Journal of Infrastructure, Policy and Development (2018) Volume 2 Issue 2.
DOI: 10.24294/jipd.v2i2.673

ORIGINAL ARTICLE

How does toll road impact accessibilities, trades, and investments in short term? A case study of Cipali toll road in West Java, Indonesia

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ABSTRACT

To increase inter-region connectivity, the Indonesian government initiated infrastructure projects such as toll roads, airport, highways, as well as agriculture ones throughout the countries. One of the big projects in road infrastructure was the Cikampek–Palimanan (Cipali) toll road in West Java with a budget of more than USD1 billion which started to operate in July 2015. This paper is aimed to evaluate the impact of the toll road on accessibilities, trades, and investments in the region it traverses. To carry out the analysis, we used qualitative approach, difference-in-difference approach, and ANOVA, utilizing three kinds of data. The first data is collected from a survey of 331 small-medium enterprises (SMEs) in the logistics and the hotel and restaurant industries. The second one is bank loan data sourced from Bank Indonesia, while the third one is investment data from Investment Coordinating Board of Indonesia (BKPM).

After two years of its operation, Cipali toll road has increased accessibility, mobility, trade, and investment in the region it traverses. The travel time was reduced by 39%, while the cargo volume of the local businesses increased by 30% to 40%. These led to an improvement of wholesale trade volume in almost all regencies. However, SMEs in the hotel and restaurant industry along the traditional northern coastal highway in Subang, Indramayu, and Brebes experienced a decline due to the traffic shifting. Meanwhile, investments from national companies especially those of labor-intensive manufacturing industries flowed significantly especially to Subang and Majalengka, which reflected a "sorting effect". However, investments from local and foreign businesses did not increase significantly yet after 2.5 years of toll operation.

To reap the benefit from the presence of Cipali toll road, the local governments should improve the ease of doing business to attract investments that boost employment in return. In addition, given a better accessibility from Greater Jakarta and a large number of potential visitors passing through the toll road, local businesses in the trade sector would benefit if they could promote the local attractions such as in tourism activities supported by the local government. The latter strategy should also be implemented by the local governments and local businesses in the northern coastal traditional route to minimize the negative impact of the toll road due to the traffic shifting. This strategy should be strengthened through increasing connectivity from the toll exits to local business areas and through increasing the ease of doing business.

***Keywords**: infrastructure; Indonesia; Java; toll road*

1. The research was a Bank Indonesia's project, however the views expressed are those of the authors and do not necessarily reflect the views and policies of Bank Indonesia. Authors would like to thank Mr. Dwi Pranoto, the Executive Director of Regional Department II (Java) at Bank Indonesia, for the guidance, constructive critics and support throughout completion of this research. Authors would also like to thank Mr. Warsono for managing administrative process of the research. This research is greatly supported with data and valuable information by Representative Office of Bank Indonesia (West Java, Cirebon and Tegal), provincial and district/city government in West Java area (Majalengka, Cirebon, and Indramayu), Cirebon Siliwangi Sub Branch Office of Bank Mandiri, Subang Branch Office of Bank Rakyat Indonesia and other parties that can't be mentioned one by one.

1. Introduction

The development of connectivity infrastructure aims to integrate inter-regional economies through increased efficiency and smooth flow of goods and services. Increased efficiency and smooth flow of goods and services are expected to expand and strengthen the production network and the supply chain of goods and services between regions. This in turn will improve productivity and competitiveness as well as trades and investment flows in various regions so that inclusive economic growth can be achieved (ADB, 2012).

The government of Indonesia has sought to boost the development of connectivity infrastructures in various regions. From the 226 national strategic projects launched, 101 projects are aimed to establish better connectivity between regions. These infrastructure projects include 52 road construction projects of both toll roads and national roads in Sumatera, Java, Kalimantan, Sulawesi, Papua, and other islands in Indonesia. In Java, one of the biggest projects is the development of the toll road network called Trans Java that is designed to connect the western part and eastern part of Java.

After full completion, the new section of Trans Java Toll Road will stretch as long as 615 km, connecting the eastern part of greater Jakarta to Surabaya with a total investment of Rp51.41 trillion or USD3.8 billion (Sihombing, 2017). As of June 2015, a section of 116-km length in the northern coastal line in West Java have been completed and operating since then. This toll road section is well known as Cipali toll road and is the subject of this research.

As part of Trans Java, Cipali toll road is designed to reduce the heavy traffic in the northern coastal highway (Pantura) (Figure 1). During the festive season of Idhul Fitri when most Indonesians especially those who reside in Java undertake their homecomings, the number of vehicles including motorcycle, cars, trucks, and buses topped to more than 489,000 per day in 2014 (Wage, 2014). The annual massive movement would cause very long hours of travel time when congestions occur everywhere along the route (Ivansyah, 2014). Economically, the long hours spent on the road would mean the waste of gas, extra money, as well as opportunity cost for passengers and businesses (Sumaryono, 2013). Socially, the frustrating conditions of the traditional route would prevent people's mobility as other modes of transportation would be fully booked even if ticket prices increase sharply. Politically, the congested traffic was a playground for the politicians to blame each other.

ARTICLE INFO
Received: March 29, 2018
Accepted: July 2, 2018
Available online: July 13, 2018

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CITATION
Ardiyono SK, Parenrengi NPA, Faturachman F (2018). "How does toll road impact accessibilities, trades, and investments in short term? A case study of Cipali toll road in West Java, Indonesia". *Journal of Infrastructure, Policy and Development*, 2(2): 673. doi: 10.24294/jipd.v2i2.673

Figure 1. Map of Cipali toll road and northern coastline highway

Having so many problems occurring on the congested northern coastal road of West Java, the central government started the project of Cipali Toll Road on May 2013 to construct a 116.75-km-long road stretching from the regencies of Purwakarta at the west-end and the regencies of Cirebon at the east-end. As similar projects are being implemented across Indonesia, a thorough impact analysis of the toll road should be conducted to optimize the benefit as well as to mitigate the negative impact of toll road or highway infrastructure.

2. Impact evaluation of highway infrastructure to trades and investments

Some literature proposes that the direct benefit of toll road are mainly lower vehicle operating costs, faster driving times, and lower accident rates. However, all of these economic benefits are felt only by direct road users, while those living around the road may have negative externalities (Handy, Kubly and Oden, 2000). For example, the construction of the Jakarta–Bandung toll road that actually makes the economy in Cianjur region previously growing along the Jakarta–Bandung route slightly dimmed due to the decrease in vehicle volume. This research seeks to see the overall impact, both positive and negative, from the Cipali toll road especially on trades and investments that are necessary to boost the economic growth.

