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# The Impact of Logistics and Infrastructure on Economic Growth: Empirical Evidence from Vietnam

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## Abstract

The study aims to evaluate the impact of the determinants of logistics on Vietnam's economy, especially the period after Vietnam joined WTO. We used the logistics indexes as a representative for the logistics sector to assess their impacts. Vietnam's logistics data is collected from World Bank in the period from 2007 to 2019. Our research also used the OLS regression model to assess the influence of logistics on the Vietnam economy with independent and dependent variables. Six independent variables are representing for logistics activities such as logistics infrastructure (Log 1), logistics service quality (Log 2), on-time shipment (Log 3), up-to-date delivery information (Log 4), logistics competitive price (Log 5), and convenient customs (Log 6). The results of models showed that the logistics infrastructure, the on-time shipment, up-to-date delivery, and the competitive price have impacted positively on Vietnam's economy. While the service quality has an insignificant effect and the convenient customs (Log 6) have significant negative effects. The results of the studying also indicated that the models are appropriate to evaluate the influence of logistics on Vietnam's economy. Moreover, the Vietnam government can use these findings to formulate suitable economic policies, especially logistics policies on the integration process.

**Keywords:** Logistics, Infrastructure, Economic Growth, Vietnam

**JEL Classification Code:** C32, C51, F10, O47

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## 1. Introduction

In the context of integration, the effects of logistics on the economy are becoming ever more important. When the economy of a nation develops, it leads to the development of logistics. On the other hand, as logistics develops, it is the foundation for the development of other industries in the economy. Today, logistics is even more important when it is considered a base for sectors of the economy because it helps to link the flow of services and goods from the first partners to the final customers. This explains the reason why logistics

is indispensable to all businesses as well as the economy. We can see that many nations gain benefits from logistics activities. Companies and enterprises also have a trend to connect all activities of logistics or supply chain functions. Based on those activities, logistics will make conditions for business activities of companies more effective and faster.

In the past 35 years from 1986, Vietnam has signed many free trade agreements with countries and territories. Vietnam has become one of the countries with a ratio of trade to GDP over 160%. Vietnam's export grows over 15% a year for many years (MOIT, 2020). In 2018, Vietnam's export generated US\$243.48 billion, an increase of 13.2% comparing to 2017, exceeding the target of the government. This achievement impacts positively on the balance of payments and stabilization of macroeconomic variables. Despite facing many difficulties and challenges, Vietnam's total export turnover still reached US\$241.42 billion in 2019, an increase of 7.8% comparing to 2018 (Pham, 2020).

With these achievements, Vietnam has become one of the most attractive destinations for foreign investment, with a registered capital volume of over US\$35 billion in 2017. In 2018, Vietnam had about 3,046 foreign direct investment projects, with a total capital of US\$18 billion, higher than the

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previous period. In 2019, foreign direct investment projects were implemented reaching US\$20.38 billion, increasing 6.7% compared to that of 2018 (Viet, 2019). However, Vietnam's exporting costs are still more expensive than many countries in ASEAN and the world. Therefore, it is difficult for Vietnam to take part in the global value chain. The cause of the problem comes from Vietnam's logistics costs. It is too high, accounting for over 18% in total product expenses, double the cost of developed countries, and 4% higher than the cost of the global average (Suong, 2017). In recent years, Vietnam's logistics sector has seen large changes. The growth rate of the logistics sector increases about 15% per year, from US\$40 to 42 billion per year (Pham, 2019). There are over 3,000 domestic enterprises and 25 foreign corporations providing logistics services in Vietnam such as the DHL, CJ Logistics FedEx, Maersk Logistics, APL, or KMTC. Vietnam is ranked 64th in logistics development in the world, 4th in ASEAN (MOIT, 2020). Moreover, in past years, Vietnam's logistics industry has developed fast. The development of economic factors such as manufacturing and e-commerce sectors also support the development of logistics. Vietnam's logistics has also improved based on the increase of shipment demand when international integration develops. With the purpose to become an industrial country in 2035, Vietnam's government begins to establish economic zones in many areas as well as industrial parks to foster investments as well as the development of logistics in the future.

