Working Paper 2023.2.4.10
- Vol 2, No 4

ĐÁNH GIÁ VAI TRÒ CỦA EVFTA VÀ CÁC YẾU TỐ KHÁC TRONG VIỆC QUYẾT ĐỊNH GIÁ TRỊ XUẤT KHẨU GỖ VIỆT NAM SANG CÁC NƯỚC EU: GÓC NHÌN THÔNG QUA MÔ HÌNH TRỌNG LỰC

Bách Nguyễn Huyền Anh[1], Bùi Lê Thành An, Nguyễn Hồng Dương, Nguyễn Minh Hiếu, Vũ Minh Bảo Khánh, Lê Hiếu Ngân

Sinh viên K60 Kinh tế đối ngoại – Viện Kinh tế và Kinh doanh quốc tế

Trường Đại học Ngoại thương, Hà Nội, Việt Nam

Vũ Huyền Phương

Giảng viên Viện Kinh tế và Kinh doanh quốc tế

Trường Đại học Ngoại thương, Hà Nội, Việt Nam

Tóm tắt

Mặc dù đã có những nghiên cứu phân tích các yếu tố tác động đến xuất nhập khẩu đồ gỗ của Việt Nam nhưng chưa có nhiều những phân tích cụ thể xung quanh hoạt động xuất khẩu đồ gỗ sang Liên minh châu Âu dưới tác động của hiệp định EVFTA và các yếu tố khác. Nghiên cứu của chúng tôi sử dụng mô hình trọng lực mở rộng để phân tích dữ liệu bảng nhằm xem xét các biến số ảnh hưởng đến xuất khẩu đồ gỗ của Việt Nam sang thị trường EU giai đoạn 2016-2021 trong bối cảnh EVFTA có hiệu lực. Kết quả nghiên cứu cho thấy, trong khi các yếu tố như GDP bình quân đầu người, lợi thế so sánh, khoảng cách địa lý và hiệp định EVFTA có tác động tích cực thì độ mở thương mại và thuế quan gia tăng sẽ cản trở ngành xuất khẩu gỗ. Một số chính sách đã được đề

[1] Tác giả liên hệ, Email: k60.2113150004@ftu.edu.vn

xuất dựa trên kết quả nghiên cứu nhằm hỗ trợ chính phủ cũng như các nhà hoạch định chính sách đưa ra các giải pháp và chiến lược hiệu quả, thúc đẩy xuất khẩu gỗ sang thị trường EU.

Từ khóa: EVFTA, sản phẩm gỗ, xuất khẩu, Việt Nam, mô hình trọng lực

ASSESSING THE ROLE OF DETERMINANTS AND EVFTA IN SHAPING VIETNAM'S WOOD EXPORT TO EU COUNTRIES: INSIGHTS FROM A GRAVITY MODEL ANALYSIS

Abstract

Although there have been studies that analyze the factors affecting the import and export of wooden furniture in Vietnam, the specific analysis surrounding the export of wooden products to the European Union under the impact of the agreement The EVFTA and other elements have never been fully implemented. Our study uses an extended gravity model for panel data to examine variables affecting Vietnam's furniture exports to the EU market in the 2016-2021 period in the context of the EVFTA in effect. Research results show that while factors such as GDP per capita, comparative advantage, geographical distance and the EVFTA agreement have a positive effect, increases in trade openness and tariffs will hinder the wood export industry. A number of policies have been proposed based on research results to support the government as well as policy makers to come up with efficient solutions and strategies, promoting timber exports to the EU market.

Key words: EVFTA, wooden products, export, Vietnam, gravity model

1. Introduction

1.1. Overview of EVFTA

The European-Vietnam Free Trade Agreement (EVFTA) was signed in June 2019 and has opened numerous opportunities for both parties. The agreement consists of 17 chapters, 2 protocols, 8 annexes, 2 Memorandums of Understanding, and 4 joint statements, covering various issues. These are the key provisions and implications of the EVFTA's policies: Tariff Reductions, Non-Tariff Measures, Services and Investment, Intellectual Property Rights (IPR) Protection, Sustainable Development and Dispute Settlement Mechanism.

EVFTA is a highly effective trade agreement between the Vietnamese market and the European single market, establishing an institutional foundation with common rules, regulations, and values. This makes it easier for both parties to conduct business and trade, with a current trade turnover of €37 billion between the two markets.

1.2. Background information of wooden product trade

Vietnam's timber and wooden products are significant exports, ranking 6th in 2022 at $15.86 billion. The country's favorable natural conditions offer opportunities for expansion in timber cultivation. Vietnam is the 5th supplier of wooden furniture to the EU, with an export volume of 140.5 thousand tons valued at $679.7 million in 2022.

However, recent declines in export turnover to the EU market are attributed to economic downturns, inflation, and failures to meet EU quality, transparency, and ethical requirements.

To overcome these challenges and boost the timber industry, the Vietnamese government and businesses must analyze factors influencing exportation to the EU, adjusting policies and strategies to address quality concerns and obstacles.

1.3. Significance of the study

The timber sector has always been one of the sectors that contribute to the major part of total Vietnamese exportation. Research on the determinants of Vietnamese wooden product export to the EU allows to show and quantify the impact of these factors on the export of Vietnamese timber goods, both meaningful in terms of practical as well as scientific significance. The results of that study together with in-depth qualitative studies will serve as an important basis for developing solutions to boost Vietnam's wooden product exports and maintaining its position as one of the largest exporters in the EU market.

1.4. Research objectives

This study will determine the factors that have an influence on the change in wooden products exportation from Vietnam to EU countries and how each of them plays the role in altering the exporting data, using the gravity model. After analyzing and explaining results, suggestions of policy implications and business strategies will be made for the government and timber businesses.

In order to implement the study and achieve research objectives, several questions are made that need answering:

- What are the factors that might have an impact on wooden products exportation?
- What is the level of impact resulting from the listed factors? What is the impact trend?
- What are the suggested solutions to the corresponding affairs?

1.5. Subject and scope of the study

The research subject is the impact of EU- Vietnam FTA (EVFTA) on Vietnam’s timber exports. The scope of the research revolves around Vietnam’s fishery exports data to 27 EU countries. The time frame for the data collected is from 2016 to 2021.

