The Impacts of Vietnam's WTO Accession on the Intensive and Extensive Margins of Imports

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I.   Introduction

  The last successful multilateral trade liberalization was the Uruguay Round implemented in 1996-2005. After the Uruguay Round, multilateral trade liberalization is so far not achieved as Doha Development Agenda (DDA) launched in November 2001 remains still unresolved after missing its official deadline of 2005. Thus the analysis time span of many empirical studies on the impacts of trade liberalization on trade margins is limited to the early 2000s. Debaere and Mostshari (2010) investigate the effects of U.S. tariff reductions on the bilateral imports between 1989 and 2000. Disdier et al, (2013) explore the relationship between tariff cuts resulting from the Uruguay Round and exports growth in emerging countries between 1996 and 2006. Besedes and Prusa (2011) use bilateral manufacturing exports of 46 countries between 1975 and 2003. Using firm-level data for France Buono and Lalanne (2012) investigate the impact of the Uruguay Round on trade margins.

  As Baldwin (2016) shows, however, many WTO members have lowered barriers to trade bilaterally, regionally, and unilaterally. In particular, Vietnam became the WTO's 150th member on 11 January 2007. With WTO accession Vietnam is granted Most Favored Nation Treatment by the WTO members. At the same time Vietnam also had to cut its tariffs to a large extent to the existing WTO members. The implementation of tariff reductions for most products of Vietnam was completed in 2012, however the tariff reduction schedule of a few products will end in 2019. Therefore, trade liberalization of Vietnam following WTO accession provides a good case to examine how recent trade liberalization affects imports

growth.

The studies on trade effects of WTO began with Rose (2004) and many studies (Subramanian and Wei, 2007; Allee and Scalera, 2012; Mansfield and Reinhardt, 2008; Roy, 2011; Eicher and Henn, 2011; Chang and Lee, 2011) followed to estimate the effects of WTO membership on trade volume by applying different empirical techniques and data sets. In addition, Lissovolik and Lissovolik (2007) and Ni (2016) examined the trade effects of WTO accession at the country-level and show Russia and Vietnam exported more to non-WTO members than to WTO members, respectively. All of these studies, only focus on trade volume at the aggregate level and do not decompose trade volume into the extensive and intensive margin. The exception is Dutt et al. (2011) who used HS 6-digit bilateral trade data find that WTO membership increased growth in newly traded goods but decreased trade of already traded goods at the aggregate level.[1]

However, we cannot conduct the analysis at the aggregate level because according to Most Favored Nation (MFN) principle Vietnam cannot discriminate between their trading partners and this tariff rate at the aggregate level is the same to all trading partner. Moreover, if the extensive margin of import is defined as the number of products, their counting and simple summation do not account for differences across industries.

Instead we investigate the impacts of Vietnam's tariff reduction on the extensive and intensive margin at the industry level as well as at the disaggregate HS 6-digit product level. The trade analysis at the industry level has the advantage that accounts to trade pattern determined by comparative advantage of exporter. To do this, we aggregate the imports of HS 6-digit products from worldwide to Vietnam into 22 industries which correspond to two-digit ISIC rev. 4 codes. The first measure of the extensive and intensive margin is defined as the number of HS 6-digit products from a country and their average imports at the industry level, respectively.

Furthermore, the literature on the role of intensive and extensive margins in the growth of

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[1] A number of studies investigate the impacts of crisis or policy changes on the extensive and intensive margin of export of developing countries. Aisen et al. (2013) study the impacts of financial crisis on the extensive and intensive margin of export and find that a large proportion of the Chilean export variation during 2008-09 can be attributed to the intensive margin. Reis and Taglioni (2013) study the effects of Pakistan's protective intervention on the intensive and extensive margin of exports using a firm-level data. Beverelli et al. (2015) find a positive impact of WTO trade facilitation agreement on the extensive margins of trade and Shepherd (2010) also find that tariff reduction is associated with geographical export diversification of developing countries.

