



Determinants of Vietnam's exports: An application of the gravity model

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ARTICLE INFO	ABSTRACT
<p><i>Received 22 Aug. 2017</i> <i>Revised 4 Jan. 2018</i> <i>Accepted 1 Jan. 2018</i></p> <p>Available online 12 January 2018</p> <p>JEL classifications: F14; F15; O24</p> <p>KEYWORDS Gravity model Exports of Vietnam Determinants of Vietnam's exports FDI</p>	<p>The success of exports in Vietnam has become a driving force for economic growth since the reform in 1986. The paper uses data from 2010 to 2014 to estimate the gravity model for Vietnam's exports with the random effect estimation. The empirical results show that the bilateral trade of Vietnam is positively associated with the country's GDP and importing countries' GDP. Furthermore, it has a negative relationship with distance from Vietnam to trading partners. These results are akin to those of the previous studies of the gravity model. Particularly, foreign direct investment, border effects and exchange rate play a significant role in promoting exports of Vietnam. Besides, the deepened integration into the region and world market also has significant impacts on expanding exports of Vietnam. Therefore, these factors have contributed to explaining the success in exports of Vietnam over the past few years.</p>

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1. Introduction

Before the renovation process¹ in 1986, Vietnam experienced a prolonged central-planning regime and import-dominated economy. Most decisions on foreign trade were made by central authority, and biased towards socialist countries. Moreover, international trade instruments were applied such as trading rights, quantitative restrictions, and a multiple exchange rate system. Following the loss of traditional markets in 1989, trade barriers on the export side were dismantled rapidly. This resulted in low competitiveness and poor economic performance.

In 1986, Vietnam launched economic reforms. Under the reform process, Vietnam's trade regime has gradually been liberalized. Most restrictions on an establishment of export and import companies have been eased. Since 1986, exports have made a significant contribution to the success of the renovation process and become a driving force for rapid economic growth of Vietnam, particularly in the period of macroeconomic instability from 2010 to 2014. During this period, Vietnam experienced economic turbulence with average growth rate below 6% per year and high inflation rates². Despite the weak performance of Vietnam's macro economy, the trade sector and manufacturing exports from foreign direct investment (FDI) projects become a buffer against macroeconomic instability and facilitated momentum for the recovery of the economic growth after the year 2014 (CIEM, 2014).

According to General Statistical Office (GSO) in 2014, economic growth has partly contributed by the expansion of exports, which has been a 21.2% of growth rate annually since the reforms. The turnover of exports increased from USD789 million in 1986 to USD150 billion in 2014. In 2014, exports accounted for 80% of GDP of Vietnam. Vietnam's composition of exports reduced from 74% of resource-based products in 1985 to nearly 17.6% in 2014. Manufactured exports represented of over 60% of total exports of Vietnam (GSO, 2015). The export market has been diversified. At present, Vietnam has trade relations with over 221 countries and territories, exporting to 219 countries. Vietnam's export volume to the United States, The EU, Japan and China represented 62% of total exports in 2014.

There have been a few empirical researches on the exports of Vietnam. However, they did not consider all factors that affect exports, opportunities, and challenges of Vietnam's exports during Vietnam's macroeconomic instability in the 2010–2014 period. Nguyen (2002) applies the gravity model to investigate effects of ASEAN Free Trade Area (AFTA) on Vietnam's exports to ASEAN countries. He concludes that AFTA was not a key element in Vietnam's bilateral trade. Similar to Nguyen (2002), Tran (2005) uses the gravity model to

¹ Known as '*Doi moi*'

² See further details of Vietnam's macroeconomic instability in CIEM, 2014, 'Macroeconomic Report, fourth quarter', Restructuring for a more competitive, Vietnam Project (RCV). In 2010, the Vietnamese inflation rate was 8.6% and continued over 6% over the 2010–2014 period (Vu, 2010).

forecast the impacts of the trade agreement on the economic relationship between Vietnam and Japan. Despite these studies' application of the gravity model, they have still not covered the whole picture of Vietnam's exports. Martin (2002) introduces the overview of Vietnam's exports pointing out factors that led to the success in the expansion of exports. Nevertheless, his study does not analyze exports quantitatively. Similarly, Dinh et al. (2011) only analyze bilateral trade activities using the gravity model from 2000 to 2010 and ignore the key variable of FDI in the empirical model. Pham et al. (2014) investigate the determinants of services trade flow between Vietnam and European Union from 2002 to 2011. In addition, the authors also neglect the role of FDI in the gravity model.

