MAPPING THE EFFECTIVE RATE OF PROTECTION IN MANUFACTURING INDUSTRIES: EVIDENCE FROM VIETNAM

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Abstract: ***This paper presents the first study to map the industry-level effective rate of protection (ERP) to provinces in a developing country such as Vietnam. By exploiting firm-level data and national input-output tables, our main findings are as follows. First, at the industry level, the ERP exhibited a decreasing trend from 2011 to 2015. This trend aligns with movements in the nominal rate of protection (NRP) on outputs and the input tariff rate (ITR). Notably, some high-technology-intensive industries consistently recorded negative ERP values (indicating negative net protection, which is harmful to the domestic industry). This was particularly evident in the manufacture of chemical products and computers, electronic, and optical equipment throughout the 2011-2015 period. Conversely, the highest positive ERP values (signifying the most protected industries) were consistently observed in certain final goods manufacturing sectors: textiles, leather, and footwear; motor vehicles, trailers, and semi-trailers; and manufacturing n.e.c. (not elsewhere classified), including recycling. Second, at the provincial level, several provinces within the Northern Key Economic Zone exhibited higher ERP values in 2011; however, these values declined significantly by 2015. By 2015, some provinces in the Central region demonstrated the highest provincial ERP values. The mapping methodology developed in this study and its findings may provide valuable insights of the regional effective rate of protection for trade policymakers when negotiating bilateral and multilateral trade agreements.***

• Keywords: *Vietnam, mapping, trade policies, ERP.*

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1. Introduction and Literature Review

Liberalization in trade induces two pro-competitive forces driving the productivity of firms (Topalova and Khaldewald, 2011). The first force is the competition, which is caused by lowering tariffs that are imposed on imported final goods (output tariff) (Melitz, 2003 and Melitz et al.,2008). The second force is an increase in firms' access to better imported inputs due to a reduction in tariffs on imported intermediates (e.g., Goldberg, 2009). To evaluate the net effect of trade protection in an industry needs a measurement of the effective rate of protection (ERP) that is calculated from both output tariffs and input tariffs. Topalova and Khalderwald (2011) recommend using ERP to capture the net effects of tariff policies on firm-level total factor productivity.

This study adds to the existing literature fresh evidence of provincial net effects of tariff protection (ERP) of a developing country, such as Vietnam, for sixteen 2-digit manufacturing industries, and proposes an updated measurement to map ERP into 63 provinces in Vietnam. Vietnam is an interesting case study to analyze the ERP in light of trade liberalization, especially for the period between 2011 and 2015. Importantly, the period between 2011 and 2015 witnessed the substantial trade reforms of the country when several bilateral trade agreements (BTAs) and free trade agreements (FTAs) were signed and negotiated, for example: the ASEAN-India FTA and the ASEAN-New Zealand FTA in 2010, the Vietnam-EFTA in 2012 (in negotiation),[1] the Regional Economic Comprehensive Partnership - RECP in 2013 (in negotiation), the Vietnam-Chile BTA in 2014, the Vietnam-Korea BTA in 2015, and the Vietnam-Israel BTA in 2015 (in negotiation). Figure 1 plots the weighted average effectively applied tariffs for goods imported to Vietnam in the timeline of some key BTAs and FTAs.

For the case study of the Vietnam manufacturing during the period of important trade reforms (2001 to 2009), Ha (2015) finds that a reduction in output tariffs is harmful to firm-level total productivity, but a cut in input tariffs stimulates productivity. Vu et al. (2017) state that workers in processing exporting firms were paid less than in non-exporting firms in Vietnam. For the case study of Chinese manufacturing firms, Brandt et al (2017) show that a cut in output tariff reduces

[1] *the EFTA (European Free Trade Association) includes members: Switzerland, Norway, Iceland, and Liechtenstein.*

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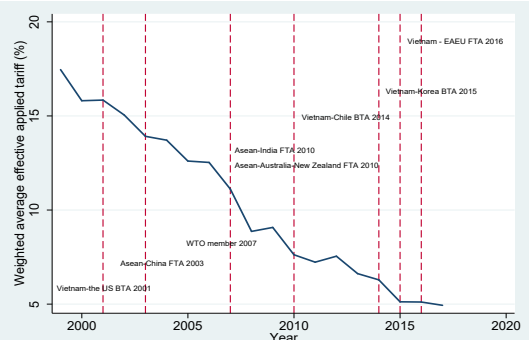
markup and raises TFP, but a reduction in input tariffs pushes both markup and TFP of firms. In a more complete investigation of tariff structures, Athukorala (2006) estimates ERP of industries in Vietnam during the period between 1997 and 2003. Our analysis is built closely from the existing literature, particularly the theoretical framework of trade liberalization and wages of Amiti and Davis (2011), and other empirical studies of Athukorala (2006), McCaig (2011), Topalova and Khaldewald (2011), and Fukase (2013).

