkets and supermarkets has increased in tandem with the growth of the middle class (Soliha, 2008).

In recent years, household consumption has been the largest source of expenditures, thereby contributing to economic growth. With a growing population and a rising GDP per capita, the retail industry will continue to expand and develop. The composition of household consumption expenditure accounts for 56.62% of the GDP expenditure distribution, according to (BPS, 2019). In addition, the distribution of GDP in Indonesia according to the income approach has grown. (BPS, 2019) reports that wholesale and retail trade contribute 4.80% of the national GDP to the business sector's GDP contribution. This substantial amount results from the expansion of Indonesia's retail industry. Java contributes the most to the national average GDP (58.2%); the next largest contributor was Sumatra, with a 21.7% share. In contrast to Java, connectivity on Sumatra is still limited, relying on public, national, provincial, and district roads, necessitating longer travel times and higher travel costs. The existence of Trans Sumatra toll roads is expected to have an economic impact on the Sumatra region, particularly the retail industry.

On the other hand, the Indonesian Government's infrastructure spending has continued to increase yearly (Ministry of Finance, 2022). In 2019, infrastructure expenditures totalled 414 trillion rupiah, representing a 482% increase compared to infrastructure expenditures in 2010. The increase in infrastructure spending is expected to positively affect economic growth, which will knock on effect on the growth of the retail sector. The number of toll roads in operation in Indonesia continues to rise due to the expansion of transportation infrastructure, particularly the Trans Sumatra toll roads. The Indonesian government has also set an infrastructure development target for Trans Sumatra toll roads until 2024.Badan Pengatur Jalan Tol (2022) reported the total length of Indonesian Trans Sumatra toll

roads had reached 2545 kilometers (km). Supported by the Trans Sumatra toll road infrastructure, Indonesia can hopefully become a more competitive nation, producing goods at a lower price. Palei (2015) demonstrates that institutional level and other factors, such as road infrastructure, significantly impact national competitiveness. The Indonesian competitiveness ranking on a global scale was ranked 50 out of 141 by the Ministry of Finance in 2022. These results indicate an increase from the previous year, but when compared to neighbouring countries in ASEAN, Indonesia ranks lower than Singapore (1^{th}), Malaysia (27^{th}), and Thailand (40^{th}).

Figure 1. Design of Trans Sumatra Toll Road
Source: Hutama Karya, 2022

The Indonesian government has designated Trans Sumatra toll road construction as one of its national strategic projects. The construction of this toll road is intended to increase regional development on the island of Sumatra, which is expected to contribute to national economic growth. Therefore, by supporting of Trans Sumatra toll road, Sumatra will influence the expansion of the economy in Sumatra, particularly in the retail sector, which is comprised of a large number of minimarkets.

In both developed and developing nations, research has been conducted on the effect of toll road infrastructure on the local economy. Zhang et al. (2020) investigate the effect of toll road construction on the local economy in the Yangtze T River Delta, China. The author used the difference-in-difference (DiD) method and provincial-level data from 1993 to 2013. Its result determine that the construction of toll roads significantly impact local economic development. The connectivity of toll road networks can decrease logistics expenses, thereby expanding the market potential. Consequently, high market potential will contribute to local or regional economic development. Xiao et al. (2018) explained that road network construction provides more access to urban markets and promotes industrial and agricultural activities. This result is in line with previous studies conducted by (Xu & Nakajima, 2017) that asses the effect of highways on economic development at the district level in China during the period when China's roadway infrastructure developed rapidly. The result is that

highways positively promote heavy industry and labor productivity. Other research on measuring the impact of a highway can be seen from Alder (2015) which utilizes satellite data of night lights to setup counterfactuals to analyze the impact of a highway project in India. The findings indicate that the recent investment in toll roads in India resulted in favorable aggregate net gains but heterogeneous effects among districts.