Thus, so far there has been no research on the determinants of Vietnam's exports by using the gravity model during Vietnam's economic turbulence from 2010 to 2014. Accompanied with the macroeconomic instability, there were many factors which drove a significant increase in Vietnam's export such as the improvement of demand for export products and country's supplying capacity, the booming of foreign direct investment, an increase in competitiveness of exchange rate, and integration of Vietnam into the world economy, which mitigated the negative effects resulted from macroeconomic instability during this period. The objective of this research is, therefore, to identify factors, which influence Vietnam's exports by applying the gravity model approach in the 2010–2014 period. It will apply the model developed by Bergstrand (1985) to empirically estimate the effects of GDP of Vietnam and trading partners, the distance, border, FDI, exchange rate and trading blocks on the exports of Vietnam. The paper also contributes to the literature by examining the role of FDI in explaining Vietnam's export growth, which is not covered in previous studies. The findings of the research show quantitatively effects of these factors on exports of Vietnam and the relevance of the gravity model in analyzing determinants, which explain the export growth.

The paper is structured as follows. Section 2 introduces the methodology of the research, which includes model specification, hypotheses and data. Section 3 provides empirical results of the gravity equations. Section 4 assesses estimated results and gives some discussion and Section 5 provides conclusions.

2. Overview of Vietnam's exports in the period 2010-2014

In this section, the performance of Vietnam's exports is investigated over the 2010–2014 period. Although the global financial crisis resulted in negative impacts on economic performance of Vietnam during this difficult period, there were no significant fluctuations in Vietnam's exports (World Bank, 2014). Except for some new trends, the traditional markets such as the EU, ASEAN, the US, Japan and China remained the main export markets of Vietnam (World Bank, 2014). As observed from Figure 1, these traditional markets alone accounted for three-quarters of the export value. Each major market such as the US and EU attracted almost 20% of Vietnam export value. Export revenue from Vietnam to the US

market ranked the first amongst the ASEAN countries. Although Japan was a small market but it was a major importer of Vietnam. Except for crude oil, these traditional markets (EU, ASEAN, and the US) were interested in importing telephone and electronic goods from Vietnam. EU, the US and Japan mainly imported textiles, garment, footwear and seafood, and ASEAN, China imported rice from Vietnam during the 2010–2014 period.

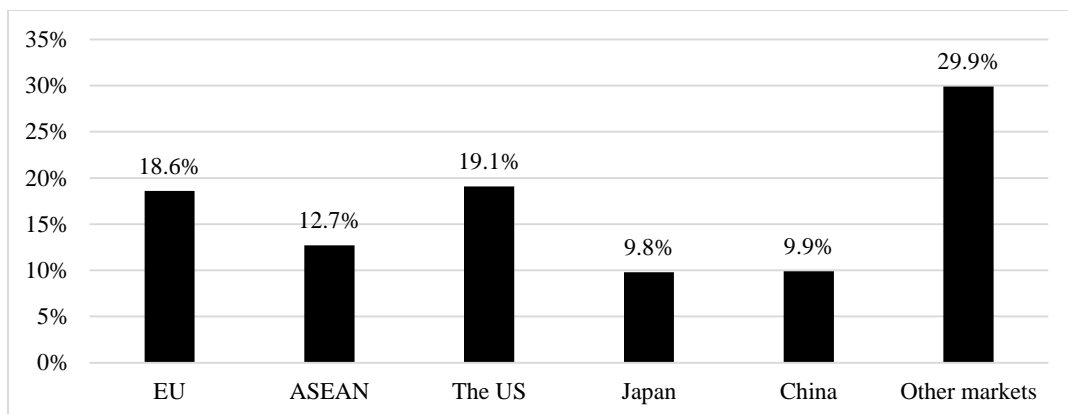


Figure 1. Ratio of export markets, 2010–2014

Source: GSO (2015)

