Journal of International Economics and Management
Journal homepage: http://jiem.ftu.edu.vn

Determinants of bilateral trade flows of Vietnam: evidence from panel fixed effects estimation approaches

Le Trung Ngoc Phat[1]
School of Economics, Can Tho University, Can Tho, Vietnam
Nguyen Kim Hanh
School of Economics, Can Tho University, Can Tho, Vietnam

Received: 06 January 2022; **Revised:** 06 June 2022; **Accepted:** 16 June 2022
https://doi.org/10.38203/jiem.022.2.0050

Abstract

This study aims to investigate the determinants of bilateral trade flows of Vietnam. The panel fixed effects estimation using Driscoll and Kraay standard errors and panel fixed effects two-stage least squares approach are employed to analyze a balanced panel data, which includes fifty-three countries that have been continuously trading with Vietnam from 1997 to 2019. The estimated results reveal that free trade agreements have a positive effect on the bilateral trade flows in trading with the developed or developing countries. Additionally, the bilateral trade flows between Vietnam and the developed countries are enhanced by the differences in income level. They are, however, impeded by the institutional distance and transportation cost. In the case of trading with the developing countries, transportation cost and exchange rate have a positive impact on the bilateral trade flows. The study provides some crucial policy implications for policymakers involving international trading activities in developing countries such as Vietnam.

Keywords: International trade, Panel fixed effects model, Instrumental variable estimation

1. Introduction

Various studies confirm that international trade significantly contributes to economic growth (Irandoust *et al.*, 2006; Bahmani-Oskooee and Brooks, 1999; Wang *et al.*, 2010). According to Wei and Liu (2006), international trade plays an important role in transferring updated knowledge and technology across borders through export and import activities. Domestic firms use foreign currency and import modern machines and high-tech equipment, which in turn support them in manufacturing merchandise and serving more rigorous demand from

[1] Corresponding author: ltnphat@ctu.edu.vn

domestic and foreign consumers. In fact, international trade is one of the major engines to boost the Vietnam economy's growth rate (Nguyen, 2020), which has been upholding more than 5% each year for three decades (since 1988). In 2019, the ratio of the total trade value turnover to Gross Domestic Product (GDP) reached 210.4%, which contributes to an increase in GDP by 7.02% (Vietnam GSO, 2019). Those figures sharply reflect a high openness of the Vietnam economy, which has established trade relationships with more than 200 nations and territories (VCCI, 2018).

Figure 1 describes the trade flows of Vietnam with the selected developing and developed countries listed in Table A1 (see Appendix). In specific, the trade flows have slowly increased from 1997 to 2007, then soared since 2007 when Vietnam became an official member of the World Trade Organization. Even though the trade flows have accidentally reduced during the period of 2008-2009 because of the global financial crisis, they have quickly recovered and continued to jump rapidly until 2019. Furthermore, the total import value far exceeds the total export value when trading with the developing countries, but not in the case of trading with the developed countries. This result implies that government should promote trade relations with developed countries to enhance the trade balance.

According to the report of OECD (2019), actively participating in various free trade agreements (FTA) is the major reason that makes ASEAN the world's fourth-largest exporting region. With a variety of bilateral FTAs as well as multilateral FTAs having been signed, the trade flows of Vietnam are expected to grow vigorously. Besides FTAs, the government should consider other policies to leverage the bilateral trade flows between Vietnam and its trading partners. Hence, it is crucial to identify the determinants of bilateral trade flows before establishing any promotional trade policies.

Numerous bilateral trade studies have mainly relied on the basic gravity model, which studies the impact of distance and national income on the bilateral trade flows (Tinbergen, 1962). Nonetheless, a drawback of the gravity model is unable to directly estimate the parameter of the time-invariant variables, for example distance, common border, common language, within panel fixed effects estimation because the inherent transformation wipes out such variables (Karamuriro and Karukuza, 2015). Hence, this study conquers the defect of gravity model by incorporating both distance and oil price as the proxy of transportation cost to retain panel fixed effects estimation. Another significant contribution to the literature of international trade studies is that this study validates some instrumental variables to solve the endogeneity problem when using FTAs as an explanatory variable.

This study aims to investigate the determinants of bilateral trade flows by analyzing panel data of fifty-three countries which have been continuously trading with Vietnam from 1997 to 2019. Profoundly, our estimated results reveal that the impact of FTAs on bilateral trade flows is seriously underestimated due to the presence of endogeneity problem. More interestingly, the estimated results in the case of trading with developed countries are thoroughly divergent from the ones with developing countries.

The rest of this study is structured as follows. The second section briefly summarizes the results of international trade studies and other related literature. The third section outlines the research framework and specifies the econometric model. The fourth section describes empirical results and discussion. The last section provides the conclusion and policy implications to improve international trade activities.

2. Theoretical background and literature review

2.1 Theoretical background

There are two principal international trade theories that explain the causes of world trade (Davis, 1997), including Ricardo's comparative advantage theory and Heckscher-Ohlin's theory. To fully grasp how comparative advantage and Heckscher-Ohlin's theory impact on bilateral trade between Vietnam and its trading partners, it is critical to ensure whether such current trading flows are in accordance with the claim of the aforementioned theories. The comparative advantage theory overcomes the limitations of the Adam Smith's absolute advantage theory, which imply that some countries might have the advantage of producing a variety of products, meanwhile other countries might not have any absolute advantage products. Comparative advantage theory (Ricardo, 1891) claims that when a country cannot produce goods more efficiently than the others, it still can manufacture such products better and more efficiently than it produces the other goods. It is then possible for a country to partially export and import goods which it does not have any comparative advantage in production.

Nevertheless, both the theories of Smith and Ricardo do not help countries identify which products would gain an advantage. Heckscher and Ohlin indicate a country's comparative advantage should be the relative abundance of labor and capital, which are the two most fundamental factors of production, to develop the neoclassical trade theory (Heckscher *et al.*, 1991). Some countries with plentiful labor and low wage rates tend to produce more labor-intensive commodities, then export them to exchange for capital-intensive goods from countries with abundant capital. Krugman *et al.* (2012) affirm that the Heckscher-Ohlin model thoroughly explains the pattern of trade between the developed and developing countries.

In this study, we apply the comparative advantage theory and Heckscher-Ohlin's theory to analyze the vital role of specialization and international trade in exploiting reasonably the scarce resources with the spirit of cooperation and sustainable development to promote the economic growth of developing countries including Vietnam.