This paper reviews the tariff policies of Vietnam between 2011 and 2015 by analyzing the tariff structure (ERP, ITR, and NRP) at the 2-digit industry level following the studies of Athukorala (2006), Topalova and Khalderwald (2011), and Corden (1969). We go one step further from the literature (Topalova and Khaldewald, 2011; Mc Caig, 2011; Fukase, 2013; and Brant et al, 2017) to map the industrial-level ERP for sixty-three provinces in Vietnam in the two years 2011 and 2015.

Figure 1: Weighted Average Effectively Applied Tariff on Imported Goods to Vietnam - Nominal rate of protection (1999-2017)



Source: Weighted average effectively applied tariffs are downloaded from http://wits.worldbank.org. The timeline of selected BTAs/FTAs signed and in effect is downloaded from www.wtocenter.vn. Note: Weighted average effectively applied tariffs include preferential tariffs when applicable in case of new FTAs or BTAs are in effect.

We use a novel data set compiled from firm-level data in manufacturing (2006, 2011, and 2015) provided by the General Statistics Office of Vietnam (GSO), inter-country input-output table in year 2011 (OECD, version 2016), and weighted average applied effective tariff data of Vietnam for the respective years (WITS).[2]

The paper is organized as follows. The next section discusses the methodology applied in our research. The fourth section describes the data used in this research. The fifth section presents empirical results, and the last section gives conclusions.

2. Methodology for the measurement of ERP

First, we follow Topalova and Khandewald (2011) and Amiti and Davis (2011) to calculate the input tariff rate ITR_{JT} of industry *j* in year t in equation 1.

$$ITR_{jt} = \sum_{s} (\delta_{js,2011} \times NRP_{jt}) \quad \text{(Equation 1)}$$

Where:

NRP_{jt} (Nominal rate of protection of industry j at time t) is the tariff imposed on imported goods in industry j at year t. $\delta_{js,2011}$ is the value share of imported inputs used in the value of output in industry j. Intuitively, ITR_{jt} is the weighted average of the Nominal rate of protection applied in industry j at year t, using a fixed share of input s imported into industry j in year 2011.

Adding to the existing literature,[3] we take a further step to calculate the NRP and ITR, which are mapped at the provincial level: They are constructed respectively using the share of labor in industry j in province p in the year 2006, which is:

$$\frac{L_{jp},2006}{L_{p},2006}$$

$$NRP_{pt} = \sum_{j} \frac{L_{jp},2006}{L_{p},2006} NRP_{jt} \quad \text{(Equation 2)}$$

$$ITR_{pt} = \sum_{j} \frac{L_{jp},2006}{L_{p},2006} ITR_{jt} \quad \text{(Equation 3)}$$

At industry-level, we measure ERP_{jt} for industry j at year t using NRPjt (tariff on import goods of industry j at year t) and ITRjt (input tariff of industry j at year t), δ_{js} is the coefficient calculated from the OECD-WTO inter-country input-output table (year 2011) to show the share of input s in the value of output j. δ_{js} is assumed to be unchanged between 2011 and 2015, and Cobb-Douglas technology is assumed (this assumption is in line with Amiti and Davis, 2011).

$$ERP_{jt} = \frac{NRP_{jt} - ITR_{jt}}{1 - \sum_{s} \delta_{js,2011}} \quad \text{(Equation 4)}$$

Then, we propose an index to measure the net effects of trade protection in industry *j* experienced by the province *p* as follows:

$$ERP_{pt} = \sum_{j} \frac{L_{jp},2006}{L_{p},2006} ERP_{jt} \quad \text{(Equation 5)}$$

In equation 2, 3 and 5, we choose the year 2006 as the pre-WTO time-invariant labor data because Vietnam joined the WTO in 2007. The analogous consideration for time-invariant labor data can be found similarly in McCaig (2011) and Topalova (2010). By applying this method, equations 2,3, and 5 only consider the variation of NPR and ITR and ERP, but not the variation of labor at the provincial level.

3. Data description

We use firm-level data in the Vietnamese enterprise survey (VES) in the years 2006, 2011, and 2015 for our analysis. In addition, the OECD-WTO input-output

table in the year 2011 is also merged with the firm data. The tariff data imposed on imported goods to Vietnam is a weighted, effectively applied tariff downloaded from data base of the World Bank (http://wits.worldbank.org). The tariffs are applied MFN, which includes a lower rate of preferential tariff when it is applicable in case of FTAs or BTAs. The 2-digit VSIC 2007 (the 2007 Vietnamese Standardized Industry Classification) in the firm-level data (VES data) is equivalent to ISIC Rev.4 (International Standardized Industry Classification). To link the VES data with the IO table of the year 2011 (2016 edition, OECD), the classification of industries in the VES data is converted from ISIC Rev.4 to ISIC Rev.3 using the concordance of the GSO. Some of the industries in the VES are also combined consistently in line with the 2-digit industry classification of the IO table.[4] When calculating NRP for the industries that are combined from other industries, we use trade weights to calculate the weighted average tariff. The weight of trade is also downloaded from the World Bank (http://wits.worldbank.org). See more details about the measurement of variables used in this study in Table 2.

