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THE EFFICIENCY AND THE PERFORMANCE OF THE LOGISTICS GLOBAL SUPPLY CHAIN ACTIVITIES TO VIETNAM EXPORTATION: AN EMPIRICAL CASE STUDY

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ABSTRACT

Purpose: This research paper aims to determine the factors affecting the efficiency and logistics performance index (LPI) of Vietnam's exports to foreign partners during 2018-2022 are due to the impact of the COVID-19 pandemic.

Theoretical Framework: Based on the primary factors affecting the efficiency and performance of global supply chain activities in logistics for Vietnam's exports, including practical impact and logistics results of enterprises in Vietnam. Based on the primary factors affecting the efficiency and performance of global supply chain activities in logistics for Vietnam's exports, including (1). Customs efficiency (speed, simplicity and predictability of customs clearance procedures) (2). Quality of infrastructure related to trade and transport, including Roads, railways, ports, airports, warehouses and information technology ...(3). The level of ease when arranging to transport import and export goods with competitive prices (costs such as warehousing fees, port fees, tolls ...) (4). Capacity and quality of logistics service providers ... (5). Ability to track and trace shipments. (6). Timeliness of the shipment to the destination within the specified time limit. The practical impact and logistics results of enterprises in Vietnam.

Method: The panel approach allows the authors to explore the heterogeneity in data across countries. Fixed effects (FE) and random effects (RE) models were used to estimate the model. Then, the Hausman test is carried out to decide which model is appropriate. The data were collected from 240 observations from Vietnam and 80 major export partner countries of Vietnam.

Findings: The research results show that the cost, time and capacity of providing logistics services have the most significant impact on Vietnam's exports.

Practical & social implications: Overall, to increase the efficiency and logistics efficiency of enterprises. The Vietnamese Government needs to cooperate and propose ideas to partner countries to improve logistics activities for exports from Vietnam. Logistics is beginning to play an increasingly important role in the competitiveness of economies.

Originality values: This study also confirms the sustainability of the extended gravity model using OLS and RE methods by substituting different variables for the country's logistics efficiency and solving the endogenous problem in the model while applying

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the regression method to industrial variables. We find that an 1% improvement in Vietnam's logistics would increase Vietnam's exports by 1.443%, and an 1% improvement in a partner country's performance would help promote Vietnam's exports to this country by 0.546%.

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A EFICIÊNCIA E O DESEMPENHO DAS ATIVIDADES DA CADEIA DE SUPRIMENTOS GLOBAL DE LOGÍSTICA PARA EXPORTAÇÃO DO VIETNÃ: UM ESTUDO DE CASO EMPÍRICO

RESUMO

Objetivo: Este trabalho de pesquisa tem como objetivo determinar os fatores que afetam a eficiência e o índice de desempenho logístico (LPI) das exportações do Vietnã para parceiros estrangeiros durante 2018-2022 devido ao impacto da pandemia de COVID-19.

Estrutura Teórica: Com base nos principais fatores que afetam a eficiência e o desempenho das atividades da cadeia de suprimentos global em logística para as exportações do Vietnã, incluindo o impacto prático e os resultados logísticos das empresas no Vietnã. Com base nos principais fatores que afetam a eficiência e o desempenho das atividades da cadeia de suprimentos global em logística para as exportações do Vietnã, incluindo (1). Eficiência aduaneira (rapidez, simplicidade e previsibilidade dos procedimentos de desembaraço aduaneiro) (2). Qualidade das infra-estruturas relacionadas com comércio e transportes, incluindo Estradas, caminhos-de-ferro, portos, aeroportos, armazéns e tecnologias de informação...(3). O nível de facilidade para transportar mercadorias de importação e exportação com preços competitivos (custos como taxas de armazenagem, taxas portuárias, pedágios...) (4). Capacidade e qualidade dos prestadores de serviços logísticos... (5). Capacidade de rastrear e rastrear remessas. (6). Pontualidade da remessa ao destino dentro do prazo especificado. O impacto prático e os resultados logísticos das empresas no Vietnã.

Método: A abordagem de painel permite que os autores explorem a heterogeneidade dos dados entre os países. Modelos de efeitos fixos (FE) e aleatórios (RE) foram usados para estimar o modelo. Em seguida, o teste de Hausman é realizado para decidir qual modelo é apropriado. Os dados foram coletados de 240 observações do Vietnã e 80 dos principais países parceiros de exportação do Vietnã.

Resultados: Os resultados da pesquisa mostram que o custo, tempo e capacidade de prestação de serviços logísticos têm o impacto mais significativo nas exportações do Vietnã.

Implicações práticas e sociais: Em geral, para aumentar a eficiência e eficiência logística das empresas. O governo vietnamita precisa cooperar e propor ideias aos países parceiros para melhorar as atividades logísticas das exportações do Vietnã. A logística começa a desempenhar um papel cada vez mais importante na competitividade das economias.

Valores de originalidade: Este estudo também confirma a sustentabilidade do modelo de gravidade estendida usando os métodos OLS e RE, substituindo diferentes variáveis para a eficiência logística do país e resolvendo o problema endógeno do modelo ao aplicar o método de regressão para variáveis industriais. Descobrimos que uma melhoria de 1% na logística do Vietnã aumentaria as exportações do Vietnã em 1,443%, e uma melhoria de 1% no desempenho de um país parceiro ajudaria a promover as exportações do Vietnã para esse país em 0,546%.

Palavras-chave: Índice de Desempenho Logístico (LPI), Exportar, Modelo de Gravidade, OLS, Eficiência, Utt.

LA EFICIENCIA Y EL DESEMPEÑO DE LAS ACTIVIDADES DE LA CADENA LOGÍSTICA GLOBAL DE SUMINISTRO PARA LA EXPORTACIÓN DE VIETNAM: UN ESTUDIO DE CASO EMPÍRICO

RESUMEN

Propósito: Este trabajo de investigación tiene como objetivo determinar los factores que afectan la eficiencia y el índice de desempeño logístico (LPI) de las exportaciones de Vietnam a socios extranjeros durante 2018-2022 debido al impacto de la pandemia de COVID-19.

Marco teórico: basado en los factores principales que afectan la eficiencia y el desempeño de las actividades de la cadena de suministro global en logística para las exportaciones de Vietnam, incluido el impacto práctico y los resultados logísticos de las empresas en Vietnam. Basado en los factores principales que afectan la eficiencia y el desempeño de las actividades de la cadena de suministro global en logística para las exportaciones de Vietnam, incluido (1). Eficiencia aduanera (rapidez, sencillez y previsibilidad de los procedimientos de despacho aduanero) (2). Calidad de la infraestructura relacionada con el comercio y el transporte, incluyendo carreteras, vías férreas, puertos, aeropuertos, almacenes y tecnología de la información...(3). El nivel de facilidad a la hora de organizar el

