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Impacts of logistics on Vietnam's exports: A stochastic frontier gravity analysis

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ABSTRACT

Over the past two decades, export-related activities have accounted for nearly half of Vietnam's gross domestic product, pivotal in the country's economic development and integration into the global trading system. Given the critical importance of exports to Vietnam's economy, a substantial body of literature has examined various potential determinants of export performance. Among these, logistics is widely regarded as a key factor influencing trade outcomes. However, empirical studies investigating the relationship between logistics performance and Vietnam's exports remain limited. Furthermore, existing research has primarily overlooked unobserved trade inefficiencies, which may significantly constrain export potential. This study addresses these gaps by applying a stochastic frontier gravity model, which enables the estimation of observable trade determinants while accounting for unobserved inefficiencies, to analy e the impact of logistics performance on Vietnam's export flows. The model is estimated using the bilateral trade data between Vietnam and 159 importing countries from 2007 to 2022. A bilateral logistics variable is constructed using the World Bank's Logistics Performance Index (LPI), reflecting the relative efficiency of logistics systems between Vietnam and its trading partners. The empirical results confirm the presence of significant export inefficiencies and demonstrate that improvements in logistics performance have a positive and statistically significant effect on actual and potential export values. Notably, the impact is more significant for potential exports, indicating substantial unreali ed trade opportunities. These findings remain robust after controlling for time-specific external shocks and interpolating missing LPI data for intervening years. Addiionaly, by quantifying export efficiencies and emphasi ing the role of logistics, the study underscores the strategic importance of sustained investment in logistics infrastructure and the continued development of the logistics services sector to enhance Vietnam's export performance.

Key words: logistics, export, Vietnam, stochastic frontier gravity analysis

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INTRODUCTION

Exports have played a crucial role in driving Vietnam's economic growth. Beyond the direct contribution to GDP, exports have also served as a buffer against macroeconomic instability, helping to sustain economic recovery during periods of downturn[1,2]. According to the World Bank (WB)[3], Vietnam benefits from trade with foreign partners more than most countries. In 2021, the ratio of total exports to Vietnam's gross domestic product (GDP) reached 93%, while export-related employment accounted for 54% of the country's total workforce—significantly higher than comparable figures for South Korea, Thailand, Malaysia, Indonesia, the Philippines, and China.

The importance of exports to Vietnam's economy is further highlighted by data from the Organization for Economic Co-operation and Development's (OECD) Trade in Value-Added (TiVA) database (Figure 1). In 1995, direct and indirect value-added contributions from exports accounted for approximately 18.6% and 8% of Vietnam's total value-added, respectively. By 2020, these figures had risen sharply to 30.1% and 18.6%, with the combined share of exports-related value-added reaching 49.3% of GDP. This means that nearly half of Vietnam's economy is driven by export-related activities. Among Southeast Asian economies, only Singapore exhibits a higher dependence on exports[4].

Source: Author's processing based on OECD TiVA data.

Recogni ing the importance of international trade, particularly exports, and global economic integration, Vietnam has actively pursued free trade agreements (FTAs) with key trading partners. As of this study, Vietnam has concluded 17 FTAs[5]. Complementing trade liberali ation efforts, the Vietnamese government prioriti es logistics development. Decision No. 493/QD-TTG, outlining a vision for 2030, explicitly identifies improvements in logistics infrastructure and reductions in logistics costs as crucial for export development. According to the Vietnam Logistics Report 2024[6], the total length of constructed

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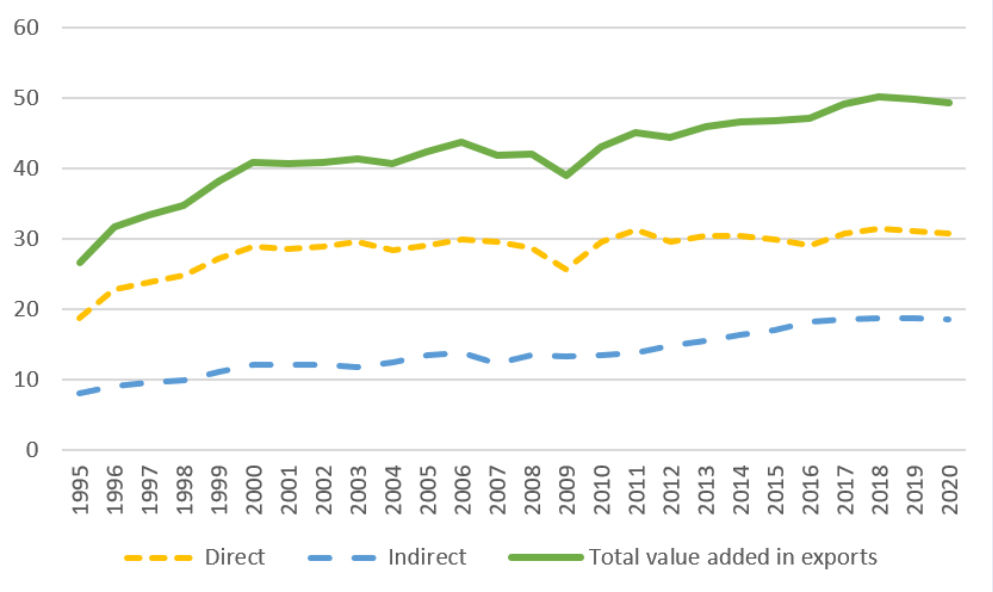