2.2 Literature review

International trade has been received attention from both academics and politics. Based on the gravity model, numerous empirical studies have been conducted to clarify the engine of Vietnam's export (Nguyen, 2014; Tran and Vo, 2020; Thu *et al.*, 2019). Nguyen *et al.* (2020) admit that the economic size and income level of trading partners have a positive impact on the export. Additionally, Tran and Vo (2020) prove that the infrastructure and level of trade openness enhance the export activities. Nguyen (2014) suggests that the exchange rate and

FTAs have a positive effect on the export volume. Tu and Giang (2018) demonstrate that the trade cost, which includes costs incurred in both the exporting and importing country, such astransportation cost and transportation insurance premium, has a negative impact on the export value. Nguyen (2010) applies the static and dynamic gravity model to investigate the determinants of Vietnamese export flows and his study shows strong evidence that adding the lagged endogenous variable as a regressor will improve the estimated results.

Recently, some articles have been published to scrutinize the main sources of bilateral trade flows of Vietnam, both export and import (Anwar and Nguyen, 2011; Vu *et al.*, 2020). Noticeably, when applying the gravity model to study the trade activities between Vietnam and trading partners, Dinh *et al.* (2014) point out that the exchange rate, economic size, and market size of trading partners have a positive relationship with the bilateral trade flows. Additionally, Nguyen *et al.* (2015) prove that tariff rate and distance have a negative effect on the bilateral trade flows between Vietnam and EU members.

Many empirical studies acknowledge that the market size, which is represented by nominal GDP or income level of the host country and its trading partners, has a positive effect on the bilateral trade flows (Summary, 1989; Wang *et al.*, 2010; Yu and Zietlow, 1995). Additionally, Linders *et al.* (2005) prove that the cultural distance is another factor that has a positive impact on the international trade. Meanwhile, the institutional distance has a reverse effect. Also, the distance between two countries restrains their bilateral trade flows (De Groot *et al.*, 2004; Yu and Zietlow, 1995). Some studies include dummy variables such as common language, border, religion, and membership in regional FTAs to explain the variation of bilateral trade flows (Linders *et al.*, 2005; Yu and Zietlow, 1995). The studies of Irandoust *et al.* (2006) and Bahmani-Oskooee and Brooks (1999) admit that exchange rate is one of the key factors that affect the bilateral trade flows. Its effect is, however, mixed.

Recent empirical studies have tried to augment the gravity model and divulged some interesting results. Gold and Rasiah (2021) apply the Poisson pseudo-maximum likelihood and dynamic bias-corrected least squares dummy variable to demonstrate that the weak control of corruption has a negative effect on the trade flows between Africa and China. Meanwhile, the trade openness has a reverse effect. Noticeably, Umair *et al.* (2022) apply the Heckscher-Ohlin and the gravity model to examine the bilateral trade performance of Pakistan and show that the remoteness, land, capital, and labor endowment have a positive relationship with the bilateral trade flows. Other studies reveal that the foreign directed investment flows and mobile subscription ratio (Oparanya *et al.*, 2019), physical and cultural distance (Hoang *et al.*, 2020) have a negative effect on trade values. Those studies also agree that exchange rate, geographical distance, GDP of each participant, and the differences in their GDP have some discernible effects on the bilateral trade flows.

To study the bilateral trade flows, diverse approaches have been utilized. Summary (1989) manipulates the gravity model with the ordinary least squares (OLS) estimation technique to determine the factors that affect the bilateral trade flows between the United States (US) and its sixty-six trading partners. The result indicates that the political factors comprising the number of arms transfer, the number of foreign agents registered in the US, and the number

of US government employees located in the trading country have a positive impact on the bilateral trade flow. Yu and Zietlow (1995) apply the gravity model with an OLS approach to identify the determinants of bilateral trade flows among fourteen Asia-Pacific countries. They indicate that political stability, cultural similarity, and being newly industrialized are significant factors that affect trade flows, apart from market size and physical distance.

Instead of applying the gravity model with the OLS estimation technique, Bahmani-Oskooee and Brooks (1999) utilize the Johansen-Juselius estimation technique to examine the long-run and short-run impact of the exchange rate and GDP level on the bilateral trade flows between USA and its six trading partners from 1973 to 1996. Furthermore, Irandoust *et al.* (2006) perform a likelihood-based panel cointegration methodology to investigate the impact of price and income elasticity on the bilateral trade flows between Sweden and the eight largest trading partners over the period 1960-2001. Nguyen *et al.* (2020) employ the Poisson pseudo-maximum-likelihood to clarify the determinants of export flows from Vietnam to 20 countries from 2000 to 2018. Meanwhile, Tran and Vo (2020) apply the Hausman-Taylor estimator to identify the determinants of Vietnam's export to the EU market in the period of 2007-2017. Dinh *et al.* (2014) use the random effect model and pooled (POLS) to analyze the bilateral trade flow between Vietnam and 60 trading partners from 2000 to 2010.

Although the gravity model is widely applied to study the bilateral trade flows (Disdier and Head, 2008), we are unable to utilize the panel fixed effects model to estimate the time-invariant variables such as distance (Martinez-Zarzoso and Nowak-Lehmann, 2003; Karamuriro and Karukuza, 2015). To avoid the weakness of the fixed effects model, this study reforms the original gravity model by incorporating both distance and oil price as the proxy of transportation cost instead of using only distance.

Overall, previous international trade studies have identified that institutional distance (ID), real effective exchange rate, the market size of each participant and their GDP difference cause a significant impact on the trade flows. Noticeably, most of those studies ignore the presence of endogeneity issues when using FTAs as an explanatory variable that may lead to a bias estimated results (Baier and Bergstrand, 2002). Hence, this study employs panel fixed effects two-stage least squares approach to gingerly estimate the impact of FTAs together with transportation cost, institutional distance (ID), real effective exchange rate and income gap on the bilateral trade flows of Vietnam.

3. Research methodology

3.1 Research model

Besides investigating the determinants of Vietnam's export value with country i at year t, we study those of Vietnam's import value from country i at year t by Equations (1) and (2). Except for ID and a dummy variable for FTAs, we transform the rest of the explanatory variables into logarithms. The function of country i's demand for Vietnam exports and Vietnam's demand for imports from country i can be expressed as follows:

$$\ln EXP_{it} = \alpha_0 + \alpha_1 \ln REER_{it} + \alpha_2 ID_{it} + \alpha_3 \ln Transc_{it} + \alpha_4 \ln Inc\_gap_{it} + \alpha_5 FTA_{it} + u_i + \varepsilon_{it} \quad (1)$$

$$\ln IMP_{it} = \beta_0 + \beta_1 \ln REER_{it} + \beta_2 ID_{it} + \beta_3 \ln Transc_{it} + \beta_4 \ln Inc\_gap_{it} t + \beta_5 FTA_{it} + v_i + \epsilon_{it} \quad (2)$$

where EXP_{it}, IMP_{it} denote Vietnam's export and import value with country i at year t, respectively; u, v are the country-specific fixed effects; ε, ϵ are the idiosyncratic errors.