In practice, there are several approaches to assess the success of a program or project including monitoring, operational evaluation, and impact evaluation (Khandker, Koolwal and Samad, 2010). Monitoring concerns with observing the execution of a project in the field whilst operational evaluation relates to assessing the effectiveness of project implementation. The latter is conducted to see if there is a difference between the plan and the realization of project implementation. In contrast to monitoring and operational evaluation that are more focused on project implementation, impact evaluation focuses more on the outcomes and impacts of the project. In accordance with its objectives, this study will use an impact evaluation method especially on post-project impact on economic development.

Post-project evaluation can be conducted using both qualitative and quantitative approaches. Khandker, Koolwal and Samad (2010) explained that qualitative impact assessments can be conducted through interviews/surveys of beneficiaries to identify what aspects are impacted by the project being perceived by the beneficiaries. However, this approach could not identify the outcomes if the project is not implemented, which is called counterfactual outcomes. This is where the role of quantitative impact assessment is theoretically capable of measuring counterfactual outcomes to avoid bias in making conclusions. To gain positive benefit of qualitative and quantitative approaches, this study is designed to utilize these two approaches in order to provide a comprehensive analysis of the project's effectiveness.

In doing a qualitative approach, Weisbrod (2000) summarized several different survey methods to assess the impact of highway infrastructure, which are: (1) expert interviews, (2) business survey, (3) vehicle origin-destination logs, (4) shopper origin-destination data, and (5) corridor inventory methods. The business survey to local enterprises is adopted in this study to provide a wealth of local insights of the project's impact. The approach has been implemented by the US Transportation Research Board in assessing the impact of highway in Appalachian region, Wisconsin, Texas, Maryland, and also Kansas.

Another quantitative approach is used by Iimi *et al*. (2015), sponsored by the World Bank, to measure the impact of rural road infrastructure development programs on the poor in the state of Tocantins in Brazil. The data used were primary data collected through surveys of poor households in four affected areas of Southeast, Bico do Papagaio, Northeast, and Jalapão. The survey was designed semi-experimentally, which was conducted twice to capture differences in the condition of the respondents before and after the implementation of the program. The timing of the survey was conducted between 2005 and 2011, adjusted to the completion of the program in each region.

The estimation method used by Iimi *et al*. (2015) are: 1) double-difference, 2) double-difference combined with propensity score matching (PSM), and 3) instrumental variables (IV) estimator. The double-difference method is used to compare the difference in mean outcomes between the two groups—treatment groups and control groups—while PSM is used to mitigate the risk of imbalance between household characteristics among groups. In this case, both the treatment group and the control group are in the same area, but the difference between the two is the treatment group consisting of households that are close to the physical construction of the road, while the control group is not directly related to the physical path.

Other example of quantitative approach use in measuring the impact of a highway can be seen from a study by Duranton, Morrow and Turner (2011). The study utilized two-stage least squares (TSLS) regression method to estimate the impact of interstate highways on the composition of trade in US cities. The estimation relied on trade, road, employment, population, and historical transportation data from credible sources. Spatial economics might also be utilized as can be seen in an interesting work by Alder (2015) that utilized satellite data of night lights to setup counterfactuals to assess the impact of a highway project in India and contrast it to that of China.

2.1. Impact of highway on economic growth, trades, and investment

Despite the method adopted, Weisbrod (2000) summarized the impact measurement of highway project into three groups, which are direct effect, indirect effect, and induced effect. Direct effect would be reflected in changes of operating cost and markets, indirect effect might affect the business growth of suppliers, while induced effect would be generated from the increased spending of workers, labor force participation, as well as land prices. Similar to Weisbrod (2000), Polzin (1999) summarized the impact into three categories, which are direct, indirect, and secondary. Slightly different from Weisbrod (2000), Polzin (1999) explained the direct impacts as improved service and accessibility, including market openness, foreign investment, and urban expansion. Meanwhile, he referred the indirect impacts as those related to mediating community responses and policy change, including increased attractiveness, reduced development costs, and tax incentives; and the secondary impacts are those related to social perception and individual behavioral changes, which would manifest as commercial and business agglomeration.

In general, newly built road infrastructures or improvement project would stimulate economic growth through trades and investments. Using panel data of Asian countries, Ismail and Mahyideen (2015) found that new road infrastructure and paved road-quality improvement are both significant to promote trade openness and investment. This finding is in line with that of Akpan (2014) that stated increasing the Lagos–Dakar average road quality from 20.38 to 100 (i.e., 391% increase) has the potential of increasing intra-regional trade by USD397.80 million, which is equivalent to a 5.27-time increase from its current level. Furthermore, if the road construction is combined with the movement of economic center such as that in Brasilia as reported by Morten and Oliveira (2016), the trade cost reduction and trade volume increase would be more plausible.

The impact of road infrastructure on economic growth is transmitted by accessibilities and logistics mobility. The first direct impact of a highway infrastructure would be a reduction in travel time and freight cost. Mitsui (2004) found that the Highway No. 5 Project in Vietnam has cut the travel time between Hanoi and Haiphong by half. The reduction is achieved as the travel speed of vehicles on the highway increases from 25 to 28 km/hour to over 60 km/hour. Furthermore, Anas, Tamin and Wibowo (2017), based on survey data on manufacturing industry respondents, found that Cipularang toll road in West Java, Indonesia, reduced the freight transportation cost by 18.4% and hence the production cost by 0.99%.

In the next round, Li, Liu and Peng (2018) explained that road network construction provides more access to urban markets and promotes industrial and agricultural activities. Under these circumstances, the local residents are active in establishing their own businesses. As a result, more jobs are available as market openness increases, which subsequently generate effects on business trade and income opportunities.

However, the impact would be different across regions, depending on the location of the infrastructure and the route it traverses. By utilizing data of non-metropolitan counties in the US, Chandra and Thompson (2000) explained that incomes in the region traversed by a highway were 3% to 10% higher compared to those not traversed by. The income increase reported by some industries included retail sales. Unfortunately, the impact on adjacent regions was found to be contrary, as economic activities in these regions moved to the region traversed by the highway.

Similar finding was revealed by Mitsui (2004) and Ghani, Goswami and Kerr (2014) on their respective works.

Besides the trade sector, highway infrastructure would also impact investment activities in the nearby region. Mitsui (2004) found that the improvement of Highway No. 5 has caused a large inflow of foreign direct investment (FDI) to the provinces along the highway, while Li, Liu and Peng (2018) reported increases in real estate sector as developers like to build in the rural area with less cost but easily accessed from the city. However, although new road infrastructure might drive firm relocation, Baldwin and Okubo (2006) reported that highly productive firms would move to the core while the less productive firms would move to the periphery—the phenomenon they called "sorting effect". Furthermore, Faber (2014) reported that falling trade costs between large and small markets can lead to a reduction of industrial and total output growth in peripheral regions as firms relocate to the core as the center of production.

