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Evaluation of the Impacts of ASEAN+3 FTAs on Vietnam Iron and Steel Trade Flows: Gravity Model Analysis[1]

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Abstract: This paper analyzes the impacts of ASEAN+3 FTAs on Vietnam iron and steel trade flows. In this respect, a gravity model is applied to the panel data covering 27 top trading partners of Vietnam from 2001 to 2012. The paper findings show positive impact of ACFTA and VJEPA on increasing imports of iron and steel into Vietnam while AKFTA, AFTA and VJEPA have positive effects on their export. AJCEP and AFTA are concluded to have little impact on either imports or exports.

Keywords: Vietnam, ASEAN+3, steel, gravity model.

1. Introduction

For the past decade, Vietnam has made a great effort to negotiate and conclude a number of Free Trade Agreements (FTAs). The increasing free regional trade agreements over the years have had impacts on the whole economy as well as different industries. The iron and steel industry is known as a sensitive industry in Vietnam and is under significant effects of free trade agreements. The steel industry is one of the core industries of Vietnam which support development of the country, especially infrastructure development. Vietnam's current consumption of steel is quite high in the ASEAN region, ranking third among ASEAN countries, after Thailand and Indonesia. Nonetheless, Vietnam's manufacturing industry is still immature and the country is becoming more urbanized. Since the trade volumes in steel between Vietnam and ASEAN+3 countries is relatively high (Appendix 1, 2) and the tariff reduction is clear (Appendix 3), ASEAN+3 FTAs is expected to have impacts on this trade flow.

In this paper, we try to assess the impacts of ASEAN+3 FTAs on the Vietnam iron and steel industry by applying a gravity model approach based upon the panel data of 27 partner countries in the period from 2001 to 2012.

The paper is divided into five major sections. The following section is a review of the methodology of related, previous studies. Section 3 analyzes the integration of the Vietnam iron and steel industry in ASEAN+3 in

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terms of the openness level of FTAs, the comparative advantage of the Vietnam iron and steel industry, and the change of trading volume of the Vietnam iron and steel industry after FTAs. Section 4 applies the gravity model approach in clarifying whether FTAs have effects on iron and steel export and imports. The final part makes a conclusion and gives recommendations for Vietnam towards its integration in ASEAN+3.

2. Methodology

Throughout the world, there have been a large number of studies focusing on the analysis of the effects of FTAs, especially studies using a gravity model to clarify the impacts of FTAs within a region on significant sectors of a country. The first formulations of the gravity model equation are found in different studies to analyze international trade flows [1, 2]. Since then, the gravity model has become popular instrument in empirical studies on trade flows. Initially, the gravity model is used for explaining export from country i to country j which depends on the economic sizes (GDP or GNP), their populations, direct geographical distance, and a set of dummies incorporating some kind of institutional characteristics common to specific flows.

In the second half of the 1970s several theoretical developments contributed to the application of the gravity model. Anderson (1979) made the first attempt to derive the gravity equation by adding the assumption of product differentiation [3]. It is also proved that the gravity equation could be justified from standard trade theories [4].

Up to now, the trend of using gravity model analysis to evaluate the effects of FTAs on trade flows has been increasing sharply. The standard gravity model often has variables as follows: real GDP, income gap, distance, and others, such as adjacency and geographical characteristics. The original gravity equation takes the following form:

$$X_{ij} = A_i \frac{Y_i^a Y_j^b}{Dist_{ij}^c}$$

In which: A, a, b, c are the parameters to be estimated. The equation's logarithmic transformation is given by:

$LogX_{ij} = A_i + a.LogY_i + b.LogY_j + c.LogDist_{ij}$

The gravity model has been widely applied in international trade studies. Its popularity is due to the simplicity of the concept, and its appropriateness to match well with the available data and the models' econometric estimation. Depending upon the significant purposes of study, in the gravity model analysis more variables are added in many researches to apply effectively the examination of the relationship among several factors based on different cases. Thus determining suitable variables is one of the primary and most important requirements in setting up a gravity model to attain precise economic results.