transporte de mercancías de importación y exportación con precios competitivos (costes como tasas de almacenaje, tasas portuarias, peajes…) (4). Capacidad y calidad de los proveedores de servicios logísticos... (5). Capacidad para rastrear y rastrear envíos. (6). Puntualidad del envío al destino dentro del límite de tiempo especificado. El impacto práctico y los resultados logísticos de las empresas en Vietnam.
Método: El enfoque de panel permite a los autores explorar la heterogeneidad de los datos entre países. Se utilizaron modelos de efectos fijos (FE) y efectos aleatorios (RE) para estimar el modelo. Luego, se realiza la prueba de Hausman para decidir qué modelo es el adecuado. Los datos se recopilaron a partir de 240 observaciones de Vietnam y 80 principales países socios exportadores de Vietnam.
Hallazgos: Los resultados de la investigación muestran que el costo, el tiempo y la capacidad de brindar servicios logísticos tienen el impacto más significativo en las exportaciones de Vietnam.
Implicaciones prácticas y sociales: en general, para aumentar la eficiencia y la eficiencia logística de las empresas. El gobierno vietnamita necesita cooperar y proponer ideas a los países socios para mejorar las actividades logísticas para las exportaciones de Vietnam. La logística comienza a jugar un papel cada vez más importante en la competitividad de las economías.
Valores de originalidad: Este estudio también confirma la sostenibilidad del modelo de gravedad extendida utilizando los métodos OLS y RE al sustituir diferentes variables por la eficiencia logística del país y resolver el problema endógeno en el modelo al aplicar el método de regresión a las variables industriales. Encontramos que una mejora del 1 % en la logística de Vietnam aumentaría las exportaciones de Vietnam en un 1,443 %, y una mejora del 1 % en el desempeño de un país socio ayudaría a promover las exportaciones de Vietnam a este país en un 0,546 %.

Palabras clave: Índice de Desempeño Logístico (LPI), Exportar, Modelo de Gravedad, MCO, Eficiencia, Utt.

INTRODUCTION

The 6th National Congress of the Communist Party of Vietnam in 1986 changed economic thinking. Accordingly, Vietnam's foreign trade with other countries in the world has significantly improved, and Vietnam's trade openness has integrated more and more deeply into the world economy and business [GS.TS Phạm Minh Quang,2017,14,26 - 40]. Since Vietnam opened up to the world for trade, Vietnam’s exports have contributed significantly to economic growth. Exports lifted the economy during the brutal downturn. The emotional development of the global market has increased trade between countries and regions, which leads to new needs for transportation, warehousing, and services.

The importance of logistics operations has been growing in various fields. For industries, logistics help to optimize existing production and distribution processes based on the same resources through management techniques to promote the efficiency and competitiveness of enterprises. The critical element in the logistics chain is the transport system, connecting different activities. Transportation accounts for a third of the money in logistics costs, and the transportation system dramatically affects the performance of the logistics system. Shipping is necessary throughout the entire manufacturing process, from production to delivery to the final consumer and return. It is true that only a good combination of each ingredient will bring maximum benefit.

Especially during the period affected by the Covid 19 pandemic. The logistics research team for 2018-2021 saw critical role before being affected by the epidemic during the most involved process. To know the importance of logistics activities, especially in the export of goods, how does it affect economic development? Research results show that logistics activities over the past time have contributed to export growth and GDP growth

Although there have been many studies in Vietnam on the factors affecting export and import activities, empirical evidence related to logistics factors still needs to be done. This is also partly affected by the need for more data available for research related to this factor. This article will fill that research gap by assessing the impact of logistics activities on Vietnam's exports with 80 major trading partners. **The purpose of this paper is** (1). clarify and redefine the factors affecting the efficiency of logistics operations, namely: Distance between Vietnam and partner countries; the Purchasing power of the importing country; The size of the economy; A standard trade agreement between two countries… affects the efficiency of logistics performance through export activities using fixed effects (FE) and random effects (RE) models to estimate the model. The figure use the latest set of logistics indicators published by the world bank. The authors test the robustness of the model by using a two-stage regression method with instrumental variables by collecting and analyzing different applications of cases and practices in logistics activities from other countries. Document. (2) Assess its impact on Vietnam's international trade. It is to provide a common framework and look forward to being introduced for further development and research. (3) Determine the factors affecting logistics activities' efficiency in Vietnam during the 2018-2021 period.

The article introduces the development of logistics and transportation-related fields based on a historical review. Then, the paper discusses the reciprocal relationship with logistics performance. This represents the benefits of developing logistics activities and vice versa. For example, reducing delivery time and increasing the quality of logistics services will change and increase the efficiency of logistics activities between Vietnam and other countries. Furthermore, some key logistics activities and concepts have been discussed in this paper. This explicitly introduces Marti et al.'s research method and approaches to assess the importance of logistics for Vietnam's export activities. Finally, this article will discuss and conclude the potential for further development of logistics operations.

LITERATURE REVIEW

Despite being negatively affected by the COVID-19 epidemic, our country's international trade still achieved positive results. Exports still grew positively and once again affirmed that export is one of the fundamental driving forces of economic development. In 2019, the exports of developing countries reached nearly $8.5 trillion for trade in goods and about $2 trillion for trade in services (World Investment Report, 2021). Along with the increase in business, logistics activities promoting import and export flows are considered the "backbone" of the entire global supply chain (Beleska-Spasova and issues, 2014).

Many studies have shown a link between increasing logistics performance and trade value between countries [Limao and Venables,2001,451-479], [Martínez-Zarzoso, García-Menéndez,2003,179-198], [Hausman, Lee,2013,236-252], [Fugazza, Hoffmann,2017,1-18], [Hoffmann, Saeed,2020,473-499]. However, most of these studies have been done almost exclusively for water groups or bodies of water. Very few studies have focused on analyzing the impact of logistics activities on a particular country's trade, especially in Southeast Asia, where it increasingly witnesses the importance of logistics activities. It is essential to the value of work and the global supply chain.

In the past ten years, Vietnam's sustainable GDP growth rate (from 5% to 8.5%)annually has primarily been based on the promotion of exports and foreign investment [Lam, Sriram,2019]. The most significant improvement is seen in the ranking of trading partners in the world, from the 39th position in 2009 to 23rd place in 2019 and then one of the countries with the highest trade openness. In addition, [Blancas, Isbell,2014] Vietnam's average export growth reached nearly 15% in the 2018–2021 period and is forecast to grow many times higher [WTO,2020]. However, Vietnam's import and export costs are still higher than the ASEAN average, with the expenses accounting for 20.8%-25% of GDP, 6% higher than that of Thailand, 12% more than Malaysia and about 2.5 times higher than that of Singapore [Phuong,2019,01-04]. In comparison, logistics' contribution to the national GDP is modest (4%–5%). According to the World Bank [World Bank,2018] assessment, high costs are caused by delays in the transportation and handling of goods which lack quality in human resources, particularly in logistics management and customs clearance procedures. The most time-consuming and costly parts of Vietnam's export process are loading and unloading at the port (accounting for 44% of the total export time and 33% of total export costs) and delays related to cumbersome customs clearance procedures.

Indeed, the efficiency of logistics activities will create favourable conditions for foreign trade in terms of ensuring the safety and speed of goods and reducing transportation costs, thereby helping to improve the value and competitiveness of exported goods and services in the international market. Although there have been many studies in Vietnam on factors affecting import and export activities, empirical evidence related to logistic aspects is still very little. This is also partly influenced by the fact that more data are needed for research related to this factor. This paper will accommodate that research gap by assessing the impact of logistics on Vietnam's exports with its 80 major trading partners.

The importance of logistics and its impact on international trade has attracted much attention from researchers. Several empirical studies have evaluated the effect of one or more national logistics factors on business. Accordingly, initial studies were limited to considering the impact of all aspects of logistics activities, such as fuel cost and transportation infrastructure index [Limao and Venables,2001,451-479], [Martí, Puertas,2014,2982-2992], transit time [Hummels,2007,131-154], quality of marine infrastructure [Fugazza, Hoffmann,2017,1-18, Hoffmann, Saeed,2020,473-499], port efficiency [Bourdet and Persson,2014,675-699, Clark, Dollar,2004,417-450, Sánchez, Hoffmann,2003,199-218], time, variation in transit time, and logistics service costs [Hausman, Lee,2013,236-252].