Figure 1: Vietnam'svalue added in exports (% of value added in the economy)

expressways exceeds 2,000 kilometres. Vietnam has three seaports ranked among the world's top 50: Ho Chi Minh City, Hai Phong, and Cai Mep. The country's seaport infrastructure can accommodate container vessels of up to 214,000 deadweight tonnage. Vietnam operates thirteen international airports located in its three central regions. Despite documented progress in Vietnam's logistics sector, reflected in the World Bank's Logistics Performance Index (LPI) from 2007 to 2023, logistics costs remain high compared to many other countries[7], thereby hindering export competitiveness.

Logistics is vital in facilitating global trade, encompassing various activities to efficiently and effectively move goods from producers to foreign markets. Christopher[8] defines logistics as the strategic management of procurement, transport, and storage of materials, parts, and finished goods to profitably and cost-efficiently fulfil orders. This involves planning, implementing, and controlling product flows, storage, and related services and information[9]. Logistics improvements can significantly reduce bottlenecks and facilitate international trade[10–16].

Extant literature includes several studies examining the relationship between logistics and Vietnam's exports. Huynh[1] explored the impact of logistics on aggregate trade value between Vietnam and 48 partners from 2010 to 2018, finding significant roles for both Vietnam's and its partners' logistics performance in promoting Vietnamese exports. Le[17,18] explored the interplay between logistics and economic integration in the agricultural and aquacultural sectors (2007–2018), reporting mixed results depending on the estimation technique. The Heckman two-step selection model and Poisson Pseudo-Maximum Likelihood (PPML) model, which addresses zero-trade issues, found Vietnam's logistics performance insignificant[17]. Meanwhile, random and fixed effects models, which control for panel heterogeneity but not zero-trade issues, also reported insignificant effects of logistics on aquacultural exports[18]. The system Generalized Method of Moments (SGMM) estimator, which accounts for endogeneity, identified significant impacts of logistics performance on exports[17,18]. However, while SGMM can address endogeneity, the required log transformation of the dependent variable can introduce bias due to zero-trade values. As suggested by Kahouli[19], dynamic models, such as SGMM, are more appropriate for analy ing trade between partners with established, intensive trade relationships.

Tran et al.[20] integrated the six subindices of the WB's LPI with emissions data to construct a green logistics indicator, building on the framework proposed by Fan et al.[21]. Their study examined the impact of green logistics on Vietnam's exports to Regional Comprehensive Economic Partnership (RCEP) member countries from 2012 to 2018. Using random effects models, they found a significant and positive relationship between overall green logistics and Vietnam's exports. However, when analy ing individual

components, CO_2 and N_2O emissions were also positively and significantly associated with exports, suggesting that higher emission intensity may enhance trade—a result contradicting Fan et al.'s findings.

Using the PPML estimator, Doan and Vu[22] examined the effects of logistics performance on Vietnam's exports (2007–2018) and found that both Vietnam's and its partners' logistics performance positively influenced exports. Among the LPI sub-indices, tracking and tracing capabilities, logistics service competence, customs clearance efficiency, and timeliness were particularly significant.

Despite variations in estimation methods, sample periods, and country coverage, most studies on the logistics–exports relationship in Vietnam have relied on the gravity trade model, using the WB's LPI as a proxy for logistics efficiency[1,17,18,20,22]. While the gravity model is widely used in international trade studies[23], it does not account for unobserved "behind-the-border" inefficiencies within the exporting country that may hinder trade performance[24,25]. Kalirajan[26] introduced a stochastic frontier gravity model (SFGM) to incorporate inefficiencies. Nguyen[24] and Pham et al.[27] applied this approach to analy e Vietnam's potential trade, but their studies focused exclusively on agricultural products. They did not examine logistics' role in exports.

This study is the first to apply a stochastic frontier gravity model to assess the impact of logistics on Vietnam's exports, addressing a key gap in the literature. Using trade data spanning 2007–2022 for Vietnam's exports to 159 countries, the analysis finds a statistically significant and positive effect of logistics on export performance. The findings remain robust after interpolating the WB LPI and incorporating time dummies.

The paper proceeds as follows: Section 2 details the methodology, Section 3 describes the data, Section 4 presents and discusses the empirical results, and Section 5 concludes the study.