In this paper, the model is based on the works of Urata and Okabe (2010) in which they depicted an image of trade flows under the effects of FTAs [5]. It is also based on the work of Bhattacharya and Bhattacharyay (2007), who used the gravity model analysis to work out the relationship between trading flows and regional trading agreements [6]. And thirdly it is especially based on the work of Nguyen Tien Dung (2011) and Nguyen Anh Thu (2012) [7, 8].

The gravity model in this study will have the general variables in the standard gravity model and a number of additional dummy

variables including FTAs, Border and Landlocked. The lack of a coastline increases the time and cost of transportation as well as the dependence on the quality of the infrastructure network across the region as a whole, particularly that of neighboring countries. Besides, we also find that the increase in the total trade of iron and steel products of Vietnam comes from improvements in infrastructure, followed by logistics and the efficiency of customs and other border agencies. Non-tariff barriers also are taken into consideration, as the main challenge of exporting the iron and steel of Vietnam into other countries in ASEAN seems to be the nontariff barriers imposed by the home countries' government, in addition to tariffs. The FTAs' dummy that was put into this equation is the FTAs' membership. When adding the FTAs' dummy, this paper mentions the impacts of membership of FTAs in general. After all, there were many motives for the author to examine the effects of several factors relating to the Vietnam iron and steel trade flow; however, depending on the availability of the database, the author will build the exporting model and importing model as follows:

(i) $\text{LogEXj} = C + ß_1 \text{Log RealGDP}_j + ß_2 \text{Log RealGDP}_{vn} + ß_3 \text{LogGap} + ß_4 \text{LogDistw} + \delta_{FTAj} \text{FTA}_j + ß_5 \text{Border} + ß_6 \text{Landlocked}$

(ii) $\text{LogIM}_j = C + ß_1 \text{Log RealGDP}_j + ß_2 \text{Log RealGDP}_{vn} + ß_3 \text{LogGap} + ß_4 \text{LogDistw} + \delta_{FTAj} \text{FTA}_j + ß_5 \text{Border} + ß_6 \text{Landlocked}$

In which, *EXj* and *IMj* are the export volume and import volume of Vietnam iron and steel products to the country j, *Gap* is the differences of Real GDP per capita of Vietnam and the country j; *Distw* is the geographical distance from Vietnam to country j which is standardized for population; FTA_j are the dummy variables measuring the impacts of FTA membership on the export and import flows between Vietnam and the countries.

In the model Export and Import flows (*Yi*) are measured in dollars; Real GDP and Gap are measured in dollars, Distance is in thousands of kilometers, Borders represents 1 if they share a common border and 0 if otherwise. The FTAs' dummy is represented by 0 if the trading partner is not the member of corresponding FTA and 1 if the trading partner is a member of that FTA since the year that the FTA went into effect or actually had efect on the sector. Consequently, the dummy variables AFTA, ACFTA, AKFTA, AJCEP and VJEPA will be 1 since the following years: 2006 (for AFTA, ACFTA), 2007 (for AJCEP) and 2010 (for AJCEP, VJEPA). Landlocked equals 1 if the trading country j is landlocked, 0 if otherwise. The author chose those years as it was in these years, a significant tariff elimination of FTAs had been practically undertaken on Vietnam iron and steel products and had resulted in big effects on the iron and steel industry trades.

Besides, some other important indexes in international trade are also used in this study. Firstly, the Reveal Comparative Advantage Index (RCA) of the Vietnam iron and steel industry is calculated to show how competitive iron and steel is in Vietnam's export compared to the product's exports in relations to its share in the world trade. The equation to calculate RCA is shown below:

$$RCA = \frac{x_{ij}/X_{it}}{x_{wj}/X_{wt}}$$

Where x_{ij} and x_{wj} are the values of Vietnam's exports of iron and steel products and world exports of iron and steel; X_{it} and X_{wt} represents Vietnam's total exports and world total exports.

