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Improving Agricultural Export Policies in Developing Countries: An Application of Gravity Modelling in the Case of Vietnam's Fishery Export

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Abstract

This paper investigates the determinants of fishery export from Vietnam using a structural gravity modelling. Taken additional trade-related variables from the World Bank's open data into the estimation of the gravity model, this research will be the first trial to examine the impacts of these variables on export of fishery products and to propose policy implications for stimulating export in Vietnam. The empirical results show that each 1% reduction of export costs might increase approximately 3.7% of the export value of fishery products. This finding is critical because the current administrative system for export of agricultural commodity in Vietnam consists of many stages and includes a long period of animal quarantine inspection, document checking, and customs clearance that might cause additional export costs. Therefore, policies aiming at reducing the costs of border and documentary compliance for export will be significant to stimulate export in developing countries as Vietnam.

Keywords

Fishery export, export policy, free trade agreement, gravity model, random effect estimation, Vietnam.

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Introduction

Vietnam's economy has transformed and developed significantly since the political and economic reform in 1986 (Do and Park, 2018) reflected by an annual Gross Domestic Product (GDP) growth rate of about 6.93% between 1987 and 2006 (The Word Bank, 2019). After that period, the country has often been ranked as one of the fastest developing economies at both regional and global levels. In the period of 2007 – 2017, the GDP growth continued to rise significantly at an annual rate of 6.11% that resulted in an increase of the GDP from US$ 77.4 billion in 2007 to US$ 223.8 billion in 2017 (current US$) (The World Bank, 2019).

Apparently, the openness and trade affairs through multilateralism and free trade agreements (FTA) have brought many good opportunities to boost the country's economic development. Vietnam's export value increased from US$ 48.6 billion in 2007 (when it officially became a member of the World Trade Organization) to US$ 213.9 billion in 2017 with a Compound Annual Growth Rate (CAGR) of 16% between 2007 and 2017 (current US$) (ITC, 2019). In other words, trading comprised up to 95% of Vietnam's GDP in 2017. Moreover, this also implies the importance of trading and positive impacts of export stimulation policies on Vietnam's economy.

In 2011, Vietnam targeted itself to become an export-oriented nation with the development of industrial sectors for both agriculture and non-agriculture products by the commencement of the Decision No. 2471/QĐ-TTg dated 28/12/2011 to approve the Strategic policy on export – import between 2011 and 2020, vision to 2030. Although the share of agricultural products in the national export value decreased from 27% to 17% between 2007 and 2017 (MARD, 2019), it is still playing a vital role in providing income sources for nearly 66% of households living in rural regions (Do and Park, 2019; GSO, 2017). Among key sub-sectors in Vietnam's agriculture, fishery export

is significantly contributing to national export. The export value of fishery products rose from US$ 3.76 billion in 2007 to about US$ 8.32 billion in 2017 (current US$) which is equal to a CAGR of 8.3% annually (MARD, 2019). Besides, this sub-sector accounted for about 23% of the total export value of agricultural products in 2017 (MARD, 2019). In the Action Plan No. 02/QĐ-BNN-KH dated 02/01/2019 of the Ministry of Agriculture and Rural Development of Vietnam, the fishery sub-sector was aimed to achieve an export value of US$ 10 billion (current US$) in 2020. However, current policies of the fishery sub-sector only focus on production and processing sides with many supporting programs, while the market and export-related aspects have not been paying enough attention in recent years.

In the context of globalization process, Vietnam has achieved some noticeable results. Recently, Vietnam and the European Union (EU) reached a consensus on final texts of the EU - Vietnam Free Trade Agreement (EVFTA) in 2018 and it was successfully signed in Jun 2019. This FTA is critical to Vietnam's economy and its agricultural sector in particular because the EU is one of the key markets of its agricultural products and one of the largest foreign investors in Vietnam (EC, 2019). Particularly, fishery products are among the commodities receiving benefits from the EVFTA for both Vietnam and the EU. With regard to the EU's products, Vietnam will immediately remove all the tariffs at the coming-into-force for fishery products such as salmon, halibut, trout, and rock lobster. The other fishery products from the EU will be liberated after three years. In the case of Vietnam's products, the EU will liberalize its tariffs for non-processed shrimps when the FTA comes into effect and for pangasius and catfish after three years (EU, 2019).