2. Literature review

Wooden products have become increasingly important in the trade relationship between Vietnam and the European Union (EU), which has seen significant growth. For policymakers and industry stakeholders, it is crucial to understand the factors that influence the wooden product export from Vietnam to the EU. This literature review intends to review existing research on the topic with an emphasis on studies that have used a gravity model method. The relevant previous research will be discussed first, followed by the identification of the literature's research gaps.

2.1. Related Previous Research:

Using a gravity model method, several studies have looked into the factors that influence the wooden product export from Vietnam to the EU. These researches have offered insightful information about the variables affecting trade flows.

A study by Thi Thanh Huyen Vu, Gang Tian, Bin Zhang & Thanh Van Nguyen (2020) examined Vietnam's wood product trade determinants using a gravity model. The findings showed that GDP, population, and distance significantly influenced trade flows. Larger economies and populations had higher trade with Vietnam. Market access and trade agreements promoted exports to the EU. However, the study did not specifically focus on the EU market, highlighting a research gap in the relationship between Vietnam and the EU.

Furthermore, Kangas and Niskanen's 2003 study of the factors affecting trade in forestry products discovered that distance, per capita income, importer and exporter GDP all had an impact on trade flows. These results underlined how important economic variables are in determining trade patterns in the wooden product sector.

Buongiorno, Tenny, and Gilless (1980) studied the multilateral flow of tropical logs and the impact of political and economic systems on trade. They found that transportation distance, importing country size, relative prices, development, wood availability, and overall trade volume significantly affect log flow.

According to many studies (Akyüz et al., 2010; Buongiorno, 2015, 2016; Das et al., 2018; Hujala et al., 2013; Zhang & Yanshu, 2009) ,factors affecting trade in wooden products between Vietnam and the EU include population, exchange rates, trade agreements, languages, and borders. Population size and openness of partner countries significantly impact exports. Vietnam's participation in trade agreements benefits its wooden product exports, and shipping distance is a crucial factor in determining trade intensity.

2.2. Impacts of EVFTA on wooden product export from Vietnam to the EU

2.2.1. Opportunities

Tu and Phuong (2022) suggest that joining the EVFTA will give Vietnam a competitive advantage in EU markets by reducing tariffs. This will increase exports of Vietnamese advantaged goods, such as wooden furniture, as the EVFTA removes import taxes up to 100% of the agreed tariff and trade value. Vietnam's wood and wood-related exports to the US increased by 42% in 2019, now accounting for 57.39% of all exports.

2.2.2. Challenges

Tu, P. H., and Phuong, D. T.'s research in 2022 found that Vietnam has not fully benefited from the EVFTA implementation to enhance wood product exports to member countries. The COVID-19 pandemic, high logistics costs, and a shortage of empty containers have led to a decrease in export turnover. The EU and Vietnam signed the Voluntary Partnership Agreement on Forest Law Enforcement, Governance, and Trade in June 2019. Vietnamese companies must ensure compliance with legal standards when exporting raw materials to the EU, as a lack of raw wood materials is a significant concern for businesses.

2.3. Research Gap:

Although earlier study has helped us understand the factors that influence the export of wooden product from Vietnam to the EU, there are still a number of knowledge gaps that call for further research:

● Sector-specific Analysis: Most studies focus on specific sub-sectors like wooden furniture, but analyzing plywood, timber, and wood-based panels can provide valuable insights for policymakers and stakeholders.

● Non-economic Measures: The majority of research has concentrated on analyzing the effects of economic factors, such as the size of the economies and the level of trade barriers. But other elements, like the quality of the wood products and the accessibility of trade finance, might also be important.

● Comparative Analysis: Conducting a comparative analysis of Vietnam's competitive advantages and disadvantages with other countries exporting wooden goods to the EU can identify areas for improvement and boost competitiveness strategies.

● Panel data analysis: Research primarily analyzes trade factors using cross-sectional data, but panel data analysis is more accurate due to trade flows' change over time.

● Determinants of Trade between Particular EU Countries: Studies on trade between Vietnam and the EU focus on general factors, but it's crucial to examine specific EU countries' trade variables for more insightful results, because the EU is a group of nations with various economic and political structures.

2.4. Conclusion:

Policymakers and industry stakeholders can create effective strategies to improve trade in wooden products between Vietnam and the EU by filling in the research gaps mentioned above through future study. Future research's findings would also help the wooden products industry grow sustainably and promote improved trade relationships between Vietnam and the EU.

3. Theoretical Framework

3.1. Overview of the gravity model and its applications in international trade

The gravity model is an economic concept and a widely used empirical model in international trade analysis. It is based on the idea that the volume of trade between two countries is proportional to their economic sizes (measured by GDP) and inversely proportional to the distance between them. The gravity model takes its name from the analogy to Newton's law of universal gravitation, where larger masses attract each other more strongly and the force of attraction decreases with distance.

The basic gravity model equation can be expressed as:

$$T_{ij} = A * (Y_i * Y_j) / D_{ij}$$

Where:

Tij represents the volume of trade between country i and country j.

A is a constant term.

Yi and Yj are the GDPs of countries i and j, respectively.

Dij is the distance between countries i and j.

The gravity model assumes that trade flows are influenced by the economic size of countries and the costs associated with distance, which capture factors like transportation costs, cultural proximity, language, and trade barriers. However, variations of the gravity model can also incorporate other factors such as common borders, regional integration agreements, and other economic variables.

Applications of the gravity model in international trade analysis include:

● Trade flows analysis: The gravity model helps explain and predict bilateral trade flows between countries by quantifying the impact of various factors, such as economic size and distance.

● Trade policy analysis: The model provides a framework for assessing the effects of trade policies, such as tariffs, quotas, or trade agreements, on trade patterns between countries.

● Estimating trade potentials: The gravity model can be used to estimate the potential volume of trade between countries by considering their economic sizes and distances, providing insights into untapped trade opportunities.

● Evaluating the impact of transportation infrastructure: The model can assess the effects of improvements in transportation infrastructure, such as the construction of highways or ports, on trade volumes between countries.

● Regional integration analysis: The gravity model helps evaluate the effects of regional integration agreements, such as free trade agreements or customs unions, on trade flows among member countries.

● Foreign direct investment (FDI) analysis: The gravity model can be adapted to analyze FDI flows, taking into account factors like the size of the economies, distance, and other relevant variables.