The study aims to assess determinants of logistics on Vietnam's economy through indicators representing logistics activities such as logistics overall (Log), logistics infrastructure (Log 1), logistics service quality (Log 2), on-time shipment (Log 3), up-to-date delivery information (Log 4), competitive price (Log 5), and convenient customs (Log 6). The study evaluates the impact of logistics on Vietnam's economy by using the OLS models with data from 2007 to 2019. This study is different from others because it focuses on the Vietnam logistics sector in recent years. Moreover, there is very little research on this problem in Vietnam. The paper includes five sections. The first section is the introduction part. Other parts are the background of literature, methodology, selected data, research variables, research hypotheses, research models, empirical results, and conclusions.

## 2. Literature Review

Logistics is one of the important sectors of global trade. It contributes to many economic achievements and creates different values. Logistics has become an important element for enhancing the competitiveness of a country and the economy. Many researchers have shown the linkages between the issues of logistics and the economy by qualitative and quantitative results.

To explore the impacts of logistics on the economy, Liu, Li, and Zhu (2010) selected logistics data in Henan province, China, to study this issue. They concluded that the logistics sector contributes significantly to the economy of Henan. Chu (2012) also concluded that the logistics industry is associated with the national economy and is significant for sustaining economic development. Reza (2013) showed that there is a connection between logistics issues and Indonesia's economy with logistics data such as traffic volume and the economy in the period from 1988 to 2010. Goods volume shipped by sea, air, and rail is used as the logistics indicators, while GDP is used as the economic index. Findings indicated that the logistics sector supports and sustains the economy, besides the economy also pushes the development of logistics. Richard (2020) applied the simple regression model to estimate the support of logistics to Tanzania's economy from 2007 to 2016. The study tested the relationships between macroeconomic variables such as economic growth (GDP) as a dependent variable and logistics as the independent variable. The findings showed that logistics had a positive relationship with the development of Tanzania's economy.

Many other researchers used the Granger causality test to study this relationship such as Wang (2010); Cheng, Liu, Xie, and Zhou (2010). Their results also indicated that logistics support the development of the economy. Sultan and Emrah (2014) investigated this relationship in Turkey by using Unit Root Tests, as well Granger causality tests. GDP is represented for the economy, and different variables such as turnover from transportation, and storage are represented for logistics. Results showed that these variables are significant in the long term. Besides, the input-output method is also used to assess the impact of logistics on the economy. Dai and Yang (2013) used this kind of method to study the issues of logistics park construction on Chizhou's economy, China. Similarly, Prawpan (2018) also used input and output analysis to examine the role of the logistics sector in Thailand's economy from 1975 to 2010. The findings showed that the logistics sector has certain effects on Thailand's economy.

Besides, Petrini and Pozzebon (2009), Suong (2017), and Khan (2019) indicated that logistics is very important to the economy. When logistics develops, it will support international trade by increasing the competitiveness of countries and supporting the development of the economy (Muneer, 2020). Moreover, Ismail and Mahyideen (2015) studied the impacts of logistics infrastructure on trade as well as many macro variables in Asia. Results showed that if transportation is improved (ports, railways, air transport, road network, etc.), the trade will increase too. Moreover, technology infrastructure also supports trade activities with the development of Internet and technology networks. Pinar (2015) studied the impact of the logistic sector on the economy in 32 OECD countries from 1995 to 2011. He used

the panel data with the variables such as railway transport, inland transport, road transport, airline transport, number of internet users, and telephone lines as representative variables for the logistics. The study showed that there is a relationship between the logistics index and the economy. Khan (2019) realized that there is also a relationship between the economy and green logistics, or environmental and social factors in the Asian countries. The results showed that activities of logistics represented by the convenient customs, logistics service quality, and infrastructure relates to per capita income, trade openness, and added values.