Numerous studies in Indonesia regarding the impact of toll road construction on the retail industry are still very limited, especially the case study of the Trans Sumatra toll road. The majority of current research focuses on Trans Java toll road and the general economic effects of road construction as well. Natalia et al. (2021) examines the effect of the Trans Java on the growth of SMEs industries, had found that toll roads stimulates emergence of SMEs in that region. Nugraha et al. (2020) examines of 34 provinces in Indonesia; road length positively affected economic growth and reduced economic inequality. In addition, as revealed by Lestari (2019), who examines the impact of infrastructure in general, other research reveals that road infrastructure can promote economic growth and economic equality. Fakhurozi et al. (2020) asses the effects of the Trans Sumatra construction on the local area's development by using descriptive analysis techniques. The Trans Sumatra toll road is designed to enhance productive activities by enabling the movement of products and services and to generate new prospects for regional economic, social, and other infrastructure development, according to research findings. Andriany & Qibthiyyah (2018) explore the relationship between spending road infrastructure and tax capacity in Indonesia by applying the stochastic frontier analysis method and tax revenue data from 34 provinces in 2011-2016. The findings confirm that the availability of road infrastructure has a significant positive impact on local tax capacity.

Furthermore, research conducted by Ardiyono et al. (2018) evaluate the impact of toll road on accessibilities, trade, and investment in the region they traverse, utilizing SMEs data, bank loan data, and investment data. The result is that after two years of operation, the Cipali toll road has increased accessibility, mobility, trade, and investment in the region traversed by the toll road. Toll road in Indonesia can have direct and indirect effects, while the impact varies across geographic areas and individuals (Andani, 2019). Gertler et al. (2019) asses the effect of road quality on Indonesia's highways on economic activity using temporal variation genrated by road maintenance investment. The findings are that higher road quality leads to job creation in the manufacturing sector, which is reflected in household consumption and income. Others argued that opening highways encourages the agglomeration of production factors in regional primate cities but disrupts the economy in nearby areas (Bosker et al., 2018). Furthermore, Siswoyo (2020) states that the impact of highways is positive for the economy but negative for the ecology.

In light of the limitations above and context, it is essential to perform this study to estimate the impact of the Trans Sumatra toll road on retail in the places it traverses. The research questions that were attempted to be answered based on the background and formulation of the problems in this study were: how is the impact of the Trans Sumatra toll road on the retail industry in the area it passes through?

This study aims to identify the impact of the Trans Sumatra toll road development on the retail industry in the area it passes through. This research is expected to fill a research gap by providing an overview of the relationship between Trans Sumatra toll road development and the growth of the retail sector in Sumatra. In addition, this research is able to evaluate the direction of infrastructure in Indonesia by providing an overview of the relationship between the construction of the Trans Sumatra toll roads and the growth of the retail industry, whose operational periods vary. By applying the difference-in-difference (DiD) method, it provides a clearer picture of the variation between the construction of the Trans Sumatra toll roads and the growth of the retail industry as a result of differences in treatment intensity and operating time sections of the Trans Sumatra toll road.

METHODS

Variables and Data

This study utilises Trans Sumatra toll road data for the observation year 2006-2019 for roads that began operation in 2017-2019. Trans Sumatra toll road construction data consists of Trans Sumatra toll road sections, years of construction, and years of operation of Trans Sumatra toll roads obtained via data

requests to the *Badan Pengatur Jalan Tol (BPJT),* Ministry of Public Works and Housing. In addition, this study utilises data from the Directorate General of Highways, Ministry of Public Works and Housing, pertaining to villages traversed by the Trans Sumatra toll road.

Moreover, the retail industry in this study uses a proxy based on the number of minimarkets. We decided to use the minimarket as a proxy because not only it is the last part of the supply chain of goods from producers to consumers, but there is also some polarisation in shopping, with consumers preferring to shop in smaller, more attractive, focused and convenient stores (Robertson & Fennell, 2007). In addition, the result shows that the main retail businesses are the sale of foodstuffs, household needs, and consumer durables (Opoko et al., 2018). Minimarkets' data has been compiled from the Central Bureau of Statistics and relevant databases, such as *Potensi Desa (Podes)* that define minimarkets as the classification of business premises in fixed buildings to sell various types of goods at retail with price tags, self-service systems and a floor area of less than 400 square meters.