It's worth noting that while the gravity model is a useful tool for understanding and predicting trade patterns, it has its limitations. It assumes a linear relationship between the variables and doesn't capture all the complexities of international trade, such as non-economic factors or country-specific characteristics. Nonetheless, it remains a widely used and valuable framework for analyzing international trade relationships.

3.2. Determinants of trade between Vietnam and the European countries.

● Wood export: Several studies have examined the global import and export of wood and wood products (Skog et al., 1998; Ince, 2000; Haynes, 2003). Skog et al. (1998) found that the United States is a net importer of forest products, with expected increases in pulpwood and wood pulp imports. Ince (2000) observed a 39% increase in industrial wood productivity in the United States, primarily attributed to the utilization of wood residues and recycled wood fiber. Haynes (2003) predicted a 42% rise in forest product consumption in the United States by 2050. In gravity models, the determinant of wood export refers to the factors that influence the flow of wood exports between countries, including economic, geographical, and policy-related factors.

● GDP per capita: GDP per capita reflects a country's GDP divided by its population, indicating market size and economic scale. Larger economies and higher income levels are associated with increased trade volume. Tran et al. (2020) studied China-ASEAN trade relations from 2000-2018, finding significant growth and highlighting China's economic size as a key influencer. This suggests that Vietnam's trade with countries like Vietnam and the Euro countries will be affected by their economic scale. In summary, GDP per capita is an important factor influencing Vietnam's trade with other nations. In a gravity model, the determinant of GDP per capita refers to the factor that influences the flow of trade between countries based on their respective GDP per capita levels.

● Trade openness: Trade openness has long been recognized as beneficial in international trade. Hye, Wizarat, and Lau (2016) developed a trade openness index, finding a positive association with future and short-term economic growth. However, due to data limitations, they used the Trade/GDP index as a substitute, which they argue carries the same meaning and yields similar results. In a gravity model, the determinant of trade openness refers to the degree of openness and liberalization of trade policies between two countries. Trade openness is a significant factor that influences trade flows and is commonly included as a determinant in gravity models.

● Distance: Gravity models in trade literature suggest that trade costs, including distance, have a significant impact on trade creation and diversion (Urata & Okabe, 2010). These costs encompass factors such as time, market penetration, cultural differences, personal preferences, and institutional disparities (Hoo and Doanh, 2015; Blum and Goldfarb, 2006). David Ricardo's theory of comparative advantage, which supports free trade, assumes zero transportation fees for trading goods between countries. However, in reality, especially for long distances, shipping costs are higher, posing a barrier to international trade. Perishable goods, like fishery products, face greater risks with longer transit times. Geographical distance plays a crucial role in shaping the gravity equation, affecting trade flows between countries.

● Tariff: Various factors, including lower tariffs and reduced trade barriers facilitated by Free Trade Agreement (FTA) agreements, can influence the demand for goods, potentially increasing trade volume (Nguyen, 2014, 2016). The gravity model analysis conducted by Nguyen (2014, 2016) on Vietnam-EU trade flows found that a 1% reduction in tariffs between the EU and Vietnam led to a 0.52% to 0.95% increase in trade. The article discusses the benefits of the EVFTA for Vietnam, such as improved trade policies and access to advanced EU technology. However, challenges such as declining tariff revenues, increased domestic market competition, and reliance on cheaper exports while importing more expensive goods from the EU are noted. Brauer et al. (2014) also highlight the need for judicial reforms in Vietnam to fully leverage the potential of the EVFTA. In gravity models, tariffs refer to import duties or taxes that act as trade barriers, significantly influencing trade flows between countries (Brauer et al., 2014).

● Revealed comparative advantage: The concept of revealed comparative advantage (RCA) is used to measure comparative advantages in trade policy (Balassa, 1965). The RCA index compares a country's share of world exports (or regional trade area exports) for different products to determine if it has a comparative advantage in a specific product. If a country's share of exports for a product is higher than the share at the trade area level, it is considered to have a comparative advantage in that product. However, doubts have been raised about the accuracy of the Balassa index as a measure of comparative advantages. RCA is commonly used in international trade analysis, particularly in the context of the gravity model, which explains bilateral trade flows between countries.

3.3. Hypotheses

● H1: Higher GDP per capita (GDPPC) positively impacts wooden product exports (WEX) to EU countries.

Higher GDP per capita indicates a better standard of living and increased purchasing power, leading to greater demand for goods and services, including wooden products. Countries with higher GDPPC tend to have advanced technology, infrastructure, and education, enabling them to produce higher value-added goods that can be exported at higher prices.

● H2: Increased trade openness boosts wooden product exports from Vietnam to EU countries.

Trade openness refers to the degree of involvement in international trade activities, measured by the ratio of the combined value of exports and imports to GDP. Higher trade openness signifies reduced trade barriers and smoother trade flows. In the case of Vietnam, increased trade openness with EU countries can expand market access and create more export opportunities for wooden products.

● H3: Distance between Vietnam and EU countries negatively affects wooden product export values.

Longer distances present logistical challenges and increase transportation costs, potentially reducing the competitiveness of Vietnamese wooden products in the EU market. Higher transportation costs can raise the final prices of wooden products, making them less attractive compared to products from closer or local sources.

● H4: Tariffs on wooden product imports negatively impact Vietnam's exports to EU countries.

Tariffs are taxes or duties imposed on imported goods, increasing their cost and reducing competitiveness. Higher tariff rates on wooden products imported from Vietnam can raise prices, potentially decreasing demand and export values.

● H5: Vietnam's Relative Comparative Advantage (RCA) in wood export to EU countries has a negative impact on its overall wood export performance.

RCA measures a country's comparative advantage in a specific product or industry by comparing its share of global exports in that sector to its overall share of global exports. If Vietnam's RCA in wood exports to the EU is significantly higher than its overall RCA in wood exports, it suggests a concentration of resources and efforts in serving the EU market.

● H6: The dummy variable EVFTA has a positive impact on Vietnam’s wooden export value to EU countries.

The EVFTA is a bilateral trade agreement between the EU and Vietnam aimed at reducing or eliminating trade barriers. It eliminates or reduces tariffs on wooden products, improves market access, streamlines customs procedures, and addresses technical barriers to trade. Additionally, the EVFTA enhances investment cooperation, attracting foreign direct investment into Vietnam's wooden product industry. Overall, the EVFTA promotes economic integration and collaboration between the EU and Vietnam, enhancing the competitiveness and productivity of Vietnam's wooden product industry.

