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Non-Tariff Measures and Their Impacts on ASEAN Economic Integration

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Abstract

Using a gravity model that accounts for the asymmetric effects of non-tariff measures (NTMs), the study examined the impact of the five most prevalent NTMs in the region on intra-ASEAN imports. The study found that all five NTMs are significant factors affecting intra-ASEAN imports. However, their effects vary at the sectoral level, by pairs of trading partners, and whether the products are covered by mutual recognition and harmonization agreements (MRA) or not. For example, sanitary and phytosanitary (SPS) measures, in general, negatively affect imports and are trade-reducing. Exceptions are prepared foodstuff and medicinal products, both of which are covered by MRAs and harmonization agreements among the ASEAN. The positive effects of SPS measures on these two sectors provide evidence that NTMs that assure consumer safety and protection, while they could increase costs and price, increase consumer trust, and hence, promotes trade. Technical barriers to trade (TBT) measures are also deterrents to imports, in general. However, they are found to promote imports and are trade-enhancing for products covered by MRAs and harmonization agreements such as electrical machinery and equipment, prepared foodstuff, telecommunications equipment, and medical devices. The study also found that regulatory distance between ASEAN Member States (AMS) contributes positively to the effects of SPS and TBT. This means that in instances when an SPS or TBT measure is a deterrent to imports, regulatory distance lessens the negative effects.

Key words: regional economic integration, gravity model, trade in goods, non-tariff measures, regulatory distance, PPML method

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Introduction

Tariff rates have gone down globally since the 1990s due to the liberalization of trade policies at all levels (unilateral, bilateral, regional, and multilateral). However, the tariff decline was accompanied by an increase in non-tariff measures (NTMs) over the years. NTMs have become a prominent feature in the regulation of international trade in goods. The nature of NTMs has also changed over time (Cadot & Gourdon, 2015). Prior to the 1990s, they were dominated by non-technical measures such as quota and price restrictions; however, technical measures, especially sanitary and phytosanitary (SPS) and technical barriers to trade (TBT), became prominent over time. Because of these shifts, NTMs have become the subject of discussions and debates, especially in deep regional integration efforts.

Broadly defined, NTMs refer to any measure other than tariffs that distort trade (United Nations Conference on Trade and Development [UNCTAD], 2015). Unlike tariffs, they take a variety of forms and have both trade and non-trade objectives. Technical measures, for example, are directed at strategic policy concerns such as consumer safety and the protection of plant and animal life and the environment. Some are designed to address market imperfections such as informational asymmetries and externalities (Berden & Francois, 2015). Because of the non-trade objectives, these measures are expected to continue to exist, and eliminating them may no longer be an option (Cadot et al., 2015). Nonetheless, although the pursuit of domestic policy objectives is legitimate, NTMs have the potential to become trade barriers.

There are emerging truths about NTMs, though. They increase production and trade costs and hence, products' prices. The effects on demand for import, however, is ambiguous. Demand could decrease because of the price increase, but it could also be stimulated if the demand-enhancing effects outweigh the price-raising effects that may arise from compliance costs. The demand-enhancing effects could spring from NTMs that address market imperfections and, thus, provide signaling effects that could increase consumer trust (Xiong & Beghin 2014; Bratt, 2017; Cadot et al., 2018). Hence, NTMs cannot be regarded solely as trade costs (Fugazza, 2013).

In the ASEAN, the member states have committed to removing non-tariff barriers (NTBs) and mutually recognize and harmonize each other's NTMs. As a single production base, the free flow of goods in the region under the ASEAN Economic Community (AEC) is of utmost importance. This cannot be more emphasized than the greater role played by the ASEAN member

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states (AMS) in the global production networks of multinational companies operating in the region. Yet, the incidence of NTMs has steadily increased in the region. According to Hirang (2017), the rising incidence of NTMs happened together with the increased participation of AMS in the production networks. At the same time, it was accompanied by an increase of NTMs in industries and sectors that are suffering a decline. The latter may indicate some protectionist motives. Thus, an interesting question has emerged—what has been the impact of NTMs on ASEAN trade?