In this study, the selected country i must have incurred continuously both export and import activities with Vietnam during the period of 1997-2019. Furthermore, the impact on bilateral trade flows might rely on the properties of the development stage of trading partners. Thus, according to the classification of United Nations (2019), we divide fifty-three trading partners into two groups (see Appendix). These partners include 26 developed countries and 27 developing countries. There are numerous studies exploring the relationship between exchange rate and export performance (Boug and Fagereng, 2010; Hall *et al.*, 2010; Nguyen and Do, 2020). The results are different and still debated. Theoretically, a devaluation of a nation's currency will make its products cheaper in the foreign market, and will stimulate the purchasing power of foreign customers. This will lead to an expansion of export. The price of imported commodities will be, however, higher if the value of the nation's currency is lessened. Consequently, the domestic market will certainly consume fewer imported commodities than it used to. Based on these theories, the exchange rate is expected to cause a positive effect on exports and a negative effect on imports.

Apart from that, institutional distance is used to measure the disparity in governance infrastructure quality between two nations. Logically, firms of a country will quickly adapt to the business environment and boldly invest in another country if two nations have the same conditions regarding political stability, regulatory quality, government effectiveness, voice and accountability, rule of law and control of corruption. In other words, a firm is more likely to export to another country that has the same institutional quality as its home country because it does not severely suffer from adaptation costs deriving from the unfamiliarity related to the transaction contingencies in trade (Linders *et al.*, 2005). Furthermore, the studies of Linders *et al.* (2005) and De Groot *et al.* (2004) confidently endorse a negative effect between the trade flows and institutional distance. Therefore, we suppose that the lower institutional distance between the two countries, the higher bilateral trade flows.

With respect to the Heckscher-Ohlin theory, some developed countries have plenty of modern machinery and equipment. However, the wage for employees constitutes a large proportion. That induces their costs of producing labor-intensive goods to be higher than countries with plentiful labor and low wage rates. As a result, a win-win relationship will be established between the two countries. A lower-income country will import modern machines and technology from a higher-income country, who inversely imports more labor-intensive goods due to lower price. We assume that the income gap, which reflects the difference in development levels between the two countries, has a positive effect on the bilateral trade flows, as confirmed in the previous studies (Umair *et al.*, 2022; Karamuriro and Karukuza, 2015).

De Groot *et al.* (2004) and Linders *et al.* (2005) affirm that the distance between two countries, which is a proxy of transportation cost, has a negative effect on the bilateral trade flows. In fact, the transportation cost depends on the distance between the two countries. Accordingly, a nation is more likely to do business with its closer neighbors to reduce the cost of shipping. We expect

that an increase in transportation cost, which is represented by the combination of the oil price and the distance between the two nations, will decrease the bilateral trade flows.

According to the terms of FTAs, each country that embarks on FTAs must eliminate most of trade barriers such as tariffs, quotas, or subsidies to promote the trade flows among members. Therefore, goods and services can be bought and sold across international borders without any prohibitions or restrictions. If two countries are members of a common bilateral or multilateral FTA, the bilateral trade flows between them will be surged. Nevertheless, Baier and Bergstrand (2002) notify that FTAs are not exogenous. The effect of FTAs on trade flows is seriously underestimated.

3.2 Research framework

To evade biased when estimating Equations (1) and (2), this study employs the panel fixed effects estimation with Driscoll-Kraay standard errors and the panel fixed effects two-stage least squares (FE-2SLS) approaches.

As stated by Wooldridge (2013), to eliminate the country-specific fixed effects ai, all variables in the estimation function are within-transformed into fixed effects model. Consider a model with n explanatory variables:

$$y_{it} = \theta_1 x1_{it} + \ldots + \theta_n xn_{it} + a_i + \omega_{it}, t = 1, 2, \ldots, T \quad (3)$$

where y_{it} is dependent variable; $x1_{it}, \ldots, xn_{it}$ are explanatory variables; a_i is the country-specific fixed effects; ω_{it} is the idiosyncratic errors. For each i, by averaging this equation over time, we get:

$$\overline{y}_i = \theta_1 \overline{x_{ni}} + \ldots + \theta_n \overline{x_{ni}} + a_i + \overline{\omega_i} \quad (4)$$

where $\overline{y}_i = T^{-1}\sum_{t=1}^{T} y_{it}$; If we subtract Equations (4) from (3), we could eliminate the country-specific fixed effects a_i:

$$y_{it} - \overline{y}_i = \theta_1(x_{1it} - \overline{x_{1t}}) + \ldots + \theta_n(x_{nit} - \overline{x_{nt}}) + \omega_{it} - \overline{\omega_i} \quad (5)$$

or

$$\ddot{y}_i = \theta_1 \ddot{x}_{1it} + \ldots + \theta_n \ddot{x}_{it} + \ddot{\omega}_{it}, t = 1, 2, \ldots, T \quad (6)$$

where $\ddot{y}_{it} = y_{it} - \overline{y_{it}}$ are time-demeaned data of dependent variables. Also, time-demeaned data of explanatory variables $\ddot{x}_{1it}$, $\ddot{x}_{nit}$ and the idiosyncratic errors $\ddot{\omega}_{it}$ are similarly generated.

Noticeably, Hoechle (2007) argues that analyzing panel models without considering cross-sectional correlation might lead to severely biased statistical results. Hence, this study implements the panel fixed effects model with Driscoll and Kraay standard errors to deal with the heteroskedasticity, autocorrelation, and cross-sectional dependence violation (Hoechle, 2007). The panel fixed effects regression model using Driscoll and Kraay standard errors is executed in two steps (Hoechle, 2007). In the first step, all variables are within-transformed into the panel fixed effects model. Then, Driscoll and Kraay standard errors for the coefficient estimates (θ) are obtained as the square roots of the diagonal elements of the asymptotic (robust) covariance matrix.

Also, this study performs the panel fixed effects two-stage least squares (FE-2SLS) method to manage the endogeneity issue in the right-hand side variables. To deploy the FE-2SLS procedure we need to identify some valid instrumental variables z_{it}, which is strictly exogenous conditional on a_i and uncorrelated with the idiosyncratic errors ω_{it} (Semykina and Wooldridge, 2010).