At global levels, fishery sub-sector plays a crucial role in developing countries to provide an important source of livelihood for fish farmers (Allison and Ellis, 2001; Betcherman and Marschke, 2016) and generate income for workers (mostly female labors) in fishery processing industry. Therefore, taking international trade of fishery products to examine its impacts on trade and trade flows is essential to provide evidence for supporting FTAs such as the EVFTA, acquire knowledge of trade determinants of fishery products, and recommend supporting policies on stimulating fishery sub-sector in developing countries.

In the literature of international trade assessment, the gravity model is one of the most popular methods employed to analyze trade flows and impacts of trade since its first introduction by Tinbergen (1962). However, several relevant variables have not been included in trade flow analyses such as the export costs and import costs introduced by the World Bank's open data since 2014. These variables can be scientifically applied as explaining variables of international trade researches. Hence, this paper is aimed at addressing two research questions (i) which key determinants can influence trade between Vietnam and its key importers of fishery products and (ii) what implications can be withdrawn from this research for export stimulation policies in Vietnam.

Literature review

The gravity model has been widely applied for assessments in the field of migration (Backhaus et al., 2015) and, especially, trade flows (Bakucs et al., 2019; Baldwin, 1994; Braha et al., 2017; Cardoso et al., 2017; Hndi et al., 2016; Kepaptsoglou et al., 2010; Maciejewski and Wach, 2019; Wach and Wojciechowski, 2016). The concept of the gravity model was based on the Newton's law of gravity (Shepherd, 2016) indicating that the trade between two economies is affected by their mass and distance. After a thorough review, the authors withdrew two critical notes of gravity modelling application in previous researches with regard to estimation methods and variable selections.

Firstly, there is a diverse application of estimation methods in examining gravity modelling. They have been developed from the Ordinary Least Squares (OLS), to Fixed effect/Random effects, Poisson Pseudo Maximum Likelihood (PPML), and, later, to Poisson Quasi Maximum Likelihood (PQML) in the last two decades. Nevertheless, some scholars mentioned that the OLS used for gravity modelling might contain some methodological and modelling flaws (Kepaptsoglou et al., 2010). Particularly, Anderson and Van Wincoop (2003) and Henderson and Millimet (2008) pointed out that the OLS's implementation assumptions were not consistent with the theoretical models. In addition, Kepaptsoglou et al. (2010) concluded that many empirical researches put more emphasis on the fixed effects approaches because of its appropriateness and the selection of estimation methods would depend on researchers' interests of the analysis, countries' and data's characteristics, and theoretical models.

Secondly, the literature review shows that previous studies only focused on some core explanatory variables such as GDP/GDP per capita/Gross National Income (GNI)/Distance/Population and some additional variables as FTA/common languages/border/exchange rate/tariffs/colonial history in estimating gravity models to explain international flows in the last two decades. However, the variable of distance that is widely used in previous studies is a physical distance that remains unchanged permanently, while trade is dramatically changing in the past few decades because of the globalization process. Therefore, this research proposes an alternative application of new variables to measure distance in gravity modelling that is an average shipping time (e.g. number of days) using sea freight from exporter's international ports to importer's international ports (Table 1). The reason why our research uses this variable is that sea freight shipping is the main measure of transportation for fishery products. Besides, this variable will reflect the practical trading that heavily relies on the development of logistics and shipping services, rather than the static physical distance between the capitals of home and host countries.

Moreover, since 2014, the World Bank's open database has included some additional trade-related variables such as export costs and import costs that could represent practical obstacles to the import and export of a country. Therefore, this paper will be the first trial to apply these variables for the estimation of gravity model to examine determinants of export from Vietnam to its top importers of fishery products (Harmonized System code: 03 and 16) and to propose policy implications for stimulating export.

Materials and methods

Research method

The gravity modelling is a principal measure of scholars who would like to explore and assess the impacts on international trade between countries. In recent years, the gravity models have been widely applied in the field of analyzing trade-related policies with significant improvement of both the uses of variables and estimation methods. In particular, there are many gravity models (such as structural gravity models (Anderson and Van Wincoop, 2003)) applied various fundamental theories in international trade to advance the original mode. These advanced models provide an appropriate platform for conducting simulations of trade impacts and ensure the consistency and unbalanced parameters of estimations (Deardorff, 1998).