METHODOLOGY

Gravity model of trade

The gravity equation is widely recogni ed as the primary econometric approach in international trade literature[28]. It has been extensively used for its empirical success and flexibility[23]. Based on the metaphor of Newton's Law of Gravitation in physics, the gravity model posits that trade between two countries is proportional to their economic sizes and diminishes with the distance between them. Tinbergen[29] was among the first to adopt the gravity model for analyzing international trade. In its basic form, geographical distance is the sole factor representing trade resistance. However, as the model gained popularity, researchers incorporated additional determinants of trade resistance, such as institutional quality, language, free trade agreements, and colonial ties[23,30,31].

This study employs an augmented log-linear gravity model to analy e Vietnam's exports, specified as follows:

$$\text{Exports}_{jt} = \beta_0 + \beta_1\text{Logistics}_{jt} + \beta_2\text{GDP}_{jt} + \beta_3\text{Institution}_{jt} + \beta_4\text{Exchange}_{jt} + \beta_5\text{RTA}_{jt} + \beta_6\text{Distance}_j + \beta_7\text{Border}_j + \beta_8\text{WTO}_{jt} + \varepsilon_{jt} \quad (1)$$

The key explanatory variable of this study is $Logistics_{jt}$, computed as the natural logarithm of the sum of Vietnam's and partner's logistics development levels in year t, as suggested by Behar et al.[13]. Song and Lee[32] also applied this approach to examine the relationship between logistics and South Korea's international trade.

The dependent variable, $Exports_{jt}$, represents the natural logarithm of Vietnam's exports to importing country j in year t. Besides logistics development, additional potential determinants of Vietnam's trade with its partners, controlled in Equation (1), include bilateral economic size, institutional quality, exchange rate, regional trade agreements (RTAs), geographical distance, shared borders, and the partner's World Trade Organization (WTO) membership.

The bilateral economic size variable (GDP_{jt}) is the natural logarithm of the product of Vietnam's GDP and that of its trading partner's GDPs in year t. In the gravity model, economic size represents the attraction forces driving trade between countries.

Beyond traditional barriers such as tariffs and quotas, informal barriers stemming from institutional factors can also hinder international trade[31]. The variable for bilateral institutional quality ($Institution_{jt}$) is represented as the natural logarithm of the product of Vietnam's and its partner's institutional quality.

The exchange rate variable (*Exchange*) is defined as the natural logarithm of the price of the Vietnamese Dong in terms of the currency of importing country's currency in year t. An increase in this exchange rate makes Vietnamese products relatively more expensive, thereby negatively affecting exports and vice versa.

RTA_{jt} is a binary variable that takes a value of 1 if Vietnam and country j are both members of a regional trade agreement in year t and zero otherwise. The existence of RTAs between Vietnam and its trade partners is expected to facilitate bilateral trade.

The natural logarithm of geographical distance (*Distance*) between Vietnam and importing country *j* serves as a proxy for transportation costs and reflects the information asymmetry between producers and foreign buyers. In international trade literature, geographical distance is often a significant trade resistance factor.

$Border_j$ is a dummy variable equal to 1 if Vietnam shares a land border with country j and zero otherwise. This variable captures the notion that neighbouring countries tend to trade more.

Vietnam has been a member of the WTO since 2007. WTO membership facilitates trade between Vietnam and other member countries. Therefore, WTO_{jt} is assigned a value of 1 if country *j* is a WTO member in year *t* and zero otherwise.

Finally, ε_{jt} represents the error term.

Stochastic frontier gravity model

In the gravity trade model, actual bilateral trade is assumed to occur at its potential level. However, various "behind-the-border" constraints in the exporting country can prevent trade from reaching its full potential. Identifying and quantifying all such inefficiencies may be beyond the scope of researchers[33]. To address this challenge, Kalirajan[25,26] proposed the Stochastic Frontier Gravity Model (SFGM), which incorporates and accounts for these "behind-the-border" constraints.

The general form of the SFGM is expressed as:

$$X_{ij} = f(z_i, \beta)\xi_i \exp(v_i) \quad (2)$$

where X_{ij} represents the actual exports from country *i* to country *j*. The term $f(z_i, \beta)$ denotes the potential trade, a function of determinants z_i, with β being the corresponding parameter vector. Trade efficiency, ξ_i takes values in the interval (0, 1], where $\xi_i < 1$ indicates that actual trade X_{ij} falls short of the potential level $f(z_i, \beta)$. The term v_i represents the idiosyncratic component.

By taking the natural logarithm of both sides and defining $u_i \equiv -\ln(\xi_i)$, Equation (2) transforms into:

$$\ln X_{ij} = \ln f(z_i, \beta) + (v_i - u_i) \quad (3)$$

where u_i is a non-negative, one-sided error term that captures the impact of all "behind-the-border" constraints in the exporting country *i*. The presence of u_i leads to the inability of the exporting country to reach its full export potential, preventing it from attaining the export frontier.