Based upon the welfare-maximizing theoretical framework, Goldberg and Maggi (1999) and Baier and Bergstrand (2002) agree that government is likely to form or enforce an FTA because of economic welfare rather than political welfare. Government tends to form an FTA with a country to effortlessly access that country's sizable market such as exporting commodities that require more inputs from a production factor that they have comparative advantage. They import the goods that they do not have any comparative advantage compared to their partner as stated in Heckscher-Ohlin theory. Therefore, market size, which is represented by nominal GDP, and factor endowment, which is represented by capital per labor ratio, should be considered before forming an FTA. Baier and Bergstrand (2004) proves that nominal GDP and capital per labor ratio are determinants of the formation of FTAs.

Following Baier and Bergstrand (2002, 2004), this study applies some valid instrumental variables (IVs) involving nominal GDP and relative factor endowment, which is capital-labor ratio, to evaluate the influence of FTAs with an assumption that FTAs have a positive effect on the bilateral trade flows.

3.3 Variables and measures

To examine the determinants on the bilateral trade flows of Vietnam, the explanatory variables are interpreted as follows:

$REER_{it}$ is the real effective exchange rate between Vietnam and country i at year t:

$$REER_{it} = e_{it} \times \frac{(p_t^i)}{(p_t^{VN})} \tag{7}$$

where e_{it} is the nominal exchange rate between Vietnam's currency and the currency of country i at year t, which is obtained from fxtop website; p_t^i and p_t^{VN} denote price level of country i and price level of Vietnam in year t, respectively.

ID_{it} is the institutional distance between Vietnam and country i at year t. The measure of institutional distance is based on six dimensions of the governance infrastructure quality (Kaufmann *et al.*, 2003) including voice and accountability, political stability, government effectiveness, regulatory quality, rule of law, and control of corruption. We apply Kogut and Singh's (1988) index to compute the institutional distance:

$$ID_{it} = \frac{\frac{1}{6}\sum_{k=1}^{6}\left(I_{kt}^{i} - I_{kt}^{VN}\right)^2}{V_k} \tag{8}$$

where I_{kt}^{i} indicates country i's score on k^{th} dimension at year t; I_{kt}^{VN} indicates the score of Vietnam on k^{th} dimension at year t; and V_k the variance of k^{th} dimension during the period of 1997-2019.

$Transc_{it}$ is the transportation cost between Vietnam and country i at year t. To deal with the time-invariant regression with geographical distance, this study combines both the oil price at year t and distance between Vietnam and country i to compute transportation cost:

$$Transc_{it} = oilpr_t \times D_i \quad (9)$$

where D_i denotes airline distance between the capital of Vietnam and the capital of country i. Data are collected from the website timeanddate.com. The oil price is measured by the global price of Brent Crude, which is taken from the Federal Reserve Economic Data, and then transformed into real oil price by using the exchange rate and the US and domestic GDP deflators (Nguyen and Kakinaka, 2019).

Inc_gap_{it} represents distance per capita income. Instead of income level of each country, this study utilizes the absolute distance per capita income between Vietnam and country i at year t, which is computed as:

$$Inc\_gap_{it} = |inc_t^i - inc_t^{VN}| \quad (10)$$

where inc_t^{VN} and inc_t^i stand for per capita income in US dollars of Vietnam and country i in year t, respectively.

FTA_{it} is a dummy variable that takes the value of 1 if Vietnam and country i are members of a bilateral or multilateral FTA in year t, and 0 otherwise.

3.4 Data sources

Data of export and import value are obtained from the International Monetary Fund database. The explanatory variables are collected from various reliable data resources as summarized in Table 1.

Table 1. Sources of data

Variables	Description	Sources
REER	Real effective exchange rate between Vietnam and the selected country	Penn World Table version 10.0
ID	Institutional distance between Vietnam and the selected country	World Development Indicators
Transc	Transportation cost between Vietnam and the selected country	Federal Reserve Economic Data
Inc_gap	Distance per capita income between Vietnam and the selected country	Penn World Table version 10.0
FTA	Takes the value 1 if Vietnam and the selected country are members of a common FTA	Vietnam Chamber of Commerce and Industry
NGDP	Nominal GDP of the selected country	World Bank database
KpL	Capital per Labor ratio of the selected country	Penn World table version 10.0

Sources: The authors' compilation

4. Empirical results and discussions

4.1 Panel unit root tests

It is obligatory to perform unit root tests for all series to avoid a spurious regression under the presence of one or more non-stationary variables (Hill *et al.*, 2010). With a balanced panel data, two types of panel unit root tests, including Levin-Lin-Chu and Breitung tests, are conducted to check the stationarity of all variables. All of these tests employ a null hypothesis of a unit root. In addition, those unit root tests follow a procedure that subtracts the cross-sectional averages from the series to mitigate the impact of cross-sectional dependence as proposed by Levin *et al.* (2002). Furthermore, as suggested by Herwartz *et al.* (2018), we perform heteroskedasticity-robust panel unit-root tests to deal with heteroskedasticity problems. The results of panel unit root test in Table 2 reject the null hypothesis and confirm that all variables are stationary at first difference.

Table 2. Panel unit root test

	Type of test	Export function	Import function
Developed countries group	F-test	F(25, 567) = 101.13***	F(25, 567) = 95.09***
	Hausman test	$chi^2(5)$ = 17.7**	$chi^2(5)$ = 30.17***
	Modified Wald test	$chi^2(26)$ = 1269.94***	$chi^2(26)$ = 1278.85***
	Wooldridge test	F(1, 25) = 115.352***	F(1, 25) = 50.918***
	Pesaran's test	CD = 19.603***	CD = 15.854***
	F-test	F(26, 589) = 45.04***	F(26, 589) = 66.59***
Developing countries group	Hausman test	$chi^2(5)$ = 143.29***	$chi^2(5)$ = 18.63**
	Modified Wald test	$chi^2(27)$ = 696.15***	$chi^2(27)$ = 567.23***
	Wooldridge test	F(1, 26) = 116.845***	F(1, 26) = 109.417***
	Pesaran's test	CD = 45.141***	CD = 28.953***
	-1.904**	-11.634***	-3.159***
	-2.839**	-5.091***	-2.5786***

Notes: *, **, *** indicate 10%, 5%, and 1% level of significance, respectively.

Source: The authors' calculation

4.2 Model selection

According to Wooldridge (2013), besides POLS approach, fixed effects or random effects could be employed to estimate a stationary panel data. The value of F-test and Hausman tests reported in Table 3 show that fixed effects is the most appropriate technique for both export and import model estimations for both developed and developing countries.