No	Dependent variables	Independent variables		Estimation method	Authors
		Core	Additional		
1	Export	GDPs, GDP per capita, population, distance	FTA members, common language, common currency, bilateral exchange rate, political union membership	OLS	Breuss and Egger 1999; Rose, 2000; Feenstra et al., 2001; Sapir, 2001.
2	Export	GDP, GDP per capita, population, distance	Common border, tariffs, common language, country specific factors, remoteness, technological differences	Fixed effect/ random effects	Baltagi et al., 2003; Gopinath and Echeverria, 2004; Cardoso et al., 2017; Maciejewski and Wach, 2019.
3	Imports/ Exports	GDP, distance, population	Land area, common border, island, common language, available trade agreement	Tobit and fixed effects	Soloaga and Winters, 2001.
4	Export/ Import/ Bilateral trade flows	GNI, GDP, distance, population	Common border, tariffs, adjacency, FTA, languages, colony history	PPML and PQML	Siliverstovs and Schumacher, 2008; Lampe, 2008; Braha et al., 2017.

Source: own processing, (Kepaptsoglou et al., 2010, pp. 4-8)

Table 1: Some typical applications of gravity modelling in empirical research.

The intuitive equation of the gravity model from McCallum (1995) is specified as:

$$\log Export_{ij} = c + \beta_1 \log GDP_i + \beta_2 \log GDP_j + \beta_3 \log Distance_{ij} + \varepsilon_{ij} \quad (1)$$

In the Equation (1), $Export_{ij}$ denotes monetary export value from country i to country j, GDPs are each country's (i and j) gross domestic products (economic mass), $Distance_{ij}$ represents an indicator of trade costs which can be the geographical distance between the two countries, and ε_{ij} is the term of random error. Based on the gravity law of Newton, the interpretation of this equation is that larger countries tend to trade more bilaterally and two countries with a larger distance (from each other) will tend to trade less because of higher transportation costs.

However, the intuitive gravity model that was developed in 1960s could not reflect the new advancement of trade literature (Shepherd, 2016). That is why scholars paid more attention to the structural gravity models of Anderson and Van Wincoop (2003) because they include the outward and inward multilateral resistance terms into the trade costs. The structural gravity model (in a short form of aggregate trade) developed by Anderson and Van Wincoop (2003) can be expressed as following:

$$\log Export_{ij} = \log GDP_i + \log GDP_j - \log Y - (1-\sigma)[\log \tau_{ij} - \log \Pi_i - \log P_j] \quad (2a)$$

Whereas,

$$\Pi_i = \sum_{j=1}^{c} \left\{\frac{\tau_{ij}}{P_j}\right\}^{1-\sigma} \frac{Y_j}{Y} \quad (2b)$$

$$P_j = \sum_{i=1}^{c} \left\{\frac{\tau_{ij}}{\Pi_i}\right\}^{1-\sigma} \frac{Y_i}{Y} \quad (2c)$$

$$\log \tau_{ij} = b_1 \log Distance_{ij} + b_2 contig + b_3 comlang\_off + b_4 colony + b_5 comcol \quad (2d)$$

In the equation (2a), the Π_i and P_j are the outward and inward multilateral resistance. The former denotes that exports from country i to country j will rely on the trade costs throughout all export markets. Similarly, the latter indicates that imports of country i from country j will depend on the trade cost from all import markets. This model can reflect an important aspect of international trade that the trade costs of one bilateral flow of export or import might have an impact on all other flows (Shepherd, 2016). Hence, this research paper will employ this structural gravity modelling to assess the trade of fishery products between Vietnam and its key importing partners.

Research data

There are 29 key importers selected to analyze the trade flows of fishery products from Vietnam due to the availability of data (e.g. missing data). These 29 importers account for approximately 80% of total export value from Vietnam between 2014 and 2017 (see Table 5. in the Appendix for the detailed list of selected countries and general information of Vietnam's fishery export). On this list, the Netherlands will represent the EU because this country is one of the largest importers and a major gate of goods from Vietnam to enter other European countries. In other words, the Netherlands is playing an intermediate role in distributing imported products from Vietnam.