Substituting the error term into Equation (1) results in:

$$Exports_{jt} = \beta_0 + \beta_1 Logistics_{jt} + \beta_2 GDP_{jt} + \beta_3 Institution_{jt} + \beta_4 Exchange_{jt} + \beta_5 RTA_{jt} + \beta_6 Distance_j + \beta_7 Border_j + \beta_8 WTO_{jt} - u_{jt} + v_{jt} \quad (4)$$

where u_{jt} follows a half-normal distribution $N^+(0, \sigma_u^2)$, while v_{ij} is normally distributed as $N(0, \sigma_v^2)$. The two error terms are assumed to be identically and independently distributed.

DATA

This study draws on data from multiple sources. Vietnam's export data are obtained from the Centre d'Études Prospectives et d'Informations Internationales (CEPII) BACI database, covering 159 bilateral trade linkages. Logistics efficiency is measured using the overall score from the WB's LPI. The study employs the Economic Freedom Index from the Heritage Foundation to assess institutional quality. Exchange rate data are sourced from the International Monetary Fund (IMF), while geographical distance and border data are derived from the CEPII Geodist database. Finally, information on RTAs and trade partners' WTO membership is obtained from the WTO database.

Due to the availability of the WB's LPI, the initial analyses in this study are limited to the years 2007, 2010, 2012, 2014, 2016, and 2018. As of the time of this study, the most recent version of the LPI was published in early 2023. However, export data from the CEPII BACI database is only available up to 2022. The missing LPI values for intervening years are linearly interpolated in subsequent analyses to maximi e the use of all available annual data from 2007 to 2022.

Table 1 presents the data description. Since all trade data are aggregated, zero-trade issues are not present. Moreover, the summary statistics indicate that the log-transformed values of Vietnam's exports remain positive, satisfying the positivity requirement of the stochastic production frontier model. With the exception of binary variables (*RTA*, *Border*, and *WTO*), all other variables are converted to their natural logarithms to facilitate elasticity estimation.

Figure 2 provides an overview of the relationship between logistics performance and Vietnam's exports. The scatter plot suggests a strong linear association, with higher logistics performance corresponding to increased export levels. The fitted trend line exhibits an upward trajectory, reinforcing the notion that enhancements in logistics efficiency may contribute to more excellent export performance for Vietnam.

Table 2 presents the pairwise linear correlation between variables in the model. Column (1) shows that logistics and GDP exhibit strong positive correlations with the dependent variable, suggesting their potential influence on Vietnam's export performance. However, some explanatory variables also display

Table 1: Descriptive statistics

Variable	Mean	Std. dev.	Min	Max
Exports (log)	11.303	2.391	2.146	17.691
Logistics (log)	1.779	0.098	1.528	2.011
GDP (log)	50.894	2.105	45.339	57.113
Institution (log)	8.051	0.164	7.374	8.464
Exchange (log)	-6.951	2.783	-11.226	0.592
RTA	0.107	0.310	0.000	1.000
Distance (log)	8.988	0.703	5.352	9.883
Border	0.022	0.146	0.000	1.000
WTO	0.899	0.302	0.000	1.000

Source: Author's calculation based on CEPII, Heritage Foundation, IMF, WB, and WTO data.

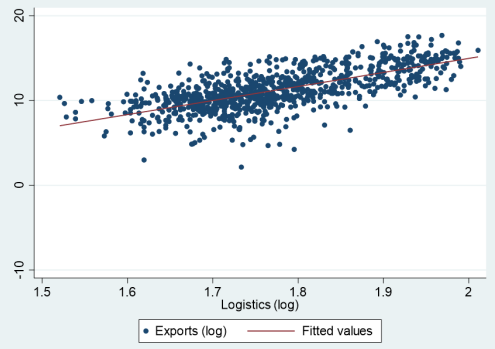

Figure 2: Relationshipbetween Vietnam's exports and logistics (*Source: Author's processing.)*

high correlations with each other, raising potential collinearity concerns.

In Column (2), GDP and institutional quality strongly correlate with logistics, which aligns with economic expectations. Larger economies invest heavily in transport-related infrastructure, leading to higher logistics efficiency. Similarly, institutional factors are critical for logistics sector development, as efficient governance, regulatory stability, and transparency foster better infrastructure and trade facilitation. This relationship is supported by Wong and Tang[34] high logistics performance levels are often associated with low corruption levels and stable political conditions.

A particularly notable finding in Column (6) is the strong negative correlation between RTA and Distance, indicating that Vietnam is more likely to establish RTAs with geographically closer trading partners. This trend is economically intuitive, as proximity reduces trade costs and encourages regional integration.

Given the strong correlations observed among some explanatory variables, a multicollinearity assessment is necessary for subsequent empirical analyses to ensure the robustness and reliability of the estimations.