Both the modified Wald test and Woodridge test are performed to detect the violation of the fixed effects model involving heteroskedasticity and serial correlation problems. The results shown in Table 3 reject the null hypothesis and validate the existence of heteroskedasticity

and autocorrelation problems. Another problem that should be considered with panel data regression is the presence of cross-sectional dependence of errors across units which might lead to biased statistical results (Hoechle, 2007; De Hoyos and Sarafidis, 2006). The results of Pesaran's CD statistics reported in Table 3 reject the null hypothesis and endorse the existence of cross-sectional dependence in the error terms.

Table 3. Model selection criterions

	Variables	Levin, Lin and Chu		Breitung (lambda)		Hetero -robust	
		At Level	At first different	At Level	At first different	At Level	At first different
Developed countries group	lnEXP	-2.270**	-10.744***	-2.306**	-8.925***	2.218	-2.472***
	lnIMP	-3.564***	-15.833***	-2.887***	-12.001***	2.326	-2.708***
	lnREER	-4.077***	-13.078***	-1.817**	-12.371***	-0.235	-2.248***
	ID	-2.6381***	-7.961***	-2.782***	-12.855***	0.296	-2.512***
	lnTransc	-69.560***	-46.589***	-3.5337***	-11.000***	-1.629	-2.075**
	lnInc_gap	-2.153**	-9.860***	-3.559***	-6.727***	1.178	-2.625***
Developing countries group	lnEXP	-2.732***	-11.973***	-6.075***	-6.414***	2.285	-2.296**
	lnIMP	-7.885***	-9.801***	-3.704***	-8.421***	1.431	-2.054**
	lnREER	-2.112**	-9.340***	-1.837**	-5.414***	2.040	-2.382**
	ID	-3.723***	-14.804***	-2.237**	-13.260***	-1.460	-2.059**
	lnTransc	-1.904**	-11.634***	-3.159***	-8.553***	1.059	-2.358***
	lnInc_gap	-2.839**	-5.091***	-2.5786***	-6.914***	-0.938	-2.535***

Note: *, **, *** indicate 10%, 5% and 1% level of significance, respectively.

Source: The authors' calculation

4.3 Empirical results

In this study, the panel fixed effects regression model encounters three problems, which are heteroskedasticity, autocorrelation, and cross-sectional dependence (HAC) in the error terms. To mitigate these problems, Hoechle (2007) suggests using Driscoll and Kraay standard errors in fixed effects regression.

Another serious violation that must be considered is the endogenous explanatory variables. The Durbin-Wu-Hans test reported in Table 4 indicates that there is an endogeneity problem with the FTA variable in our estimation. As proposed by Baier and Bergstrand (2002), this study uses nominal GDP and relative factor endowment, capital-labor ratio, as the instrumental variables to deal with the endogeneity problem caused by FTAs. The result of Hansen J statistic in Table 4 convinces us that the instrumental variables are valid.

Table 4. Estimated results

	Independent Variables	Export function			Import function		
		FE	FE with Drisc/ Kraay S.E	FE with IV	FE	FE with Drisc/ Kraay S.E	FE with IV
Developed countries group	_Constant	-18.814*** (2.464)	-18.814*** (5.860)		-21.342*** (2.271)	-21.342*** (4.779)	
	lnREER	1.008*** (0.152)	1.008*** (0.209)	-0.368 (0.327)	0.629*** (0.140)	0.629*** (0.201)	-0.539 (0.286)
	ID	-0.754*** (0.047)	-0.754*** (0.072)	-0.726*** (0.081)	-0.675*** (0.043)	-0.675*** (0.051)	-0.650*** (0.070)
	lnTransc	-0.100*** (0.036)	-0.100 (0.060)	-0.197** (0.064)	-0.029 (0.033)	-0.029 (0.060)	-0.112** (0.056)
	lnInc_gap	3.289*** (0.252)	3.289*** (0.600)	3.781*** (0.441)	3.664*** (0.232)	3.664*** (0.491)	4.081*** (0.385)
	FTA	0.877*** (0.182)	0.877*** (0.249)	7.007*** (0.926)	1.068*** (0.167)	1.068*** (0.226)	6.272*** (0.809)
	Observation	598	598	598	598	598	598
	Endogeneity test of FTA				65.634***	65.634***	
	Hansen J stat				25.835***	43.378***	
Developing countries group	_Constant	-20.722*** (2.323)	-20.722*** (6.234)		-20.285*** (2.189)	-20.285*** (6.316)	
	lnREER	1.164*** (0.129)	1.164*** (0. 321)	0.867*** (0.161)	1.387*** (0.122)	1.387*** (0.308)	1.116*** (0.151)
	ID	-0.203*** (0.073)	-0.203 (0. 114)	0.065 (0.101)	-0.224*** (0.069)	-0.224*** (0. 097)	0.020 (0.095)
	lnTransc	1.711*** (0.097)	1.711*** (0. 259)	1.480*** (0.122)	1.753*** (0.092)	1.753*** (0.299)	1.543*** (0.114)
	lnInc_gap	0.593*** (0.116)	0.593** (0. 214)	0.161 (0.161)	0.336*** (0.109)	0.336*** (0.152)	-0.058 (0.151)
	FTA	1.287*** (0.201)	1.287*** (0.179)	4.159*** (0.641)	0.829*** (0.189)	0.829*** (0.117)	3.446*** (0.599)
	Observation	621	621	621	621	621	621
	Endogeneity test of FTA				77.944***		66.682***
	Hansen J stat				207.587***		22.493***

Note: *, **, *** indicate 10%, 5%, and 1% level of significance, respectively; the figures in the bracket () show the standard error.

Source: The authors' calculation

Table 4 shows that there is a divergence among the three kinds of panel fixed effects estimation techniques, which are original panel fixed effects, panel fixed effects estimation using Driscoll and Kraay standard errors, and panel fixed effects estimation using instrumental variables. It can be clearly seen that the results of the original panel fixed effects estimation are biased due to the presence of HAC violation, which causes normal standard errors to be lower than actual. Because of the endogeneity problem caused by FTAs, its magnitude impacts on the bilateral trade flows are severely underestimated. This result is consistent with the study of Baier and Bergstrand (2002).

Our estimated results suggest that FTAs are the most powerful engine to boost Vietnam's bilateral trade flows with the developed and developing countries. Theoretically, if both countries are members of a FTA, their bilateral trade flows will be enlarged due to the removal of trade barriers. This result is in alignment with the study of Karamuriro and Karukuza (2015), and Yu and Zietlow (1995).