Secondly, other indexes which are also used are Export Intensity Index and Import intensity Indices. These indices reflect the ratio of the share of country i's trade with country j relative

to the share of the world trade destined for country j. They can be defined as follows:

$$EII_i = \frac{x_{ij}/X_{iw}}{M_{jw}/(M_w - M_{iw})}$$

$$MII_i = \frac{m_{ij}/M_{iw}}{X_{jw}/(X_w - X_{iw})}$$

Where: x_{ij}: Country i's exports to country j; X_{iw}: country i's total exports to the world; M_{jw}: country j's total imports from the world; M_w: world total imports; M_{iw}: country i's total imports from the world; m_{ij}: country i's exports to country j; X_{jw}: country j's total exports to the world; X_w: world total exports.

3. Data

The model uses the export and import statistics from UN COMTRADE database from the year 2001 to 2012 as the availability of Vietnam's data base in this period. Real GDP are sourced from World Bank; the Gap is calculated from Real GDP per capita taken from World Bank; Distw; Border and Landlocked are taken from CEPII. There are a total 27 top trading partners in iron and steel which are recorded in the model for the period 2001-2012 from the data base of UN COMTRADE.

According to economic theory, real GDP will correlate positively with trade activities. Higher income levels will lead to higher demand for trade in goods. Therefore, the volume of exchange goods will be greater. Iron and steel are the typical goods that follow that trend. Distances are supposed to have a negative impact on both exporting and importing. The farther the distance is, the higher the transportation costs might be. High transportation costs will hinder the exchanges of goods among nations. In other words, the greater the distance is, the less trade there is between countries. The Income Gap variable is calculated as the difference between real GDP per capita of each country and it is used to check whether the trade depends on intra-trade or inter-trade. It may be positive or negative. When the coefficient of this variable is positive, this means trade flows are mainly dependent upon the inter-industry trade based on differences in factors of production resources. In contrast, if the income gap has a negative sign, it shows the impact of intra-industry trade.

Data used in the model is from 2001 to 2012, and is collected from trusted sources such as:

- Real GDP, real GDP per capita (taken fixed 2005 USD's price), are taken from the World Bank's World Development Indicators;

- Export and import flows are picked up from WIST;

- Distances, border and landlocked are taken from the Centre d'Etudes Prospectives at d'Informations Internationales (CEPII).

Comment [BW1]: Are these words necessary?

4. Findings

From Table 1, the outstanding outcome to be noted is the RCA of Vietnam in the iron and steel industry appear to be the highest index compared to ASEAN nations in each year from 2001 to 2012. The computation of RCA for iron and steel shows that Vietnam has somehow improved its comparative advantage of this product over the period.

Nevertheless, the RCA of Vietnam was below one, meaning that Vietnam does not have comparative advantages in iron and steel products (although there was a surge of Vietnam's export of steel in 2008, leading to a higher RCA of 0.88. This trend is not sustainable however). This industry depends on the availability of natural resources in the country and the development of the industry. A snapshot of the Vietnamese iron and steel

industry in the integration phase can explain clearly why Vietnam has a low comparative disadvantage in the iron and steel industry, although the role of this industry is typically important for the reform of the country.

Besides, the RCA of ASEAN nations were below one, in other words, all of these countries do not have a comparative advantage like big trading partners such as China, Korea, Japan.

Apart from measuring the competitive advantages of Vietnam iron and steel with other nations; trade intensities is the typical index for pointing out the share of Vietnam iron and steel trade with another country. The value of the index may range from 0 to 100. This reflects that country is importing more (or less) from country j than might be expected from that country's share in total world trade. On the export side, if the value is 0 or near to 0, it implies that the export link between these countries is negligible, and if the value is nearer to 100 that indicates that the performance is relatively significant, and if it exceeds 100 it reveals that a country exports more than expected compared with other countries. The trade intensity is usually divided into export intensity and import intensity.