4. Methodology

4.1. Specification of the gravity model and its variables

The initial equation of the gravity model, which relates bilateral trade flows to economic size and distance, has evolved into a logarithmic form to on enhances its suitability for econometric analysis by achieving linearization, facilitating interpretation of coefficients as elasticities, and introducing symmetry between exporters and importers.

The logarithmic form of the gravity model equation typically appears as:

$$ln(Trade) = \beta_0 + \beta_1 ln(GDP_1) + \beta_2 ln(GDP_2) - \beta_3 ln(Distance) + \varepsilon$$

Where:

Trade: Bilateral trade flow between countries.

GDP_1, GDP_2: Economic size (GDP or GDP per capita) of the exporter and importer, respectively.

Distance: Physical distance between countries.

β_0, β_1, β_2, β_3: Coefficients to be estimated.

ε: Error term accounting for unexplained factors and random variations.

The logarithmic transformation allows econometric techniques to estimate the coefficients and test the statistical significance of the variables in explaining bilateral trade flows.

In addition to GDP per capita and distance, the research has expanded the gravity model by including variables such as Trade openness, Tariff rates, Revealed Comparative Advantage (RCA), and the effect of EVFTA. These additional variables provide a more comprehensive understanding of bilateral trade flows, considering factors such as trade liberalization, trade barriers, sectoral advantages, and the specific dynamics of the wood export industry. Incorporating these variables enhances our analysis and sheds light on the determinants of wood exports.

4.2. Discussion of the estimation method and model diagnostics

The research will employ the Fixed Effects Model (FEM), Random Effects Model (REM), and Pooled Ordinary Least Squares (POLS) methods to estimate and develop a comprehensive model for the dependent variable, Wood export. The authors will consider various independent variables to capture the potential factors influencing wood exports. These independent variables include GDP per capita, Trade openness, Distance, Tariff, Revealed Comparative Advantage (RCA), and the effect of EU -Vietnam Free Trade Agreement (EVFTA). The study model proposed by the authors has the following equation:

$$ln(WEX) = \beta 0 + \beta 1 * ln(GDPPC) + \beta 2 * ln(TROP) + \beta 3 * ln(DIST) + \beta 4 * ln(TAR) + \beta 5 * ln(RCA) + EVFTA + \varepsilon$$

In this model:

ln(WEX) represents the natural logarithm of the wood export from Vietnam to European countries.

ln(GDPPC) represents the natural logarithm of the GDP per capita of Vietnam and European countries.

ln(TROP) represents the natural logarithm of the trade openness of Vietnam and the European countries.

ln(DIST) represents the natural logarithm of the distance between Vietnam and European countries.

ln(TAR) represents the natural logarithm of the tariff rate imposed by the European countries on wood exports from Vietnam.

ln(RCA) represents the natural logarithm of the revealed comparative advantage of Vietnam in wood exports to European countries.

EVFTA is a binary dummy variable that takes the value of 1 if the European Union-Vietnam Free Trade Agreement is in effect and 0 otherwise.

$\beta 0$, $\beta 1$, $\beta 2$, $\beta 3$, $\beta 4$, $\beta 5$, and $\beta 6$ are the estimated coefficients of the model.

The error term ε captures unobserved factors and random disturbances that affect wood exports but are not accounted for by the included variables.

The regression model estimates the relationship between wood exports and various factors while controlling for the effects of GDP per capita, distance, trade openness, tariff, revealed comparative advantage, and the presence of the EVFTA. By utilizing the FEM, REM, and POLS techniques, the research aims to uncover the relationships between these variables and wood export volumes. This analysis will provide valuable insights into the determinants of wood exports and contribute to a deeper understanding of international trade dynamics in the forestry sector.

4.3. Results and Analysis

4.3.1. Descriptive statistics of the variables and correlation analysis

4.3.1.1. Summary statistics

Before evaluating the obtained data, we will provide a broad description of the model and its parameters using STATA17's command ***sum***. This command displays the number of observations (Obs), mean, and standard deviation (Std. Dev.) as well as the variables' Minimum (Min) and Maximum (Max) values.

The results are presented in the table below:

Table 1: Variables statistical description

Variables	Observations	Mean	Std. Dev.	Min	Max
lnWEX	162	13.07171	2.462238	6.908	17.161
lnGDPPC	168	10.20207	0.7196868	7.923	11.803
lnTROP	168	4.80397	0.4473969	4.013	5.961
lnDIST	162	15.5493	0.0857832	15.388	15.754
lnTAR	162	-3.330333	0.2018981	-3.777	-3.208
lnRCA	162	-1.99463	1.094967	-4.61	0.1

Source: Author calculated in Stata17

The provided results show the descriptive statistics for several variables in the analysis:

For lnWEX (Log of Wood Export), there are 162 observations with a mean of 13.07171, a standard deviation of 2.462238, and values ranging from 6.908 to 17.161.

lnGDPPC (Log of GDP per capita) has 168 observations with a mean of 10.20207 and a standard deviation of 0.7196868, ranging from 7.923 to 11.803.

lnTROP (Log of Trade Openness) has 168 observations, with a mean of 4.80397 and a standard deviation of 0.4473969, ranging from 4.013 to 5.961.

lnDIST (Log of Distance) has 162 observations, with a mean of 15.5493 and a standard deviation of 0.0857832, ranging from 15.388 to 15.754.

lnTAR (Log of Tariffs) has 162 observations, with a mean of -3.330333 and a standard deviation of 0.2018981, ranging from -3.777 to -3.208.

lnRCA (Log of Revealed Comparative Advantage) has 162 observations, with a mean of -1.99463 and a standard deviation of 1.094967, ranging from -4.61 to 0.1.

These statistics provide a summary of the variables' distribution, giving an overview of their average values, variability, and range.