In addition, the construction of road infrastructure would give indirect impact to banking activities. Mitsui (2004) found that in the two provinces along the highway, micro-businesses have been expanding rapidly that affect banking activities. In 1999, no private enterprises received loans from the Hung Yen and Hai Duong branches of the Vietnam Bank for Agriculture and Rural Development. In the next year, private enterprises obtained 2 percent of the bank's lending, a share that increased to 13 percent in 2003. It shows that construction of road infrastructure will increase the tendency of the bank's lending to private enterprises. Therefore, this study will utilize bank lending data to capture the impact of Cipali toll road on local economic development.

3. Methodology and data

The purpose of this study is to estimate the impact of Cipali toll road on accessibilities, trades, and investments in immediate term since the toll has just been operating for two years from its opening on June 2015. Furthermore, the study is conducted to examine the localized impact in sub-province or regency level. To achieve the purpose, the analysis follows a framework as shown in Figure 2.

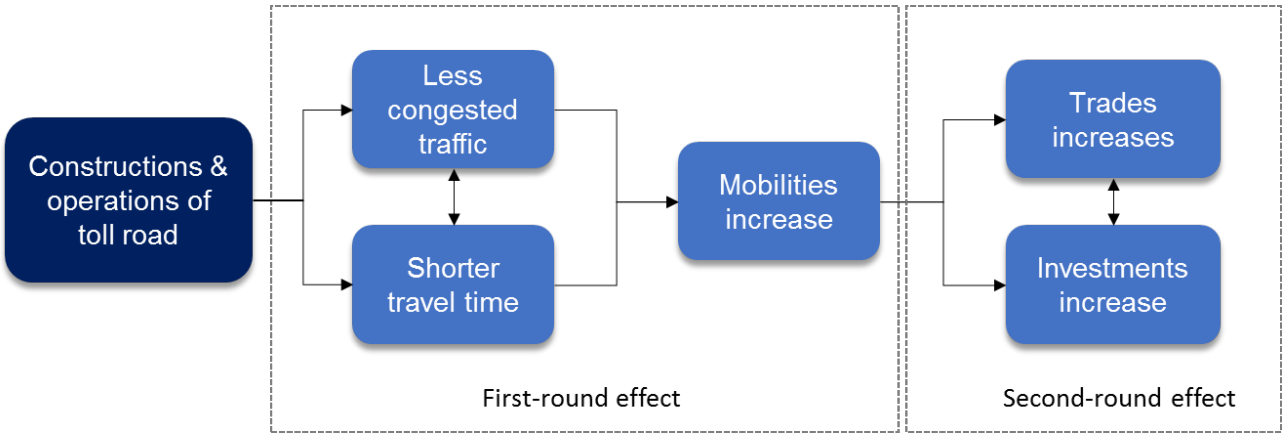

Figure 2. Analysis framework

The hypothesis is (based on review from the other paper) that the operation of the toll road reduces traffic congestions along the northern coastline highway in West Java that is traditionally the backbone of intra-Java connectivity especially from East Java and Central Java to Greater Jakarta. With smoother traffic, the travel time will get shorter and the mobility of people and goods between two areas increases. We define those impacts as the first-round effect of toll road operation. In the second round, we hypothesize that trades and investments in the regions traversed by the toll road increase.

To prove the hypothesis of the first-round effect, we undertake a qualitative analysis using data from a survey on small-medium enterprises (SMEs) in the logistics business with a coverage of six regencies traversed by Cipali toll road. These regencies are Purwakarta, Subang, Indramayu, Majalengka, Cirebon (both the regency and the city of Cirebon), and Brebes that is located at the eastern end of Cipali toll road but is administratively part of Central Java Province. The respondents are classified into general logistics and food logistics with, respectively, 94 and 118 respondents or 212 in total.

However, the survey might not meet an ideal requirement of a quasi-experimental design since it was only conducted after the completion of the toll road. Instead, to capture the impact, the questions were designed to explore the perception of respondents to some indicators prior to and after the toll road operates. There are possibly some biases for its reliance on the respondents' memory recall. However, the survey was conducted two years after the operation, or short enough time for the respondents to compare the current conditions with that they experienced before the toll exists.

In order to analyze the impact spatially with a budget constraint, we utilize a quota sampling. With this approach, the number of respondent were distributed in six areas that covered seven sub-provinces as mentioned above. Due to its proximity and similar economic characteristics, we treat the regency of Cirebon and the city of Cirebon as one sampling region. The respondents were purposively chosen from logistics enterprises whose delivery destination can be reached through Cipali toll road. However, it was not necessary that the enterprises serve only the routes. The respondents chosen from the sampling methods might not perfectly be representatives of the population but given its homogeneity and the minimum number of respondents of over 90 for each respondent group, we believe that the sample is representative to estimate the impact.

To support the first-round impact analysis, we also utilize a secondary-sourced data obtained from the regulatory body of toll road operations, or Badan Pengatur Jalan Tol (BPJT), on factors such as vehicle traffic. In some extent, we also discussed with the association of trucking companies to explore the decision-making process of using toll road and non-toll road in their daily operations.

Meanwhile, the estimation of the second-round effect is based on a hypothesis that the improved accessibilities generated by the toll road increase trades and investments in the regions traversed by Cipali toll road. To prove this hypothesis, we utilize three different set of data. The first data is the monthly data of annual growth of loan outstanding in the trade sector and that for investments purpose, while the second data is collected from a survey.

To estimate the impact using the first set of data, we undertake a difference-in-difference approach to isolate the macro effect on all regions. In the case of calculating the impact on trades, the first difference is between the loan outstanding's growth in the trade sector in one regency and that of the control group. The control group's outstanding loan is aggregated from the loan in all regencies in West Java excluding the observed regencies. The significance of the difference is statistically tested using paired test.

Next, to calculate the second difference, we compare the difference in three sequential periods, which are pre-construction period (P1), during construction period (P2), and operation period (P3). P1 was from January 2011 to the beginning of construction in June 2013, P2 was from July 2013 to May 2015, and P3 was from June 2015 to July 2017. Having calculated the difference in P1, P2, and P3, then we estimate the difference between impact among regions. We expect in P2 and P3, with construction activities during P2 and access to toll road and increased mobility in P3, the growth of loan outstanding in the trade sector and that for investment purpose in Cipali region would be higher than that of the control group.

To support the conclusion from the first set of data, we incorporate a second set of data collected from a survey on the hotel and restaurant industry in addition to that of the logistics enterprises. The survey data was collected from 119 respondents in the hotel and restaurant industry in addition to 212 respondents in the logistics industry that we used to evaluate the first-round impact. The overall respondents for this analysis was then 331. These data was utilized to estimate the impact of the toll road on growth of sales and identify the contributing factors to the sales growth, and estimate the impact on investment activities of these local firms after Cipali toll road operates.