EMPIRICAL RESULTS AND DISCUSSIONS

Stand regressions using the Ordinary Least Squares (OLS)

The initial analysis employs the Ordinary Least Squares (OLS) estimator on the gravity model specified in Equation (1). The corresponding results are presented in Table 3, where Column (1) reports estimates using conventional standard errors, while Column (2) incorporates robust standard errors and includes time dummies. The model demonstrates a good fit, as indicated by the overall model tests and the adjusted R-squared values exceeding 80%. Ex-

Table 2: Pairwise correlation matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Exports	1.000								
(2) Logistics	0.679	1.000							
(3) GDP	0.859	0.742	1.000						
(4) Institution	0.379	0.677	0.405	1.000					
(5) Exchange	-0.237	-0.468	-0.313	-0.386	1.000				
(6) RTA	0.431	0.187	0.259	0.096	0.157	1.000			
(7) Distance	-0.287	-0.050	-0.071	0.027	-0.169	-0.684	1.000		
(8) Border	0.205	-0.018	0.033	-0.117	0.185	0.430	-0.487	1.000	
(9) WTO	0.170	0.222	0.144	0.280	-0.103	0.065	0.046	-0.032	1.000

Source: Author's calculation.

pressly, the null hypothesis that all coefficients are jointly equal to zero is rejected at the 1% significance level in both specifications.

However, the Breusch–Pagan and Cook–Weisberg (BPCW) test in Column (1) rejects the null hypothesis of homoscedasticity, indicating the presence of heteroscedasticity. Consequently, Column (2) corrects this issue by applying robust standard errors. Additionally, time dummies are incorporated to account for time-specific external shocks.

As shown in Table 3, logistics has a statistically significant and positive impact on Vietnam's exports. Including time dummies alters the estimated coefficient for logistics, suggesting that its effect may be more significant when time-specific external shocks are accounted for. Specifically, after controlling for time dummies, a 1% improvement in logistics performance is associated with a 2.5% increase in Vietnam's exports. Furthermore, applying robust standard errors in Column (2) does not affect the statistical significance of the logistics variable, reinforcing the robustness of this finding.

Other key explanatory variables, including economic size (GDP), RTAs, common land borders, and WTO membership, have significant positive effects on exports, aligning with theoretical expectations. In contrast, geographical distance has a significant negative effect at the 1% level, reflecting the well-documented trade-reducing impact of distance. Meanwhile, the exchange rate shows an insignificant effect, and although the coefficient for institutional quality is positive, it is not statistically significant.

To evaluate potential multicollinearity, variance inflation factors (VIFs) are calculated, following the correlation matrix analysis. Table 4 indicates that in both model specifications, the highest VIF values remain below 5, which is well below the commonly recognized threshold of 10 for problematic multicollinearity[35,36]. These results suggest that, despite some strong correlations among explanatory variables, multicollinearity does not pose a significant issue in the estimations.

SFGM regressions

The stochastic frontier gravity model (SFGM) specified in Equation (4) is estimated, with the results presented in Table 5. Due to the detection of heteroscedasticity, robust standard errors are applied in all regressions. Column (1) provides estimates excluding time dummies, while Column (2) incorporates them to account for time-specific external shocks. To fully utilize the annual data spanning 2007 to 2022, missing LPI values are linearly interpolated. Column (3) presents estimates that integrate both time dummies and interpolated LPI values. The Wald test for model fit validates the employed specifications, as the null hypothesis is rejected at the 1% significance level across Table 5. Additionally, the likelihood-ratio (LR) test, which examines whether the trade inefficiency term is absent from the model ($\sigma\boxtimes = 0$), rejects the null hypothesis at the 1% level, confirming the relevance of the inefficiency component. Furthermore, the statistical significance

Table 3: Standard regressions

	OLS	OLS with robust, time dummies
VARIABLES	(1)	(2)
Logistics	1.935***	2.530***
	(0.739)	(0.788)
GDP	0.852***	0.850***
	(0.0272)	(0.0324)
Institution	0.148	0.0786
	(0.321)	(0.342)
Exchange	-0.00757	-0.000398
	(0.0157)	(0.0161)
RTA	0.753***	0.769***
	(0.176)	(0.134)
Distance	-0.430***	-0.419***
	(0.0759)	(0.0707)
Border	1.355***	1.336***
	(0.295)	(0.343)
WTO	0.339***	0.321**
	(0.127)	(0.146)
Constant	-33.30***	-33.72***
	(2.357)	(2.565)
Observations	829	829
F-test of overall model fit	428.06***	401.9***
BPCW test	102.75***	
Adjusted R-squared	0.805	0.807

*Notes: Estimates of time dummies are not reported for brevity. Standard errors are presented in parentheses. Statistical significance is indicated by ***, **, and * at the 1%, 5%, and 10% levels, respectively.*
Source: Author's calculation.

of *lnsig2u* ($ln\sigma^2$) further supports the appropriateness of the SFGM.