These studies show that fuel costs, transport infrastructure, and infrastructure quality positively influence and promote trade flows. There is a two-way effect between countries, while the factors of transit time and logistics service costs have the opposite effect. It can be confirmed that price significantly influences logistics activities, but how has the impact of these studies yet to be assessed? Therefore, the authors have studied the types of costs. The research results show that the factors affecting the logistics costs of enterprises in Vietnam are: Fuel costs; road maintenance costs, insurance costs; salary expenses; technology costs. The most influential factor is fuel cost, and the weakest impacting cost is salary cost. Also, Le Van Tranh, Dinh Tran Ngoc Huy, Nguyen Trong Diep (2023) pointed that One of the characteristics of business investment activities are risk and uncertainty.

Recently, a series of studies by different authors have shown the positive impact of logistics on exports through the performance of logistics operations in which the efficiency of management (Logistics Performance Index - LPI) provided by the World Bank is employed to measure the overall capacity of logistics activities of countries [Behar and & Manners,2008, Hoekman and Nicita,2011,2069-2079, Korinek and Sourdin,2011, Wang, Choi,2018,49-70]. The results of the above studies indicate that the impact of LPI on trade will vary significantly

based on the different characteristics of the given countries. The gravity model with the logistics performance index (LPI) was used as an explanatory variable to examine the role of logistics in international trade and the extent to which logistics inefficiencies limit international commercial transactions [Korinek and Sourdin,2011]. The results reveal that logistics positively influence business, especially when it comes to improving infrastructure. According to Korinek and Sourdin [Korinek and Sourdin,2011], high-quality logistics services will reduce freight costs and improve countries' export competitiveness. Research results also confirm that trade-related logistics activities significantly influence exports more than imports. In another study, to compare the impact of logistics on trade volume between two groups of developed and developing countries, authors Wang and Choi [Wang, Choi,2018,49-70] conducted a large-scale study with 43 countries in 2010, 2012 and 2014. Research has shown that LPI has a more positive impact on exports and imports in developed countries than in developing ones. And Baqleh & Alateeq (2023) investigated the moderating role of Big Data Analytics (BDA) on the relationship between supply chain management practices (SCMPs) and the competitive advantage (CA) in the Jordanian manufacturing firms.

Although in the study there is a clear difference between the above studies in terms of assumptions and meanings, the model built by the authors on the scale (5 points) of 6 main criteria of logistics is classified into two groups, input and output, in which three measures including customs, infrastructure and logistics technology belong to the input group and international shipping capacity criteria. Traceability and timely delivery belong to the group of results.

Likewise, the impact of the logistics performance index (LPI) on cross-country trade has also been explored in groups of countries or regions such as ASEAN [Sy, Villejo,2020,5], Central and Eastern European countries and Western Balkans [Abu Bakar, Jaafar,2014, Bugarčić, Skvarciany,2020] , African countries [Bugarčić, Skvarciany,2020], European countries [Puertas, Martí,2014,467-480] and Central Asian countries [Felipe and Kumar,2012,5-20]. These studies all conclude that improving logistics efficiency will have a significant impact on international trade promotion.

In addition to the overall logistics performance index (LPI), several studies have examined each component's impact on international trade. Considering the LPIs and their components' effects on business in emerging economies shows that in 2005, the logistics factors with the greatest effect on exports were time and information (Martí, Puertas, 2014). Similarly, Gani (2017) analyzed the impact of logistics on international trade using data from 60 countries.

The findings suggest that the quality of logistics services is vital to international business. Using the same method as Martí et al. and Gani, Çelebi examined the impact of LPI and its six criteria on trade in 118 countries (Çelebi and Logistics, 2019). This study provides evidence that the LPI substantially affects imports more than exports. For the importing country, the factors of price and infrastructure are more significant. Meanwhile, the exporting country's main determinants of trade flows are time, logistics capacity and shipment traceability.

Research on the relationship between state management of logistics, logistics performance and export in Vietnam has only been done (within the research limit of the authors) in the study of Mai and Ngoc and Le (2018) used the LPI to measure trade facilitation. According to the study results, the LPI positively affects trade, which is different for the trade flows of other goods, namely agricultural and non-agricultural produce. Le emphasized the positive role of the country's marketing and logistics policies in shaping export competitiveness in the era of international economic integration. Contrary to the study of Mai and Ngoc, the results in this study show that Vietnam's national logistics capacity exerts no impact on export value as Vietnam's logistics performance index has almost no effect.

In contrast, the logistics performance of the importing country has the effect of increasing the value of Vietnam's exports. This effect is weakened when Vietnam joins multilateral free trade agreements with many countries in the same free trade area. However, the two studies above just focused on illustrating LPI's overall impact on Vietnam's exports other than analyzing each aspect of logistics activities in-depth. Thus, it is still a controversial topic about the effects of Vietnam's logistics performance on Vietnam’s trade. Moreover, there are still very few studies in Vietnam related to this relationship. Accordingly, this study was conducted to fill the gap and contribute to the theory on the impact of logistics capacity and logistics factors on Vietnam's trade.

MATERIALS AND METHODOLOGY

Design/Methodology/Approach

Using the approach of Martí et al. [Martí, Puertas,2014,2982-2992] when assessing operational efficiency and the importance of logistics for international trade, this study changes a few control variables to suit the export situation of Vietnam. In addition to main variables, other essential factors are also considered to evaluate the logistics performance of exports. Specifically, this study uses an extended gravity model, including the variables of the economic size of Vietnam and the partner country, the geographical distance between the capital of

Vietnam and that of the partner country, and the general free trade agreement between Vietnam and the partner country.

The economic size variables of Vietnam and the partner country are used because these two variables represent the economic scale and purchasing power of a nation, which, in export demand models, are often expressed through the partial equilibrium method as defined in the study by Siregar & Rajan [Siregar, Rajan,2004,218-240]. The distance variable between two countries is used because it represents the cost of trade and, more specifically, the transport cost in customs. The variable free trade agreement is needed because there is a tendency that Vietnam are increasingly getting involved in free trade agreements with the expectation that this participation will facilitate trade between Vietnam and other countries.

To examine the impact of logistics performance on Vietnam's exports, this study analyzes panel data from 80 countries over four years (2018-2021) (corresponding to 4 years of published LPI) through the gravity model. Although LPI data are reported for 240 countries, the availability of data for other variables is more limited. After excluding countries with data shortages, such as Vietnam's export value to that country, GDP, and economic openness, the remaining data of the study include 80 countries. In addition, the selection of these countries is based on the importance of Vietnam's exports, especifically the value of Vietnam's exports to these countries accounting for about 98.2% of Vietnam's total exports in the previous year. The period surveyed was between 2018 and 2021. The gravity model is widely used to measure the impact of trade facilitation, trade costs or logistics performance on export value. The gravity model in trade has the following general form:

$$(T_{IJ}\ ) = A\frac{Y_I Y_J}{D_{IJ}^2}$$

In there:
Tij: Bilateral trade value between two countries i and j;
Yi, Yj: Economic size of two countries i and j (in this study measured by GDP);
Dij: Geographical distance between two countries i and j. Taking the logarithm on both sides and adding the error factor, we get the following logarithmic, linear model:

$$LnT_{IJ} = \alpha_0 + \alpha_{01}\ln(Y_i Y_J) + \alpha_2 \ln(D_{IJ}) + \mu_{IJ}$$

In addition to the essential variables of the gravity model (GDP, distance) and the two leading independent variables measuring logistics capacity, when studying the impact of

national logistics capacity on exports, this study adds to the model of the trade openness of the importing country, the dummy variable for the landlocked importing country, and the dummy variable for the signing of a free trade agreement between Vietnam and the importing country. The definitions and data sources of the variables are provided in Appendix 2.