Table 2 demonstrates that Vietnam's export intensity and import intensity indexes are mostly greater than one with all ASEAN+3 nations in the iron and steel industry, implying a strong link between Vietnam and individual members with associated FTAs in the region. Vietnam's import intensity index (MII) was quite small with Japan for many years before 2010 but has improved strongly after signing the VJEPA. Vietnam's export has expanded with Singapore recently, while declining with several countries, namely Indonesia, Thailand and Malaysia. Cambodia and Laos have become outstanding with a high value of export intensity index (EII) and MII with Vietnam. This comes from a low total volume in both total exports and imports of these two countries which the volume with Vietnam plays a majority part of.

Table 1: RCA for ASEAN+3 countries in iron and steel industry

Country	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Thailand	0.38	0.44	0.49	0.48	0.45	0.42	0.74	0.40	0.31	0.30	0.27	0.50
Philippines	0.05	0.07	0.09	0.15	0.18	0.28	0.25	0.24	0.18	0.16	0.13	0.09
Brunei	0.00	0.02	0.03	0.02	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.06
Malaysia	0.19	0.36	0.43	0.28	0.32	0.47	0.38	0.27	0.40	0.38	0.31	0.23
Indonesia	0.29	0.34	0.44	0.30	0.46	0.36	0.40	0.23	0.31	0.26	0.17	0.15
Singapore	0.17	0.23	0.26	0.20	0.20	0.25	0.27	0.18	0.24	0.23	0.21	0.23
Laos	0.04	0.06	0.45	0.15	0.01	0.00	0.02	0.01	0.03	0.01	0.02	0.03
Cambodia	0.00	0.01	0.01	0.01	0.02	0.01	0.03	0.03	0.04	0.05	0.00	0.01
Myanmar	–	–	–	–	–	–	–	–	–	–	0.01	0.02
Vietnam	0.06	0.09	0.12	0.16	0.21	0.22	0.28	0.88	0.32	0.61	0.72	0.43
China	0.46	0.36	0.36	0.70	0.72	0.94	1.07	1.15	0.50	0.71	0.79	0.77
Korea	1.84	1.60	1.69	1.51	1.65	1.56	1.44	1.55	1.91	1.81	1.87	1.97
Japan	1.51	1.63	1.53	1.36	1.50	1.46	1.37	1.54	2.19	1.96	1.93	2.11

Source: Calculated by the author from the database of UN COMTRADE.

Table 2: Vietnam's export and import intensity index with ASEAN+3 countries, sector: Iron and steel industry

Year		Indonesia	Thailand	Malaysia	Singapore	Philippines	Cambodia	Japan	Korea	China	Laos
2006	MII	4.13	3.10	11.52	2.96	0.69	1696.95	0.97	0.67	0.99	398.24
	EII	5.31	6.64	4.46	1.68	19.66	126.95	2.14	1.58	6.22	
2007	MII	17.09	1.68	14.36	1.27	3.73	1091.63	0.74	1.13	1.50	546.35
	EII	5.32	8.53	13.97	0.83	12.16	205.35	1.79	1.31	4.60	
2008	MII	12.58	5.93	5.01	5.88	29.40	498.26	0.17	0.97	0.32	369.00
	EII	6.51	7.13	8.69	1.11	4.83	86.95	2.27	2.26	3.18	
2009	MII	11.29	3.47	14.68	2.91	9.83	247.04	0.54	0.76	0.33	246.48
	EII	4.59	8.72	12.39	0.97	2.40	53.12	1.53	2.19	3.00	
2010	MII	8.91	2.09	10.98	3.86	5.25	234.72	1.63	1.81	1.47	152.84
	EII	2.99	6.49	12.91	1.33	1.63	119.23	1.81	3.16	3.29	
2011	MII	8.96	4.86	8.54	3.39	9.90	154.53	2.06	1.33	0.93	308.42
	EII	3.40	5.75	9.19	1.54	1.97	0.53	2.43	3.72	2.53	
2012	MII	10.15	4.57	8.77	2.10	7.09	110.61	2.80	0.84	0.53	106.08
	EII	2.70	1.29	3.35	2.04	0.98	67.24	2.58	3.12	3.01	

Source: Computed from Trade Map Statistics.