Table 2. Measurement of Variables

Variable	Measurement	Data	Source
$NRP_{j,t}$(%)	Weighted effective applied tariffs on goods imported to industry j at year t	2-digit ISIC.Rev 3 converted to industry classification of the input-output table (OECD version 2016)	http://wits.worldbank.org
$ITR_{j,t}$(%)	Weighted average of Nominal rate of protection applied in industry *j* at year *t* using a fixed share of input *s* imported into industry *j* in year 2011 (%)	2-digit ISIC.Rev 3 converted to industry classification of the input-output table (OECD version 2016)	Authors 'calculation using NRPj,t downloaded from http://wits.worldbank.org
$ERP_{j,t}$(%)	Equation 4 Closely follows Topalova and Khandewal (2011)	Weighted Applied Tariff years 2010 and 2014	http://wits.worldbank.org
$ERP_{p,t}$	Equation 5	Weighted Applied Tariff years 2010 and 2014 Labor weight of the province by industry year 2006	
Input-output coefficient		Inter-country input-output table, year 2011	OECD (edition 2016)
Real output	Log values of output deflated by base year 2010.	VES 2011 and 2015, and WB GDP deflator	General Statistics Office of Vietnam And the World Bank.

4. Results and discussion

4.1. Industry-level ERP

Table 3 indicates the nominal rate of protection (NRP, weighted effectively applied tariffs imposed on final goods imports to Vietnam), input tariffs (ITR, tariffs on intermediate goods), and effective rate of protection (ERP) for manufacturing industries in Vietnam for the two years 2011 and 2015. Remarkably, being highly protected from imported competition is revealed in industries imposing high NRP, such as Motor vehicles and Textiles. Highly subsidized industries with high ITR are Textiles, Chemicals, Rubbers and Plastics products, and Fabricated metal products.

The decrease in ITR and ERP is because of the reduction in NRP since the country enjoys MFN tariffs (committed in the WTO) and lower preferential tariffs (committed in new FTAs/BTAs which came into force during the period). We find a high correlation between ITR and NRP (about 0.95) for both years 2011 and 2015.

Table 3. Nominal Rate of Protection (NRP), Input Tariffs (ITR), and Effective Rate of Protection (ERP) in 2011 and 2015 by Industry (%)

Industry	NRP2011	NRP2015	ITR2011	ITR2015	ERP2011	ERP2015
Chemicals and chemical products	1.650	1.310	3.835	2.522	-6.034	-3.346
Computer, electronic, and optical equipment	1.044	1.099	2.751	1.897	-5.528	-2.583
Wood and products of wood and cork	1.170	0.740	0.703	0.490	0.628	0.336
Basic metals	1.610	1.080	1.258	0.880	0.823	0.466
Electrical machinery and apparatus, nec	4.880	1.690	2.165	1.150	4.968	0.988
Machinery and equipment, nec	2.270	1.430	0.925	0.545	1.854	1.219
Other transport equipment	11.730	3.210	3.789	1.678	18.423	3.555
Food products, beverages, and tobacco	5.115	4.208	2.442	1.777	4.594	4.177
Pulp, paper, paper products, printing, and publishing	7.430	5.220	2.570	1.805	7.935	5.577
Coke, refined petroleum products, and nuclear fuel	9.030	5.650	2.223	1.426	10.244	6.356
Fabricated metal products	8.230	5.210	3.745	2.444	13.059	8.054
Rubber and plastic products	9.920	6.590	3.536	2.411	14.004	9.168
Other non-metallic mineral products	9.960	9.650	2.725	2.030	11.017	11.603
Manufacturing NEC; recycling	15.800	10.240	1.641	1.066	21.147	13.703
Motor vehicles, trailers, and semi-trailers	18.640	11.140	2.662	1.676	24.463	14.489
Textiles, textile products, leather, and footwear	10.374	8.969	5.707	4.538	15.667	14.877

Source: Nominal rate of protection is downloaded from http://wits.worldbank.org. Inter-country Input-output (ICIO) table in the year 2011 is provided by OECD (2016 edition).

Note: NRP of merged industries is calculated using weights of trade values. ITR and ERP are measured based on the method in Toppalova and Khandewald (2011). Industry classification follows the classification of ICIO.