4.3.1.2. Correlation of variables

To identify the correlation among the six variables of the model, we used the command ***corr***, the results are illustrated as follows:

Table 2: Correlations between variables

	lnWEX	lnGDPPC	lnTROP	lnDIST	lnTAR	lnRCA	EVFTA
lnWEX	1.0000						
lnGDPPC	0.2147	1.0000					

lnTROP	-0.5523	0.2328	1.0000				
lnDIST	0.2335	0.4066	-0.0462	1.0000			
lnTAR	-0.0565	-0.1140	-0.0431	0.0000	1.0000		
lnRCA	0.5973	0.3459	-0.3166	0.0206	-0.0379	1.0000	
EVFTA	0.0736	0.0871	-0.0033	0.0000	-0.6628	0.0521	1.0000

Source: Author calculated in Stata17

Based on the results:

lnGDPPC (Log of GDP per capita) shows a positive correlation of 0.2147 with lnWEX. This suggests a weak positive relationship between GDP per capita and wood exports.

lnTROP (Log of Trade Openness) exhibits a negative correlation of -0.5523 with lnWEX. This indicates a moderate negative relationship between trade openness and wood exports.

lnDIST (Log of Distance) has a positive correlation of 0.2335 with lnWEX. This suggests a weak positive relationship between distance and wood exports.

lnTAR (Log of Tariffs) displays a negative correlation of -0.0565 with lnWEX. This indicates a weak negative relationship between tariff rates and wood exports.

lnRCA (Log of Revealed Comparative Advantage) shows a positive correlation of 0.5973 with lnWEX. This suggests a moderate positive relationship between revealed comparative advantage and wood exports.

EVFTA (Existence of a Bilateral Trade Agreement) exhibits a positive correlation of 0.0736 with lnWEX. This indicates a weak positive relationship between being part of the EVFTA and wood exports.

4.4. Presentation and interpretation of the regression results

4.4.1. The regression results

In order to select the most suitable model for the analysis, the authors compared the results of three different regression models: the Fixed Effects Model (FEM) model, the Random Effects Model (REM), and the Pooled Ordinary Least Squares (OLS) model. Each model was estimated by STATA17 using the dataset, and their respective regression coefficients and statistical measures were collected in the table below:

Table 3: POLS, REM, FEM models

Variables	Index	Pooled OLS	FEM	REM
lnGDPPC	Coef.	0.4016582	2.75973	1.616068

	Std. Err.	0.2887457	0.6858934	0.4992137
	P-value	0.166	0.000	0.001
lnTROP	Coef.	-2.378779	2.035906	-1.678817
	Std. Err.	0.3446148	1.16172	0.6734889
	P-value	0.000	0.082	0.013
lnDIST	Coef.	4.724074	Omitted because of collinearity	1.548154
	Std. Err.	1.757472		4.298233
	P-value	0.008		0.719
lnTAR	Coef.	-0.4448124	1.04034	0.0298282
	Std. Err.	0.8769776	0.4031872	0.3544405
	P-value	0.613	0.011	0.933
lnRCA	Coef.	0.9428373	0.3102196	0.4276433
	Std. Err.	0.1468481	0.1204753	0.1215332
	P-value	0.000	0.011	0.000
EVFTA	Coef.	0.09148	0.3391941	0.1548156
	Std. Err.	0.373375	0.1428221	0.1393268
	P-value	0.807	0.019	0.266
cons	Coef.	-52.74299	-21.08606	-18.66674
	Std. Err.	26.57464	7.68326	65.74618
	P-value	0.049	0.007	0.776
Observations		162	162	162
R-squared		55.44%	27.53%	42.45%

Source: Author calculated in Stata17

The table presents coefficients, standard errors, P-values, and R-squared values from three regression models: Fixed Effect Model (FEM), Random Effect Model (REM), and Pooled OLS. These measures help assess the significance, precision, and goodness-of-fit of each model. To choose between the three models, the authors will employ feasible tests.

4.4.2. The appropriate model

4.4.2.1. FEM test

To choose between FEM and Pooled OLS, the authors use FEM test as follow:

Hypotheses:

H0: The model does not have fixed effects.

H1: The model has fixed effects.

Running the command **xtreg [Dependent variable] [Independent variables], fe**, the results are as follow:

Table 4: FEM test results

F test that all u_i=0: F(26, 130) = 50.36	Prob > F = 0.0000

Source: Author calculated in Stata17

Based on the provided results, the P-value is observed to be 0.0000, which is smaller than the predetermined significance level of 5%. Therefore, we can reject the null hypothesis. Consequently, it can be inferred that the FEM model is more suitable and preferable compared to the OLS model.

4.4.2.2. Breusch-Pagan Test

To choose between REM and Pooled OLS, the authors use Breusch and Pagan Lagrangian test as follow:

Hypotheses:

H0: Pooled OLS is more appropriate.

H1: REM is more appropriate.

Running the command **xtreg [Dependent variable] [Independent variables], re** and **xttest0**, the results are shown below:

Table 5: Breusch and Pagan Lagrangian test result

Breusch and Pagan Lagrangian test for random effects	chibar2(01) = 287.71 Prob > chibar2 = 0.0000

Source: Author calculated in Stata17

Based on the obtained results, the P-value is found to be 0.0000, indicating its significance below the predetermined 5% threshold. As a result, we can reject the null hypothesis and conclude that the REM model is more appropriate and favorable when compared to the OLS model.

4.4.2.3. Hausman Test

The Hausman test helps determine whether the Fixed Effect Model (FEM) or the Random Effect Model (REM) is more suitable for a dataset. It examines the consistency of the estimators and checks for correlation between the random effects and explanatory variables. If the correlation is significant, the FEM is preferred; otherwise, the REM is considered appropriate. Hypotheses:

H0: Difference in coefficients not systematic

H1: Difference in coefficients is systematic

After store two model with the command **est sto [Name of the model]**, run the command **hausman fem rem**, the results are shown below:

Table 6: Hausman test result

Hausman test	chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 16.05 Prob > chi2 = 0.0067

Source: Author calculated in Stata17

Upon analyzing the results, the P-value is determined to be 0.0067, which falls below the designated significance level of 5%. Therefore, the research can reject the null hypothesis and deduce that the FEM model is more suitable and preferable in comparison to the REM.

After finalizing the model selection, tests are conducted to identify potential violations such as multicollinearity, heteroscedasticity, and autocorrelation. Multicollinearity occurs when independent variables are highly correlated, impacting coefficient estimates. Heteroscedasticity refers to unequal variances in error terms, affecting standard errors. Autocorrelation arises when error terms are correlated over time, impacting parameter estimates. Tests like VIF, Modified Wald, and Durbin-Watson are employed to detect and address these violations, ensuring model integrity and robustness.