In different aspects, Liu (2009) still applied a grey relational analysis method to find the effects of China’s logistics sector on the national economy. She used GDP as a dependent variable, and several logistics indicators such as the added value of products, number of employments, new investment projects, number of transport means, and business turnover as the independent variables. Liu (2009) showed that the added value of products, number of employments, new investment projects, number of transport means, and business turnover have large effects on the economy. When studying data in twenty years from 1978 to 2008, Cheng, Liu, Xie, and Zhou (2010) used a logit model in conjunction with life-cycle theory to evaluate the necessity of the logistics sector to the economy, probed the special character of the logistics sector. Yang and Jiangou (2011) used the panel regression model to study the link between the logistics sector and China’s economy from 1978 to 2008. They considered that logistics supply/demand has a linkage with the economy of China. Chu (2012) applied the conditional convergence model and the GMM estimations to show a linkage between logistics and China’s economy from 1998 to 2007. Li and Qi (2015) also used factor analysis to get a total evaluation of the effect of logistics network on the economy by using the data of 31 China provinces from 2003 to 2012. The results showed that the logistics network and the economy have a relationship together. Therefore, countries, especially developing nations, should consider the logistics networks in issuing policies for economic development, investment, as well as other economic policies.

Studying 91 countries with seaports, Munim and Schramm (2018) implemented an empirical study about the contribution of seaborne trade with quality of infrastructure and logistics. The model provided the evidence about impacts of infrastructure quality and logistics. Moreover, analysis with different countries showed different aspects, especially in developing countries. The results showed that it’s important for developing countries to improve the quality of infrastructure because it will support logistics performance more effectively, as a result, lead to higher seaway trade, and the development of the economy. Sharipbekova and Raimbekov (2018) studied issues of logistics in CIS countries. Their study analyzed the

influence of the logistics performance index in 10 years and indicated factors in logistics affecting the economy of these countries. The findings indicated that the logistics affected not only the economy, but also the further development of a country. The study of Millán, Agüeros, Hontañón, and Pesquera (2013) showed a worldwide aggregate production function that reveals the effects of logistics on the world economy. The production issues are also studied in many countries using data from the World Bank for the period 2007–2012. The results showed when the logistics index increases 1%, the world economy grows between 0.011% and 0.034%. Based on the model of Millán, Agüeros, Hontañón, and Pesquera (2013), our study tries to assess the influence of logistics on Vietnam economy from 2007 to 2019, since Vietnam joined WTO.

### 3. Research Methodology

#### 3.1. Data, Variables, and Hypotheses

To implement the study, we used the method of the average income per capita and the overall logistics activities to study the effects of logistics on Vietnam’s economy in the period from 2007 to 2019 (Table 1).

To test the hypotheses, the study used the regression in the double log model, in which the dependent variable is GDP per capita (economic growth indicator), the independent variables in the models are  $k$ , Log, Log 1, Log 2, Log 3, Log 4, Log 5, and Log 6.

#### 3.2. Model Specification

Time-series data in the period from 2007 to 2019 of logistics and economic growth (GDP) has been used to study the effect of logistics on the Vietnam economy.

**Table 1:** Variables and Hypotheses

| Indicators  | Variables | Hypotheses |
|---|-----------|------------|
| GDP per capita (constant 2010 US\$)                 | $y$       |            |
| Gross fixed capital per capita (constant 2010 US\$) | $k$       |            |
| Logistics activity index: Overall                   | Log       | +          |
| Infrastructure                                      | Log 1     | +          |
| Service quality                                     | Log 2     | +          |
| On-time shipment                                    | Log 3     | +          |
| Up to date delivery information                     | Log 4     | +          |
| Competitive price                                   | Log 5     | +          |
| Convenient customs                                  | Log 6     | +          |

The study constructed the aggregate production model, research data is calculated on a per capita basis, and logarithms.

Per capita is usually used in economic statistical analysis. It provides more data than other information. Information about per capita is still different from median because it provides an aspect of the economic issues of a nation. To calculate per capita, we used the applied mathematics range and divide it based on the population to analyze. Economic indexes such as gross domestic product (GDP) are often interested. However, the per capita can provide more information. Thus, we use the aggregate per capita production function, and modeled our study as follows:

$$\ln y = \beta_0 + \beta_1 \ln(k)_i + \beta_2 \ln(\text{logistics})_i + \varepsilon_i \quad (1)$$

The equation shows that the income per capita ( $y$ ) depends on the capital ( $k$ ) and the overall logistics activities for each period, in which  $y$  is explained by two variables to be capital for periods ( $k$ ), and the overall logistics activities (Logistics).  $\beta_0, \beta_1, \beta_2$  are parameter estimates.