In this section, through the statistical analysis of trade intensity and RCA, the strength and nature of bilateral trading relationships between countries, is examined. Some concluding remarks are made. Vietnam has a comparative disadvantage in the iron and steel industry. Meanwhile, Korea, China and Japan, with a high RCA index of more than one are confirmed as having a comparative advantage in the iron and steel sectors. ASEAN nations have a lower RCA than these big countries. Vietnam, in the near future might keep importing more from China, Japan and Korea. The export and import intensity indices have proved for this trend, especially after the years of FTAs' establishment. A last thing to note is a strong trading relation among countries in the iron and steel industry.

Table 3 gives the results for the regression coefficients of all variables for the Exports and Imports model. Almost all the standard gravity variables have the expected and statistically significant sign.

Before examining the effects of FTAs on the trade flows of the Vietnam iron and steel industry, we do wish to highlight the general effects of other variables concerned in the model to check out their impacts on trade flows of Vietnam iron and steel.

Firstly, Real GDP, which measures the economies of scale, are seen to have a positive sign in both the export and import equation. This reveals that the growth of the economy of Vietnam as well as the trading countries will foster the export and import flows in and out of Vietnam. In other words, the Real GDP factor has a positive effects on the trading of the iron and steel industry. More specifically, for exporting, the volume will increase respectively by an average of 0.496 percent and 8.09 percent if the real GDP of the destination market and Vietnam rise by about 1 unit. Importing iron and steel is also under the same positive effect of real GDP as in exporting, but with different coefficients.

Table 3: The econometric results

	Export model	**Import model**
$LogRealGDP_j$	0.496***	0.661***
	(0.00)	(0.00)
$LogRealGDP_{vn}$	8.088***	2.765***
	(0.00)	(0.00)
LogGap	0.03	-0.031
	(0.66)	(0.6263)
LogDistw	-1.689***	-0.389***
	(0.00)	(0.0047)
AFTA	0.986*	-1.910***
	(0.145)	(0.0038)
ACFTA	-0.735	2.559***
	(0.257)	(0.001)
AKFTA	1.556**	-0.186
	(0.012)	(0.757)
AJCEP	-1.631***	-1.1097**
	(0.005)	(0.0478)
VJEPA	1.614*	2.366**
	(0.131)	(0.0235)
Border	1.779***	-1.511***
	(0.0001)	(0.0005)
Landlocked	-0.058	-1.246**
	(0.91)	(0.0128)
Constant	-186.747***	-65.448***
	(0.00)	(0.00)
R-squared	0.657	0.554
Adjusted R-squared	0.641	0.537

*: p< 0.15, **: p< 0.05, ***: p< 0.01

Source: The author's calculation.

Secondly, the income gap variable appears to have a positive sign in the export model and a negative sign in the importing one, but there is no statistical significance in these two equations. It can be explained that the exporting of iron and steel of Vietnam mainly is related to inter-industry trade with trading partners; meanwhile, the importing of iron and steel of Vietnam is intra-trade. However, this effect does not play a part in the trade flows of iron and steel. It does not have any significant effects on the exporting and importing volume of the Vietnam iron and steel industry.