4.4.3. Violation testing

4.4.3.1. Detection of multicollinearity

By using the VIF as a diagnostic tool, researchers can assess and mitigate the potential impacts of multicollinearity. Running the command **vif** in STATA17, the results are collected as below:

Table 7: Variance Inflation Factor Test

Variable	VIF	1/VIF
lnTAR	1.80	0.555928
EVFTA	1.79	0.559104
lnGDPPC	1.75	0.571356
lnRCA	1.48	0.674095
lnTROP	1.39	0.719127
lnDIST	1.30	0.766794
Mean VIF	1.59	

Source: Author calculated in Stata17

All the variables have VIF values below 5, indicating a relatively low level of multicollinearity. The highest VIF value is 1.80 for the variable lnTAR, followed closely by EVFTA with a VIF of 1.79. The lowest VIF value is 1.3 for the variable lnDIST and the mean VIF for all variables is 1.59, further indicating a lack of significant multicollinearity. Based on these results, the authors can conclude that there is no severe multicollinearity issue present among the predictor variables in the model.

4.4.3.2. Detection of heteroscedasticity

By conducting the Modified Wald test, researchers can identify whether heteroscedasticity is present in the regression model. Running the command **xttest3**, in STATA17 base on two hypotheses:

H0: The model has homoscedasticity

H1: The model has heteroskedasticity

The results are as follow:

Table 8: Modified Wald test result

Modified Wald test for groupwise heteroskedasticity in FEM	chi2 (27) = 10896.77 Prob>chi2 = 0.0000

Source: Author calculated in Stata17

Upon analyzing the results, we observed a P-value of 0.0000, which is below the predetermined significance level of 5%. Consequently, the authors reject the null hypothesis and infer that the model exhibits heteroscedasticity.

4.4.3.3. Detection of auto-correlation

By conducting the Wooldridge test (Durbin-Watson test), researchers can determine whether autocorrelation is present in the model. Running the command **xtserial [Dependent variable] [Independent variables]** in STATA17 base on two hypotheses:

H0: no first-order autocorrelation

H0: the model has autocorrelation

The results are as follow:

Table 9: Wooldridge test result

Wooldridge test for autocorrelation in panel data	F(1,26) = 0.064 Prob > F = 0.8021

Source: Author calculated in Stata17

Based on the results of the Wooldridge test for autocorrelation in panel data, the test statistic is calculated as 0.064. Additionally, the corresponding F-statistic is calculated as 0.064, with a p-value of 0.8021. In this case, the p-value is significantly higher than the commonly used significance level of 0.05. This suggests that there is no strong evidence to reject the null hypothesis of no autocorrelation. Consequently, we can infer that the panel data does not exhibit significant autocorrelation based on the results of the Wooldridge test.

The selected model shows heteroscedasticity, indicating that the variability of the error terms is not constant across different levels of the independent variables. This can potentially affect the accuracy of the coefficient estimates and standard errors. However, there are no signs of multicollinearity or autocorrelation, which is favorable for the reliability and validity of the regression analysis. In the upcoming section, the author will address the identified heteroscedasticity by applying appropriate remedies to enhance the model's robustness, improve the accuracy of the parameter estimates, and ensure the validity of statistical inferences.

4.4.4. Remedies for violations

To rectify the identified violations, namely heteroscedasticity, the author will employ the Iteratively Reweighted Least Squares (IRLS) method, specifically tailored for addressing heteroscedasticity in the fixed effect model. By implementing the IGLS method, the author aims to obtain more reliable coefficient estimates and standard errors while preserving the validity of statistical inferences.

The IGLS method offers a powerful approach to tackle heteroscedasticity by iteratively reweighting the observations based on their residuals. This iterative process assigns higher weights to observations with smaller residuals, effectively downweighting the influence of observations with larger residuals. By doing so, the IGLS method mitigates the impact of heteroscedasticity on the parameter estimates, enhancing the model's robustness.

Running the command **xtgls [Dependent variable] [Independent variables], panels(heteros) igls** in STATA17, the results are shown below:

Table 10: FGLS method regression results

Cross-sectional time-series FGLS regression						
Coefficients: generalized least squares						
Panels: heteroskedastic						
Correlation: no autocorrelation						
Estimated covariances = 27			Number of obs = 162			
Estimated autocorrelations = 0			Number of groups = 27			
Estimated coefficients = 7			Time periods = 6			
			Wald chi2(6) = 1775.74			
Log likelihood = -225.9145			Prob > chi2 = 0.0000			
lnWEX	Coefficient	Std. err.	z	P>|z|	[95% conf. interval]	
lnGDPPC	1.001482	0.1167489	8.58	0.000	0.7726584	1.230306
lnTROP	-1.508918	0.1157118	-13.04	0.000	-1.735709	-1.282127
lnDIST	7.476315	0.8251455	9.06	0.000	5.859059	9.09357
lnTAR	-0.6961917	0.1979907	-3.52	0.000	-1.084246	-0.3081371
lnRCA	0.4022437	0.0525119	7.66	0.000	0.2993222	0.5051652
EVFTA	0.2511341	0.0834514	3.01	0.003	0.0875723	0.4146958
_cons	-107.5991	12.44797	-8.64	0.000	-131.9967	-83.20152

Source: Author calculated in Stata17

The provided results correspond to a cross-sectional time-series regression using the FGLS (Feasible Generalized Least Squares) method. The analysis indicates that the model accounts for heteroskedastic panels and assumes no autocorrelation. The Wald chi-square test yields a significant statistic of 1775.74, indicating the overall significance of the model. The log likelihood value is -225.9145, and the associated probability of the chi-square statistic is 0.0000, suggesting strong evidence against the null hypothesis so the model is statistically significant at a significance level of 5%. Meanwhile with all P-value < 0.01, independent variables are all statistically significant at a significance level of 1%.

4.4.5. Conclusion

Using the provided dataset, a feasible regression model was constructed with the dependent variable at a 1% level of statistical significance. The final regression model is:

lnWEX = 1.001482 * lnGDPPC - 1.508918 * lnTROP + 7.476315 * lnDIST - 0.6961917 * lnTAR + 0.4022437 * lnRCA + 0.2511341 * EVFTA - 107.5991

4.5. Discussion of the implications of the findings for the trade between Vietnam and the EU

The cross-sectional time-series FGLS regression results provide insights into the trade relationship between Vietnam and the EU.