#### 4. Findings

Table 2 represents the descriptive statistics of Vietnam's logistics index in the period from 2007 to 2019.

Table 3 shows the effect of logistics activities on Vietnam's economy. In eight regression models for Vietnam economy represented by GDP per capita has R-squared (coefficient of determination) over 40%. It tells us that Vietnam's economy is influenced by over 40% of selected independent variables in the selected model.

Table 3 indicates that model 3, model 6, and model 8 have the coefficients of the logistic activity independent variable that is significant at the 10% level. And in model 5 and model 7, they are statistically significant at the 1% level.

It is noteworthy that if only an independent variable is the logistics performance index, overall (Log) in model 2, it has an insignificant effect on the Vietnam economy. However, if the independent variables are separated by independent components of logistics (Log 1, Log 2, Log 3, Log 4, Log 5, and Log 6), there are different impacts. Specifically, the Infrastructure (Log 1), On-time shipment (Log 3), Competitive Price (Log 5), Convenient Customs (Log 6) were significant. It means that there are insignificant effects on the service quality (Log 2). Moreover, the coefficients estimated in model 3, model 5, model, model 7, and model 8 indicated the elasticities of the GDP of Vietnam when logistics activities change.

In model 2, there is still a positive, but insignificant relationship between logistics activities and Vietnam's economy. Vietnam does not have an efficient supply chain. The logistics scale is still fragmented, and the added value is rather low. Therefore, the cost of the Vietnam logistics sector is much higher than that of the world average. High logistics costs reduce the competitiveness of Vietnamese goods. The capacity of domestic logistics enterprises is still limited, domestic logistics enterprises are not linked together. This is an opportunity for foreign enterprises to increase prices. Or we can see that Vietnam does not have a macro strategy for developing logistics such as building a national agency in charge of logistics. Besides, most of Vietnam's logistics enterprises have certain limitations. The number of logistics services is small, low quality, while the service cost is high compared to that of foreign enterprises. Therefore, it is difficult for Vietnamese logistics enterprises to create modern logistics value-added services, as well as not be able to achieve high operational efficiency. Besides, competitive pressure from foreign logistics enterprises is also a problem for the Vietnam logistics sector. Therefore, Vietnamese logistics enterprises should focus on a certain market segment to issue the right business strategy.

**Table 2:** Descriptive Statistics in the Period from 2007 to 2019

| Variable | Mean     | Std. Dev. | Minimum   | Maximum  |
|----------|----------|-----------|-----------|----------|
| Ln $y$   | 7.328804 | 0.1916216 | 7.043282  | 7.641201 |
| Ln $k$   | 6.121922 | 0.2035574 | 5.868941  | 6.493253 |
| Ln log   | 1.10772  | 0.0442571 | 1.061257  | 1.18479  |
| Ln log 1 | 1.004494 | 0.0846722 | 0.9162908 | 1.135543 |
| Ln log 2 | 1.077351 | 0.0779909 | 0.9858168 | 1.223776 |
| Ln log 3 | 1.243694 | 0.0482852 | 1.169381  | 1.300192 |
| Ln log 4 | 1.126602 | 0.0666874 | 1.044832  | 1.238374 |
| Ln log 5 | 1.132629 | 0.025675  | 1.098612  | 1.168571 |
| Ln log 6 | 1.027501 | 0.0397367 | 0.9745597 | 1.081805 |