Thirdly, distance is recorded at a negative sign with both export and importing value. This matches with the theory in gravity models. Other dummies, like border, landlocked relatively meet the author's expectation. Border has a positive and significant sign in export but a negative sign in the import equation. This comes from the database that Vietnam seems to export more easily with neighboring countries while imports did not follow that trend. The imports of Vietnam might be unique for several reasons. Vietnam seems to import more from the markets in which it can supply a cheap price but still guarantee suitable quality. Having borders with Vietnam, there are only Laos, Cambodia and China. Only China has comparative advantages which are favorable for Vietnam's import. Laos and Cambodia, with the same or even a lower developed level in the iron and steel industry, are likely not the key import markets of Vietnam, even though they have a borders advantage. However, there is potential for exporting to these countries. Landlocked, as presented in the previous section, is a hindrance for trading activities. In the iron and steel equation, landlocked has a negative sign in the import equation and does not have much effect on exporting.

The most important information gained from the above table is the FTAs' effects on Vietnam iron and steel trade flows. Among all FTAs mentioned, only AKFTA and AJEPA are recorded as having a significantly positive sign for the exports model. AKFTA is noted as a FTA that has a positive and significant impact on exports when the coefficient of the AKFTA dummy is quite high at 1.556, at a significance level of 5 percent. This is appropriate with the fact that from 2010, the export volume of iron and steel to Korea has sharply plunged after 2007 when AKFTA went into force. VJEPA has a larger impact on exporting when its coefficient reaches the number of 1.614 at the significant level of 15 percent. This is consistent with the expected sign from the analysis in the previous section.

AFTA has a coefficient of 0.986 with a statistically significant level of 15 percent, indicating that AFTA has a relative impact on Vietnam export iron and steel within the ASEAN region. The complicated trend of Vietnam export flows within ASEAN, as depicted in Chapter 3 might reflect that export flows of Vietnam iron and steel products are largely conflicted over time, and it is difficult to clarify clearly the impact of AFTA on this era in the short term; but after all, AFTA still is seen to force the exports flows of Vietnam. ACFTA also does not have a significant sign in the export equation. The author can understand why this result comes out. There is the fact that China is a big country for supplying iron and steel globally, and the demand for importing these kinds of goods is still quite low. In addition, there was a downward trend in Vietnam's export flows to China recently. This causes a negative sign of ACFTA but is not statistically significant.

In terms of the importing model, ACFTA becomes the key FTA having a positive and statistically significant coefficient. An increase of about 2.559 percent in import value will be gained from the establishment of ACFTA. Meanwhile, VJEPA creates an average increase of 2.366 percent of import volume. From the point of view of the iron and steel sector, China and Japan are the two main potential suppliers for Vietnam for a long time. This outcome has therefore, totally reflected

accurately the fact of import flows among these countries thanks to tariff elimination under ACFTA and VJEPA.

However, the recent downward trend of import flows of Vietnam from ASEAN markets causes AFTA to be reflected as having a statistically negative sign of 1.910 percent. Along with AFTA, AJCEP was also recorded at the same sign as AFTA with minus 1.109 percent affecting the importing of Vietnam iron and steel. This uncovers that joining these FTA does not bring out improvement in the exports from ASEAN countries to Vietnam in the iron and steel sector. Only AKFTA, with the short time of establishment, in the model does not have significance in the importing equation. It is the complicated fluctuation of importing flow from Korea to Vietnam over the years accompanied with a short time of establishment of AKFTA that does not take into account the effects.

5. Conclusion

Based on the calculation of RCA, export intensity and import intensity index, Vietnam is considered to have a comparative disadvantage in iron and steel product; the import intensity of Vietnam is strong with China, Japan and Korea, while for ASEAN nations, the intensity levels are quite low. When FTAs are implemented, several changes in the trade flows of Vietnam iron and steel products are witnessed. Imports from China have increased sharply over the years after 2006. The export of Vietnam to Korea rises rapidly after 2010 [9]. AFTA are seen to have little impacts on the trade flows of Vietnam when trends are complicated over years. By estimating the gravity models, the impact level of AKFTA, AFTA and VJEPA are foreseen to promote the export iron and steel products of Vietnam to the related member nations. ACFTA and AJCEP do not have any significant effects on stimulating the export of iron and steel. Regarding the import model, ACFTA is proved to promote the import from China to Vietnam in these years. VJEPA is also the FTA that has positive impacts on imports from Japan. AKFTA, AFTA and AJCEP have not revealed any clear impact on Vietnam's imports of iron and steel.