The results from Table 4 show that the real effective exchange rate does not have any impact on the bilateral trade flows between Vietnam and the developed countries due to the comparative advantage. As mentioned in the Ricardian trade theory (Golub and Hsieh, 2000), the international trade products are so essential that each country needs them to improve its production capability or satisfy the resident's growing demands. For instance, Vietnam exhaustively craves hi-tech equipment and modern manufacturing processes from developed countries to improve its production capability. Therefore, any fluctuation in exchange rate may not affect trade volumes between Vietnam and the developed countries.

In trading with the developing countries, the real effective exchange rate has a positive impact on the bilateral trade flows. This result is in line with the studies of Bahmani-Oskooee and Brooks (1999), Irandoust *et al.* (2006), and Karamuriro and Karukuza (2015). In fact, an increase in the exchange rate will make its products cheaper in the foreign market and stimulate the purchasing power of foreign customers. This will lead to an enlargement of export as expected. The unexpected increase in import value can be explained that a devaluation of the Vietnamese Dong will raise the import price immediately. Meanwhile, the import volume cannot be adjusted promptly due to the signed contracts before.

Besides, the difference in income level between Vietnam and the developed countries has a statistically significant impact on both export and import values. This result implies that the more distance in income level between two countries, the higher the bilateral trade flows. The main cause may be that a developing country, which has abundant labor and low wage rate will import more modern machines and technology to improve its capability and inversely export more labor-intensive goods to the developed countries due to lower price. For instance, according to the European Commission (2020), EU countries are likely to import labor-intensive products such as footwear, textiles and clothing, coffee, rice and seafood from Vietnam. In contrast, they export high-tech products such as electrical equipment, aircraft, vehicles, and pharmaceutical products. Our result is consistent with the Heckscher-Ohlin theory and the study of Karamuriro and Karukuza (2015).

Additionally, the institutional distance restricts the bilateral trade flows between Vietnam and the developed countries. This negative effect caused by the difference in institution will establish a considerable trade barrier that diminishes the bilateral trade flows. Property rights, discriminatory tariffs, and quality of overall infrastructure are potential trade barriers. Our results, which are in accordance with Linders *et al.* (2005), imply that a more similarity in the institution or a better improvement in institutional quality will boost the bilateral trade flows between Vietnam and the developed countries.

Nevertheless, these significant impacts of income gap and institutional distance will vanish in trading with the developing countries. Vietnam and developing partners have the same level of development. Thus, the trade activities between them do not depend on the comparative advantage of each country. Also, the institutional distance between Vietnam and the developing countries is not large enough to consider the disparity in institutional conditions before conducting trade activities.

Interestingly, the impact of transportation cost is completely opposite between the two groups. Specifically, transportation cost has a negative impact on the bilateral trade flows between Vietnam and the developed countries and a positive impact in trading with the developing countries. The negative sign of transportation cost implies that an increase in transportation cost, which is caused by the far geographical distance (see Appendix for the average distance between Vietnam and the developed countries) and/or rising oil prices, will harm the bilateral trade flows. This result is in line with previous studies that employed the gravity model (De Groot *et al.*, 2004; Dinh *et al.*, 2014; Nguyen *et al.*, 2015; Vu *et al.*, 2020).

An increase in transportation cost will raise the total trade value between Vietnam and the developing countries. There are some convincing reasons to explain the unexpected effect of transportation cost. First, the average distance between Vietnam and the developing countries (see Appendix) is 6270 kilometers. If we remove MERCOSUR countries data, which only account for 3% of the total trade value with the developing countries, the average distance will be 4200 kilometers, which is far lower than that with the developed countries. Therefore, an increase in transportation cost is inconsiderable. In addition, if the oil price increases, the export/import price will jump immediately. However, the trade volume cannot adjust promptly, leading to a rise in the total value of trade flows in the short-run.

5. Conclusion and policy implication

This study aims to explore the determinants of bilateral trade flows between Vietnam and its fifty-three trading partners in the period of 1997-2019. We construct a balanced panel database taken from various reliable resources. We divide fifty-three countries into two groups, which are the developed and developing countries. The panel fixed effect estimation with Driscoll and Kraay standard errors and FE-2SLS with instrumental variables is performed to remove biased estimation.

Our estimated results specify that the availability of FTAs is the most robust engine for strengthening the bilateral trade flows in both groups. Meanwhile, the transportation cost has a negative effect on trading with the developed countries and an inverse effect on trading with the developing countries. The bilateral trade flows between Vietnam and the developed countries are enhanced by the difference in income level, but impeded by the gap of institutional distance. A devaluation of the Vietnamese Dong will raise the bilateral trade flows between Vietnam and the developing countries.

This study provides a practical implication not only for the government of Vietnam but also for governments of other developing countries to seek potential trading partners. Establishing trade relations with the developed countries should be a priority policy to leverage the trade balance of Vietnam. Moreover, the government should ameliorate its institutional condition and actively participate in FTAs to bolster its bilateral trade flows with the developed countries.

Our limitation is on sample selection. Future studies should augment not only the number of trading partners but also the time period to reach a more accurate conclusion, especially, the impact of transportation cost. Last but not least, future works should include more additional variables, and delve into the short-run and long-run impact of those explanatory variables on the bilateral trade flows, or explore the indirect impact of interactions between variables on the bilateral trade flows.

References

Anwar, S. and Nguyen, L.P. (2011), "Foreign direct investment and trade: the case of Vietnam", *Research in International Business and Finance,* Vol. 25 No. 1, pp. 39 - 52.

Bahmani-Oskooee, M. and Brooks, T.J. (1999), "Cointegration approach to estimating bilateral trade elasticities between US and her trading partners", *International Economic Journal,* Vol. 13, No. 4, pp. 119 - 128.

Baier, S.L. and Bergstrand, J.H. (2002), *On the endogeneity of international trade flows and free trade agreements,* New York: Mimeo.

Baier, S.L. and Bergstrand, J.H. (2004), "Economic determinants of free trade agreements", *Journal of International Economics,* Vol. 64 No. 1, pp. 29 - 63.

Boug, P. and Fagereng, A. (2010), "Exchange rate volatility and export performance: a cointegrated VAR approach", *Applied Economics,* Vol. 42 No. 7, pp. 851 - 864.

Davis, D.R. (1997), "Critical evidence on comparative advantage? North-North trade in a multilateral world", *Journal of Political Economy,* Vol. 105 No. 5, pp. 1051 - 1060.

De Groot, H.L., Linders, G.J., Rietveld, P. and Subramanian, U. (2004), "The institutional determinants of bilateral trade patterns", *Kyklos,* Vol. 57 No. 1, pp. 103 - 123.