**Table 3:** Regression Results with Ordinary Least Squares

|           | M1                 | M2                | M3                | M4                | M5                 | M6                | M7                 | M8                |
|-----------|--------------------|-------------------|-------------------|-------------------|--------------------|-------------------|--------------------|-------------------|
|           | Ln y               | Ln y              | Ln y              | Ln y              | Ln y               | Ln y              | Ln y               | Ln y              |
| Ln k      | 0.902***           | 0.767***          | 0.769***          | 0.973***          | 0.725***           | 0.858***          | 0.732***           | 0.949***          |
| Ln log    |                    | 0.809             |                   |                   |                    |                   |                    |                   |
| Ln log 1  |                    |                   | 0.479*            |                   |                    |                   |                    |                   |
| Ln log 2  |                    |                   |                   | -0.235            |                    |                   |                    |                   |
| Ln log 3  |                    |                   |                   |                   | 1.126***           |                   |                    |                   |
| Ln log 4  |                    |                   |                   |                   |                    | 0.281*            |                    |                   |
| Ln log 5  |                    |                   |                   |                   |                    |                   | 2.202***           |                   |
| Ln log 6  |                    |                   |                   |                   |                    |                   |                    | -0.752*           |
| _cons     | 1.805***           | 1.737***          | 2.142***          | 1.628**           | 1.489***           | 1.760***          | 0.357              | 2.290***          |
| R-squared | 0.4187             | 0.4392            | 0.4434            | 0.4222            | 0.4628             | 0.4260            | 0.4728             | 0.4405            |
| F-test    | 124.23<br>(0.0000) | 69.56<br>(0.0000) | 83.27<br>(0.0000) | 59.30<br>(0.0000) | 133.05<br>(0.0000) | 62.56<br>(0.0000) | 178.76<br>(0.0000) | 78.99<br>(0.0000) |

Note: \*, \*\*, and \*\*\* indicates significant at 10%, 5% and 1% level of significance.

Model 3 shows that the Infrastructure (Log 1) was positive and significant at the 10% level. It means when the quality of infrastructure increases by 1%, Vietnam’s GDP per capita will increase by 0.479%. Quality of infrastructure directly affects the logistics sector such as cost, time, reliability, as well as safety of supplying services, therefore it will affect the growth rate of the economy and enterprises. In freight forwarding, Vietnam’s infrastructure plays a very important role, including seaport systems, airports, railways, motorways, riverways, and other works and equipment such as warehouse systems, loading and unloading facilities, and communication systems. Among the factors that make up the logistics chain, freight forwarding is the most important stage. Logistics infrastructure development is one of the important strategies of Vietnam in the integration process. This is necessary work to link Vietnam with the economies in the region. Besides, Vietnam can also build deep-water ports and regional ports, consider form logistics centers located at convenient transportation points, gradually upgrade key roads, form a modern and integrated road network in three key economic regions, as well as expand and modernize international exchange centers. The increase in quantity and quality of Vietnam’s logistics infrastructure system will create technical facilities to help Vietnam take advantage of the integration context. Transportation costs often account for more than 1/3 of the total cost of logistics activities. In freight forwarding cost, the freight forwarding cost by sea accounts for the largest proportion, because shipping by sea has outstanding advantages that other modes of transportation do not have such as low-cost volume, environmentally friendly transport.

In model 4, there is a negative, but insignificant relationship between the service quality (Log 2) and Vietnam’s economy. Most logistic service suppliers in Vietnam are small or

medium-sized enterprises and primarily perform as associate agents for international logistics suppliers. The scales of Vietnam logistic centers are mostly quite small (under 10 ha), and primarily serves some businesses in industrial parks of the province. Therefore, Vietnam logistics centers have not developed to the regional level yet. Moreover, logistics centers in Vietnam still lack several services to create competitiveness to attract customers. Besides, the workforce in the logistics sector is not well-trained, the logistics service cost is so high, and the quality of service doesn’t still meet the requirements of customers.

According to the results of model 5 and model 7, there is a positive and significant relationship between on-time shipment (Log 3) and competitive price (Log 5) at a 1% level. It means that when the on-time shipment and the competitive price increase 1%, Vietnam’s GDP per capita increases 1.126% and 2.202%. With these findings, Vietnam can increase competitiveness with other countries inside and outside the ASEAN, building brand and trust with customers, thereby increasing international trade, and developing the economy.