So the gravity model is extended as follows:

$$EX_{IJ} = \beta_0 (GDP_i)^{\beta 1} (GDP_J)^{\beta 2} (D_{IJ})^{\beta 3} (FTA_{ij})^{\beta 4} (LPI)^{\beta 6} \varsigma_{ij} \quad (1)$$

Taking the logarithm of equation (1), we have a gravity model for Vietnam's exports as follows:

$$\ln EX_{IJ} = \beta_0 + \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{jT} + \beta_3 \ln D_{ij} + \beta_4 FTA_{ijt} + \beta_5 LPI_{it} + \beta_6 LPI_{jt} + \varsigma_{ijt} \quad (2)$$

In there:
- i is Vietnam, j is the countries that are trading partners; t = 1, 2, …, T is the number of years.
- EXijt is Vietnam's export to country j in year t.
- GDPit is the size of Vietnam's economy, with Vietnam's GDP as representative.
- GDPjt is the importing country's purchasing power, with the importing country, with the GDP of the importing country as a proxy.
- Dij is the distance between the capitals of 2 countries (Vietnam and country j).
- FTAij is a dummy variable measuring the general trade agreement between two countries. The dummy variables are equal to 1 if country j and Vietnam are members of the same free trade agreement at time t and 0 if the two countries do not have a standard free trade agreement.
- LPIit is the overall logistics performance index of Vietnam in year t.
- LPIjt is the overall logistics performance index of the partner country in year t.
- εijt is the random error of the export equation.

In the export equation, economic theories suggest that the economic size of the exporting country is an essential factor in determining the value of that country's exports because the more significant the economy, the more there is an opportunity to produce many different goods to serve the diverse needs of the partners, so β1 is expected to be positive. The income of people in the partner country is an essential factor in determining the export value of the exporting country. The demand for exports from Vietnam will increase if the income of people in the partner country rises, so β2 is expected to be positive.

Conversely, the distance between the two countries is a proxy for trade costs, which has the effect of reducing exports from Vietnam, so β3 is expected to be negative. The impact of the Free Trade Agreements (FTAs) to which Vietnam has joined is measured by the FTA

dummy variable. Implementing the FTA between Vietnam and its trading partners is expected to increase Vietnam's exports to these countries, as lower tariffs and non-tariff barriers among the members of the FTA will promote trade. Internal trade among members; therefore, β4 is expected to be positive.

The panel approach , Then, the Hausman test is carried out to decide which model is appropriate. The results show that the FE model is more suitable than the RE model (Table 3). However, the results of Wooldridge and Wald tests show autocorrelation and variable variance in the model. Therefore, to overcome this problem, the authors estimate the model using the Feasible Generalized Least Squares (FGLS) method. One problem that can be encountered when estimating a model is an endogeneity problem. The endogenous problem can occur due to the wrong choice and measurement of the variable, the omission of the explanatory variable in the model, or the existence of a two-way relationship between the independent and dependent variables. The authors suspect a two-way relationship between Vietnam's logistics capacity and export value in this case. Therefore, to overcome this phenomenon, the authors test the robustness of the model by using the two-stage regression method with the instrumental variable.

Finally, the logistics performance of both Vietnam and the partner country is predicted to have a positive effect on Vietnam's exports, as improving logistics efficiency will facilitate trade, helping goods circulate more efficiently and contribute to encouraging an increase in exports from Vietnam to these partner countries, so both β5 and β6 are expected to have positive values.

Data

This study uses panel data, including 240 observations from Vietnam and 80 major exporting partner countries. Four-year data over the period 2018-2021 were used in the export equation. The value of exports from Vietnam to its 80 major export partners was collected from the United Nations Conference on Trade and Development (UNCTAD). To create the actual export variables, export values were divided by the US GDP deflator (US GDP deflator) obtained from UNCTAD. The GDP data series of Vietnam and partner countries were used as a proxy for the economic size of Vietnam and the purchasing power of 80 export partners collected from the databases of the World Bank and UNCTAD, with the data in US Dollars converted to constant prices in 2020. FTAs between Vietnam and trading partners were collected from the Vietnam Chamber of Commerce and Industry (VCCI). Bilateral distance

data were obtained from the website of Time and Date AS [web của Time and Date AS (http://www. timeanddate.com)].

The logistics data represented by the logistics performance index - LPI - was collected from the World Bank, which introduces these indicators. LPI is measured on a scale of 1 (low) to 5 (high). Table 1 provides an overview of the data for the variables.

Table 1. Descriptive statistics of variables used in the model.

Dependent variable	Note	Number of observations	Average value	Standard deviation	Minimum value	The most significant value.
LnEX	Vietnam's exports to the country j	195	9.236	1.406	6.29	13.027
lnGDPi	Vietnam's GDP	214	12.110	0.171	11.720	12.106
lnGDPj	GDP of country j	195	13.109	1.348	9.201	15.762
lnD	The distance between the capitals of the two countries	214	8.561	0.892	6.182	9.805
FTA	Dummy variable free trade agreement	240	0.172	0.376	0.000	1.000
lnLPIi	Vietnam's logistics performance	214	3.044	0.132	2.885	3.272
lnLPIj	Country logistics performance j.	214	3.158	0.554	1.862	4.201

Note: Variables that are not dummy variables are converted to logarithmic form.
Source: Author's calculation, 2022.

Table 2 provides the correlation index between the variables used in the model. The correlation coefficient in Table 2 shows a pair of explanatory variables with a significant correlation coefficient of 0.6, so there may be multicollinearity phenomena [Wooldrige,2009,25-30]. Therefore, to ensure that the estimated model will not be affected by multicollinearity, the exaggerated variance multiplier (VIF) was employed. Wooldridge [Wooldrige,2009,25-30] suggested that if the VIF is less than 10, multicollinearity will not affect the model. The results of applying VIF will be presented in the next section of estimation results.

Table 2. Impact of each component of the LPI on Vietnam's export value in the period 2018-2021.

Dependent variable	*lnGDPi*	*lnGDPj*	*lnD*	*FTA*	*lnLPIi*	*lnLPIj*
lnGDPi	1					
lnGDPj	0.0661	1				
lnD	0	0.2003	1			
FTA	0.0248	-0.0718	-.05319	1		
lnLPIi	0.6819	0.0156	0	0.0021	1	
lnLPIj	0.0409	0.5095	0.055	-0.1194	0.1150	1

Source: Author's calculation, 2022

Estimation method

Normally, fixed effect (FE) model or variable effect - random effect (RE) model will be used when estimating a model with tabular data because these two methods will give more stable and efficient results than pooled OLS. In addition, the test results when using the Hausman test to consider whether to use FE or RE show that the estimation by RE is appropriate (p-value of Hausman test = 0.3611). With the results of this Hausman test, the analysis of panel data by the RE method will generate more efficient estimation results than the estimation by FE.