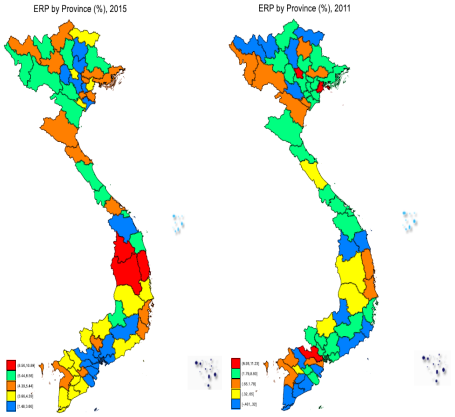
The results of ERP in Table 3 demonstrate the proportionate change in per unit value added of domestic industries induced by the structure of the tariff protection during 2011-2015 in Vietnam. The sharp drop of ERP in 2015 compared to 2011 was recorded for the manufacture of electrical machinery and apparatus, n.e.c., motor vehicles, trailers and semi-trailers, and other transport and manufacture of equipment. The negative values of ERP are presented in the manufacture of chemical products and computer, electronic, and optical equipment, which are industries of intermediate products. In opposite, the highest positive net effects of protection in positive values are shown in the manufacture of final goods, such as textiles, leather and footwear, motor vehicles, trailers and semi-trailers, and manufacturing n.e.c., recycling. These results of ERP at the industry level of manufacturing in Vietnam from 2011 to 2015 are in line with the tariff structures of the country in 2003

[4] *Source : ICIO Table version 2016 in website of OECD http://oe.cd/icio*

analyzed by Athukorala (2002). However, highly protected industries in trade in 2011 and 2015, such as the manufacture of textiles and the manufacture of fabricated metal, account for substantial shares in total output and total labor of the manufacturing sector in Vietnam. For example, the output share of the textiles industry was 8.80% and 10.72% respectively in 2011 and 2015. The textile industry created 27.22% and 30.89% of total jobs, respectively, in 2011 and 2015. This finding is not similar to the results found by Athukorala (2002) that highly protected industries do not substantially contribute to the total output and labor force of the manufacturing.

4.2. Mapping ERP to Provinces

Figure 3. Effective Rate of Protection (ERP) in 2011 and 2015 by Province (%)



Source: Nominal rate of protection is downloaded from WITS for lagged years in 2010 and 2014. Inter-country Input-output (ICIO) table in the year 2011 is provided by OECD (2016 edition). The weight is the labor data from the enterprise survey of Vietnam in 2006 (before the country's WTO accession).

Note: NRP of merged industries is calculated using the weight of trade values. ITR and ERP are measured based on the method in Toppalova and Khandewald (2011). Industry classification follows the classification of ICIO. Due to the limitations of the administrative data, these maps only show the ERP by provinces of Vietnam, but do not show the ERP in all islands of the country, such as Hoang Sa and Truong Sa islands.

In this section, we measure the provincial NRP, ITR, and ERP to investigate and visualize the net effective rate of protection for 63 provinces in Vietnam in 2011 and 2015. In this calculation, the tariffs are lagged one year. This means the indices for the studied period in 2011 and 2015 are calculated, respectively, for the years 2010 and 2014. The lagged years reflect the fact that the economy needs time to react to the effects of tariffs on input and output markets. The labor share of industries in one province, which reflects the industry structure of the province, is fixed for the year 2006 in calculating weighted NRP, ITR, and ERP (one year before Vietnam officially became a WTO member in 2007). Hence, comparing the provincial ERP in two years accounts for the variation of ERP during the research period. Figure 3 presents patterns of the ERP in 2011 and 2015 of 63 provinces of Vietnam. Generally, negative values of ERP are recorded in some provinces in 2011, but the ERP is only in positive values in 2015. Figure 3 indicates that in 2011, higher values of ERP, which imply a higher proportional rise in per-unit provincial value-added due to exposure of the province to the net effective rate of protection, were shown in municipalities and large provinces which are belong to the Northern key economic zone of the country (except for Namdinh). However, the ERP of these provinces dropped in 2015. The high values of the provincial ERP in 2015 were shown in other provinces in the Central region.

5. Conclusion

This study gives a complete review of ERP at the industry and provincial levels in Vietnam from 2011 to 2015. Our results at the industry level indicate that, together with the decreasing trend of NRP and ITR, ERP has reduced; however, ERP remains at high values in some industries of final goods such as textiles, rubber and plastics products, motor vehicles, trailers, and semi-trailers. Negative values of ERP are found in the high-technology intensive industries, such as the manufacture of chemicals and computers, electronics, and optical products. At the provincial level, we find that ERP was higher in the northern municipalities in 2011 but dropped and remained at high values in some provinces in the central regions in 2015. The mapping methodology and findings presented in this study could offer trade policymakers valuable insights into regional effective rates of protection (ERPs) during negotiations for bilateral and multilateral trade agreements.

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