Despite the above-mentioned findings, the paper can be developed in the future to have more observations as well as to use more variables to grasp fully the impacts of all regional FTAs if the needed data becomes available.

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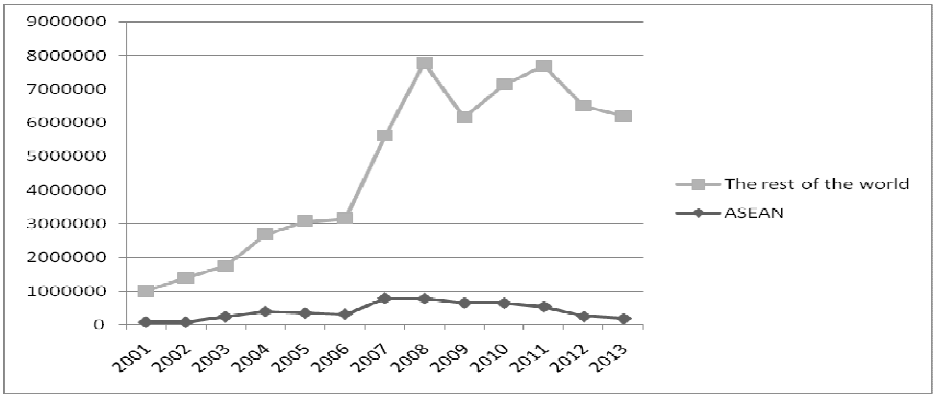
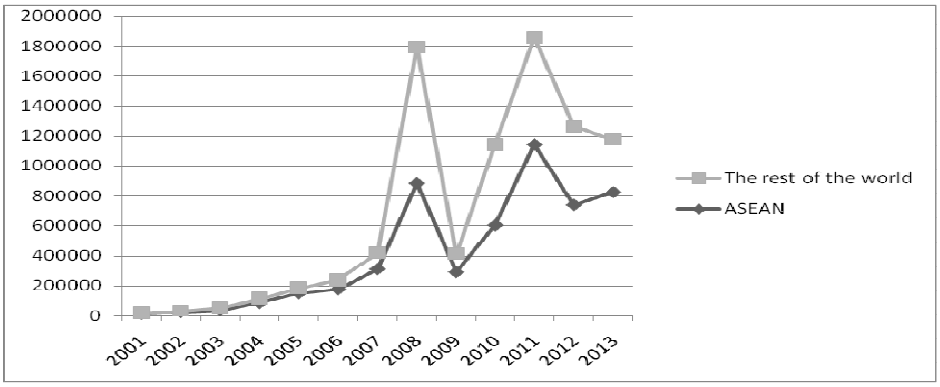
Appendix 1: Vietnam's iron and steel import flows, 2001-2013
(Unit: Thousand USD)



Source: The author's figure based on trade map data.

Appendix 2: Vietnam iron and steel's exports flows, 2001-2013
(Unit: Thousand USD)



Source: The author's calculation from trade map data base.

Appendix 3: Tariff rate schedule of Vietnam for iron and steel products under FTAs

FTAs	MFN 2010	Applied tariff, 2010	Average tax (%)						Others
			2010	2011	2013	2015	2016	2019	
AFTA	4.13	1.12	1.12	**1.12**	1.12	_	_	_	
ACFTA	4.13	10.99	10.99	8.38	_	_	_	_	190 tariff at 0-1 %
AKFTA	7.31	5.58	5.58	**4.43**	_	0	_	_	
VJEPA	7.3	7.1	7.1	7.1	_	_	1.6	0.2	

Source: MPI, 2013 [10].