De Hoyos, R.E. and Sarafidis, V. (2006), "Testing for cross-sectional dependence in panel-data models", *The Stata Journal,* Vol. 6 No. 4, pp. 482 - 496.

Dinh, T.T.B., Nguyen, V.D. & Hoang, M.C. (2014), "Applying gravity model to analyze trade activities of Vietnam", *External Economics Review,* No. 69, pp. 3 - 18.

Disdier, A.C. and Head, K. (2008), "The puzzling persistence of the distance effect on bilateral trade", *The Review of Economics and Statistics,* Vol. 90 No. 1, pp. 37 - 48.

European Commission. (2020), "Commission welcomes European Parliament's approval of EU-Vietnam trade and investment agreements", Available at https://ec.europa.eu/commission/presscorner/detail/en/ip_20_227 (Accessed 13 April, 2021).

Golub, S.S. and Hsieh, C.T. (2000), "Classical Ricardian theory of comparative advantage revisited", *Review of International Economics,* Vol. 8 No. 2, pp. 221 - 234.

Goldberg, P.K. and Maggi, G. (1999), "Protection for sale: an empirical investigation", *American Economic Review,* Vol. 89 No. 5, pp. 1135 - 1155.

Gold, K. and Rasiah, R. (2021), "China's bilateral trade in Africa: is institutional structure a determinant?", *Chinese Management Studies,* Vol. ahead-of-print No. ahead-of-print.

Hall, S., Hondroyiannis, G., Swamy, P.A.V.B., Tavlas, G. and Ulan, M. (2010), "Exchange-rate volatility and export performance: do emerging market economies resemble industrial countries or other developing countries?", *Economic Modelling,* Vol. 27 No. 6, pp. 1514 - 1521.

Hill, R.C., Griffiths, W.E. and Lim, G.C. (2010), *Principles of econometrics,* 4th edition, Pearson, London, United Kingdom.

Heckscher, G., Heckscher, E.F. & Ohlin, B. (1991), *Heckscher-Ohlin trade theory,* MIT Press.

Herwartz, H., Maxand, S., Raters, F.H. and Walle, Y.M. (2018), "Panel unit-root tests for heteroskedastic panels", *The Stata Journal,* Vol. 18 No. 1, pp. 184 - 196.

Hoang, N.T.T., Truong, H.Q. and Van Dong, C. (2020), "Determinants of trade between Taiwan and ASEAN countries: a PPML estimator approach", *SAGE Open,* Vol. 10 No. 2, pp. 1 - 13.

Hoechle, D. (2007), "Robust standard errors for panel regressions with cross-sectional dependence", *The Stata Journal,* Vol. 7 No. 3, pp. 281 - 312.

International Monetary Fund. (2021), "Data", Available at https://www.imf.org/en/Data (Accessed 24 June, 2021).

Irandoust, M., Ekblad, K. and Parmler, J, (2006), "Bilateral trade flows and exchange rate sensitivity: evidence from likelihood-based panel cointegration", *Economic Systems,* Vol. 30 No. 2, pp. 170 - 183.

Karamuriro, H.T. and Karukuza, W.N. (2015), "Determinants of Uganda's export performance: a gravity model analysis", *International Journal of Business and Economic Research,* Vol. 4 No. 2, pp. 45 - 54.

Kaufmann, D., Kraay, A. and M. Mastruzzi. (2003), "Governance Matters III: governance indicators for 1996-2002", Working paper No. 3106, World Bank Policy Research.

Kogut, B. and Singh, H. (1988), "The effect of national culture on the choice of entry mode", *Journal of International Business Studies,* Vol. 19 No. 3, pp. 411 - 432.

Krugman, P.R., Obstfeld, M. and Melitz, M.J. (2012), *International economics: theory & policy,* The Pearson Series in Economics.

Levin, A., Lin, C.F and Chu, C.S.J. (2002), "Unit root tests in panel data: asymptotic and finite-sample properties", *Journal of econometrics,* Vol. 108 No. 1, pp. 1 - 24.

Linders, G.J., Slangen, A., De Groot, H.L.F. and Beugelsdijk, S. (2005), "Cultural and institutional determinants of bilateral trade flows", Working paper No. 2005-074/3, Tinbergen Institute, Netherlands.

Martínez-Zarzoso, I. and Nowak-Lehmann, F. (2003), "Augmented gravity model: an empirical application to Mercosur-European Union trade flows", *Journal of Applied Economics,* Vol. 6 No. 2, pp. 291 - 316.

Nguyen, B.X. (2010), "The determinants of Vietnamese export flows: static and dynamic panel gravity approaches", *International Journal of Economics and Finance,* Vol. 2 No. 4, pp. 122 - 129.

Nguyen, B.D., Tu, T.A. and Nguyen, T.T. (2015), "Future Vietnam-EU Free Trade Agreement (Vietnam-EU FTA): an analysis of trade creation and trade diversion effects", *External Economics Review,* No. 72, pp. 3 - 20.

Nguyen, H. (2014). "Determinants of Vietnam's exports: application of the gravity model", Available at https://ssrn.com/abstract=2475781 (Accessed 13 April, 2020).

Nguyen, H.H. (2020), "Impact of foreign direct investment and international trade on economic growth: empirical study in Vietnam", *The Journal of Asian Finance, Economics and Business,* Vol. 7 No. 4, pp. 323 - 331.

Nguyen, K.H. and Kakinaka, M. (2019), "Renewable energy consumption, carbon emissions, and development stages: some evidence from panel cointegration analysis", *Renewable Energy,* Vol. 132, pp. 1049 - 1057.

Nguyen, V.C. and Do, T.T. (2020), "Impact of exchange rate shocks, inward FDI and import on export performance: a cointegration analysis", *The Journal of Asian Finance, Economics, and Business,* Vol. 7 No. 4, pp. 163 - 171.

Nguyen, H.Q., Tran, H.T.L., Truong, H.Q. and Van Dong, C. (2020), "Patterns and determinants of Vietnamese seafood exports", *Journal of Southwest Jiaotong University,* Vol. 55 No. 2, pp. 1 - 11.

OECD. (2019), "Business Insights on Emerging Markets 2019", Available at http://www.oecd.org/dev/oecdemnet.htm (Accessed 13 May, 2020).

Oparanya, A.W., Mdadila, K.P. and Rutasitara, L.K. (2019), "The determinant of bilateral trade in the east African community: application of the gravity model", *International Journal of Economics and Finance,* Vol. 11. No. 4, pp. 1 - 15.

Ricardo, D. (1891), *Principles of political economy and taxation,* G. Bell and Sons.