In this study, panel data, including time-series and cross-section observations were used, considering the potential correlation phenomena in terms of time and heterogeneity in the residuals of the model. According to Wooldridge, if controlled, these phenomena will produce accurate results when performing tests on the statistical significance of the coefficients in the research model [Wooldridge,2002,245-254]. This article uses the estimation method with standard error through a powerful statement on Stata software to eliminate correlation and heterogeneity.

RESULTS AND DISCUSSIONS

The estimated results of both OLS and RE pooled methods are statistically significant and consistent with the assumptions of the gravity model given above. The R2 index in both models shows that the mentioned variables can explain about 71% of the fluctuations in the export turnover of Vietnam and its 80 principal trading partners during 2018 – 2021 period. Excluding the FTA and logistic performance in Vietnam, the estimated results in both methods were almost unchanged in magnitude and statistical significance, proving the research model's robustness. As mentioned in the research method section, the experimental results from the RE model were employed because estimation results by the random effects model are normally more stable and efficient than by the pooled OLS model. They are used for discussion in this study.

The estimated results show that the logistics performance of Vietnam and its partners positively impacted Vietnam's exports. Both of these indicators are statistically significant at the 99% confidence level. Specifically, if Vietnam's logistics improves by 1%, it will increase Vietnam's exports by 1.443%. Similarly, if the logistics performance of a partner country improves by 1%, it will help Vietnam's exports to this country increase by 0.546%. This is

because improving the quality of logistics operations in Vietnam and the partner country is seen as trade facilitation:

When logistics is enhanced, customs clearance for export shipments from Vietnam will be faster, procedures will be less complicated, and the process will be less unexpected, so it is possible to encourage more exports.

When the logistics infrastructure is upgraded, the traffic and communication to deliver goods to the final consumer will be more secure, thereby increasing the demand for exported goods from Vietnam.

When quality and logistics capacity is improved, customers will be more satisfied and thereby the demand will increase, which will promote a rise in exports.

In case a more competitive freight rate can be obtained, goods exported from Vietnam become more competitive in the partner country and thus will promote more exports. Besides, suppose that logistics gets improved in tracking shipments and delivering goods on time. In that case, it will make partners more trustworthy, reduce losses and foster on-time delivery. All these improvements help to encourage the promotion of exports from Vietnam to its partner countries.

Table 3. Estimation results of Vietnam's export function for the period 2018-2021.

Dependent variable	(1)Pooled OLS lnExport	(2) RE lnExport
ln(GDPi)	1.082*** (0.059)	**1.881***** (0.048)
ln(GDPj)	0.589*** (0.037	**0.641***** (0.882)
lnD	-	–0.612*** (0.112)
FTA	0.487*** (0.275)	0.611*** (0.162)
lnLPIi	–0.025 (0.861)	**1.443*** (0.750)
lnLPIj	0.703* (0.481)	**0.546** (0.396)
Landlock	-	–0.606* (0.340)
TOP	0.026*** (0.002)	0.006*** (0.001)
Block factor	-41.805 (2704)	–32.518*** (2.432)
Hausman test	**31.220*****	
Wooldridge test	**56.310*****	
Wald test	**13.262.160*****	
Several observations	240	240
R^2	**0.728**	**0.707**
Country number	80	80

Note: When considering all variables in the regression model, there are 12 rows containing missing data. Therefore, the number of observations left in the model is 240 observations;
The interpretation of the symbols of the variables is presented in Appendix 2;
ln represents the natural logarithm of the variable;
The data in parentheses ( ) are the standard error values of the estimated coefficients;
*, **, *** are at the 10%, 5% and 1% statistical significance levels, respectively.
Source: Author's calculation, 2022

As predicted by the gravity model, both the economic size of Vietnam and the partner country impact Vietnam's exports. Both of these indices are positive and statistically significant with 99% confidence. Specifically, if Vietnam's GDP increases by 1%, it will boost Vietnam's exports to 1.881%. This is because when GDP increases, proving that Vietnam's economy becomes more extensive, then Vietnam can not only increase the scale of production but also diversify production activities and improve the quality of goods. As a result, Vietnam could produce many different goods with increasing quantity and quality to serve the diverse needs of its partners, so it encouraged the promotion of exports from Vietnam to those countries.

As for the GDP coefficient of the partner country, with a rise of 1%, it will boost Vietnam's exports by 0.641%. This is because when the economic size of the partner country develops, there will be an increase in its people's income, ability to pay as well as their interest and demand for consumer goods from Vietnam, which accordingly helps promote the export of goods from Vietnam.

Also, as can be seen from the gravity model results, the countries with considerable influence on the efficiency of logistics activities to export in Vietnam in this period were divided by region and relationship. Vietnam had export relations with countries in Southeast Asia (ASEAN -10 countries):

Indonesia, Laos, Cambodia, Malaysia, Singapore, Myanmar, Philippines, Thailand, Brunei and East Timor. On average, during 2018-2022, the total two-way trade turnover between Vietnam and ASEAN was estimated at 40.8 billion USD, up 38.5% compared to the period before 2018; exports reached 16.1 billion USD, accounting for 11% of the whole country. The main import and export markets of Vietnam and ASEAN are Thailand (27%), Malaysia (7.4%), Indonesia (15.9), Cambodia (14.5%), and Singapore (12%).It can be said that East Asia region (6 countries), including China; Taiwan; Japan; Korea; North Korea and Mongolia is the busiest area of Vietnam in Asia. China is the market with the most significant total import/export turnover of Vietnam. The average in this period was 51.51 billion USD, accounting for over 24%. Korea is the market with import and export turnover ranked the second with 51.3 billion USD, 11%. The third is Japan, the total bilateral trade turnover between Vietnam and which witnessed an estimated two-way turnover of 27.5 billion USD, with exports reaching about 13.4 billion USD, accounting for 6%. Vietnam recorded positive growth in export turnover to Taiwan with an average of 5.53 billion USD, accounting for 1.92%.

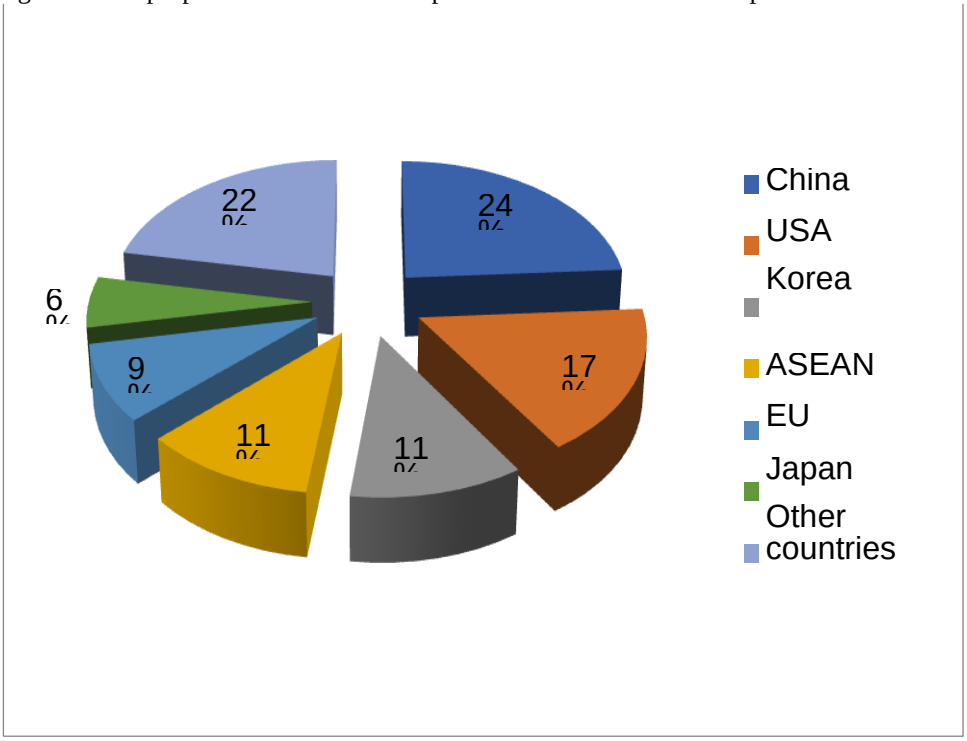
Vietnam also enjoyed turnover from the Middle East and South Asia region (10 countries), including Afghanistan, India, Iran, Israel, Pakistan, Palestine, Turkey, Yemen, UAE