In this study, we conduct an estimation test with control variables. There are variable conflict and variable topography obtained from the Central Bureau of Statistics and relevant database such as *Potensi Desa (Podes)* which define conflict as the number of dispute cases in districts in the past year and topography as the geographical condition of districts. Conflict could harm the sustainability of minimarkets' businesses (Esmark & Noble, 2016). Topography and the environment are related, and the frequency of natural disasters will impact on the sustainability of local retail companies (Pauline & Selvi, 2018; Waxell, 2014).

Identification group for this study, the treatment group was villages that were passed by toll roads, whereas the control group were villages that were not passed by toll roads but were in the same sub-district as the treatment group. Identification of groupings for the control group is required so that the location comparison between the control and treatment groups is not too far apart, allowing the impact of the toll road development to be observed.

Table 1. Progress Status of Trans Sumatra Toll Road

No	Section	Start Project	Start Operating	Toll Length (km)	Information
1	Medan-Binjai	2015	2017	17.67	Active Operates
2	Medan-Kualanamu-Tebing Tinggi	2015	2017	61.7	Active Operates
3	Bakaheuni-Terbanggi Besar	2015	2018	140.94	Active Operates
4	Palembang-Indralaya	2015	2017	21.8	Active Operates
5	Kayu Agung-Palembang-Betung	2017	2019	111.69	Active Operates
6	Terbanggi Besar-Kayu Agung	2017	2019	189.2	Active Operates
7	Pekanbaru-Dumai	2016	2020	131	Operates but not used in this study

Source: Hutama Karya , 2022

In Table 1 it can be seen that in the observation years from 2017 to 2020, 7 (seven) sections of Trans Sumatra toll road are represented. The research begins by identifying the construction process for the 24 (twenty-four) sections of Trans Sumatra toll roads that will be built in Sumatra and the results of the identification show that until 2020 there were 7 (seven) sections of Trans Sumatra toll roads that were already operating, such as Medan-Binjai, Medan-Kualanamu, Palembang-Indralaya, Bakauheni-Terbanggi Besar, Terbanggi Besar-Pematang Panggang, Pematang Panggang-Kayu Agung, and Pekanbaru-Dumai. In this study, however, the author will only use 6 (six) of the 7 (seven) sections because sections of Pekanbaru-Dumai began operating in 2020, respectively, and it is believed that the operation of the toll road in those years has not yet had any significant impact.

This study employs the number of minimarkets as the dependent variable to examine the effect of toll road development on retail expansion in Trans Sumatra toll road-accessible areas. The variable *tollroad*, variable *yeartoll*, and variable *timerescale* variables are used as independent variables. In addition, conflict and topography are used as control variables in this study. The variable *tollroad* is a dummy variable representing the village it passed by toll road. Villages that are traversed by the toll road are denoted with 1 for their variables and 0 otherwise. In the meantime, variable *yeartoll* is a dummy variable used to describe the time of year the implementation of Trans Sumatra toll road operations occurs due to the different operationalization implementations in each section. Villages traversed by Trans Sumatra toll roads that have been in operation are denoted by the variables 1 and 0 respectively. In addition, the variable *timerescale* used for the parallel trend test is the year the toll road operation was implemented, where the variable is marked with the number 0 as the first year the toll road policy is implemented; -1,-2,-3, etc. are before the operational year of the toll road and 1,2,3 etc. are after the operational year of toll road. In this study, conflict and topography serve as the control variables. Variable conflict is a dummy variable describing disputes in the village over the past year. Villages with a dispute conflict in the previous year are marked with 1 and those without a dispute conflict are marked with 0. The variable topography is marked with a value of 1 if the village is on plains and a value of 0 otherwise.