The third set of data was the realization of foreign direct investment (FDI) and cross-province domestic investments in Cipali region to explore the response of both international and domestic corporations post the toll road operations. We also discussed with local bankers to collect anecdotal information about factors contributing to the loan growth. Furthermore, we also discussed with the local government in West Java province as well as the governments in the regencies of Purwakarta, Subang, Majalengka, Indramayu, Cirebon, and the city of Cirebon to identify their perception about the toll road's impact and their upcoming plan.

4. Impact of Cipali toll road on accessibilities

4.1. Does the traffic meet the expectation?

Since its opening in July 2015, the number of vehicles going through Cipali toll road has been fluctuating with the Indonesian holiday seasons. When it opened for free before the festive season of Idhul Fitri in July 2015, the number of vehicles that passed through the road reached 1.57 million vehicles or 50,672 vehicles per day. Afterwards, the number gradually decreased to 657,000 vehicles in November 2015 or 21,933 per day, less than half of that during free access period in the festive season.

The pattern for the second year of its operations was very similar, which increased during the holiday season of Idhul Fitri and the New Year celebration that was also a long holiday. The pattern shows that passenger vehicles are still the potential user, as shown by the domination of type 1

vehicles. Until July 2017, the share of type 1 such as sedans, jeeps, pickups, and buses was 80% to 90% of the total traffic.

On average, the number of vehicle traffic through Cipali toll road from 2015 to June 2017 was 30,322 vehicles per day or above the traffic threshold of 20,000 vehicles. The average number has met the expectation of as many as 27,501 vehicles per day (Sari, 2014). However, based on interviews with the operator, the occupancy of the commercial vehicles is still below the expectation. Furthermore, if compared to the already developed toll road such as Padaleunyi[2] where the average traffic is 166,222 vehicles per day, there is still a huge gap and also a potential to increase the traffic on Cipali toll road.

In addition, compared to Padaleunyi with a stable traffic from day to day, daily traffic of Cipali toll road is still fluctuating, which tends to increase in the period leading up to the holidays such as Idhul Fitri and end of year, while declining afterwards. However, the occupancy is estimated to increase as trades and investments increase in the east-end of Cipali toll road.

4.2. The increases of accessibilities: Toll road and non-toll road

Based on responses of 212 respondents in the logistics industry, we found that majority or 89% of 212 respondents claimed to have used Cipali toll road. The main reason is a faster time to travel as stated by 97% of respondents who use them. Respondents also stated that the travel time decreased significantly by 38% or 78 minutes faster compared to the prior average. It means the average travel time decreased from 206 minutes in average to 128 minutes in average.

Spatially, the logistics respondents in Purwakarta, the west-end of the toll road, are indicated to benefit the most from the toll road operations with a reduction of travel time by 54%. The significant reduction of time is related to the characteristics of the logistics respondents in Purwakarta whose most of the delivery destinations are to Cirebon and Indramayu at the east-end of the toll road.

However, these respondents do not always use the toll road for all their transporting activities. Instead, they also utilize the traditional highway because of the expensive toll fee as stated by 50% of 212 respondents. The difference in the cost of using the toll road on average is approximately USD11.12 (current ER). A small percentage of these respondents (17% of 212) also declared not using the toll road because the access gates are too far from their business locations.

In addition, there is an indication that the respondents do not use the toll road due to positive externalities that occurred on non-toll roads. After the operations of Cipali toll road, some vehicles, especially passenger/private vehicles, use the toll road instead of the traditional highway. As a result, non-toll roads become less congested. The majority of general logistics respondents (77% of 94) stated that travel time using non-toll roads also improved with a 45-minutes cut. Hence, the smoother traffic through both toll road and non-toll road is estimated to increase the mobility as well as trades and investments in the region.

2. Padaleunyi toll road connects Bandung with Greater Jakarta.

4.3. Impact on mobility

Using the same set of survey data collected from 212 respondents in the logistics industry, we estimated the impact of Cipali toll road on mobility. The survey revealed that since Cipali toll road operates, the mobility of goods increased. As many as 60% of 212 respondents stated that their cargo volume increased after the toll operates.

Spatially, the increases were reported by respondents in Purwakarta, Majalengka, Cirebon, and Brebes. It indicates that respondents located at the ends of the toll road especially Purwakarta in the west-end and Cirebon and Brebes at the east-end gain more benefit because of the significant travel time reduction. As many as 83% or 33 of 40 logistics respondents in Purwakarta claimed to have a main destination route to the east-end of the toll such as Cirebon and Brebes.

Compared to pre-toll period, the logistics volume of the general logistics respondents (94 respondents) increased by 43% at average, while that of food logistics (118) increased by 34.3% at average. Spatially, for both groups, those in Purwakarta are indicated to gain more benefit with the highest increase in cargo volume by 57% due to the shorter travel time to the east-end of the toll road.

5. Impact of Cipali toll road operations on trades

Based on loan data, we found that after Cipali toll road operates, the wholesale trade activities in Majalengka and Indramayu increase while those in Cirebon area grow better from below the control group to above the control group. Meanwhile, the SME trade activities increase in Cirebon and Majalengka. The SME trade activities in the traditional northern coastal highway decrease as traffic shifts.

5.1. Evidence from loan outstanding for wholesale and retail trade sector: Different impact for different business scale

5.1.1 Total loans

The construction and operation of Cipali toll road bring a positive impact to the trade sector in general in almost all regencies such as Majalengka, Indramayu, City of Cirebon, and regency of Cirebon except Subang. A significant impact was recorded in Majalengka and Indramayu where the growth of total loan for the trade sector after the toll road operates was higher than the control group at, respectively, 5.63% and 4.65%. However, the positive impact in Majalengka was also amplified by the ongoing construction of Kertajati Airport that jointly drive the consumption in the region.[3] Meanwhile, the growth in trade sector in Indramayu was mostly driven by wholesale distribution center activities when the SME activities shrank as explained later in this section. An on-plan Patimban International Seaport in Indramayu retained the distribution center in Indramayu to anticipate the construction of the seaport that would be started in mid of 2018.

An improvement also occurred in City of Cirebon with a smaller negative growth of loan to the trade sector compared to the control group after Cipali toll road operates (P3). Before and during the construction, the loan for trades grew double digits below the control group at 16.95% for P1

3.The project cost USD192 billion or around 20% of Cipali toll road's project value.

and 14.90% for P2 and got better to 3.20% below the control group after the operation of the toll road. It indicates that City of Cirebon was able to catch up with other regions in West Java after the operation of toll road. In the regency of Cirebon, the growth is significantly not different from the control group after Cipali toll road operates (P3) or back to the previous pattern in P1 (Table 1).