● GDP per capita (lnGDPPC): The coefficient of 1.001482 suggests that a 1% increase in GDP per capita in Vietnam is associated with a 1.001482% increase in trade between Vietnam and the EU. This finding implies that economic growth in Vietnam positively affects trade flows with the EU. As GDP per capita increases, consumers' purchasing power and demand for imported goods and services from the EU may also increase. This positive correlation supports the initial hypothesis.

● Trade openness (lnTROP): The coefficient of -1.508918 indicates that a 1% increase in trade openness results in a 1.508918% decrease in trade between Vietnam and the EU. This suggests that a higher level of trade openness in Vietnam may lead to a shift in trade patterns, possibly diverting some trade away from the EU. It highlights the importance of maintaining a balance between trade partners and ensuring a diverse trading portfolio. The negative correlation contradicts the initial hypothesis.

● Distance (lnDIST): The coefficient of 7.476315 implies that a 1% increase in distance between Vietnam and the EU leads to a 7.476315% increase in trade between the two regions. The relationship between distance and wood export between Vietnam and EU countries is influenced by multiple factors. While closer proximity typically reduces transportation costs and enhances communication, leading to increased wood export, there are instances where an increase in distance can also result in higher wood export volumes. This can be attributed to market diversification, specific demands and quality preferences of distant markets, trade agreements, incentives, and Vietnam's competitive advantages in wood products. Therefore, distance alone cannot solely determine the level of wood export, as other variables and factors come into play. The negative correlation contradicts the initial hypothesis.

● Tariffs (lnTAR): The coefficient of -0.6961917% implies that a 1% increase in tariff rates imposed on wood exports leads to a 0.6961917% decrease in trade between the two regions. This negative correlation supports the initial hypothesis.

● Revealed Comparative Advantage (lnRCA) and EVFTA: The coefficients of 0.4022437 and 0.2511341 for lnRCA and EVFTA, respectively, suggest that higher revealed comparative advantage and the presence of the EVFTA (European Union-Vietnam Free Trade Agreement) have positive effects on trade between Vietnam and the EU. This indicates that industries where Vietnam has a comparative advantage and the trade agreement with the EU can facilitate increased trade flows. The positive correlation between lnRCA and lnWEX contradicts the initial hypothesis meanwhile the positive correlation between EVFTA and lnWEX supports the initial hypothesis.

Overall, the regression results imply that factors such as GDP per capita, trade openness, distance, revealed comparative advantage, and trade agreements significantly influence trade between Vietnam and the EU. Policymakers can leverage these findings to foster favorable trade policies, strengthen economic cooperation, and identify potential areas for further collaboration and trade expansion between Vietnam and the EU.

5. Conclusion

5.1. Summary of the main findings and contributions

This paper examines the determinants of wooden product trade between Vietnam and the EU from 2016 to 2021 using the gravity model. The study finds that the implementation of EVFTA, along with factors such as GDP per capita and revealed comparative advantage, positively influence wood exports. Interestingly, higher distance is no longer a significant barrier to Vietnam's wood export, and trade openness presents opportunities for the country to expand its export market. The study provides valuable insights for policymakers to develop strategies and regulations that promote exportation and strengthen the trade relationship between Vietnam and the EU.

5.2. Policies and recommendations

Regarding the wooden product trade between Vietnam and the EU, there are policies that present both opportunities and challenges for Vietnam’s export performance:

● European Union-Vietnam Free Trade Agreement (EVFTA): The EVFTA benefits Vietnam's wood export to the EU by reducing duties, promoting regulatory cooperation, and enhancing investment protection, but compliance with rules of origin and standards can be challenging.

● Voluntary Partnership Agreement (VPA): The Vietnam Forest Protection Act (VPA) aims to combat illegal logging and promote sustainable forest management through a Timber Legality Assurance System (TLAS), enabling Vietnam to export verified legal timber to EU markets. However, establishing and implementing the TLAS can be resource-intensive and require substantial investment.

● EU Timber Regulation (EUTR): EUTR prohibits illegally harvested timber placement in EU markets, promoting responsible sourcing and combating illegal logging. Compliance requires Vietnamese wood exporters to implement due diligence systems and ensure legality.

Based on the findings that indicate the significant factors influencing wooden product trade between Vietnam and the EU, together with the opportunities and challenges from the aforementioned agreements and regulations, several policy recommendations can be made to promote and enhance this trade relationship. The government should:

● Strengthen economic cooperation between Vietnam and EU through bilateral and multilateral agreements, promoting EVFTA for wooden products and investment.

● Promote sustainable forest management practices in Vietnam by implementing regulations on logging, timber sourcing, and reforestation. Compliance with international standards and certifications enhances Vietnamese wooden product marketability in the EU.

● Develop market access strategies for Vietnamese wooden products in the EU, reducing trade barriers, reducing tariffs, and staying informed about EU regulations, standards, and certification requirements.

● Encourage Vietnam wood exporters to meet international quality standards, promote sustainable manufacturing practices, and ensure EU safety compliance. Provide capacity-building programs and technical assistance for upgrading production processes.

● Encourage technology transfer, research, and development in wood industry to enhance product value and competitiveness, promoting collaboration between Vietnamese and European companies.

● Enhance market intelligence capabilities to understand EU trends, consumer preferences, and sustainability requirements, support Vietnamese wood exporters in identifying opportunities, adapting offerings, and promoting Vietnamese wooden products.

By implementing these policies, Vietnam can enhance its wooden product trade with the EU, capitalize on the identified factors that influence trade, and foster a sustainable and mutually beneficial trade relationship.

5.3. Limitations and suggestions for future research

The study provides informative results, however, there are some limitations. Some factors such as product quality, market demand and trend, technology and exchange rates, etc are not included in this paper while they still affect the export figure. Therefore, this may lead to some inaccuracies in the research results. Moreover, the study only covers the data in a short period of 2016 to 2021, which causes some limitations in providing a detailed view of the influence of the factors on the trade overtime.

For further research, it is suggested that the research be done in a larger time scale with deeper analysis of the determinants. Additionally, more factors can be included in the study to achieve a higher accuracy of the results.

6. References

Buongiorno, J. (2015), “Monetary Union and forest products trade – the case of the Euro”, *Journal of Forest Economics*, Vol. 21 No. 4, pp. 238–249.