Consistent with the OLS results, logistics remains statistically significant at the 1% level across all SFGM estimations, aligning with prior studies highlighting its positive impact on Vietnam's exports [1,17,18,20,22]. When the trade inefficiency component is accounted for, the effect of logistics on potential exports becomes more pronounced. Specifically, in Column (1), a 1% increase in logistics performance is associated with a 2.9% increase in potential exports. With the inclusion of time dummies in Column (2), the estimated coefficient for logistics is higher, suggesting that a 1% increase in logistics performance corresponds to more than a 3.5% increase in exports. When utili ing the full dataset spanning 2007–2022 with time dummies included (Column 3), a 1% increase in logistics performance is linked to a 3.1% increase in exports. These findings confirm the robustness of the positive effect of logistics and emphasi e its importance in improving export efficiency.

Regarding the control variables, the SFGM estimations yield results consistent with the OLS analysis. The positive effects of economic size (*GDP*), regional integration (*RTA*), and common land border (*Border*) are statistically significant at the 1% level across Table 5. The partner's WTO membership (*WTO*) is also found to facilitate exports from Vietnam, with statis-

Table 4: Variance inflation factors

VARIABLES	OLS	OLS with robust, time dummies
Logistics	3.86	4.33
GDP	2.43	2.53
Institution	2.05	2.25
Exchange	1.41	1.45
RTA	2.20	2.20
Distance	2.11	2.12
Border	1.38	1.38
WTO	1.10	1.10
Max VIF	3.86	4.33

Note: VIFs of time dummies are not reported for brevity.
Source: Author's calculation.

tical significance at the 10% level in Columns (1) and (2) and at the 1% level in Column (3) when the entire period from 2007 to 2022 is considered. The negative impact of geographical distance (*Distance*) remains highly significant at the 1% level across all specifications, indicating its persistent adverse effect on bilateral trade due to transportation costs and information asymmetry. Meanwhile, the impact of exchange rates (*Exchange*) and institutional quality (*Institution*) remain statistically insignificant.

Based on the SFGM estimations, the export efficiency component is calculated and summaried in Table 6. The interpolation of missing values does not lead to substantial changes in the efficiency estimates. The average efficiency of Vietnam's exports is approximately 43–44%, suggesting that the country operates below its export potential. In comparison, the maximum efficiency exceeds 85%, indicating that certain trade relationships achieve near-optimal performance. These findings suggest substantial room for improvement in Vietnam's export efficiency. Among the determinants of potential exports, logistics has the highest elasticity, highlighting that enhancing logistics performance is one of the most effective strategies for improving Vietnam's export efficiency.

CONCLUSIONS

This study examines the impact of logistics performance on Vietnam's export frontier, distinguishing itself from previous research that relied on the gravity model without accounting for "behind-the-border" constraints. Analy ing trade data from Vietnam to 159 importing partners from 2007 to 2022, the findings confirm that logistics performance significantly and positively affects actual and potential exports. These results remain robust after controlling for time-specific external shocks and interpolating missing LPI values for intervening years. The findings highlight the critical role of logistics in Vietnam's export growth, aligning with the government's strategy outlined in Decision No. 493/QD-TTg.

Furthermore, this study reveals that logistics performance exerts a more significant influence on the export frontier than actual exports and exhibits the highest elasticity among all determinants. Given that Vietnam still has room to improve export efficiency, further investment in logistics infrastructure and the development of the logistics business sector emerge as the most effective strategies for enhancing exports.

Despite its contributions, this study has some limitations. First, logistics performance is measured using the World Bank's LPI, a survey-based index often critici ed for its qualitative nature. Second, the analysis relies on the overall LPI score and pools data for estimation. Future research could examine the effects of specific LPI subindices or adopt alternative quantitative logistics efficiency measures to provide deeper insights. Additionally, a comparative analysis of the impact of logistics on Vietnam's exports and those of other countries with varying logistics performances could offer a more comprehensive understanding of this relationship.

ABBREVIATIONS

BPCW – Breusch–Pagan and Cook–Weisberg
CEPII – Centre d'Études Prospectives et d'Informations Internationales
GDP – Gross Domestic Product
IMF – International Monetary Fund
LPI – Logistics Performance Index

Table 5: Stochastic frontier gravity models

	SFGM with robust	SFGM with robust, time dummies	SFGM with robust, time dummies, interpolation
VARIABLES	(1)	(2)	(3)
Logistics	2.890***	3.528***	3.133***
	(0.729)	(0.771)	(0.569)
GDP	0.775***	0.770***	0.792***
	(0.0284)	(0.0289)	(0.0206)
Institution	-0.173	-0.349	-0.0803
	(0.330)	(0.350)	(0.250)
Exchange	-0.0153	-0.0117	-0.00491
	(0.0159)	(0.0157)	(0.0102)
RTA	0.794***	0.797***	0.653***
	(0.145)	(0.140)	(0.0743)
Distance	-0.385***	-0.378***	-0.391***
	(0.0696)	(0.0682)	(0.0365)
Border	1.566***	1.570***	1.634***
	(0.275)	(0.277)	(0.170)
WTO	0.244*	0.237*	0.333***
	(0.128)	(0.125)	(0.0870)
Constant	-27.77***	-27.15***	-29.58***
	(2.508)	(2.622)	(1.861)
lnsig2u (ln)	0.651***	0.641***	0.735***
	(0.149)	(0.149)	(0.0877)
lnsig2v (ln)	-0.975***	-0.999***	-0.896***
	(0.132)	(0.139)	(0.0849)
Observations	829	829	2,152
sigma_u (σu)	1.385	1.378	1.444
sigma_v (σv)	0.614	0.607	0.639
Wald test of overall model fit	3575.87***	3795.79***	8832.51***
LR test of sigma_u = 0	66.28***	64.97***	170.00***