Model 6, the up-to-date delivery information (Log 4) was positive, but statistically significant. A complete logistics system is that it is suitable for the processes of e-commerce activities and meeting customer requirements quickly and promptly. This determines the success of the business as well as the development of the economy. In general, businesses, as well as logistics enterprises need to apply information technology during operation. Some systems can be applied such as global supply chain management and radio recognition technology. Because these systems will help information be transmitted quickly and accurately, from which logistics decisions of the enterprises will be

issued effectively, and the delivery process will also take place more smoothly and quickly. Currently, many Vietnam logistics enterprises become applying high-tech scientific research into logistics activities to trace consignments such as Transportation Management System and GPS navigation system. These systems provide remote routes for managers as well as provide up-to-date shipment information for customers, create transport exchanges that connect sellers and goods transport means. Moreover, the software for road planning, tracking the volume of goods, warehouse management, automation has been set up in many warehouses and yards to take advantage of resources and save costs.

In model 8, there is a negative relationship between the convenient customs (Log 6) and Vietnam's economy at the 10% level. That means an increase of 1% in the convenient customs will lead the GDP per capita of Vietnam to decrease by 0.752%. Although Vietnam's customs procedures have had a lot of positive reforms such as implementing the VNACCS/VCIS system for nearly two years and adopted an electronic customs system with many positive changes in the clearance process and law, the public departments are still bureaucratic, causing problems for export-import procedures. Moreover, many Vietnamese enterprises taking part in logistics activities are afraid of customs procedures. The reason is that many customs officers often cause difficulties in processing and resolving administration documents. And they often catch small errors of enterprises in the process of import and export procedures.

## 5. Conclusion

In conclusion, we saw that there is an impact of logistics on Vietnam's economic development. Findings show that infrastructure (Log 1), on-time shipment (Log 3), and competitive price (Log 5) have an extremely positive impact on Vietnam's economy. And it explains that the efficiency of logistics increases by 1%, Vietnam's economy increases, ranging from 0.479% to 2.202%. Besides, convenient customs (Log 6) has a negative impact on the economy. According to theories and practices in studies of Petrini and Pozzebon (2009), Chu (2012), Ismail and Mahyideen (2015), Pinar (2015), Khan (2019), Richard (2020), Kim and Kim (2020), Abbas, Alalawi, and Almaktoumi (2020) have arrived at the same findings of the logistics' influence on the economic development; when these indicators increase, the economic growth will have a positive impact, but Vietnam has some different results. The reason may be that the Vietnam customs is not effective, there are still too many problems with procedures or legal corridors. The government needs to improve this area so that the above indicator and economic growth will have a positive

influence. Moreover, Vietnam's logistics system is rather weak, the indicators of the up-to-date delivery information (Log 4) and logistics activity (Log) have a positive impact on Vietnam's economy, but they are insignificant. Meanwhile, logistics service quality (Log 2) has a negative effect on Vietnam's economy.

Logistics is considered one of the important services of the economy. It includes some main services such as seaway transport, air transport, customs consulting, warehousing services, and distribution. Not only in Vietnam, but in all countries in the world, logistics contributes to improving the competitiveness of imports and exports. As a result, it supports the development of the economy. However, Vietnam's logistics activities are quite weak and do not develop as expected. Therefore, it does not reach its full potential in supporting the economy. However, the Vietnam logistics industry has still many opportunities to develop and expand. Some opportunities can be mentioned such as developing new warehousing facilities, building regional logistics centers, or integrating existing infrastructure with other logistics activities in the supply chain. Other activities of the supply chain are inventory management, improving the quality and quantity of cold storage. Besides, Vietnam's logistics sector can also apply and develop technological solutions to connect the whole process of the supply chain from raw materials to finished products and end consumers. Today, the strong development of e-commerce has opened up many opportunities for logistics as well as cargo delivery, especially fast delivery services in two hours and a day, because the middle class in Vietnam is increasing fast and they can fully afford the costs. The findings indicated that logistics is very necessary for the development of not only related sectors, but also the whole economy.

The study has certain limitations. Our study only uses the logistics index in the period from 2007 to 2019. Besides, findings indicated that logistics service quality (Log 2) and the up-to-date delivery information (Log 4) influence Vietnam's economic growth unclear. This issue reduces the accuracy of the study. In the next study, we will select some other logistics indicators such as the logistics capacity of Vietnam enterprises or the number of logistics centers to study the determinants of logistics to Vietnam's economy.

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