Table 1. Growth of loan to trade industry in total

Regency/City	Growth Difference Compared to Control Group (%)			Growth Trend	Toll Road Impact
	P1	P2	P3		
Majalengka			5.63	Increase	Positive
Indramayu			4.65	Increase	Positive
City of Cirebon	-16.95	-14.90	-3.20	Get better	Positive
Regency of Cirebon		-5.93		Get better	Positive
Purwakarta				No change	Neutral
Subang	11.16		-3.66	Decrease	Negative

Notes: P1=Before construction, P2=During construction, P3=After toll operates; blank column mean no difference

Meanwhile, the trade sector in Subang indicated a decline as shown by a lower loan growth below the control group after Cipali operates. In P1, loan growth in Subang was 11.16% above the control group, no difference in P2, and 3.66% lower in P3. The sharp decline from P1 to P3 might be subject to a very high growth in P1 for specific circumstances in Subang. However, the growth in P3 is also lower than that in P2, when there was no difference between Subang and the control group. It shows that there is no positive impact yet in trades in Subang. Before the operation of Cipali toll road, many travelers who passed through the traditional northern coastal highway would stop in Subang before heading to Jakarta. The traffic shifting reduced the trade activities in this region as new attractions and infrastructures were absent.

Meanwhile, there was no significant impact on total trade activities in Purwakarta before and after Cipali toll road operates. The neutral impact was contributed by growing wholesale activities that distributed manufacturing goods to the eastern part of West Java and Central Java. This growth compensated the declining SME-scale business in the trade sector in this region as we will explain in the next section.

5.1.2 SMEs loan for trade industry

The result of paired test on SME loan data shows that SME-scale industries in Purwakarta, Subang, and Indramayu were worse-off due to the operation of Cipali toll road. It can be seen from a lower loan growth for SMEs in the trade sector compared to the control group. Indramayu and Subang suffered the worst as loan growth fell from 14.52% above the control group before the construction (P1) to -3.68% below the control group after Cipali toll road operates (P3). While in Indramayu, it fell from 21.46% above the control group in P1 to -2.06% in P3.

In addition to Subang and Indramayu, the SMEs in the trade industry in Purwakarta also suffered after Cipali toll road operates although not as severe as the two regencies. Hence, it shows that in the near term, without any new attraction, SME-scale trading activities would decline in the traditional route due to the traffic shifting (Table 2).

Table 2. Growth of loan to SME-scale trade industry

Regency/City	Growth Difference Compared to Control Group (%)			Growth Trend	Toll Road Impact
	P1	P2	P3		
City of Cirebon	-16.54	-16.67	3.16	Increase	Positive
Majalengka			2.99	Increase	Positive
Regency of Cirebon	-2.53	-2.10		Get better	Positive
Purwakarta			-2.95	Decrease	Negative
Subang	14.52	4.92	-3.68	Decrease	Negative
Indramayu	21.46		-2.06	Decrease	Negative

Notes: P1=Before construction, P2=During construction, P3=After toll operates; blank column mean no difference

Meanwhile, loans to SMEs in the trade industry in the city of Cirebon improved significantly from below to be above the control group with a significant increase of 19.7% from P1 to P3. After the Cipali toll road operates, the travel time from greater Jakarta to Cirebon gets shorter. Many people who reside in Jakarta are originally from areas around Cirebon. Based on National Socio-Economic Survey (BPS, 2015), 10% of the lifetime migrants or around 560,000 people in Greater Jakarta were born in Tegal, Brebes, Pemalang, Pekalongan, Cirebon, and Kuningan and would most likely use the Cirebon exit to reach their hometowns. As a well-known traditional culture and culinary attraction, Cirebon becomes a getaway and hub especially for those spending holidays. Moreover, Cirebon is the center of growth in the east economic corridor of West Java province.

Meanwhile, the positive impact on SME-scale trade industry in Majalengka is in line with the growth of total trade industry. It shows that Majalengka is clearly better off after Cipali toll road operates with a significant and consistent positive increase in its trade sector. The positive impact is also amplified by the construction of Kertajati Airport in this regency. This is in line with survey data conducted on the hotel and restaurant industry.

5.2. Impact on hotel and restaurant sales

The survey reveals that most respondents in hotel and restaurant business are not so optimistic after the operations of the toll. However, the perceptions across region are very different as shown in Figure 3.

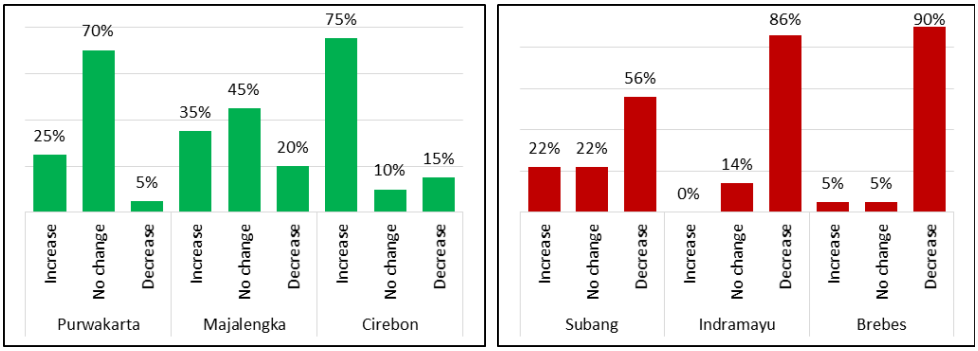

Figure 3. The impact perception across regencies

The survey indicates that Cipali toll road operations bring a positive impact on the sales for respondents in Purwakarta, Majalengka, and Cirebon but a negative one for those in Subang, Indramayu, and Brebes. The area which gets the most positive impact is Cirebon where 75% of the respondents there stated a sales increase. Respondents in Majalengka and Purwakarta are also better off from the toll road as, respectively, 35% and 25% respondents in each regency reported a sales increase.

Meanwhile, a large number of respondents in Subang, Indramayu, and Brebes declared a decrease in sales, with Indramayu and Brebes as regencies that suffered the most. As many as 90% respondents in Brebes and 86% respondents in Indramayu report a sales decrease. Subang is likely to be worse off by the toll operations as 56% of the respondents also report a sales decrease. The declining sales in these three regencies occur as a large number of vehicles no longer go through the traditional route of the northern coastal highway since the toll road opens.

5.3. Factors contributing to the impact

To explore what factors contribute to the sales change of the hotel and restaurant respondents, we conduct a one-way ANOVA test with Tukey post-hoc test and graph plotting. To conduct the test, we use a set of data collected from the survey on respondents in the hotel and restaurant business. The potential factors that we test are those available from the data set such as location factor, distance from toll gate, and business scale.

5.3.1 Factor 1: Location (regencies)

Having analyzed the survey data qualitatively, we test a hypothesis that location (regencies) factor significantly contributes to the sales changes as notated below.