trade shows that their different definitions lead to the different conclusions (Besedes and Prusa, 2011). While many studies including Hummels and Klenow (2005), Evenett and Venables (2002), Kehoe and Ruhl (2013) find that the extensive margins are more important for the growth of exports. Also, a number of studies find that the majority of the growth of trade is due to the intensive margin rather than the extensive margin. Evenett and Venables (2002) define the extensive margin at the country-product level, Amiti and Freund (2010) at the product level, and Helpman, Melitz, and Rubinstein (2008) and Felbermayr and Kohler (2006) at the country level. To check the sensitivity of our empirical results, we use alternative measure of the extensive and intensive margin. Our second measure of the extensive margin is defined as the number of newly imported HS 6-digit products and the intensive margin as the changes in imports of already imported products.

At the industry level, we find that the reduction of tariff is negatively correlated with imports. We also find that the intensive margin plays the significant role in the increase of Vietnam's imports, but not in the extensive margin. At the product level where the extensive margin is defined as the number of newly imported products and the intensive margin as the changes in import volume of HS 6-digit product that already has imported before Vietnam's WTO accession, we also find that the intensive margin is more influential in increase of Vietnam's imports than the extensive margin.

The rest of this paper is organized as follows. Section 2 discusses the evolution of Vietnam's tariffs between 2006 and 2013. In section 3, we present the empirical models to estimate the impacts of tariff reduction on the extensive and intensive margin at the industry and product level, respectively. Section 4 provides the estimation results. Section 5 concludes.

II.   Data

We focus on the period 2006-2013, i.e. before Vietnam's WTO accession and end of implementation period of import liberalization. The tariff data are taken from the WTO tariff accession's Tariff Database available at the HS 6-digit level. We also obtain data on bilateral imports of HS 6-digit products from UN Comtrade database.

1. Evolution of Vietnam's Tariffs

Figure 1 shows the evolution of Vietnam's tariff rates at the aggregate level over 2006-2013. Starting from 15.1 percent in 2006 the simple average of applied tariff rates(tariff_s) has decreased to about 9.0 percent. The weighted average of applied tariff rates (tariff_w) was lower than the simple tariff rates. It also showed a decreasing tendency and fell to around 5.9 percent in 2013.

Figure 1. Evolution of Vietnam's Tariff Rates at the aggregate level
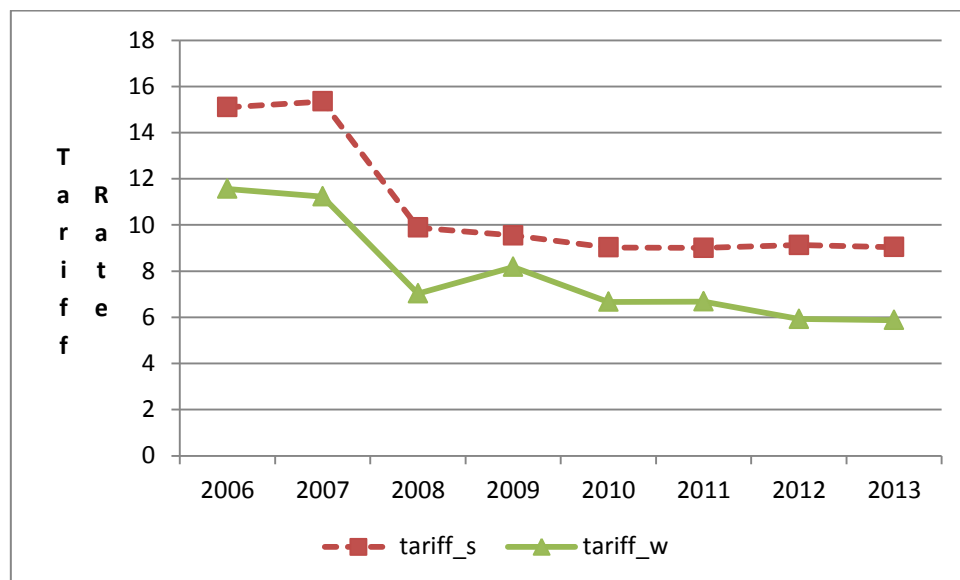
Source: WTO Tariff Database