In addition, exports were mainly from the FDI sector. Figure 2 demonstrates the difference of export volume between FDI and domestic enterprises during the period of 2010–2014. FDI dominated all Vietnam's exports. FDI enterprises accounted for larger share of Vietnam's exports due to their advantages in terms of markets availability in their home countries and the distribution channels in other foreign markets. In 2010, the gap between two groups of enterprises in exports was only 8.4%. However, this figure increased sharply to 28.6% in 2014 and tended to expand due to increasing FDI into Vietnam.

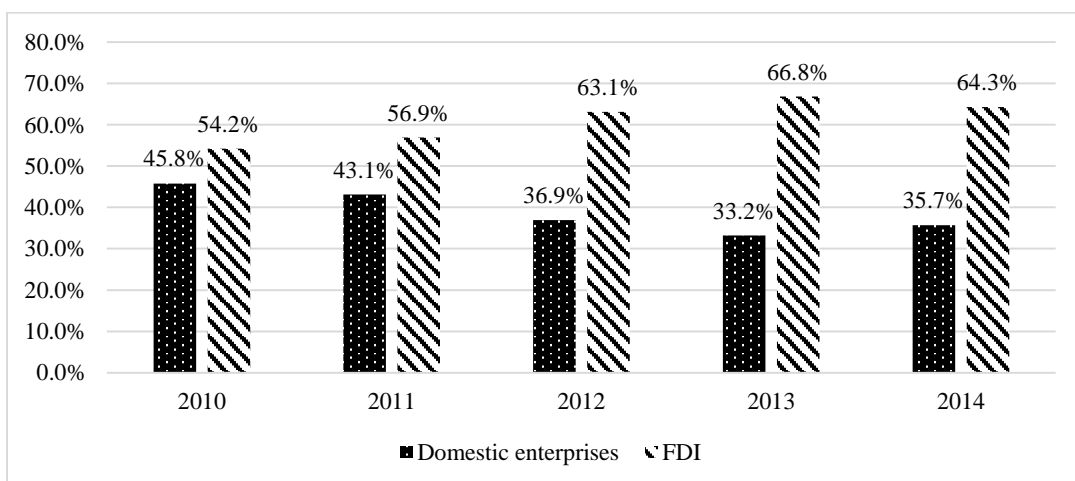


Figure 2. Export ratio between FDI and domestic enterprises, 2010–2014

Source: GSO (2015)

Figure 3 shows the comparison of export ratio of some commodities between domestic and FDI enterprises in 2014. FDI enterprises were the far most exporters in electronic goods, footwear, machines, equipment and tools. Especially for electronic goods and telephones, almost 100% of exported products were from FDI enterprises. According to GSO (2015), the total export revenue of telephones nationwide reached over \$23.6 billion, while FDI sector accounted for \$23.5 billion. Nearly 100% of the exports value was from telephones and electronic accessories of Samsung Electronics in Vietnam.