H0: $\mu1=\mu2=\mu3=\mu4=\mu5=\mu6$

H1: The means are not all equal

Using a confidence level of 95%, we draw three conclusions as follows: First, there is no difference in the increase of sales among respondents in Purwakarta, Majalengka, and Cirebon. Second, the average increase of respondents' sales in Purwakarta, Majalengka, and Cirebon is significantly different (higher) than that in Subang, Indramayu, and Brebes. Third, the Tukey

post-hoc test provides the difference among the regencies as shown in Table 3. Among others, respondents in Cirebon consistently yield the highest increase in sales compared to other regencies. The respondents in Purwakarta and Majalengka also record a higher increase of sales compared to in Subang, Indramayu, and Brebes.

Table 3. The difference for sales growth across regencies (%)

Observed Region (I)	Observable region over comparable region (I-J)		
	Subang (J)	Indramayu (J)	Brebes (J)
Purwakarta	48.4*	74.3*	60.2*
Majalengka	n.d.	54.8*	40.7*
Cirebon	54.4**	80.3*	66.2*

*Notes: * The mean difference is significant at α=5%; n.d.=no difference*

The declining sales of hotel and restaurant business in the traditional main route of northern coastal highway is in line with the previous study by Chandra and Thompson (2000) who found that the retail and services industries in adjacent counties in the United States are worse off after the operation of a highway in close-by counties. Similar findings also reported by Mitsui (2004) from a study in Vietnam and Ghani *et al*. (2014) based on their study in India.

5.3.2 Factor 2: Distance from toll exit

To test the contribution of distance of respondents' business location from the toll exit or entrance, we plot the data of two variables into Figure 4. It shows that respondents who are located close to toll gates tend to record a higher or positive increase in sales after the toll road operates. This shows a tendency of people to stay at hotels or shop at restaurants close to the toll gate. It also indicates the presence of transit activity from people before entering the toll road or after going the route.

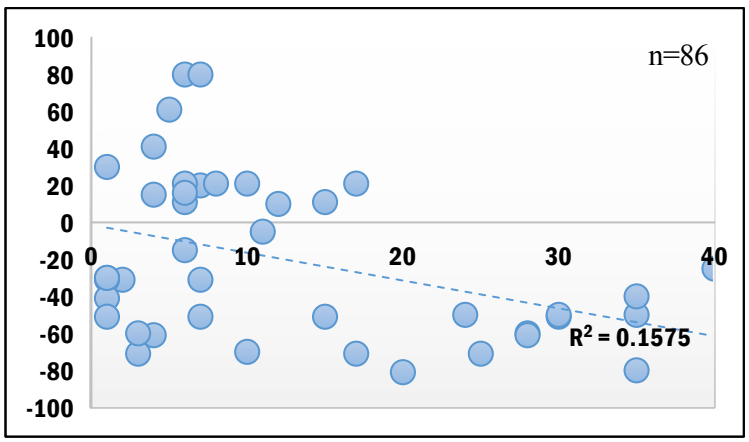

Figure 4. The contribution of distances to sales increase

5.3.3 Factor 3: Scale of business

The business scale also determines the increase of respondents' sales. To test this hypothesis, we conduct a one-way ANOVA test with Tukey post-hoc test with a notation similar to that used to test the location factor (Table 4). The main finding of the test is the sales increase of small-scale respondents (Group 1), with average sales per month below Rp100 million, is lower than that of medium-and-up-scale businesses (Group 2 and Group 3). The post-hoc test shows the sales growth of Group 1 is 49.8% lower than that of Group 2 and 69.3% lower than that of Group 3. This suggests that travelers prefer middle-class restaurants to dine in and medium-class hotels to stay in.

Table 4. The differences for sales increase based on size of business (%)

Observed Group (I)	Comparison Group (J)	Mean Difference (I-J) in %
Group 1: < Rp100 million	Group 2: Rp100–250 million	-49.8*
	Group 3: > Rp250 million	-69.3*
Group 2: Rp100–250 million	Group 1: < Rp100 million	49.7*
	Group 3: > Rp250 million	-19.5
Group 3: > Rp250 million	Group 1: < Rp100 million	69.3*
	Group 2: Rp100–250 million	19.5

Notes: Significant at α=5%.*

6. Impact of Cipali toll road on investments

6.1. Evidence from loan outstanding for investment purposes

The constructions and operations of Cipali toll road indicate a positive impact in investment growth in Subang, Majalengka, City of Cirebon, and Regency of Cirebon as shown by a higher growth of loan for investment in Cipali area than that of the control area (Table 5).

The impact of Cipali toll road on investments was notably witnessed in Subang where investment loan grew on average 8.53% higher than that in the control area during construction (P2) and reached 93.72% above the control group post the operation of Cipali toll (P3). Investment loan was mainly channeled to the manufacturing sector as many labor-intensive industries such as footwear and garment industries were newly set up in these regions. The high growth of loan for the

Table 5. Growth of investment loan

Regency/City	Growth Difference Compared to Control Group (%)			Trend
	P1	P2	P3	
Subang		8.5	93.7	Increase
Majalengka			45.2	Increase
City of Cirebon	13.8		18.7	Increase
Regency of Cirebon	34.2		11.4	Increase
Purwakarta	-20.2	-8.7		Get better
Indramayu		42.2	-16.8	Decrease

Notes: Significant at α=5%. Groups are categorized by monthly sales.*

manufacturing sector was amplified by Subang's connectivity to Jakarta by Cipali toll road and its proximity to the industrial estates in Purwakarta.

High growth of investment loan was also recorded in Majalengka although not as high as that in Subang. After the operation of Cipali toll road (P3), investment loan in Majalengka grew at an average of 45.22% above the control group. Similar to Subang, better connectivity to Jakarta, Bandung, and Cirebon increased as Cipali toll road operates. In addition, investment loan growth in Majalengka was also supported by the construction of Kertajati Airport.

Nevertheless, the growth rate of investment loan in Majalengka in P3 was still lower compared to similar figures in Subang. From a discussion, the local government was selective in granting investment permits to maintain agricultural land and to hinder predatory big businesses on local micro small-medium enterprises. However, despite the selective policy, investment loans in the manufacturing sector in Majalengka continued to rise as businessmen saw its strategic role in the future.

Moreover, the other factor that contributed to the growth of investment loan as well as the newly set-up manufacturing firms was the lower monthly wages in Majalengka and Subang compared to other regions in West Java especially Purwakarta and Karawang at the west-end of Cipali toll road. In 2017, minimum wages in Majalengka and Subang were Rp 1.5 million (USD 111) and Rp 2.3 million (USD 170), respectively. They were much lower compared to the closest industrial regions of Purwakarta and Karawang with minimum wage of Rp3.6 million (USD267). The flow of labor-intensive industries in these regions showed a "sorting effect" as proposed by Baldwin and Okubo (2006) and implied by Faber (2014). When connectivity among regions increased, the low-productivity industries relocated further to the east from Purwakarta and Karawang to optimize profit from a lower labor cost.