*Notes: Estimates of time dummies are not reported for brevity. Robust standard errors are presented in parentheses. Statistical significance is indicated by ***, **, and * at the 1%, 5%, and 10% levels, respectively.*
Source: Author's calculation.

Table 6: Efficiencies of Vietnam's exports

Period	Mean	Std. dev.	Min	Max
2007, 2010, 2012, 2014, 2016, and 2018	0.44143	0.19161	0.00277	0.85179
2007-2022 with interpolation	0.42956	0.19025	0.00275	0.85974

Source: Author's calculation.

OECD – Organization for Economic Co-operation and Development
OLS – Ordinary Least Squares
RTA – Regional Trade Agreement
SFGM – Stochastic Frontier Gravity Model
TiVA – Trade in Value-Added
VIF – Variance Inflation Factor
WB – World Bank
WTO – World Trade Organization

COMPETING INTERESTS

The author(s) declare that they have no competing interests.

AUTHORS' CONTRIBUTIONS

Vu Le Huy was responsible for the manuscript's conception, design, writing, and final approval.

REFERENCES

1. Huynh LTD. The Importance of logistics to Vietnam's exports. Kinh Te va Phat Trien.
2. Nguyen QH. Determinants of Vietnam's exports: An application of the gravity model. Journal of Asian Business and Economic Studies;25(Special Issue 01):103–16.
3. The World Bank. Viet Nam 2045: Trading up in a changing world [Internet.
4. World Bank Vietnam Office. Vietnam economic update presentation - August 10 [Internet.
5. The Center for WTO and International Trade - VCCI.
6. Vietnamese Ministry of Industry and Trade. Vietnam Logistics Report;.
7. Global V. Vietnam's logistics costs higher than world's.
8. Christopher M. Logistics and supply chain management. 5th ed. Pearson;.
9. Makris S, Alexopoulos K, Chryssolouris G. Logistics. Berlin, Heidelberg: Springer.
10. Martí L, Puertas R. The importance of export logistics and trade costs in emerging economies. Maritime Economics & Logistics;7;19(2):315–33.
11. Çelebi D. The role of logistics performance in promoting trade. Maritime Economics & Logistics;14;21(3):307–23.
12. Martí L, Puertas R, García L. The importance of the Logistics Performance Index in international trade. Appl Econ;46(24).
13. Behar A, Manners P, Nelson BD. Exports and international logistics*. Oxf Bull Econ Stat;8;75(6):855–86.
14. Puertas R, Martí L, García L. Logistics performance and export competitiveness: European experience. Empirica;Aug 6;41(3):467–80.
15. Ž Bugarčić F, Skvarciany V, Stanišić N. Logistics Performance Index in international trade: case of Central and Eastern European and Western Balkans countries. Business: Theory and Practice;Jun 25;21(2):452–9.
16. Gul N, Iqbal J, Nosheen M, Wohar M. Untapping the role of trade facilitation indicators, logistics and information technology in export expansion and diversification. J Int Trade Econ Dev;2;33(3):369–89.
17. Le DN. Globalisation, Logistics and food supply: Evidence from Vietnam. Malaysian Journal of Economic Studies;5;58(2):267–91.
18. Export LDN. Logistics performance, and regional economic integration: Sectoral and sub-sectoral evidence from Vietnam. Journal of International Logistics and Trade;Mar;20(1):37–56.
19. Kahouli B. Regional integration agreements, trade flows and economic crisis: A static and dynamic gravity model. Int Econ J;19;30(4):450–75.
20. Tran MN, Cao LTK, Quach HT, Phan VTT. Impact of green logistics performance on Vietnam's export trade to Regional Comprehensive Economic Partnership countries. Journal of Trade Science;178:31–9.
21. Fan M, Wu Z, Qalati SA, He D, Hussain RY. Impact of green logistics performance on China's export Trade to Regional Comprehensive Economic Partnership countries. Front Environ Sci;.
22. Doan TH, Vu LH. Effects of logistics performance on Vietnam's exports: a quantitative analysis using the PPML method. Journal of International Economics and Management;21;24(1):1–16.
23. V YY, R P, JA M, M L. An advanced guide to trade policy analysis: The structural gravity model. WTO;.
24. Nguyen DD. Determinants of Vietnam's rice and coffee exports: using stochastic frontier gravity model. Journal of Asian Business and Economic Studies;Feb 15;29(1):19–34.
25. Kalirajan K. Gravity model specification and estimation: revisited. Appl Econ Lett;Oct 24;15(13):1037–9.
26. Kalirajan K. Regional cooperation and bilateral trade flows: An empirical measurement of resistance. The International Trade Journal;May;21(2):85–107.
27. Linh PH, Doanh NK, Quynh NN. Determinants of Vietnam's potential trade: A case study of agricultural exports to the European Union. Asian Journal of Agriculture and Rural Development;27;9(1):33–46.
28. Baier SL, Bergstrand JH, Feng M. Economic integration agreements and the margins of international trade. J Int Econ;.
29. Tinbergen J. Shaping the world economy, suggestions for an international economic policy. The Twentieth Century Fund;.
30. Álvarez IC, Barbero J, Rodríguez-Pose A, Zofío JL. Does institutional quality matter for trade? Institutional conditions in a sectoral trade framework. World Dev;.
31. HLF G, G L, P R, U S. The institutional determinants of bilateral trade patterns. Kyklos;Feb 6;57(1):103–23.
32. Song MJ, Lee HY. The relationship between international trade and logistics performance: A focus on the South Korean industrial sector. Research in Transportation Business & Management;44(100786).
33. Kalirajan K, Paudel R. India's trade deficit with China: Will Free Trade Agreement (FTA) work for India? Global Economy Journal;1;15(4):485–505.
34. Wong WP, Tang CF. The major determinants of logistic performance in a global perspective: evidence from panel data analysis. International Journal of Logistics Research and Applications;4;21(4):431–43.
35. Chatterjee S, Hadi AS. Influential observations, high leverage points, and outliers in linear regression. Statistical Science;Aug;1(3):379–93.
36. Wooldridge JM. Introductory econometrics: A modern approach. 7th ed. Cengage;.