Table 1 presents the simple average and import weighted average of tariff rates by industry and their changes between 2006 and 2013. We look at the decrease in tariff rates for all industries between 2006 and 2013, but with large variations across industries. Similarly at the aggregate level, the import weighted average of tariffs is lower than the simple average. There are significant heterogeneities across industries in the initial level of tariff rates and the magnitude of changes. For example, it is notable that the weighted average tariff rates of Text/app/other decreased by 20.7 percent between 2006 and 2013, while the import weighted average tariff rates of forestry remains unchanged.

Table 1. Tariff Rates at the industry level between 2006 and 2013

Industry	Simple average			Weighted average		
	2006	2013	Δ(2013-2006)	2006	2013	ΔΔ(2013-2006)
Crop/hunting	20.1	12.2	-7.8	11.4	7.2	-4.2
Forestry	4.0	3.3	-0.6	0.4	0.4	0.0
Fishing	22.7	11.6	-11.1	21.1	20.3	-0.9
Mining	3.9	2.0	-2.0	3.2	0.4	-2.8
Food products/tobacco	35.9	21.2	-14.7	18.8	9.1	-9.7
Text/app/other	34.8	14.5	-20.4	32.4	11.7	-20.7
Wood/wood products	11.0	7.9	-3.1	3.1	2.1	-1.0
Paper	19.9	13.4	-6.5	16.2	12.2	-4.0
Printing/recorded media	18.7	13.4	-5.3	13.2	13.2	-0.1
Coke/refined petroleum	8.1	5.6	-2.6	14.5	11.2	-3.3
Chemicals	5.3	3.3	-1.9	3.1	2.0	-1.1
Pharmaceutical	2.6	1.2	-1.4	5.6	2.5	-3.2
Rubber/plastic	17.2	11.0	-6.2	19.8	11.0	-8.8
Non-metallic	20.0	16.3	-3.8	23.4	17.0	-6.4
Basic metals	3.6	2.9	-0.7	2.6	1.7	-1.0
Fabricated metal	18.2	13.0	-5.2	15.4	9.8	-5.6
Computer/electronic	4.2	2.2	-2.1	4.1	0.6	-3.5
Electrical equipment	12.3	8.3	-3.9	7.9	4.4	-3.5
Machinery	6.4	4.1	-2.3	5.5	4.0	-1.5
Motor vehicles	31.5	19.5	-12.1	29.9	19.4	-10.5
Other transport equipment	24.0	19.0	-5.0	44.1	6.6	-37.5
Furniture/other manuf.	21.1	15.4	-5.7	15.3	6.1	-9.2

III.   Empirical Model and Data

1. Industry level Analysis

Rather counting the number of all products exported from origin country and their simple summation at the aggregate level, we account for differences across industries. We aggregate the imports of HS 6-digit products from worldwide to Vietnam into 22 industries.[2]

The volume of imports in the industry k can be decomposed into the extensive and intensive margin.

$$M_{jk} = N_{jk}\left(\frac{M_{jk}}{N_{jk}}\right) ,$$ (1)

where M_{jk} is imports in the industry k from j country and N_{jk} is the number of product (HS 6-digit level) belong to the industry k from j country (extensive margin of imports). The last term in eq. (1) is the intensive margin in the industry k that is measured by the average value of imports per product.

Based on a gravity model that has been used as a workhorse for empirical analysis on the determinants of bilateral trade flows, our basic empirical specification is as follows:

$$\ln X_{jkt} = \alpha_0 + \alpha_k + \alpha_t + \beta_1 \ln(GDP)_{jt} + \eta Y' + \lambda FTA_{jt} + \gamma \ln(Tariff)_{kt} + u_{jkt} ,$$ (2)

where the dependent variable is imports, the intensive margin or the extensive margin; α_k is industry fixed effects, which account for time-invariant differences across industries,; α_t denotes year fixed effects, which account for changes over time that influence all exporters and industries equally; GDP is GDP of exporting country; Y is a vector of variables affect bilateral trade costs such as distance and contiguity, and $Tariff_{kt}$ is import weighted applied tariff rates of

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[2] See Appendix 1

industry k at the time t. Colony and Common language that frequently used in the gravity estimation are excluded, because most of these variables are zero.