Positive impact on investment was also shown in the regency of Cirebon and the city of Cirebon where investment loans in both regions grew above the control group in P3. However, other projects, especially the power plant construction in the regency of Cirebon, also contributed to the growth. Meanwhile, by sector, investment loans in the city of Cirebon were still driven by the primary sector of mining and excavation with commodities of rocks and sands that were needed for construction projects in the region. Besides this primary sector, secondary sectors such as construction and real estate started to grow in both regions since the construction of Cipali toll road.

Purwakarta was indicated to be not significantly affected by the toll road as investment loan growth in this region was not different from the control group. Meanwhile, the only region negatively impacted by Cipali toll road in investment was Indramayu. Post-operation of Cipali toll road, investment loans in this region grew lower than control group. However, the completion of the electricity project in Indramayu might likely contribute negatively to the decline as well.

6.1.2 Loan approval from Jakarta

After Cipali toll operates, the loans for investments flow from Jakarta's bank offices to the region as shown in Figure 5. In 2012, the share of investment loans disbursed by banks based in West Java still dominated the total investment loans in Cipali region except in Indramayu where most investment loans flowed from Jakarta due to a big financing of the electricity project.

Meanwhile, during the construction period (P2), the investment loans flowed from Jakarta

increased especially to Purwakarta, the regency of Cirebon, and the city of Cirebon. In 2017, or after the operation of Cipali toll, the share of the investment loans from Jakarta became dominant in all regions. It indicates the presence of big investments and also the emergence of major projects in Cipali.

The flows show a strong indication of the toll road's positive impact to investments. However, it is difficult to isolate the impact exclusively from the operation of the toll road especially in Majalengka as another project such as the construction of Kertajati Airport also contributes to the growing investment from Jakarta (Figure 5).

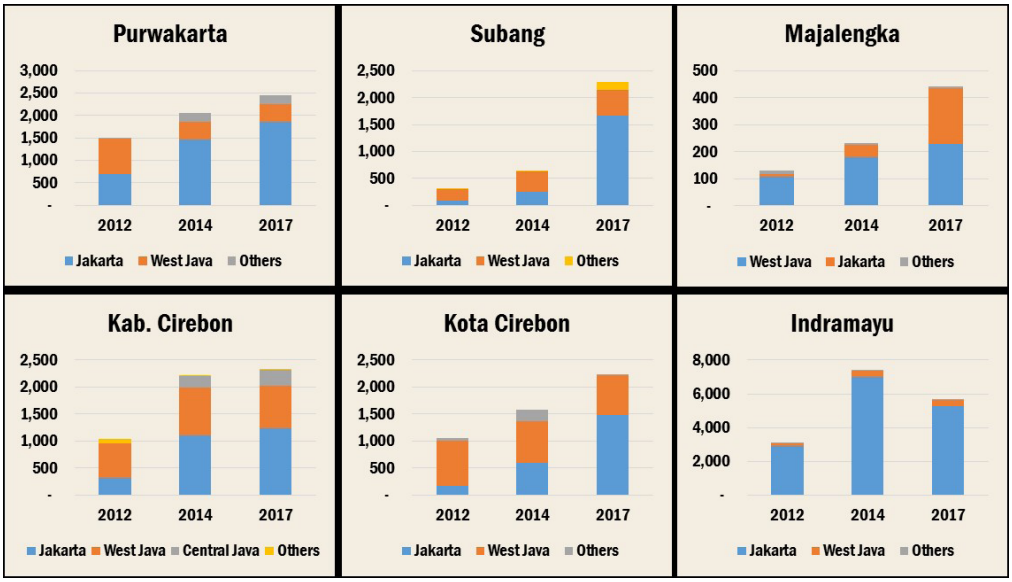

Figure 5. The flow of investments from Jakarta to the region (Rp billion)

Foreign direct investment (FDI) in the region increased during the construction period (P2), especially in 2014. This is in line with the progress of toll road construction project financed by PT Lintas Marga Sedaya, whose majority share (55%) is controlled by Plus Express Berhad from Malaysia. The industries sector such as road construction, building, and electrical installation recorded a high growth at the time.

Spatially, Purwakarta still dominates the realization of FDI driven by investment in the automotive industry which was traditionally the major source of investment. Nevertheless, Purwakarta's FDI share in 2014 has declined due to the high realization of large toll road constructions in Subang, Majalengka, dan Cirebon. After Cipali operates (P3), the realization of FDI gradually declined, which indicates that foreign investors did not respond yet to the increasing accessibilities in the two years after the operations.

A total of 33% of respondents out of 331 stated that the documents to submit for a permit have become more in the number of documents required. As many as 26% of respondents stated that the time to handle is also longer, especially in Purwakarta and Cirebon. Meanwhile, 12% of respondents stated that the cost of maintenance is also more expensive, especially in Purwakarta and Subang (Figure 8).

6.2. How foreign and local investments response to exploit the benefit

Since Cipali toll road operates, domestic investments have been increasing since 2015 and expected to continue in 2017 (the data available until Q3-2017 position). The industries are mainly dominated by traditionally-invested industries in the Cipali region such as food and paper products. New industries also emerged, such as housing and industrial complex as well as rubber products. This further reinforces the conclusion that Cipali toll road brings a positive impact in the areas it traverses (Figures 6 and 7).

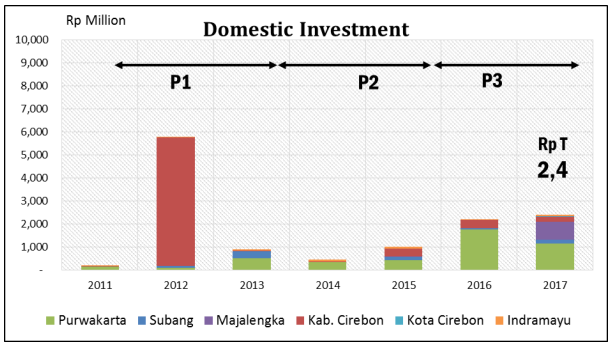

Figure 6. Cross-province domestic investment to the region

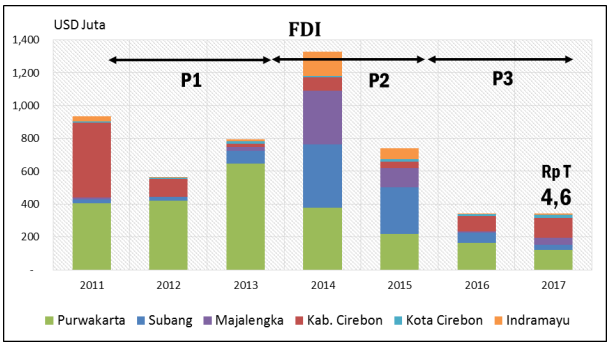

Figure 7. Foreign direct investment (FDI) to the region

Foreign direct investment (FDI) in the region increased during the construction period (P2), especially in 2014. This is in line with the progress of toll road construction project financed by PT Lintas Marga Sedaya, whose majority share (55%) is controlled by Plus Express Berhad from Malaysia. The industries sector such as road construction, building, and electrical installation recorded a high growth at the time.