and Qatar. Particularly, the total two-way trade turnover between Vietnam and UAE reached 809 million USD in the period shown.

The European region has three areas: Eastern Europe; Western Europe, and the European Union: specifically: Eastern Europe: Russia (18 countries); Estonia; Latvia; Lithuania; Slovenia; Croatia; Bosnia and Herzegovina; Serbia; Montenegro; North Macedonia; Albania; Bulgaria; Poland; Czech Republic; Slovakia; Hungary; Belarus; Ukraine; Romania and Moldova. Western Europe (16 countries): UK; Belgium; Portugal; Denmark; Virtue; Netherlands; Greek; Luxembourg; Norway; France; Finland; Spain; Switzerland. In terms of trade, the total export turnover from Vietnam to the EU averages 41.7 billion USD/year, accounting for 9%. After two years of implementing the Vietnam-EU Free Trade Agreement (EVFTA), many of Vietnam's exports to the EU market have recorded impressive growth. However, more synchronous solutions in terms of management agencies and businesses are needed to better take advantage of the potential opportunities, especially in logistics activities. Vietnam’s exports to New Zealand and Australia in the Oceania region reached 2.43 billion USD, up 2.8% and accounting for 1.7%.

On average, in the period 2018 - 2021, Vietnam had trade relationship with 27/35 countries in the Americas. The average annual value was about 135-139 billion USD, accounting for 20.7% of Vietnam's total trade turnover with foreign countries. Specifically, Vietnam's imports and exports with this region reached 114 billion USD, up 26.5% and 25 billion USD, up 14.2%, respectively. Notably, trade with all major markets in the region recorded adouble-digit growth rate, namely Chile (54.1%), Mexico (37.5%), Brazil (35.2%), United States (22.9%), Cuba (21.2%), Canada (18.5%), ... These were the largest trading partner countries, especially in the context of the Covid-19 pandemic, which imposed a substantial impact on the economy and society of Vietnam and the Americas as well as on a global scale. Vietnam's export turnover to the African region averaged $2.24 billion USD, with rice being the most important export item (accounting for 20% of the country's total export turnover). The major exporting countries of Vietnam in this region are Algeria, Angola, and Libya.

Figure 1. The proportion of Vietnam's exports to other countries in the period of 2018-2021.



Source: Prepared by author

The estimated results of the distance variable and the gravity model prediction show that the distance between Vietnam and the partner country negatively impacted Vietnam's exports. This coefficient is also statistically significant with 99% confidence. To be specific, when the distance between the two countries increases by 1%, it will reduce exports from Vietnam to partner countries by about 0.612%. This is because when geographical distance increases, transportation costs will also increase. As a result, trade costs for exports will increase, putting Vietnamese goods at a competitive disadvantage in foreign countries.

Regarding model results of logistics components, the impact of six aspects of logistics efficiency and performance index (LPI) on export value was demonstrated, with most of the coefficients giving the same results. Positive and significant results reaffirm that enhancing logistics operations in exporting and importing countries is essential in promoting trade. Moreover, for efficiency and performance and its components (except for the Tracking variable), the results in Table 4 confirm the more significant impact of Vietnam's logistics capacity compared to that of the import country.

Table 4. Impact of each component of efficiency and performance index on Vietnam's export value.

Dependent variable	(1) lnExport	(2) lnExport	(3) lnExport	(4) lnExport	(5) lnExport	(6) lnExport
ln(GDPi.GDPj)	0,875*** (0,019)	0,891*** (0,025)	0,859*** (0,021)	0,886*** (0,022)	0,884*** (0,022)	0,833*** (0,037)
lnDistance	–0,542*** (0,034)	-0,530*** (0,036)	-0,542*** (0,031)	-0,506*** (0,036)	-0,537*** (0,034)	-0,529*** (0,081)
lnCustomsi	1,010* (0,535)					
lnCustomsj	0,459*** (0,147)					
lnInfrastructurei		0,851*** (0,282)				
lnInfrastructurej		0,315** (0,159)				
lnCompetencei			1,588*** (0,363)			
lnCompetencej			0,636*** (0,163)			
lnShipmenti				3,684*** (1,000)		
lnShipmentj				0,616*** (0,210)		
lnTrackingi					–0,079 (0,343)	
lnTrackingj					0,549*** (0,186)	
lnTimelinenessi						2,275** (1,063)
lnTimelinenessj						0,299 (0,411)
FTA	0,847*** (0,065)	0,858*** (0,068)	0,867*** (0,065)	0,909*** (0,064)	0,882*** 0,065	1,036*** (0,154)
Landlock	–0,460*** (0,109)	-0,434*** (0,118)	-0,462*** (0,124)	-0,428*** (0,125)	–0,462*** (0,114)	–0,416*** (0,152)
TOP	0,003*** (0,000)	0,003*** (0,001)	0,003*** (0,000)	0,003*** (0,001)	0,003*** (0,000)	0,003*** (0,001)
Block factor	–31,005*** (1,087)	–30,650*** (1,178)	–30,064*** (0,959)	–34,258*** (1,301)	–29,506*** 1,032)	–29,612*** (1,836)
Several observations	240	240	240	240	240	240
Country number	80	80	80	80	80	80

Note: When considering all variables in the regression model, there are 12 rows containing missing data. Therefore, the number of observations left in the model is 240 observations;
The interpretation of the symbols of the variables is presented in Appendix 2;
ln represents the natural logarithm of the variable;
The data in parentheses ( ) are the standard error values of the estimated coefficients;
*, **, *** are at the 10%, 5% and 1% statistical significance levels, respectively.
Source: Author's calculation, 2022

Of the six components of the performance index, Vietnam's logistics efficiency (LPI), Regardless of customs clearance efficiency and infrastructure quality, show a relatively small effect. Meanwhile, delivery time and the capacity and quality of logistics services are the three most influential factors in explaining the role of logistics activities in the country's exports. This trend can be explained by the fact that the customs clearance process and the quality of

infrastructure largely depend on the government and public sector policies. At the same factors such as time, delivery, logistics capacity, shipment tracking and transit times are decided on the business side to respond to market fluctuations more easily.

The study also confirms the importance of two elements, namely cost and logistics services for the logistics system of Vietnam. Regarding the logistics activities of importers, except for the time, the remaining components all show a positive impact on Vietnam's exports, with coefficients ranging from 0.315 (Infrastructure) to 0.636 (Capacity).