Semykina, A. and Wooldridge, J.M. (2010), "Estimating panel data models in the presence of endogeneity and selection", *Journal of Econometrics,* Vol. 157 No. 2, pp. 375 - 380.

Summary, R.M. (1989), "A political-economic model of US bilateral trade", *The Review of Economics and Statistics,* Vol. 71 No. 1, pp. 179 - 182.

Thu, L.A., Fang, S. and Kessani, S.S. (2019), "Factors influencing Vietnam's handicraft export with the gravity model", *Journal of Economics and Development,* Vol. 21 No. 2, pp. 156 - 171.

Tinbergen, J. (1962), *Shaping the world economy: suggestions for an international economic policy,* New York: Twentieth Century Fund.

Tran, T. and Vo, M. (2020), "Determinants of Vietnam's export to EU market", *Accounting,* Vol. 6 No. 4, pp. 421 - 424.

Tu, M.T.C. and Giang, H.T.T. (2018), "Estimating the impact of trade cost on export: a case study in Vietnam", *The Journal of Asian Finance, Economics, and Business,* Vol. 5 No. 3, pp. 43 - 50.

Umair, M., Sheikh, M.R. and Tufail, A. (2022), "Determinants of pakistan's bilateral trade with major trading partners: an application of Heckscher-Ohlin model and Tinbergen gravity model", *Bulletin of Business and Economics,* Vol. 11 No. 1, pp. 24 - 36.

United Nations. (2019), "World Economic Situation and Prospects 2019", Available at https://www.un.org/development/desa/dpad/wp-content/uploads/sites/45/WESP2019_BOOK-web.pdf (Accessed 13 April, 2020).

VCCI. (2018), "Doing Business in Vietnam", Available at https://www.pwc.com/vn/en/publications/2018/pwc-vietnam-dbg-2018.pdf (Accessed 13 April, 2020).

Vietnam GSO. (2019), *Statistical Summary Book of Vietnam 2019,* Statistical Publishing House, Vietnam.

Vu, T.T.H., Tian, G., Zhang, B. and Nguyen, T.V. (2020), "Determinants of Vietnam's wood products trade: application of the gravity model", *Journal of Sustainable Forestry,* Vol. 39 No. 5, pp. 445 - 460.

Wang, C., Wei, Y. and Liu, X. (2010), "Determinants of bilateral trade flows in OECD countries: evidence from gravity panel data models", *The World Economy,* Vol. 33 No. 7, pp. 894 - 915.

Wei, Y. and Liu, X. (2006), "Productivity spillovers from R&D, exports and FDI in China's manufacturing sector", *Journal of International Business Studies,* Vol. 37 No. 4, pp. 544 - 557.

Wooldridge, J.M. (2013), *Introductory econometrics: a modern approach (5th Edition),* Mason, OH.: Cengage Learning.

Yu, C.M.J. and Zietlow, D.S. (1995), "The determinants of bilateral trade among Asia-Pacific countries", *Asean Economic Bulletin,* Vol. 11 No. 3, pp. 298 - 305.

Appendix

Table A1. List of sample countries

Developed countries		Developing countries	
Austria (8257)	Netherlands (8895)	Argentina* (17860)	Brazil* (17201)
Belgium (8993)	Bulgaria (7860)	Peru* (18967)	Chile* (18588)
Canada (12644	Cyprus (7142)	Cambodia (1052)	Indonesia (3008)
Denmark (8302)	Finland (7500)	Lao (481)	Malaysia (2028)
France (9212)	Germany (8342)	Myanmar (1123)	Philippines (1754)
Greece (7934)	Hungary (8080)	Singapore (2196)	Thailand (989)
Ireland (9525)	Italy (8746)	China (2321)	Hong Kong (873)
Poland (7842)	Portugal (10555)	India (3006)	Korea (2739)
Slovakia (8205)	Spain (10057)	Israel (7029)	Kuwait (5849)
Sweden (7894)	Switzerland (8939)	Pakistan (3515)	Mexico (14774)
Norway (8285)	United Kingdom (9250)	Russia (6741)	Saudi Arabia (6037)
Japan (3668)	New Zealand (9896)	South Africa (9852)	Taiwan (1665)
Australia (7727)	USA (11012)	Turkey (7118)	Ukraine (7204)
		UAE (5271)	

Notes: The number in bracket () shows the distance between Hanoi, the capital of Vietnam, and the capital of country i. The average distance between Vietnam and the developed countries is approximate 8645 kilometers, and 6270 kilometers for the case of the developing countries. * MERCOSUR countries.

Source: The authors' compilation

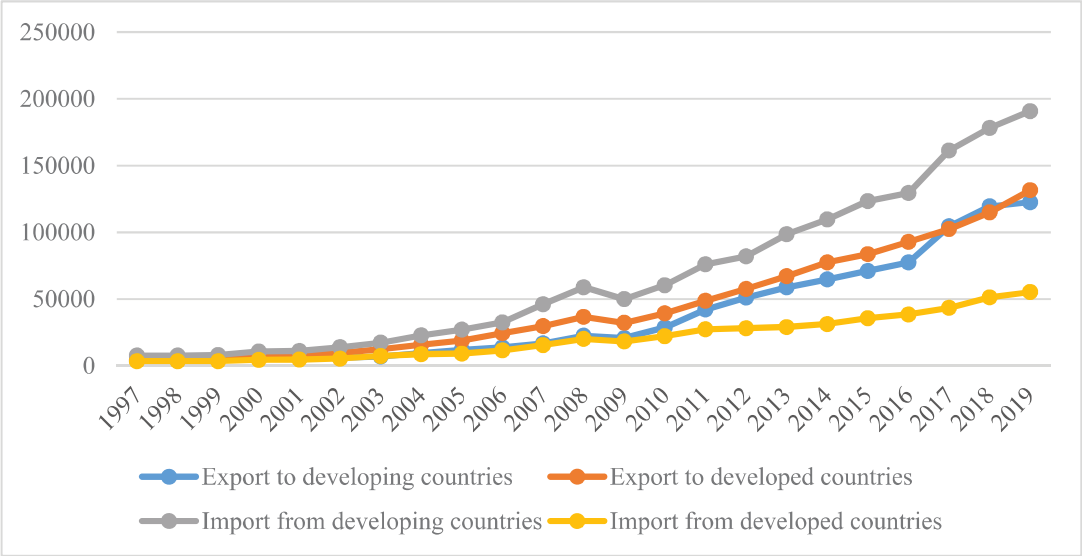

Figure A1. The trade flows of Vietnam with selected country groups

Source: International Monetary Fund (2021)