Though we include exporter specific variables and country-pair variables in the estimation equation, the estimate of tariff changes may be still biased due to omitted variables. To address this concern, we include time-varying exporter fixed effects, which control for time-variant unobserved exporter characteristics as well as country-pair characteristics. Since importer is only Vietnam, time-varying exporter fixed effects control for the characteristics of exporting countries as well as bilateral relations such as changes in GDP and FTAs. Thus the empirical model can be written as follows:

$$\ln X_{jkt} = \alpha_0 + \alpha_k + \alpha_t + \alpha_{jt} + \gamma \ln(Tariff)_{kt} + u_{jkt} \tag{3}$$

2. Product level analysis

So far we define the extensive margin of import in the industry k as the number of HS 6-digit products classified as belong to that industry. In this section, following Debaere and Mostashari (2010) and Disdier et al. (2013), we define the extensive margin of imports as the number of newly imported HS 6-digit products from an exporter which was not imported before Vietnam's WTO accession, but imported after WTO accession.

We specify the empirical equation which estimates the impact of Vietnam's WTO accession on the extensive margin of imports as follows:

$$y_{jz}^{*} = \beta \Delta \ln tariff_z + \alpha_1 X_j + \alpha_2 X_{jv} + \varepsilon_{jz} \tag{4}$$

$$y_{jz} = 1\left[y_{jz}^{*} > 0 \right]$$

where y_{jz}^{*} is a latent variable, $\Delta \ln tariff_z$ is the variation in the logarithm of tariffs on imports of good z between 2006 and 2013, X_j (Z) is a vector of exporter specific variables, X_{jv} denotes a vector of country-pair (exporter and Vietnam) specific variables, and ε_{jz} is the error term.

The dependent variable, y_{jz}, is the probability that good z is imported by Vietnam from the

country j in 2013, but not imported in 2006.

To alleviate omitted variable bias, we include exporter fixed effects that control for unobserved exporter-specific characteristics and country-pair factors. The empirical model can be written as follows:

$$y_{jz}^* = \beta \Delta \ln tariff_z + \phi_j + \varepsilon_{jz} \tag{5}$$

$$y_{jz} = 1\left[y_{jz}^* > 0 \right],$$

where ϕ_j is exporter fixed effects.

To investigate the impacts of Vietnam's WTO accession on the intensive margins of imports, we define the intensive margins of imports as the changes in imports of good z between 2006 and 2013. Thus only positive imports in both 2006 and 2013 are included in the estimation. The estimating equation for the intensive margin is as follows:

$$\Delta \ln M_{jz} = \gamma \Delta \ln tariff_z + \gamma_1 X_j + \gamma_2 X_{jv} + u_{jz} \tag{6}$$

When we also include the exporter fixed effects to account for unobserved country-specific factors and country-pair relations, the empirical model can be expressed as follows:

$$\Delta \ln M_{jz} = \gamma \Delta \ln tariff_z + \eta_j + u_{jz} \tag{7}$$

3. Data

We use the HS 6-digit import data from Comtrade database (UNCTAD) and obtain geographical indicators such as distance and border from CEPII as presented by Mayer and Zignago (2011). We get data on GDP from World Development Indicators (World Bank). FTA dummies are obtained from Regional Trade Agreements Database (WTO). This focus is warranted since earlier literature, especially Kehoe and Ruhl(2003) and Hilberry and McDaniel(2002), has reported significant changes in the extensive margin in the wake of NAFTA in US export.