Buongiorno, J. (2016), "Gravity models of forest products trade: Applications to forecasting and Policy Analysis", *Forestry*, Vol. 89 No. 2, pp. 117–126.

Buongiorno, J., Tenny, P.A. & Gilless, J.K. (1980), "Economic and political influences on international trade of Tropical Logs", *Agricultural Systems*, Vol. 6 No. 1, pp. 53–66.

Chu, K. (2022), "Xuất khẩu gỗ và đồ gỗ hướng tới kỷ lục 16 tỷ USD", *Nhịp sống kinh tế Việt Nam & Thế giới*, Available at: https://vneconomy.vn/xuat-khau-go-va-do-go-huong-toi-ky-luc-16-ty-usd.html (Accessed: 20 May 2023).

Das, J. *et al.* (2018), "Examining the relationship between regulatory quality and forest products exports to India: A gravity model approach", *Forest Products Journal* [Preprint], doi:10.13073/fpj-d-17-00022.

EUTR: European Timber Regulation. (n. d.), *Timber Trade Portal*, Available at: https://www.timbertradeportal.com/en/p/4/eutr (Accessed: 23 May 2023).

FLEGT. (n.d.), "Combating illegal logging through forest law enforcement, government and trade", *FLEGT.org*, Available at: https://flegt.org/about-flegt/ (Accessed: 16 May 2023).

Freeman, R. & Lewis, J. (2021), "Gravity model estimates of the spatial determinants of trade, migration, and trade-and-migration policies", *Economics Letters*, Vol. 204, pp. 109873.

Gnutzmann-Mkrtchyan, A. & Hugot, J. (2022), "Gravity-based tools for assessing the impact of tariff changes", *Asian Development Bank*, Available at: https://www.adb.org/sites/default/files/publication/774811/ewp-649-gravity-based-tools-assessing-impact-tariff-changes.pdf (Accessed: 23 May 2023).

Go Viet. (2023), "The export value of wood and wood products to the EU market has experienced a significant decrease", *The media agency of the Vietnam Timber and Forest Product Association,* Available at: https://goviet.org.vn/bai-viet/kim-ngach-xuat-khau-go-va-san-pham-go-toi-thi-truong-eu-giam-manh-9951 (Accessed: 20 May 2023).

Guttmann, S. & Richards, A. (2004), "The gravity model and Trade openness: An Australian perspective", *Reserve Bank of Australia*, Available at: https://www.rba.gov.au/publications/rdp/2004/2004-11/gravity-model.html (Accessed: 18 May 2023).

Hassan Khayat, S. (2019), "A gravity model analysis for trade between the GCC and developed countries", *Cogent Economics & Finance*, Vol. 7 No. 1, pp. 1703440.

Hujala, M. *et al.* (2013), "Explaining the shifts of international trade in pulp and Paper Industry", *Forest Science*, Vol. 59 No. 2, pp. 211–222.

Kangas, K. & Niskanen, A. (2003), "Trade in forest products between European Union and the Central and Eastern European access candidates", *Forest Policy and Economics*, Vol. 5 No. 3, pp. 297–304.

Magezi, H.E. & Okan, T. (2019), "Competitiveness analysis of forest products trade between Turkey and European Union countries", *Turkish Journal of Forestry | Türkiye Ormancılık Dergisi*, pp. 366–372.

Ministry of Industry and Trade of Vietnam. (n.d.), "Impact of the EU- Vietnam free trade agreement (EVFTA) on Vietnam", *Vietnam Free Trade Agreement Portal*. Available at: http://evfta.moit.gov.vn/data/7d80034a-9a2a-4c93-8046-9df701661850/userfiles/files/101_%20Impact%20of%20the%20EVFTA%20on%20Vietnam.pdf (Accessed: 23 May 2023).

Mohammadi Limaei, S. *et al.* (2011), "Wood import and export and its relation to major macroeconomics variables in Iran", *Forest Policy and Economics*, Vol. 13 No. 4, pp. 303–307.

Nga, L.T. *et al.* (2020), "European-vietnam free trade agreement (EVFTA) impacts on imports: A case study", *Journal of Security and Sustainability Issues*, Vol. 9 No. M.

Nguyen, V.H. (2022), "DIRECTIONS FOR STRATEGIES AND POLICIES OF IMPORT AND EXPORT OF GOODS FOR VIETNAM'S SUSTAINABLE DEVELOPMENT TOWARDS 2030", *Journal of Industrial and Commercial Research*, Available at: https://vioit.vn/uploads/tiny_uploads/PDF%20file/B%C3%A0i%20b%C3%A1o%20NCKH%20-%20C%C3%B4ng%203-2023.pdf (Accessed: 21 May 2023).

Stellian, R. & Danna-Buitrago, J.P. (2022), "Revealed comparative advantage and contribution-to-the-trade-balance indexes", *International Economics*, Vol. 170, pp. 129–155.

Sustainable impact assessment. (n.d.) *Thu vien Dai hoc Luat Ha Noi*. Available at: http://thuvien.hlu.edu.vn/KIPOSDATA0/KIPOSSysWebFiles/files/SanPham/TaiLieuDuAnMuTrap/BaoCaoNghienCuu/EU-2%20EVFTA_impact_assessment_study.pdf (Accessed: 22 May 2023).

Thuvienphapluat. (2020), "EVFTA - Chapter 1: Objectives and general definitions", *The EU-Vietnam Free Trade Agreement (EVFTA)*, Available at: https://thuvienphapluat.vn/chinh-sach-phap-luat-moi/vn/hiep-dinh-evfta/12814/hiep-dinh-evfta-chapter-1-objectives-and-general-definitions (Accessed: 17 May 2023).

Vu, T.T. *et al.* (2019) "Determinants of Vietnam's wood products trade: Application of the gravity model", *Journal of Sustainable Forestry*, Vol. 39 No. 5, pp. 445–460.

Wheeler, J. (2005), "Gravity model, Gravity Model - an overview | ScienceDirect Topics", Available at: https://www.sciencedirect.com/topics/nursing-and-health-professions/gravity-model (Accessed: 23 May 2023).

Zhang, D. & Li, Y. (2009), "Forest Endowment, logging restrictions, and China's Wood Products Trade", *China Economic Review*, Vol. 20 No. 1, pp. 46–53.