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Bài nghiên cứu

Tác động của logistics đến xuất khẩu của Việt Nam: Phân tích trọng lực biên ngẫu nhiên

Vũ Lê Huy[1,2,*]

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TÓM TẮT

Trong hai thập kỷ qua, các hoạt động liên quan đến xuất khẩu đã chiếm gần một nửa tổng sản phẩm quốc nội (GDP) của Việt Nam, đóng vai trò then chốt trong quá trình phát triển kinh tế và hội nhập vào hệ thống thương mại toàn cầu. Với tầm quan trọng thiết yếu của xuất khẩu đối với nền kinh tế, đã có nhiều nghiên cứu phân tích các yếu tố có thể ảnh hưởng đến hiệu quả xuất khẩu của Việt Nam. Trong số đó, logistics được xem là một yếu tố quan trọng tác động đến kết quả thương mại. Tuy nhiên, các nghiên cứu thực nghiệm tập trung vào mối quan hệ giữa hiệu quả logistics và xuất khẩu của Việt Nam vẫn còn hạn chế. Bên cạnh đó, phần lớn các nghiên cứu trước đây chưa chú trọng đúng mức đến các yếu tố kém hiệu quả không quan sát được trong thương mại quốc tế, vốn có thể làm giảm đáng kể tiềm năng xuất khẩu. Nghiên cứu này khắc phục những hạn chế trên bằng cách áp dụng mô hình trọng lực biên ngẫu nhiên, cho phép ước lượng các yếu tố quan sát được đồng thời kiểm soát các yếu tố kém hiệu quả không quan sát được, để phân tích tác động của hiệu quả logistics đến dòng xuất khẩu của Việt Nam. Mô hình được ước lượng trên dữ liệu thương mại song phương giữa Việt Nam và 159 quốc gia nhập khẩu trong giai đoạn 2007–2022. Biến logistics song phương được xây dựng dựa trên chỉ số hiệu quả logistics (LPI) của Ngân hàng Thế giới, phản ánh mức độ hiệu quả tương đối của hệ thống logistics giữa Việt Nam và từng đối tác thương mại. Kết quả thực nghiệm cho thấy tồn tại yếu tố kém hiệu quả trong xuất khẩu và khẳng định rằng việc cải thiện hiệu quả logistics có tác động tích cực và có ý nghĩa thống kê đến cả giá trị xuất khẩu thực tế và tiềm năng, trong đó tác động đến xuất khẩu tiềm năng là lớn hơn. Các kết quả này thể hiện tính vững chắc sau khi kiểm soát các cú sốc bên ngoài theo thời gian và nội suy dữ liệu LPI trong những năm Ngân hàng Thế giới không công bố. Bằng cách lượng hóa mức độ hiệu quả trong xuất khẩu và làm nổi bật vai trò của logistics, nghiên cứu nhấn mạnh tầm quan trọng chiến lược của việc đầu tư bền vững vào hạ tầng logistics và phát triển hơn nữa ngành dịch vụ logistics nhằm nâng cao hiệu quả xuất khẩu của Việt Nam.

Từ khoá: logistics, xuất khẩu, Việt Nam, phân tích trọng lực biên ngẫu nhiên

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