Tariff data are taken from the WTO tariff accession's Tariff Database. They are available for commodity descriptions at the HTS 6-digit level. Our objective is to consider changes in the range of imported goods and to quantify the importance in Vietnam tariff changes. We work

at the 6-digit level on HS02 classified. To ensure omitting reclassified goods concordance.

We look at the changes in tariffs by industries based on the ISIC rev4. We find that actual tariff decreases have been different by industries[3]. Table.1 shows the change in tariffs mean variation by industry. The highest decreases in manufacture are observed for Texture/apparel(-59.2%) and Pharmaceuticals(-54.0%).

IV.   Estimation Results

Table 2 presents the estimation results at the industry level with panel data. Columns (1)-(6) report the dependent variable as logarithmic import value, the intensive margin and the extensive margin, respectively. In the column (1), (3) and (5) we see that the coefficients of variables included the traditional gravity equation such as GDP and distance have the expected sign and significant at the 1% level. In addition, the coefficient of FTA is positive and significant. Moreover, the coefficient of tariff in the column (1) and (3) is negative and significant at the 1% level, meaning that Vietnam's tariff reduction is associated with increase in imports and the intensive margin. However, we do not find the significant impacts of tariff on the extensive margin as shown in column (5).

However, industry fixed effects and time fixed effects are included in the column (1), (3) and (5), results for these estimations are still may suffer from the endogeneity problem due to omitted variables. To alleviate this problem, we include time-varying exporter fixed effects, which control for time-variant unobserved exporter characteristics as well as country-pair characteristics.

The coefficient of tariff in the column (2) is negative and significant at the 1% level. Its magnitude of is -0.227, meaning that tariff reduction by 1% increase imports by 0.227%. Column (4) and (6) report the estimation results for the impacts of tariff on the intensive margin of imports and the extensive margin, respectively. The coefficient of tariff in column (4) is negative and significant at the 1% level, but the coefficient of tariff in column (6) is not significant, meaning that it is not different from zero. This estimation results imply that the

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[3] See appendix 2

increase in Vietnam's imports after WTO accession is mainly driven by changes in the intensive margin

Table 2. The Estimation Results at the Industry Level

Dep. variable	ln(M)		ln(M/N)		ln(N)	
	(1)	(2)	(3)	(4)	(5)	(6)
ln(GDP)	0.862 (0.013)a		0.345 (0.010)a		0.518 (0.005)a	
ln(Dist)	-0.467 (0.044)a		-0.166 (0.035)a		-0.301 (0.017)a	
Border	-0.059 (0.144)		0.208 (0.113)c		-0.266 (0.056)a	
FTA	2.329 (0.095)a		1.377 (0.074)a		0.953 (0.037)a	
ln(Tariff)	-0.297 (0.105)a	-0.227 (0.088)a	-0.262 (0.082)a	-0.192 (0.073)a	-0.036 (0.041)	-0.036 (0.029)
time-varying exporter fixed effects	No	Yes	No	Yes	No	Yes
industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
No. obs.	11,514	13,077	11,514	13,077	11,514	13,077
Adj. R sq.	0.42	0.56	0.30	0.39	0.61	0.79

Note: Standard errors are reported in the parentheses, and a, b, and c denotes significance at the 1%, 5%, and, 10% levels, respectively.

Table 3 shows the empirical results at the HS 6-digit product level. Column (1), (2) and (3) report the estimation results for the extensive margins of imports of Vietnam that is defined as the number of HS 6-digit product which is newly imported between 2006 and 2013. Column (1) shows the estimated result of the probit model. Also, the column (2) and (3) report the OLS results. The estimated coefficients of tariff in column (1) and (2) are negative and significant at the 1% level, which means that tariff reduction leads to the increase in the extensive margins, i.e. the newly imported goods from countries that were not imported in 2006. To address the concern of omitted variable bias, we include exporter fixed effects, which control for time-invariant exporter characteristics as well as country-pair relations in column (3), but significance and the sign of the estimated coefficient of tariff do not change. For completeness, column (4) and (5) show the results for the impacts of tariff reduction in the intensive margins measured by the changes in imports between 2006 and 2013. The coefficients of tariff change are also negative and significant at the 1% level. As we have

seen in the column (3) and (5) including exporter fixed effects, tariff reduction, which has stronger impacts on the intensive margins than the extensive margins. It implies that the intensive margin than the extensive margin is more influential in increase in Vietnam's imports. Our results are in line with the findings of Felbermayr and Kohler (2006), Eaton et al. (2008), and Helpman, Melitz, and Rubinstein (2008) who found the majority of the growth of trade is due to the intensive margin rather than the extensive margin.