Table 2. shows the selected variables and their measurements for the estimation of gravity model. The selection of these variables is mainly relied on previous empirical findings and data's availability. In this regard, the dependent variable is the export value of fishery products from Vietnam and 10 independent variables include Distance from Vietnam to importers; Vietnam's GDP; Importers' GDP; Import costs of importers; Export costs of Vietnam; Ratio of trade to GDP of importers; Ratio of trade to GDP of Vietnam; Foreign direct investment; Tariff levels; and Members of FTA. Among them, the import costs of the importers and export costs of Vietnam are new trial variables in the gravity modelling. These data obtained from the World Bank's open data that are only available since 2014 for the Doing business project.

According to (The World Bank, 2019), the costs of import/export include border compliance and documentary compliance. The former is designed to capture the associated time and cost in order to comply with the country's mandatory regulations for export/import. It also consists of time and cost for operations at ports or borders, customs clearance, and inspection procedures. On the other hand, the latter reflect the time and costs in order to comply with documentary requirements of government agencies in the departure country, destination country, and any transit places. These variables might be practical obstacles to export/import because the high costs of border and documentary compliance might directly affect the export/import process (see Table 3.

Variables	Denotation	Description and Measurement	Data source
Dependent variable			
Fishery Export	EXPORT	Export value of fishery products from Vietnam between 2014 and 2017; US$ Thousand.	(ITC, 2019)
Independent variables			
Distance from Vietnam to importers	DISTANCE	Average time for sea freight shipping from Vietnam's main port to importer's main port; Number of days.	(Linescape, 2019)
Vietnam's GDP	GDP_EXPORTER	Gross Domestic Products of Vietnam between 2014 and 2017; current US$ Billion.	(The World Bank, 2019)
Importers' GDP	GDP_IMPORTER	Gross Domestic Products of Vietnam's fishery importers between 2014 and 2017; current US$ Billion.	(The World Bank, 2019)
Import costs of the importers	COST_IMPORT	Costs associated with the import of the importers including border and documentary compliance; US$ per shipment.	(The World Bank, 2019)
Export costs of Vietnam	COST_EXPORT	Costs associated with the export of Vietnam including border and documentary compliance; US$.	(The World Bank, 2019)
Trade to GDP of importers	OPENNESS_IM	Ratio of Trade to GDP or the economy's openness of the importers; Percentage.	(The World Bank, 2019)
Trade to GDP of Vietnam	OPENNESS_EX	Ratio of Trade to GDP or the economy's openness of Vietnam; Percentage.	(The World Bank, 2019)
Foreign Direct Investment	FDI	Amount of registered FDI capital from the importers in Vietnam; US$ Million.	(MPI, 2019)
Tariff levels	TARIFFS	Average tariff level of fishery products from Vietnam to the importers; Percentage.	(ITC, 2019; (WTO, 2019)
Members of FTA	FTA	Dummy variables; Available bilateral or regional FTA = 1.	(ITC, 2019)

Source: own processing

Table 2: Selected variables and their measurement.

Rank of export value	Country	Export value of fishery products (US$ thousand)	Costs to export (US$)
	World	**169 319 950**	
1	China	22 276 720	569
2	Norway	11 093 251	125
3	Thailand	8 410 162	320
4	**Vietnam**	**8 226 460**	**429**
5	United States of America	7 555 374	235
6	India	7 062 071	474
7	Netherlands	6 119 097	-
8	Canada	5 687 087	323
9	Chile	5 613 779	340
10	Spain	5 378 484	-
11	Germany	5 096 045	390
12	Ecuador	4 471 023	700
13	Sweden	4 245 222	95
14	Indonesia	4 203 170	393
15	Denmark	4 060 645	-
16	Russian Federation	3 650 675	672
17	Poland	3 348 729	-
18	United Kingdom	2 727 897	305
19	Argentina	2 054 631	210
20	Iceland	1 738 431	405

Source: own processing, ITC and the World Bank

Table 3: The world 20 largest exporters of fishery products and their export costs in 2017.

for the summary of the world 20 largest exporters of fishery products and their export costs in 2017). The application of these new variables in the gravity modelling will be the first trial for justifying their significance and impacts on trade. In this research, the authors hypothesize that the variables of import and export costs will have negative impacts on export of Vietnam to the selected countries. In other words, the higher the costs, the lower the export. Hence, a panel data of 29 selected countries importing the vast majority of fishery products from Vietnam between 2014 and 2017 will be used to run the gravity model.