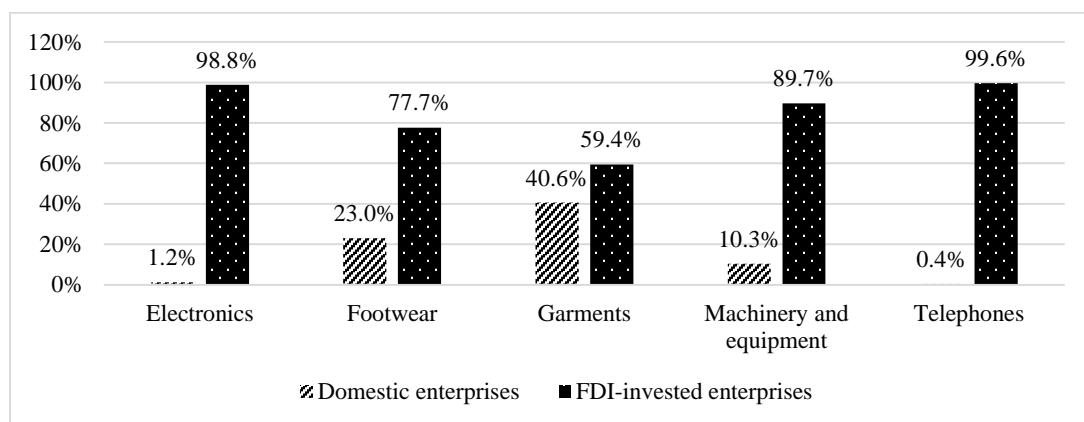


Figure 3. The export ratio of some commodities between FDI and domestic enterprises in 2014

Source: GSO (2015)

3. Methodology

3.1. Foundation of the model

There have been many previous studies on the gravity model, which is widely applied in examining determinants of exports. Tinbergen (1962) was the first to develop the gravity model, stating that GDP of trading countries has a positive effect on exports, while distance can impose a negative effect on exports. Based on Newton’s law of universal gravitation, Tinbergen shows that the trade from country *i* to country *k* is defined as:

$$EX_{ij} = G \frac{Y_i * Y_j}{Distance_{ij}} \tag{1}$$

where EX_{ik} represents the trade between country *i* and *k*. Y_i and Y_k are GDP of country *i* and country *k*. $Distance_{ik}$ captures the distance from country *i* to country *k*.

Linnemann (1966), together with Aiken (1973), applies the gravity model but exclude prices. They provide a general specification of the gravity model which the flow of trade between countries is subject to GDP of country *i*, *k* (Y_i , Y_k), distance from *i* to *k* (D_{ik}) and factors that affect trade between country *i* and *k*. The equation is defined as:

$$EX_{ik} = \beta_0 (Y_i)^{\beta_1} (Y_k)^{\beta_2} (D_{ik})^{\beta_3} (A_{ik})^{\beta_4} u_{ik} \tag{2}$$

Similarly, Anderson (1979) develops the gravity model by applying product differentiation and Cobb-Douglas preferences for many goods. The model, however, is limited by the assumptions of identical preferences for goods and the identical structure for tax and transport. Bergstrand (1985) establishes a foundation for the gravity model. Developing the Equation (2) from a general equilibrium framework, the author concludes that the gravity equation is derived form of a model based on differentiated products. Baldwin (1994) uses the gravity equation to identify factors that affect trade of manufactured goods. His study emphasizes the effects of increasing return to scale on intra-industry trade. Like Baldwin, Dearnorff (1995) applies the Heckscher-Ohlin theory to derive the gravity equation. He states that the Heckscher-Ohlin model can provide the foundation of the gravity model.

Finally, Helpman (1998) claims that the gravity model is only suitable for intra-industry trade, not inter-industry trade. He suggests that it works best for identifying factors affecting the trade volume. Feenstra (2004) shows that the bilateral trade between two countries depends on countries' GDPs.

3.2. Specification of the model

Bergstrand (1985) presents the gravity model, which calculates the effects of variables on exports between two trading countries. The model specification is shown in Equation (2). The paper uses Equation (2) with further extension of some variables to identify the gravity model specification for Vietnam.

$$EX_{ik,t} = \beta_0 (Y_{i,t})^{\beta_1} (Y_{k,t})^{\beta_2} (D_{ik,t})^{\beta_3} (FDI_{k,t})^{\beta_4} (ER_{ik,t})^{\beta_5} (B_{ik,t})^{\beta_6} (Block_{k,t})^{\beta_7} u_{ik,t} \quad (3)$$