The estimated results of the FTA variable show that participation in free trade agreements has a positive impact on Vietnam's exports when this coefficient is positive, however this positive result is insignificant. Because of statistical significance, this study discontinued analyzing the effect of the free trade agreement variable.

The test results using the variance exaggeration factor (VIF) method are presented in Table 5. Here we can conclude that the model's estimated effects are not affected by the current multicollinearity.

Table 5. Multicollinearity Test.

Dependent variable	VIF	1/VIF
lnGDPi	3.33	0.5501
lnGDPj	2.19	0.5119
lnD	2.71	0.6048
FTA	2.62	0.6701
lnLPIi	1.70	0.6228
lnLPIj	1.53	0.6041
Mean VIF	**1.82**	

Source: Author's calculation, 2022

Check the stability of research results in the model

With statistically significant estimation results in the proposed research models, the random effects method may still face endogenous problems due to the autocorrelation inthe dependent variable, export value, bilaterally of Vietnam. Therefore, the research models are considered to add lagged variables of the independent variable to limit the opposite impact of the dependent variable on the independent variables in the model. Table 6 in column (3) shows the estimated results using lagged variables in equation (2).

This study continues to test the sustainability of the research model by changing the variables representing the right side of equation (2). Specifically, the variable representing the size of the partner country's economy (GDP) is replaced by the per capita income variable in the partner country, PPPj. The results of estimating equation (2) with the new representative variable by the RE estimation method are presented in Table 5, column (4).

This further confirmed the sustainability of the research results. In all cases, the primary variable to be studied in this paper - the logistics performance variables constantly produces similar results to the previous estimates. Thus, the estimated effects of the gravity model in this study are not affected by the application of the representative variable.

Table 6. Impact of national logistics capacity on Vietnam's export value. – replace LPI with indexes (3) RE and (4) RE

Dependent variable	**(3)RE lnExport**	**Dependent variable**	**(4)RE lnExport**
lnGDPi	0.701*** (0.045)	lnGDPi	1.651*** (0.033)
lnGDPj	0.669*** (0.075)	lnPPPj	0.435*** (0.137)
lnD	–0.486*** (0.058)	lnD	-0.581*** (0.069)
Ln(3)REi	0.400*** (0.120)	Ln(3)REi	
Ln(3)REj	0.689*** (0.076)	Ln(3)REj	
Ln(4)REi		Ln(4)REi	1.197*** (0.383)
Ln(4)REj		Ln(4)REj	0.402** (0.196)
FTA	1.014*** (0.135)	FTA	1.018*** (0.147)
lnLPIi	1.172*** (0.337)	lnLPIi	1.146*** (0.332)
lnLPIj	1.181*** (0.400)	lnLPIj	1.209** (0.565)
TOP	0.002*** (0.001)	TOP	0.002*** (0.001)
Landlock		Landlock	–0.499*** (0.151)
Block factor	–19.557*** (1.800)	Block factor	–28.993*** (1.689)
Several observations	195	Several observations	240
Country number	76	Country number	80
R2	**0.764**	**R2**	**0.454**

Note: When considering all variables in the regression model, there are 12 rows containing missing data. Therefore, the number of observations left in the model is 240 observations;
The interpretation of the symbols of the variables is presented in Appendix 2;
ln represents the natural logarithm of the variable;
The data in parentheses ( ) are the standard error values of the estimated coefficients;
*, **,*** are at the 10%, 5% and 1% statistical significance levels, respectively.
Source: Author's calculation, 2022

RESEARCH, PRACTICAL & SOCIAL IMPLICATIONS:

This study is of great significance. It shows the logistics performance of Vietnam's exporting country with partner countries. It shows the influence of the logistics performance of the partner country on Vietnam through the variables used in the model: Vietnam's exports to

the partner country; Vietnam's GDP, GDP of the partner country; the distance between the capitals of the two countries; Commercial activity dummy variable; and logistics performance results of Vietnam and partner countries. This study will have outstanding theoretical and practical significance for Vietnam and partner countries to determine the efficiency of logistics activities based on the impact of factors such as transportation cost, ranking data, infrastructure, and some related administrative procedures.

The variables affecting Vietnam's LPI in this study are similar to those identified by some researchers. The efficiency of logistics activities to export is the best reflection of that country's trade activity (Wilson and & Delaney, 2002). Using the gravity model in logistics analysis confirms that the model is effective (Tho, 2013). Costs affect logistics services, and the speed of economic development affects the logistics service business. The general reflection can be applied to logistics and distribution principles in any country in the world.

The impact of exchange rate fluctuations on Indonesia's trade during the 1990s confirms that exchange rate changes significantly impacted logistics services and required government intervention to control this ratio. According to these studies, logistics performance plays a vital role in determining the factors affecting costs and the need to minimize expenses, especially the highest costs such as transport infrastructure: information, fuel costs and time costs for administrative procedures .

However, the estimated results of the variables in this study, particularly the robustness of the research results in the RE model, have been checked. Specifically, here, the variable representing the size of the economy of the partner country (GDPj) is replaced by the variable per capita income in the partner country (PPPj). This is a novelty that other studies have not done yet.

Moreover, this study is instrumental in research and teaching at universities, colleges and logistics management subjects because it uses the gravity model and panel data of 80 partner countries with Vietnam to analyze the logistics performance. Through that, the students can acquire a comprehensive view of the research process from descriptive statistics of the variables used in the model as well as the impact of each component of the LPI on Vietnam's export value. On the other hand, this study shows the sustainability of the research results when the representative variables are changed. It can be seen that this study is beneficial for Vietnamese exports in particular and foreign partners, businesses and related organizations in general.

ORIGINALITY/VALUE

The originality of the article: "Efficiency and performance of global supply chain activities in logistics for Vietnam's exports: An empirical case study". The article uses a model (LPI) to identify factors affecting logistics activities in Vietnam's goods exports in the period 2018-2020.

Research results show that countries that have a great influence on Vietnam's exports such as China, Korea; Japan... This is an information channel to help the Government of Vietnam as well as businesses see the impact on export activities between countries. Besides, the research results show that the cost, time and capacity of providing logistics services have the most significant impact on Vietnam's exports.

The novelty in this study confirms the sustainability of the extended gravity model using OLS and RE methods by substituting different variables for the country's logistics efficiency and solving the problem of endogeneity in the model. Simultaneously apply the regression method to industrial variables. We find that a 1% improvement in Vietnam's logistics will boost Vietnam's exports by 1,443 percent, and a 1% improvement in a partner country's performance will help boost Vietnam's exports to Vietnam. this country by 0.546%. It can be affirmed that this is a very practical research project.

CONCLUSIONS

In this paper, the authors have developed a new search-and-match model that reflects that logistics activities in Vietnam during this period had an evident influence on exports: The lack of empty containers and international cargo ships has recently caused the price of international freight to be even more than three times higher. The pandemic has caused great difficulties for Vietnamese export enterprises. As a result, it's more than just businesses that have been hit hard by rising costs and lost opportunities to ship goods. The authors have calibrated the model to assess the impact on Vietnam's logistics efficiency in 2018-2021. Estimated results of the extended gravity model by OLS and RE methods reveal that the size of the economy, the level of market development, the geographical distance, the FTA and its forms significantly impacted bilateral trade between Vietnam and its partners. Meanwhile, no conclusion was found for the hypothesis that the size of the partner country's economy (GDP) would be replaced by the per capita income (PPPj) variable in the partner country.