Model specification and estimation method

Based on the theoretical model of Anderson and Van Wincoop (2003), the model specification of this paper is presented as following:

$$\ln EXPORT_{ij} = \alpha_0 + \alpha_1 \ln GDP\_EXPORTER_i + \alpha_2 \ln GDP\_IMPORTER_j + \alpha_3 \ln COST\_EXPORT_i + \alpha_4 \ln COST\_IMPORT_j + \alpha_5 \ln DISTANCE_{ij} + \alpha_6 \ln OPENNESS\_EX_i + \alpha_7 \ln OPENNESS\_IM_j + \alpha_8 \ln FDI_j + \alpha_9 TARIFFS_{ij} + \alpha_{10} FTA_{ij} + \varepsilon_{ij} \quad (3)$$

Whereas,

α_0: is the intercept.

α_1 - α_{10}: are the coefficients of 10 explanatory variables namely *GDP_EXPORTER*, *GDP_IMPORTER*, *COST_EXPORT*, *COST_IMPORT*, *DISTANCE*, *OPENNESS_EX*, *OPENNESS_IM*, *FDI*, *TARIFFS*, and *FTA*.

Among explanatory variables, *GDP_EXPORTER*, *GDP_IMPORTER*, *COST_EXPORT*, *COST_IMPORT*, *DISTANCE*, *OPENNESS_EX*, *OPENNESS_IM*, and *FDI* will be estimated in logarithm.

ε_{ij}: is the random error term.

In the Equation (3), variables such as *GDP_EXPORTER, GDP_IMPORTER, OPENNESS_EX, OPENNESS_IM, FDI*, and *FTA* are expected to have a positive impact on the export value of fishery products, while *COST_EXPORT, COST_IMPORT, DISTANCE*, and *TARIFFS* are supposed to have a negative impact on the export value. It is noted that the panel data that consists of trade data over time could help eliminate biases caused by heterogeneity across observations (Prehn et al., 2016). However, with some time-invariant and relevant variables such as DISTANCE, TARIFFS, and FTA, estimations using fixed effects might cause a perfect collinearity. In this case, random effects would be a more appropriate method for the estimation.

Fundamentally, the fixed and random effects are developed to control over unobserved heterogeneity. However, there are some important differences of the two methodologies. Particularly, the former permit free or structural less variation, whereas the latter require the unobserved heterogeneity to comply with some probability constraints. That is why random effects rely on a strong assumption that unobserved heterogeneity's pattern is randomly distributed to given variance and mean (Gómez-Herrera, 2013). Hence, this research paper will implement the estimation of the gravity model using random effects method. In addition, Breusch and Pagan Lagrangian test for random effects and the Hausman test should be implemented to test whether the random effect model is an appropriate selection.

Results and discussion

Determinants of fishery export from Vietnam

Before conducting the estimation of the gravity model, the authors have implemented the Hausman test and Breusch and Pagan Lagrangian test to justify the appropriateness of the random effect model. The results of the two tests indicate that, under this current specification, the model is firmly fit for the random effect estimation. (see Table 7 and 8 in the Appendix for the detailed results of the Hausman test and Breusch and Pagan Lagrangian test, respectively).

Table 4 shows the empirical results of the gravity model with random effects. Overall, the explanatory variables can explain more than 73% of the response variable by the estimated random effect model and statistically significant at 1%. The results point out that the independent variables are in line with their assumption of expected impacts except for *OPENNESS_EX* and *OPENNESS_IM*. In particular, the variables with positive impacts on the export value consist of *GDP_EXPORTER, GDP_IMPORTER, FDI*, and *FTA*, while the other variables with negative impacts include *COST_EXPORT, COST_IMPORT, DISTANCE*, and *TARIFFS*.