Taking natural log of Equation (3), the gravity model specification is defined as:

$$\ln EX_{ik,t} = \beta_0 + \beta_1 \ln Y_{i,t} + \beta_2 \ln Y_{k,t} + \beta_3 \ln D_{ik,t} + \beta_4 \ln FDI_{k,t} + \beta_5 \ln ER_{ik,t} + \beta_6 B_{ik} + \beta_7 Block + u_{ik,t}$$

where EX_{ik} is the export volume from Vietnam to trading partner at time t . Y_i denotes GDP of Vietnam, Y_k denotes GDP of country k . FDI_k represents foreign direct investment of country k into Vietnam. ER_{ik} is the foreign exchange rate between VND and foreign currency (foreign currency per VND) at time t , B_{ik} denotes the dummy variable that captures border effects (1 if country k shares the same border and 0 if different border). $Block_{ik}$ denotes the dummy variable including three cases: (i) country j signs the trade agreement with Vietnam (BTA); (ii) country k is a member of ASEAN and join ASEAN free trade area (AFTA); and (iii) country j is a member of the EU. D_{ik} is the distance from Vietnam to country k (from Hanoi to capitals of country k).

Table 1

Description of specific variables

Variables	Description	Sources
EX_{ik}	Export volume from Vietnam to country j	GSO
Y_i	Gross domestic products of Vietnam (base year 1995) is defined as the production capacity of the economy	GSO
Y_k	Gross domestic products of country j , which captures the demand capacity for Vietnam's export products	IMF
FDI_k	Foreign direct investment of country j into Vietnam	GSO
ER_{ik}	Exchange rate (VND per foreign currency)	IMF
Distance	Distance between Vietnam and country j , which captures transaction, transport costs, risks of transportation and cultural differences	WRI
Border	Dummy variable (1 if sharing same border and 0 is others)	GSO
AFTA	ASEAN free trade area (1 = member and 0 is others)	GSO
BTA	Bilateral trade agreement with Vietnam	GSO

3.3. Data

The paper covers data of 28 countries from 2010 to 2014³. It uses the panel data, which shows the effects of different variables over time and unobservable variables. Data are collected from different sources including International Monetary Fund (IMF) (GDP of country k , foreign exchange rate), General Statistics Office of Vietnam (GSO) (export volume of Vietnam, GDP of Vietnam and FDI), and World Resource Institute (WRI) (distance from Vietnam to country k). The number of observations is 104. Summary of statistics is provided in Table 2.

³ The number of observation is smaller than that of the study by Dinh et al. (2011). The present paper only concentrates on main trade partners and includes countries that invested in Vietnam during the period 2010-2014 due to available and reliable sources of data.

Table 2

Summary of statistics

Variables	Unit	Mean	Std. deviation	Min	Max
EX _{ik}	1000 USD	644095.5	850041.2	15400	5024800
Y _i	1000 USD	3.67e+07	6311025	2.89e+07	4.53e+07
Y _k	1000 USD	1.14e+09	2.04e+09	3656000	1.17e+10
FDI _k	1000 USD	166697.8	195656.1	0	1074000
ER _{ik}	\$ per VND	7711.211	8067.758	1.380756	33716.8
Distance	km	6361.357	3830.618	952	13362

4. Empirical results

There are three ways to estimate the model specification including pooled ordinary least square (OLS), fixed effects and random effects when using unbalanced panel data (Rahman, 2004). This paper uses Stata 12 to estimate and test a method of estimation, which is likely to provide the best estimation of the gravity equation for Vietnam's trade.

4.1. Tests of the model selection

Some tests are applied to select the estimation method. First, the BP Lagrange multiplier test is used to identify the appropriate method between OLS and fixed effects and random effects. Table 3 shows that the null hypothesis $H_0: \text{Var}(u) = 0$ can be rejected due to calculated value of chi2 is greater than the critical value at 5 % significant level. As a result, the OLS estimation could create biased coefficients. Therefore, this method cannot be applied in this paper. Second, the Hausman test is designed to verify fixed effects and random effects. It can be seen in Table 3, which reports the result of estimates using the Hausman test. The null hypothesis H_0 : difference in coefficients not systematic cannot be rejected because chi2 is low at 2.77. Hence, the random effect estimation is selected to estimate the gravity model.