Emperical Methods

This research uses the variable *tollroad* to describe the village along with toll roads and the variable *yeartoll* to describe the period during which the section toll road was opened because the operation of toll roads differed in each section. The interaction variable between *tollroad* and *yeartoll* is the treatment effect, which is the difference between the control and treatment groups' average outcomes after and before the construction of the toll road. In addition, conflict and topography influence the number of minimarkets in an area. According to Esmark & Noble (2016) conflict can impact the presence of minimarkets in the area. Another control variable is topography or the geographical condition of a region, including slopes, peaks, valleys and plateaus. According to the findings of Pauline & Selvi (2018) and (Waxell, 2014), the local topography or geographical conditions will impact the sustainability of retail stores in the region, as topography is related to the environment and the frequency of natural disasters. In this study's model, topography and conflict serve as control variables to capture the factors influencing minimarket growth. The equations used in this study are based on the model of Muralidharan & Prakash (2017) and Gultom (2019). The model of the regression equation is as follows:

$$y_{it} = \alpha_0 + \beta_1 tollroad_{it} + \beta_2 yeartoll_{it} + \beta_3 tollroad_{it} \times yeartoll_{it} + \sum_{k=2}^{j} Z_k control_{it} + \gamma_i + \delta_t + \mu_{it} \quad \ldots\ldots\ldots\ldots (1)$$

y_{it} represent the dependent variable capturing the number of minimarkets in the village *i* during the year t. The number village is 3494 during year 2006, 2008, 2011, 2014, 2018, and 2019. A variable $tollroad_{it}$ is an independent variable in the form of a dummy variable used to implement toll road development operations in villages. Whereas $yeartoll_{it}$ is an independent variable in the form of a

dummy variable used to implement the operational year of toll road construction in a village. Moreover, $Z_k control_{it}$ is the control variable; k (1) is conflict as the number of dispute cases in districts in the past year and k (2) is topography; as the geographical condition of districts. Data on k(1) conflict and k(2) topography has been compiled from Central Bureau of Statistics and relevant databases called *Potensi Desa (Podes)*. γi represents the individual effect, δ_t denotes the year effect, and μ_{it} represents the term error for each minimarket in village i during the year period t. The individual effect is to capture the average outcome for each village every year. This is necessary to obtain the main explanatory coefficient (β_3) so as to obtain variations from the impact of toll road development.

Before applying DiD or interaction between variable *tollroad* and variable *yeartoll,* it is important to conduct a common pre-treatment trend test first, in order to identify the occurrence of similarities in the trend of the number of minimarkets between the treatment group and the control group before operating a toll road. In testing the common pre-treatment trend by adopting the method used by Muralidharan & Prakash (2017) and Gultom (2019). The basic model of the regression equation is as follows:

$$y_{it} = \alpha_0 + \theta_1 timerescale + \theta_2 timerescale \times tollroad + \gamma_i + \delta_t + \mu_{it} \quad \ldots\ldots\ldots\ldots (2)$$

y_{it} represent the dependent variable capturing the number of minimarkets in the village *i* during the year *t*. The number village is 3494 during year 2006, 2008, 2011, 2014, 2018, and 2019. (θ_1) represent timerescale that coefficient capture varies over time and controls the fact that conditions change over time for all observations. (θ_2) is the coefficient for capturing the similarity of trends in the pre-treatment period, before the implementation of toll road in control group and treatment group.

Panel Data Model Estimation

In the first model for this study, we conduct Lagrange Multiplier (LM) test to determine the most appropriate between Pooled Least Square (PLS) or Random Effect (RE) for estimating the panel data. Based on the result on Table 2, it can be seen that the random effect method is chosen as the value of probability is less than 0.05 (5%). Furthermore, in regard to determine the best model between Fixed Effect (FE) or Random Effect (RE), we conduct the Hausman test. Based on the result in Table 2, it can be seen that the probability is more than 0.05 (5%) so the Random Effect (RE) is chosen.