Among the 10 explanatory variables, *GDP_EXPORTER, GDP_IMPORTER, FDI*, especially *COST_EXPORT* and *COST_IMPORT* are statistically significant at or less than 10% level,

Random-effects GLS regression			Number of obs.	=	91
Group variable: pairid			Number of groups	=	25
R-sq:					
within	=	0.3060			
between	=	0.7344			
overall	=	0.7314			
			Wald $chi^2(10)$	=	146.34
corr(u_i, X) = 0 (assumed)			Prob > chi^2	=	0.0000

LNEXPORT	**Coef.**	**Robust Std. Err.**	**P>z**	**[95% Conf.**	**Interval]**
_cons (α_0)	40.6994	20.9698	**0.05**	-0.4006	81.7995
LNGDP_EXPORTER(α_1)	3.3695	2.0537	**0.10**	-0.6556	7.3946
LNGDP_IMPORTER(α_2)	0.6635	0.1335	**0.00**	0.4019	0.9252
LNCOST_EXPORT(α_3)	-3.7203	2.1150	**0.08**	-7.8656	0.4251
LNCOST_IMPORT(α_4)	-0.7206	0.3088	**0.02**	-1.3257	-0.1154
LNDISTANCE(α_5)	-0.2120	0.2199	0.34	-0.6430	0.2190
LNOPENNESS_EX(α_6)	-4.4891	2.9237	0.13	-10.2194	1.2412
LNOPENNESS_IM(α_7)	-0.1502	0.3420	0.66	-0.8206	0.5202
LNFDI(α_8)	0.0370	0.0165	**0.03**	0.0046	0.0694
TARIFFS(α_9)	-0.0028	0.0070	0.69	-0.0164	0.0109
FTA(α_{10})	0.3083	0.3425	0.37	-0.3630	0.9796
sigma_u	0.7437				
sigma_e	0.1988				
rho	0.9333		(fraction of variance due to u_i)		

Source: own processing

Table 4: Empirical results of the gravity model estimation.

while the remaining independent variables are not statistically significant. The authors firmly believe that these insignificant variables are mainly due to a small number of observations. Nevertheless, they still suggest some meaningful interpretations such as *DISTANCE, TARIFFS*, and *FTA*. For example, the coefficient of *DISTANCE* shows that for each percentage of traveling time of sea freight will decrease 0.21% of the export value. The negative impact is also applied for the *TARIFFS* that each 1% increase of the tariff level will relatively reduce 0.0028% value of the export. On the contrary, the coefficient of *FTA* denotes that having a *FTA* between the exporter and importer might help increase 0.31% of the export value.

Regarding the variables with statistical significance, the coefficients of *GDP_EXPORTER* and *GDP_IMPORTER* point out the every 1% increase of these two figures can positively improve the export value of fishery products at 3.37% and 0.67%, respectively. This is understandable with the case of Vietnam since it is an export-oriented country and the fishery sub-sector is contributing significantly to export of agricultural commodities and GDP.

The remaining statistically significant variables including *COST_EXPORT, COST_IMPORT,* and *FDI* imply some remarkable findings. First, the coefficient of *COST_IMPORT* indicates that 1% increase of the import costs from the importers will cause a 0.72% decrease of the export from Vietnam with a statistical significance at 5% level. Nevertheless, this variable is an external variable that is mainly due to conditions and government policies of the importing countries.

Second, the estimation result of *FDI* variable that is statistically significant at 5% level shows that 1% increase of the *FDI* from the importing countries can result in a 0.04% increase of the export value from Vietnam. In other words, the flow of *FDI* capital can positively influence the bilateral trading between the two economies. This is critical because Vietnam is attracting a considerable amount of *FDI* in recent years (MPI, 2019). So, the higher the amount of *FDI*, the higher the trading value between Vietnam and investing countries.

Finally, the coefficient of the *COST_EXPORT* implies that each 1% decrease of the export costs will help to increase approximately 3.7% of the export value of fishery products

from Vietnam. This coefficient is statistically significant at 10% level. This finding is critical because it directly relates to Vietnam's administration policies and strategies, as well as the domestic conditions for export such as logistics services and infrastructure. If the country can improve this variable, it might have a significant impact on the export.