Table 3. The Estimation Results at the Product Level

	Extensive margins			Intensive margins	
	Probit (1)	OLS (2)	OLS (3)	OLS (4)	OLS (5)
$\triangle$ln(tariff)	-0.104 (0.009)a	-0.034 (0.002)a	-0.020 (0.003)a	-0.147 (0.023)a	-0.141 (0.022)a
$\triangle$ln(GDP)	0.550 (0.034)a	0.179 (0.011)a		0.978 (0.075)a	
ln(Distance)	0.267 (0.009)a	0.090 (0.003)a		0.505 (0.025)a	
FTA	-0.475 (0.015)a	-0.157 (0.005)a		0.213 (0.038)a	
No. obs.	67,868	67,868	67,860	31,946	31,949
Pseudo R_sq./ Adj. R-sq.	0.06	0.07	0.17	0.02	0.07
exporter fixed effects	No	No	Yes	No	Yes

Note: Standard errors are reported in the parentheses, and a, b, and c denotes significance at the 1%, 5%, and, 10% levels, respectively.

V.   Conclusion

In this paper we investigate the impacts of Vietnam's tariff reduction on the extensive and intensive margin. Considering the literature on the role of intensive and extensive margins in the growth of trade shows that their different definitions lead to the different conclusions (Besedes and Prusa, 2011), we use two measures of the extensive and intensive margin at the industry level as well as at the disaggregate HS 6-digit product level. At the industry level, the extensive and intensive margin defined as the number of HS 6-digit products from a country and their average imports, respectively. At the product level, we define the extensive margin as the number of newly imported products after Vietnam's WTO accession and the intensive margin as the changes in imports of HS 6-digit product imported in both 2006 and 2013.

At the industry level, we find that Vietnam's tariff reduction resulting from the WTO accession is negatively associated with imports. We also find the evidence that the increase in imports is driven by the intensive margin, but not by the extensive margin. At the product level, our empirical results show that both the extensive and intensive margin do matter to increase in Vietnam's imports after WTO accession, but the intensive margin plays the dominant role. Our results confirm the findings of Felbermayr and Kohler (2006), Eaton et al. (2008), and Helpman, Melitz, and Rubinstein (2008) who found the growth of trade is mainly driven by the intensive margin rather than the extensive margin.

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Appendix tables

Table 1. List of industry(ISIC rev 4.)

Industry Code	Industry Description
A01	Crop and animal production, hunting and related service activities
A02	Forestry and logging
A03	Fishing and aquaculture
B	Mining and quarrying
C10-C12	Manufacture of food products, beverages and tobacco products
C13-C15	Manufacture of textiles, wearing apparel and leather products
C16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
C17	Manufacture of paper and paper products
C18	Printing and reproduction of recorded media
C19	Manufacture of coke and refined petroleum products
C20	Manufacture of chemicals and chemical products
C21	Manufacture of basic pharmaceutical products and pharmaceutical preparations
C22	Manufacture of rubber and plastic products
C23	Manufacture of other non-metallic mineral products
C24	Manufacture of basic metals
C25	Manufacture of fabricated metal products, except machinery and equipment
C26	Manufacture of computer, electronic and optical products
C27	Manufacture of electrical equipment
C28	Manufacture of machinery and equipment n.e.c.
C29	Manufacture of motor vehicles, trailers and semi-trailers
C30	Manufacture of other transport equipment
C31_C32	Manufacture of furniture; other manufacturing