Table 3

Results of model selection

Null hypothesis	χ^2 - statistics	χ^2 - critical value	Decision
1. BP lagrangian multiplier test: H ₀ : Var(u) = 0	123.40	3.84	Rejected
2. Hausman test: H ₀ : Difference in coefficients not systematic	2.77	5.99	Fail to reject H ₀
3. Wald test: H ₀ : $\beta_1=\beta_2=\beta_3=\beta_4=\beta_5=\beta_6=\beta_7=\beta_8=0$	231.23	15.50	Rejected

Finally, a test of heteroskedasticity and autocorrelation is designed in a random effect model. Results of the random effect model show that some variables are not significant and the rho value is greater than 0.5, which means that the estimation has heteroskedasticity and autocorrelation problem. Therefore, the generalized least squares (GLS) are applied to estimate the random effect model because it has corrected heteroskedasticity and autocorrelation by white covariance matrix.

4.2. The estimation result

The paper uses the GLS random effect estimation to identify parameters of the gravity model for Vietnam’s exports. The results of the model are shown in Table 4.

As can be seen in Table 4, coefficients are significant at 5% level. The increase in GDP of Vietnam and importing countries will encourage the expansion of Vietnam’s exports. Similarly, the growing foreign direct investment into Vietnam will have a positive impact on exports. Moreover, if Vietnam depreciates its currency, this policy will enhance the competitiveness of Vietnamese export commodities.

Table 4

Random effects model of Vietnamese exports

	Coefficients	Std. errors	z - ratio
Constant	-12.2318	7.1593	-1.71
$\ln Y_i$	0.6479	0.4100	1.65
$\ln Y_j$	0.7257	0.0829	8.75
$\ln FDI_j$	0.202	0.0695	2.90
$\ln ER_{ij}$	0.0738	0.0353	2.09
Border	1.3139	0.4378	3.00
Distance	-05107	0.1494	-3.42
AFTA	1.1478	0.2406	4.77
BTA	-0.2879	0.4087	-0.70
Log likelihood	-111.5645	Num. of obs:	104

A similar pattern can be seen in border effects, if country j shares the same border with Vietnam, the export volume to this country will be higher at 1.31% than others without the common border with Vietnam. The dummy variable AFTA has the same outcome due to the positive sign of the coefficient, which means that exports to members of AFTA will have higher of 1.14% than non-members. In contrast, the variable of distance has a negative relationship with export volume.

5. Discussion

Vietnam has gained great achievements in export growth. If oil exports are not calculated, the export earnings of manufactured goods constituted over 50% of the export revenue. This shows a positive trend of Vietnam's export as sustainable the path of industrialization. This change in the export structure is the same as the path of successful exporting countries (Martin, 2002). Vietnam is moving from resource-based products to labor-intensive and capital-intensive products. Through this trend, it is suitable for the development level of Vietnam and tapping available comparative advantage as labor abundance. Empirical results in this study can identify the effects of factors, which contribute to success in Vietnam's exports.

First, GDP of Vietnam, which shows production capacity, has a positive impact on Vietnamese exports. The economic growth rate of Vietnam maintained at 7.24% annually from 1989 to 2008 (World Bank, 2010). This contributes to enhancing the capacity of production and industrial development that was a key factor to upgrade the export composition. Experience of many countries shows that a strong industrial foundation promotes exports of manufactured goods. Over the past decade, Vietnam's industry has

grown rapidly with an average rate of 14% per year. Vietnam expanded its industrial capacity and technology base substantially, with the establishment of many new industries. Consequently, the gross value of industrial production at current prices more than tripled during 1995–2014. According to Vo (2014), the development of new industries such as electronics, electrical components and construction materials supported industries with high competitiveness. The total investment was USD130 billion in the 1988–2003 period⁴. The investment focused on upgrading infrastructure and strengthening technology capacity, which facilitated growth of the industrial sector. Thus, economic growth will promote the economic structure shift, which contributes to diversifying export commodities and improve competitiveness.