Table 2. Best Model Selection for Model (1)

Test	Probability	Result
Lagrange Multiplier	0.0000	Random Effect
Hausman	0.1408	Random Effect

Source: Author's estimation using STATA MP 17

In the second model, we apply Lagrange Multiplier (LM) test to determine the most appropriate between Pooled Least Square (PLS) or Random Effect (RE) for estimating the panel data. Based on the result Table 3, it can be seen the Random Effect (RE) method is chosen as the value of probability is less than 0.05 (5%). Finally, considering the second model use time invariant variable namely variable topography, we did not apply the Hausman test.

Table 3. Best Model Selection for Model (2)

Test	Probability	Result
Lagrange Multiplier	0.0000	Random Effect

Source: Author's estimation using STATA MP 17

Furthermore, this research used the unbalanced panel data to acquire better variations. This study did not apply the assumption test in classical regression, i.e. the heteroscedasticity and the autocorrelation test, because the panel data set employed contained a large number of observations but little fluctuation over time. For this reason, the researchers made an estimate using the clustered standard errors method which has overcome the problem of heteroscedasticity and autocorrelation (Woorldridge, 2010). Considering all the explanation, we built hypothesis as follow: The Trans Sumatara toll road has a positive and significant impact on the retail industry.

RESULTS AND DISCUSSIONS

Estimation Result

This research is conducted to determine the impact of Trans Sumatra toll road on retail industry proxied the number of minimarkets in villages along the toll road. The discussion of this research was discussed by applying the common pre-treatment trend assumption in equation (2) and examining DiD or the interaction between tollroad and yeartoll in equation (1).

Common Pre-treatment Test

The DiD approach begins with the common pre-treatment trend assumption in equation (2) which is the initial assumption. The common pre-treatment trend test was conducted to demonstrate the difference in the average number of minimarkets between the treatment group and the control group prior to the implementation of the Trans Sumatra toll road construction policy was implemented. If the test findings are not statistically significant, there is a trend between the treatment and control groups in the average number of minimarkets in the period before the development policy. Furthermore, if there is a difference in the trend of the average number of minimarkets between the treatment group and the control group following the implementation of the toll road construction policy, this indicates that the toll road had an effect.

Table 4. Result of Common Pre-treatment Test

Dependent Variable Minimarket	
Independent Variable	Coefficient Pre-treatment
Timerescale	0.08***
	(0.01)
Interaction (Timerescale x Tollroad)	-0.01
	(0.02)
Number of Observation	1616
Number of Groups	615

Standard errors in parentheses
*p<0.1, **p<0.05, ***p<0.01

Source: Author's estimation using STATA MP 17

Based on the results in Table 4, it can be seen that the interaction between *timerescale* and *tollroad* shown in the coefficient (θ_2) shows insignificant results, which means accepting H0 or rejecting H1 as proposed by the author. Based on this, it can be concluded that there was no minimarket growth trend prior to the implementation of the toll road development policy. This result follows the authors' estimation, which shows that there is a common pre-treatment test or a similar trend between the number of minimarkets among the treatment group and the control group before the implementation of the toll road development operational policy.