Policy implications for Vietnam and developing countries

As mentioned in the research data section, the import and export costs include border compliance and documentary compliance. The former is designed to capture the associated time and cost in order to comply with the country's mandatory regulations for export/import. It also consists of time and cost for operations at ports or borders, customs clearance, and inspection procedures. The latter, on the other hand, reflect the time and cost in order to comply with documentary requirements of government agencies in the departure country, destination country, and any transit places. Since the export costs of Vietnam is remarkably higher than some fishery exporters in the Southeast Asia region such as Thailand and Indonesia (The World Bank, 2019), Vietnam and developing countries should stimulate export through improvements in their administrative system and logistics for export.

Firstly, the administrative system for export of agricultural commodity in Vietnam consists of many stages from animal quarantine (out-port) to customs (in-port) which might include a long period of animal quarantine inspection, document checking, and customs clearance resulting in a higher export cost (Nguyen et al., 2015). In some cases, this might be a cause of corruption since exporters have to bribe officials for a faster inspection or customs clearance. With regard to this aspect, the government should apply more transparent measures such as e-government for its administrative and online declaration in the customs system for export because they might help minimize the paper compliance, reduce conduction time, and increase transparency in export procedures that can save time and money for domestic exporters.

Besides, policies on stimulating export must consider the market sides that can facilitate exports fast, efficiently, and legally. For instance, the government can reduce number of required documents and shorten the implementation period which are currently too costly (in terms of both time and money) in order to comply with documentary requirements of government agencies.

Secondly, the logistic system including infrastructure such as, roads, seaports, and airports in Vietnam and some developing countries is very poor. Exports of agricultural products mainly depend on a few standardized ports in large cities. However, the producing and processing areas are distant from the ports that might take a long period for transportation. This issue is compounded by the poor quality of roads system that might damage quality of products. Therefore, improving logistic system is crucial to reduce the export costs and stimulate export in Vietnam and developing countries.

Conclusion

The results of the gravity model point out some significant findings of the ten explanatory variables. In general, the results show that these variables are having expected impacts (negative/positive) on the dependent variable of fishery export from Vietnam. Among them, five key determinants are statistically significant including GDP of the exporter and importers, FDI capital from the importers into the exporter's territory, and the costs of export and imports.

There is a striking feature that the coefficient of the export cost variable implies that each 1% reduction of the export costs will help increase approximately 3.7% of the export value of fishery products. In the case of Vietnam, it is critical because the current administrative system for export of agricultural commodity in Vietnam consists of many stages and includes a long period of animal quarantine inspection, document checking, and customs clearance that might cause additional export costs. Therefore, this finding is significant because improvements of the government's administrative system can remarkably stimulate exports.

The other five statistically insignificant variables are including openness of the exporter and importers, tariff levels, bilateral or regional free trade agreements, and the distance by sea freight shipping time from the exporter to importers. The reason why these variable are not statistically significant might be due to the data is not large enough and the targeted variables are only available since 2014. Hence, the authors propose a further research applied in a larger number of exporters and importers, as well as a wider range of products in order to justify the impacts of these variables and their statistical significance.