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6.3. Challenges in boosting investments

To encourage investment in Cipali areas, business licensing should be further simplified as the respondents of general logistics, food transport, and hotel and restaurant businesses have not seen any improvement in the bureaucracy.

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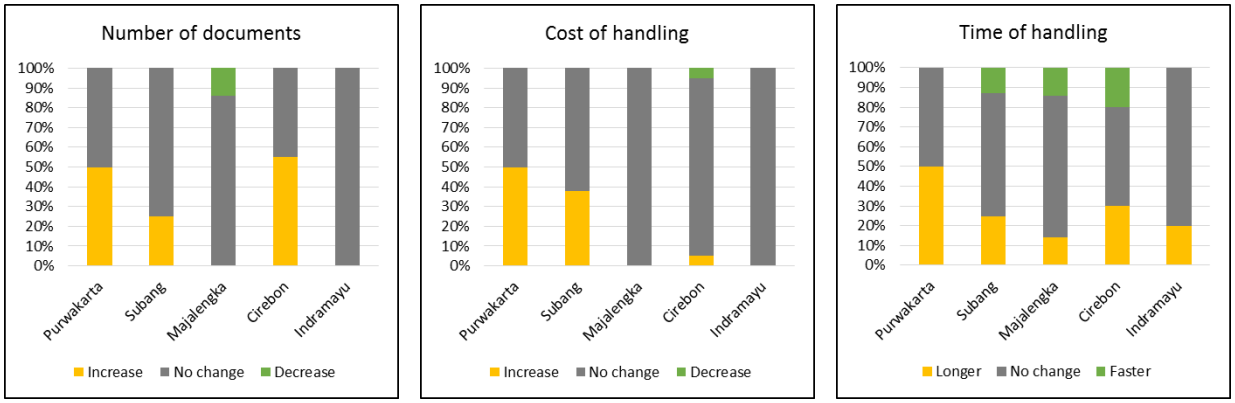

Figure 8. Low progress of ease of doing business

7. Discussion

Based on the finding from the survey data as well as the secondary data which include the growth of loan for trades and investments as well as domestic and foreign investments, there are some notable findings to refer to the government in formulating policy on infrastructure. In overall, the toll road has been bringing more activities and investments to the region it traverses. However, it negatively impacts the region where the traditional route lies in term of a decline in retail sales as reflected by hotel and restaurant sales drop as well as negative growth of loan. Governments especially at the local level should prepare for the consequences of the infrastructure. Rather than blaming the infrastructure for the decline, local governments and businesses should instead embrace it and take advantage of the new infrastructure. Connectivity should be enhanced while ease of doing business should be optimized to attract investments.

There are some limitations on this research as it utilizes a survey-based estimation as well as a quantitative approach based on secondary data. The survey conducted on 313 respondents might not sufficient enough to draw a conclusion for the population. The impact estimated based on the survey data might be biased due to the selected respondents as well as its reliance on memory recall.

However, as the survey-based conclusion was drawn in a specific area of business such as the logistics business as well as hotel and restaurant SMEs, this research would benefit policy makers in estimating the impact of toll road infrastructures as well as preparing the policy response to minimize the negative impacts while maximizing the positive ones. Furthermore, the secondary data of loan and investment were in line with the finding of the survey, thus making the conclusion more robust.

We acknowledge that the research is not strong enough in isolating the impact of the toll road from other infrastructure projects such as airport and another toll road that was started to be constructed as well. A further study with a strong data and approach to isolate the impact would be beneficial in providing a better estimation.

8. Conclusions

Cipali toll road improves accessibility in the region it traverses in the form of smoother traffic and faster travel time. Survey data shows a 39% reduction of travel time using toll road or equivalent to 75 minutes in average. Furthermore, it creates a positive externality to non-toll road that is now less congested with a 45-minute less time to travel. However, the smoother traffic in non-toll road and the amount of toll charge that is considered to be expensive by most respondents are among the factors contributing to a low occupancy of the toll road. The average amount of traffic that passed through Cipali per day was over 20,000 vehicles but lower than the expectation. Meanwhile, the mobility of goods in the regions indicates a positive impact as shown by an increase of the cargo volume transported along the regions. The biggest benefit goes to the logistics firms in Purwakarta at the west-end of Cipali and Cirebon at the east-end of Cipali.

The operation of Cipali toll road encourages trade activities especially in Cirebon and Majalengka both in wholesale and SME-scale business amplified by different additional factors. The regency and city of Cirebon's trade industry, especially hotel and restaurant industry, benefited from Cipali toll road as more travelers come to Cirebon due to its cultural attraction, culinary, and close transit to neighboring areas. Meanwhile, an additional factor that boosts trading activities besides the operation of Cipali toll road in Majalengka is the on-going construction of Kertajati International Airport.

Nevertheless, small and medium enterprises in Indramayu, Subang, and Brebes which are in the traditional northern coastal highway showed a decline in their sales due to traffic shifting. This finding was confirmed by decreased growth of loan to the trade industry in those areas. Furthermore, analysis of ANOVA using survey data shows that besides locations, the contributing factors affecting the sales growth are the size of business and distance from toll road. The implication of these findings is an urgency to push better connectivity from the toll road to the economic center of the region as well as the empowerment of SME businesses to provide better service and product.

The increasing accessibility and mobility have driven investments in the region especially Subang and Majalengka. A large number of cross-province investments especially from Jakarta flowed to these regencies significantly. However, the flows were dominated by labor-intensive industries such as garment, textile, and paper attracted by lower wages in these areas. This finding confirmed a "sorting effect" as proposed by some literature which argue that better connectivity would move highly productive industry to the core areas while moving low-productivity industry to the periphery. While cross-province investments flowed to the region, domestic business investments were still limited.

To wrap up, in order to utilize the presence of Cipali toll road, the local governments should improve the accessibilities in their region, as well as the ease of doing business, to attract investment. Meanwhile, to mitigate the negative impact of the toll road on SME businesses in the traditional route, the local governments should facilitate SMEs' empowerment programs and also encourage private businesses to develop local attractions by providing incentives. The first and foremost incentive is to ease the business license process that is deemed to be convoluted.

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