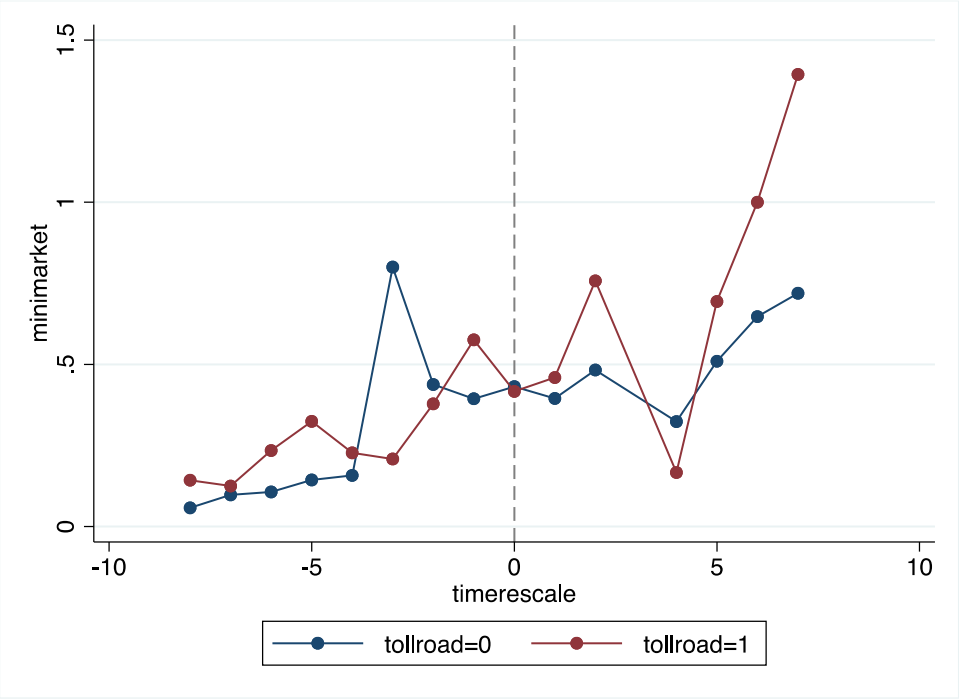

Figure 2. The Trend of Average Number of Minimarkets
Source: Author's estimation using STATA MP 17

The pre-treatment graph also supports the conclusions of the common pre-treatment trend regression. According to Figure 2, there is a tendency between the treatment and the control groups regarding the average number of minimarkets in the pre-treatment period, or the time preceding toll road development. The number 0 is assigned to the time rescale variable to represent the first year of the toll road development policy's implementation. The graph demonstrates that during the pre-treatment period or before the policy period (time rescale < 0), there is no difference in the average trend of minimarkets between the treatment group and the control group. The graph also demonstrates a trend difference after the toll road development policy (time rescale > 0) between the treatment and control groups. It can be concluded that the difference in the average trend of the number of minimarkets is the result of the toll road policy.

Difference-in-Difference (DiD) Test

To determine the effect of toll roads on the retail sector, which is represented in this study by the number of minimarkets, this study utilized treatment groups, specifically villages along toll roads. Furthermore, this study applies an estimation test with variable conflict and topography to acquire consistent results.

Table 5. Effect of Trans Sumatra Toll Road on the Treatment Group Along Toll Road

Variable	Model Standard	Model Control Variable
Dependent Variable	(1)	(2)
Minimarket		
Independent Variable		
Tollroad	0.05	0.05
	(0.09)	(0.09)

Yeartoll	0.20*	0.20*
	(0.11)	(0.11)
DiD (Tollroad x Yeartoll)	0.30***	0.30***
	(0.09)	(0.09)
Control Variable		
Conflict	--	0.04
		(0.15)
Topography	--	0.40*
		(0.23)
Number of Observation	3494	3494
Number of Groups	626	626

Standart errors in parentheses
*p<0.1, **p<0.05, ***p<0.01
Source: Author's estimation using STATA MP 172

Table 5 applies treatment groups along the toll road, and the regression results reveal that the coefficient (β_3) or the DiD interaction variable (*tollroad x yeartoll*) in the basic model is positive by 0.30 in column (1) and by 0.30 in column (2) using control variable, both are significant at the 1% level. The results of the coefficient of the interaction variable (*tollroad x yeartoll)* in columns (1) and (2) indicate that the average value after toll road demonstrates an upward trend in the presence of minimarkets in villages through which toll road passed as compared to other villages through which it did not pass. The column 2 (two) results are consistent despite the presence of extra control variables. The interaction coefficients in columns (1) and (2) indicate that, on average, following the construction of toll roads, the number of minimarkets is 0.30 percentage points greater in villages that are passed by toll roads than in villages that are not passed by toll roads.