Overall, The research results show that China has Vietnam's most significant export activities. Next come the United States, Korea, ASEAN, EU, Japan and other countries. In

addition, the Government needs to popularize the importance of logistics for Vietnamese exporters, orienting Vietnamese enterprises to export to markets with favourable logistics performance indexes, making it easier to increase export turnover to these markets.

At the same time, the research team's results show the importance of logistics for Vietnam's exports. Accordingly, policymakers need to have more appropriate policies to promote sustainable investment in logistics to further improve its operational efficiency to create conditions for competitiveness and growth of Vietnam's exports.

Therefore, future studies should continue to clarify which specific logistics criteria will impact Vietnam's international trade most for policymakers to refer to. Last but not least, more specific policies need to be proposed to improve the efficiency of logistics activities, thereby promoting foreign exchange and economic flourish of Vietnam.

This study confirms the critical role of logistics in Vietnam's exports by demonstrating that improving logistics will encourage exports from Vietnam to its main trading partners. However, the logistics performance index combines six specific criteria: customs, infrastructure, quality, capacity, international shipping and tracking and traceability standards. Therefore, future studies must continue to clarify which logistics criteria will impact Vietnam's international trade most for policymakers. And come up with more specific policies to improve the efficiency of logistics activities, thereby promoting foreign exchange and economic growth in Vietnam.

AUTHOR CONTRIBUTIONS

Conceptualization, TTTX, NTT; Methodology, MB, PHQ; BTT Formal analysis, ĐQT, TTH; Investigation, TTTX, MB, PHQ, NVT, NNT Writing—original draft preparation, TTX, MB, NVT; Writing—review and editing, TTTX, MB. All authors have read and agreed to the published version of the manuscript.

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INFORMED CONSENT STATEMENT

Not applicable

DATA AVAILABILITY STATEMENT

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CONFLICTS OF INTEREST

There is no conflict of interest between any authors of this paper

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APPENDIX

Appendix 1. Components of the LPI.

English	Explain
Customs	Customs efficiency (speed, simplicity and predictability of customs clearance procedures)
Customs	Quality of infrastructure related to trade and transport, including Roads, railways, ports, airports, warehouses and information technology..
International Shipments	The level of ease when arranging to transport import and export goods with competitive prices (costs such as warehousing fees, port fees, tolls...).
Competence	Capacity and quality of logistics service providers..
Tracking	Ability to track and trace shipments.
Timelineness	Timeliness of the shipment to the destination within the specified time limit.

Appendix 2. Definitions and data sources

Dependent variable	Define	Data sources (Data collected in 2021)
Export	Export value of Vietnam (million USD).	UNCOMTRADE. Access from the website: https://comtrade.un.org/data
GDPi	Value of Vietnam's domestic product (millions of USD).	WorldBank. Access from the website: https://data.worldbank.org/indicator/NY.GDP.MKTP.CD
GDPj	Value of domestic product of the partner country (millions of USD).	WorldBank. Access from the website: https://data.worldbank.org/indicator/NY.GDP.MKTP.CD
Distance	The geographical distance between Vietnam and the partner country (km).	CEPII-GeoDist Access from the website: http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=6
LPIi	Vietnam logistics performance index.	WorldBank. Access from the website: https://lpi.worldbank.org/international/aggregated-ranking
LPIj	Import country logistics performance index.	WorldBank. Access from the website: https://lpi.worldbank.org/international/aggregated-ranking
Customii	Efficiency index of Vietnamese customs authorities.	WorldBank. Access from the website: https://lpi.worldbank.org/international/aggregated-ranking
Customij	Efficiency index of the importing country's customs authorities.	
Infrastructurei	Quality index of Vietnam's trade and transport infrastructure	
Infrastructurej	Quality index of trade and transport infrastructure of the importing country.	
Competencei	Performance and quality index of Vietnamese logistics service providers.	
Competencej	Performance and quality index of logistics service providers in the importing country.	
Shipmenti	Index of how easy it is to arrange the transportation of import and export goods at competitive prices in Vietnam.	

Shipmentj	An indicator of how easy it is to arrange for the transportation of imported and exported goods at competitive prices in the importing country..	
Timelinessi	Index of on-time arrivals of Vietnamese shipments.	
Timelinessj	An indicator of the on-time arrival of shipments from the importing country.	
Trackingi	Index of tracking and traceability of Vietnamese shipments..	
Trackingj	Index of tracking and traceability of the importing country's shipments.	
(3)Rei	Maritime Connectivity Index of Vietnam.	Worldbank. Access from the website: https://data.worldbank.org/indicator/IS.SHP.GCNW.XQ
(3)REj	Index of maritime connectivity of the importing country.	Worldbank. Access from the website: https://data.worldbank.org/indicator/IS.SHP.GCNW.XQ
(4)Rei	Vietnam's transport infrastructure index.	Global Competitiveness Index Data. Access from the website: http://reports.weforum.org/globalcompetitiveness-index-2017- 2018/#topic=data
(4)Rej	Transport infrastructure index of the importing country.	Global Competitiveness Index Data. Access from the website: http://reports.weforum.org/globalcompetitiveness-index-2017- 2018/#topic=data
TOP	The trade openness of an importing partner country is measured as a percentage of total import and export value compared to that country's GDP.	WorldBank. Access from the website: https://data.worldbank.org/indicator/TG.VAL.TOTL.GD.ZS
FTA	The dummy variable takes the value of 1 if Vietnam and the importing country have signed at least 01 bilateral or regional trade agreement and 0 otherwise.	The author group synthesizes information from the website:https://trungtamwto.vn/fta
Landlock	Get the value one if the importing country has no sea border and 0 otherwise..	CEPII-GeoDist. Access from the website: http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=6
Quality regulations;	Government's ability to formulate policies that encourage private sector development.	The Global Innovation Index. Access from the website: https://www.globalinnovationindex.org/analysis-indicator
Telecommunications infrastructure	Information and communication technology infrastructure capacity	United Nations – E-Government Survey Data. Access from the website: https://publicadministration.un.org/egovkb/en-us/data-center

Appendix 3: Descriptive statistics of variables used in the model

Dependent variable	Number of observations	Average value	Standard deviation	Minimum value	The most significant value.
LnEX	195	9.236	1.406	6.29	13.027
lnGDPi	214	12.110	0.171	11.720	12.106
lnGDPj	195	13.109	1.348	9.201	15.762
lnD	214	8.561	0.892	6.182	9.805
FTA	240	0.172	0.376	0.000	1.000
lnLPIi	214	3.044	0.132	2.885	3.272
lnLPIj	214	3.158	0.554	1.862	4.201
Infrastructurei	195	2.759	0.223	2.550	3.101
Infrastructurej	214	3.709	0.673	1.658	4.192
Competencei	195	2.942	0.173	2.601	3.009
Competencej	214	3.152	0.570	1.701	4.316
Shipmenti	240	3.118	0.057	3.001	3.290
Shipmentj	195	3.120	0.483	1.723	4.239
Timelinessi	214	3.949	0.150	3.600	3.801
Timelinessj	195	3.544	0.533	2.008	3.310
Trackingi	214	3.000	0.203	2.831	3.429
Trackingj	240	3.2430	0.553	1.508	4.312
TOP	195	0.420	0.373	0.000	1.000
FTA	214	0.0420	0.293	0.000	1.000
Landlock	240	91.973	67.047	0,218	430.569