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Appendix

No.	Importer	2014	2015	2016	2017	CAGR of 2014 - 2017 (%)
	World	**7,770,359**	**6,550,718**	**7,039,533**	**8,226,460**	1.9%
	Total of 29 importers	**6,165,205**	**5,219,281**	**5,733,868**	**6,835,164**	3.5%
	Share of 29 importers (%)	**79%**	**80%**	**81%**	**83%**	
1	USA	1,710,337	1,314,867	1,440,634	1,414,157	-6.1%
2	Japan	1,193,543	1,032,723	1,096,409	1,305,326	3.0%
3	China	468,558	447,827	681,888	1,089,861	32.5%
4	Korea, Republic	651,747	572,724	607,906	786,105	6.4%
5	Netherlands	211,049	166,957	203,710	304,726	13.0%
6	Thailand	182,381	216,162	241,749	245,680	10.4%
7	Canada	262,627	189,924	183,093	223,214	-5.3%
8	Australia	227,995	170,035	185,870	185,663	-6.6%
9	Hong Kong	148,644	151,066	152,294	161,018	2.7%
10	Philippines	63,412	72,486	80,838	131,788	27.6%
11	Mexico	123,368	109,405	95,473	123,495	0.0%
12	Brazil	124,587	77,826	68,016	105,982	-5.2%
13	Singapore	105,818	102,172	98,678	102,603	-1.0%
14	Malaysia	70,498	71,978	72,957	101,834	13.0%
15	Russian Federation	103,978	78,792	95,506	97,335	-2.2%
16	Israel	42,972	39,324	48,326	74,434	20.1%
17	Saudi Arabia	65,877	69,446	61,308	64,941	-0.5%
18	Colombia	73,628	64,090	57,778	55,906	-8.8%
19	Ukraine	60,051	53,051	50,516	42,514	-10.9%
20	Pakistan	19,776	22,970	23,395	38,250	24.6%
21	Switzerland	66,400	35,752	38,695	34,337	-19.7%
22	Egypt	71,705	63,989	45,794	31,390	-24.1%
23	India	16,377	19,843	20,333	21,076	8.8%
24	New Zealand	21,533	21,735	21,087	17,951	-5.9%
25	Chile	12,497	10,848	14,090	17,506	11.9%
26	UAE	36,654	10,414	14,011	16,381	-23.5%
27	South Africa	3,096	2,599	8,888	15,423	70.8%
28	Cambodia	14,524	16,094	12,384	13,806	-1.7%
29	Dominican Republic	11,573	14,182	12,242	12,462	2.5%

Source: own processing, ITC

Table 5: General information of fishery exports from Vietnam and the 29 selected importers.

Variable	Unit	Obs.	Mean	Std. Dev.	Min	Max
EXPORT	US$ Thousand	116	206,495.80	350,691.70	2,599.00	1,710,337.00
GDP_EXPORTER	US$ Billion	116	202.13	14.30	186.20	223.78
GDP_IMPORTER	US$ Billion	116	1,801.58	3,808.14	16.70	19,390.60
COST_EXPORT	US$	116	443.25	8.26	429.00	448.00
COST_IMPORT	US$	116	552.00	308.00	0.00	1,554.00
DISTANCE	Days	116	18.52	11.38	2.00	43.00
OPENNESS_EX	Percentage	116	183.34	11.27	169.53	200.38
OPENNESS_IM	Percentage	116	91.78	84.04	24.12	425.98
FDI	US$ Million	116	692.09	1,695.92	0.00	8,937.78
TARIFFS	Percentage	116	5.64	6.95	0.00	30.00
FTA	Dummy	116	0.41	0.49	0	1

Source: own processing

Table 6: Descriptive summary of data.

	---- Coefficients ----			
	(b	B)	(b-B)	sqrt(diag(V_b-V_B))
	fixed	random	Difference	S.E.
LNGDP_EXPORT	2.4780	3.3695	-0.8915	0.6177
LNGDP_IMPORT	0.9562	0.6635	0.2927	0.3755
LNCOST_EXPORT	-3.4659	-3.7203	0.2544	2.1250
LNCOST_IMPORT	1.0320	-0.7206	1.7526	1.1894
LNOPENNESS_EX	-3.4426	-4.4891	1.0464	1.1585
LNOPENNESS_IM	-0.1426	-0.1502	0.0076	0.5057
LNFDI	0.0394	0.0370	0.0025	0.0051
TARIFFS	0.0028	-0.0028	0.0056	0.0037

b = consistent under Ho and Ha

B = inconsistent under Ha, efficient under Ho

Test: Ho: difference in coefficients not systematic

$chi^2(8)$	=	(b-B)'[(V_b-V_B)^(-1)](b-B)
	=	7.92
$Prob>chi^2$	=	0.4418

Source: own processing

Table 7: Results of the Hausman test.

Breusch and Pagan Lagrangian multiplier test for random effects

" LNIMPORT[pairid,t] = Xb + u[pairid] + e[pairid,t]"

Estimated results:

	Var	sd = sqrt(Var)
LNIMPORT	1.7032	1.3051
e	0.0395	0.1988
u	0.5530	0.7437

Test Var(u) = 0

chibar2(01)	=	86.17
Prob > chibar2	=	0.0000

Source: own processing

Table 8: Result of Breusch and Pagan Lagrangian multiplier test for random effects.