Robustness Check

To ensure the accuracy of the estimates, the author applies a robustness check by estimating by setting up a data sample village from the treatment group that is near the toll gate. This indicates that it is distinct from the previous primary model, which employed village data along the toll road for the treatment group. It is predicted that settlements near the toll gate will have a bigger impact than villages along the toll road's periphery. Model (2) to capture the alterations in the existing samples due to the more particular sample location, specifically the sample near the toll gate. This model's results will be expected to be consistent with a model (1), which uses a sample village along the toll road.

After analysing it, we found that 30 villages were included in the treatment group and 462 in the control group, bringing the total number of villages sampled for this study to 492. There is a difference with the number of previous sample data used in the main model (1), which used villages along the toll road, where there were 164 villages included in the treatment group and 462 included in the control group, so that the total number of villages or sub-districts that were sampled in the main model (1) as many as 626. In order to get clearer comparison in difference treatment group (between 164 sample and 30 sample), we put comparison and show it in Table 4 which are model and result in model (1) in Table 4 are same with previous model and result in Table 3.

Furthermore, in regard to the robustness check estimation test, this study continues to employ the fundamental equation from the main model (1) and adds the control variable to determine the consistency of the acquired results. Comparing the estimation results from the main model (1) to the robustness check model (2), if the results obtained stay consistent, it can be stated that the model utilized by the author is able to accurately capture the effects of sample variance changes.

Table 6.
Comparison of Robustness Check on the Impact of Trans Sumatra Toll Road on Minimarkets in Difference Treatment Group Models

Variable	Main Model (1)		Robustness Check Model (2)	
	Treatment Group along Tollroad (n = 164 villages)		Treatment Group at Toll Gate (n = 30 villages)	
	Model Standard	Model Control Variable	Model Standard	Model Control Variable
Dependent Variable Minimarket	(1)	(2)	(1)	(2)
Independent Variable				
Tollroad	0.05	0.05	0.20	0.21
	(0.09)	(0.09)	(0.19)	(0.19)
Yeartoll	0.20	0.20	0.19	0.18
	(0.11)	(0.11)	(0.12)	(0.12)
DiD (*Tollroad x Yeartoll*)	0.30***	0.30***	0.69***	0.70***
	(0.09)	(0.09)	(0.19)	(0.19)
Control Variable				
Conflict	--	0.04	--	-0.08
		(0.14)		(0.17)
Topography	--	0.40*	--	0.41*
		(0.22)		(0.24)
Number of Observation	3494	3494	2726	2726
Number of Groups	626	626	492	492

Standart errors in parentheses
*p<0.1, **p<0.05, ***p<0.01
Source: Author's estimation using STATA MP 17

Comparing the estimation result of the basic model equation (1) to the robustness check model (2), yields consistent results, as shown in Table 6. The robustness check model (2) reveals that the DiD coefficient value, i.e., the interaction variable (Tollroad x Yeartoll), has a positive value of 0.69 in column (1) and 0.70 in column (2), both of which are significant at the 1% level. This indicates that the average value of the number of minimarkets in the areas covered by the toll road development program is increasing. The results obtained in the robustness check model (2) in column 2 (two) remain constant despite the addition of control variables. Hence, it can be inferred that the model used by the researchers is able to capture variations in the existing variables.

Discussions

This study's findings are also consistent with some previous studies such as Natalia et al. (2021), the Trans Java toll road has a major impact on the development of the SMEs industry in the regions it traverses. Based on the outcomes of this study, we may conclude that the building of the Trans Sumatra toll road may have an effect on retail demand in the areas it traverses. This is a result of the increased mobility of capital (Lindgren et al., 2021; Pugh & Fairburn, 2008), goods and humans (Junwook Chi et al., 2017; Piskin et al., 2020). In addition, expanding the availability of goods will enhance both commerce and the company's productivity. An increase in capital flows indicates the existence of new business activities and the growth of existing businesses (Xiao et al., 2018), which will have an effect on the creation of new jobs or employment possibilities (Pugh & Fairburn, 2008). Based on this, in the end, the high job prospects will affect the trend of per capita income and purchasing power, so that the level of consumption will be higger which will have an impact on retail demand in a region.