Second, GDP of trading partners also has a positive effect on exports of Vietnam. It is defined as consumption capacity of importing countries. At present, Vietnam is still a small economy and depends much on foreign markets. The Heckscher-Ohlin theory shows that if an economy has relatively well endowment of factors, it will export goods, which produce goods that are intensive in the factors (Krugman, 1997). Vietnam has a comparative advantage of labor. Thus, this country mainly exports labor-intensive products to developed countries such as Japan and the EU. In addition, Feenstra (2004) states that increasing return and monopolistic competition will make country export varieties of the differentiated product to another. Thus, there has been increasing demand for Vietnam's export products over the past few years. This finding is similar to the theory of the gravity model which shows that the bilateral trade between the two countries is directly proportional to the product of the countries' GDP (Feenstra, 2004).

Third, foreign direct investment (FDI) has become an important factor contributing to export growth of Vietnam. As can be seen in the empirical results, if there is an increase in FDI by 1%, export volume will rise by 0.202%. Like other countries, Vietnam's exports have been influenced by a rapid increase in FDI. FDI shifted towards light manufactures and export industries in the period of 2010–2014.

Fourth, exchange rate plays a vital role in exports. Empirical results show that the increase in exchange rate will encourage export growth. Miles (1979), and Warner and Kreini (1983) found that the impacts of the exchange rate depreciation on exports is significant. The adjustment of the exchange rate will impact on prices of export and import goods, and competitiveness of goods. With its outward-looking strategy, Vietnam has maintained the managed exchange rate regime in the last decade. The official exchange rate, however, has been identified by the foreign exchange market since 1994⁵ The government has allowed a 10% margin between the official exchange rate and market rate since 1997. In order to encourage exports, Vietnam sustained competitive real exchange rates. The VND depreciated by nearly 20% during the Asian financial crisis but has demonstrated broad stability with a mild

⁴Report of MPI, 2003

⁵The inter-bank foreign exchange transaction market was established on the 20th of September 1994.

depreciation since then.

Fifth, according to the empirical result, there is a large border effects on exports of Vietnam. Anderson and Van Wincoop (2003) state that small economies have a greater border effects. Table 4 shows that Vietnam's exports are 1.31% greater if sharing the same border than without. In recent years, there has been a blooming of Vietnam's exports to China, which became one of the largest markets. The reduction of transportation costs, time and risk has facilitated the improvement in the bilateral trade between Vietnam and China.

Finally, the ASEAN free trade area has a positive impact on Vietnamese exports (Table 4). The coefficient of this dummy variable is highly significant when Vietnam is a member of AFTA. AFTA was formally established in 1992. The Common Effective Preferential Tariff (CEPT) scheme was designed to bring down tariffs on all manufactured and processed agricultural products to 0-5% within 15 years (Fukase & Martin, 1999). This tariff reduction has provided Vietnam with greater access to ASEAN exports markets.

6. Conclusion

The purpose of this paper is to identify determinants of exports of Vietnam in the 2010-2014 period and to support the gravity model by empirical results. The study uses the econometric model to estimate coefficients in the gravity model. The random effect estimation is designed to provide the empirical result, which indicates that independent variables are significant with the exception of the dummy variable BTA. This result is the same as previous studies, which shows that bilateral trade has a positive relationship with the country's GDP and importing countries' GDP and a negative relationship with distance. In particular, foreign direct investment, border effects and exchange rate play a significant role in promoting exports of Vietnam. As the same time, the deepened integration into the region and world also contribute to explaining the success of Vietnam's exports.

The study, however, has some limitations. There are many other factors such as trade policies, the impact of World Trade Organization's accession, and protectionism of developed countries, which are not captured by this paper. Therefore, the lack of these variables may have an impact on the accuracy of the result. Moreover, the paper only covers the data from 2010 to 2014. This is a short period that cannot capture the changes of export volume overtime. Nevertheless, this study may provide a picture of the gravity model for Vietnam's exports, which will enable policy-makers to have sound policies to increase the export volume of Vietnam such as further exports to large markets and countries sharing the same border with Vietnam, competitive exchange rate policy, the expansion of foreign direct investment and further integration in the world economy ■

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