The expansion of the retail business is one example of the Trans Sumatra toll road's role as a creator of a new economic hub. The objective of the Trans Sumatra toll road to become one of Sumatra's economic cornerstones (Hutama Karya, 2022). The new economic centers will create employment opportunities, improving the community's purchasing power or household consumption, and ultimately influencing retail demand. These findings indicate that the Trans Sumatra toll road program in the villages it traverses will foster the expansion of the retail business, as evidenced in this study by an increase in minimarkets. Based on the results of this research, it is envisaged that the continuation of the construction of the Trans Sumatra toll road will be completed, connecting from the north to the south on the island of Sumatra.

Some factors affect retail growth in a region, as revealed by Pauline & Selvi (2018) and Waxell (2014) which state that local geographic conditions will affect the sustainability of retail stores in that area because topography is related to the environment and the frequency of occurrence natural disasters. The results of this study are in line with this statement where the results of model estimation with control variables show that topography or geographic conditions produce positive and significant numbers at the 10% level, which means that the characteristics of the area in villages or sub-districts that are in plain areas tend to increase the number of minimarkets.

However, conflict has a negative coefficient but not significant in robustness model. This result reveals that economic growth will be fragile by impedes investment, trade and productivity. As mentioned by Le et al. (2022) that conflict negatively affect both short and long-term economic and social outcome. In the end, the less area's conflict level, the higher economic growth, and then will spur the growth of minimarkets. This is in line with research conducted by Esmark & Noble (2016) that discovered the higher number of disputes or conflicts will inhibit the growth of minimarkets in an area. The robustness models have also offered a response to the question raised by this study regarding the impact of the Trans Sumatra toll road on the retail industry in the regions it passes. The results of the estimation of robustness checks using villages close to the toll gate show positive and significant results, which is in line with research conducted by Zhang et al. (2020) and Xu & Nakajima (2017), who state those toll roads give rise to local industrial or economic centers and will have different impacts in terms of different locations. In other words, the average value after the Trans Sumatra toll road indicates a trend toward increasing the number of minimarkets in villages near toll gates compared to villages that are not nearby.

CONCLUSIONS

This paper examines how the Trans Sumatra toll road affects the retail sector. We employ the DiD method and subdistrict data that covers the Trans Sumatra toll road from 2006 to 2019. For robustness check, we try to set up data sample of villages from both groups, the treatment and the control group that near toll gates to ensure the reliability of our result.

The empirical result show that the Trans Sumatra toll road can significantly promote minimarkets' growth. We find the positive effect of the Trans Sumatra toll road even stronger with robustness check method. It reflects that the farther the villages is away from toll gates, the less affected by the Trans Sumatra toll road. Another result is that variable topography significantly positive

affect the minimarkets' growth. It indicates that the characteristics of subdistricts in plain areas with fewer natural disasters tend to promote the growth of minimarkets. In addition, we found that the coefficient results for the conflict variable are negative means the higher number of disputes or conflict will inhibit the growth of minimarkets in an area.

Given the empirical findings that indicate a beneficial effect on the growth of the retail business, the Government needs to pay attention to the highway infrastructure development policy. This indicates that some regions of Sumatra gain economically from the Trans Sumatra toll road's presence. Hence, to foster growth in the retail sector, the Government needs to expand the coverage of subdistricts that pass by the Trans Sumatra toll road.

This study has some limitations and needs further research. The scope of the analysis is restricted by the limited availability of data, and the short duration of the toll road's operation. Such villages should be included in this study. However, in this research, due to the fact that data on minimarkets from the statistical authority database is not available, causing impossible to determine it. This is a limitation of the current study, that will be addressed in future studies.

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