The primary objective of this paper is to evaluate the impact of NTMs on the imports of AMS from each other. Specifically, it aims to: (a) determine if the effects of NTMs are trade-reducing or trade-enhancing; (b) differentiate the effects of each NTM type on imports; (c) examine if there are variations on the effects of NTMs across products and sectors, and between trading partners; (d) compare the effects of NTMs on products covered by existing MRAs and harmonization agreements with products not subject to such agreements; (e) determine the effect of NTMs attributable to the regulatory distance between trading partners; and (f) recommend policies to ensure that NTMs enhance the region's economic integration.

The paper is organized as follows. Section 0 briefly discusses the region's intra-ASEAN import performance, the existing and forthcoming MRAs and harmonization agreements, and NTMs in the region. Section 0 reviews the literature on the methods employed to quantify the effects of NTMs on international trade. Section 0 discusses the theoretical framework to assess the effects of NTMs on ASEAN's trade flows. Section 0 explains the model specification and data and data sources. Section 0 discusses the results and findings. Finally, Section 0 presents the conclusions and policy recommendations.

Non-Tariff Measures and Intra-ASEAN Imports

Intra-ASEAN Imports

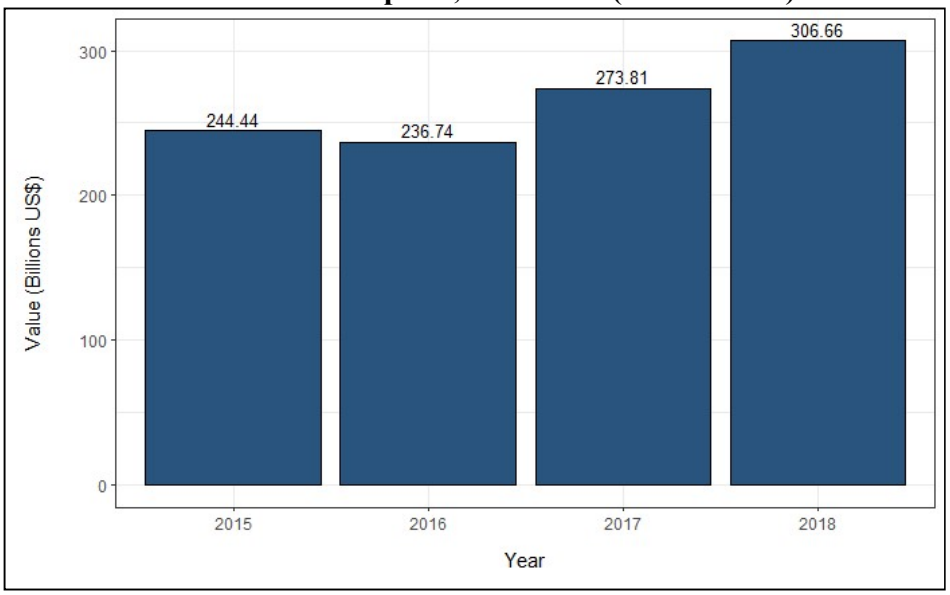
Total intra-ASEAN imports increased from US$244.4 billion in 2015 to US$306.7 billion in 2018 (Figure 1), or an average real growth rate of 5.6% per year during the period. Singapore accounted for the bulk of intra-ASEAN imports with an average annual share of 26.1%, whereas Brunei accounted for the least share, at less than 1% (Figure 2).

Total intra-ASEAN imports represent less than one-fourth of the region's total imports, and the share has been gradually declining from 22.2% in 2015 to 21.5% in 2018 (Table 1). Nonetheless, the region is an important source of imports for Brunei and the less developed AMS (Cambodia, Laos, and Myanmar). The region accounts for an average of 42%, 37%, 68%, and 41% of these countries' total imports, respectively (Table 1). Cambodia also registered the highest growth rate of intra-ASEAN imports at 21.6% for the period 2015–2018, followed by the Philippines at 16.4%.

Intra-ASEAN imports are highly concentrated on a few products, as shown in Table 2. The top 15 accounted for 80% of intra-ASEAN imports (Table 2 and Figure 3). Mineral fuels and oil (HS 27) and electrical machinery and equipment (HS 85) represent the bulk, with each product group accounting for an average of 22% of the total. On the other hand, the fastest growing intra-

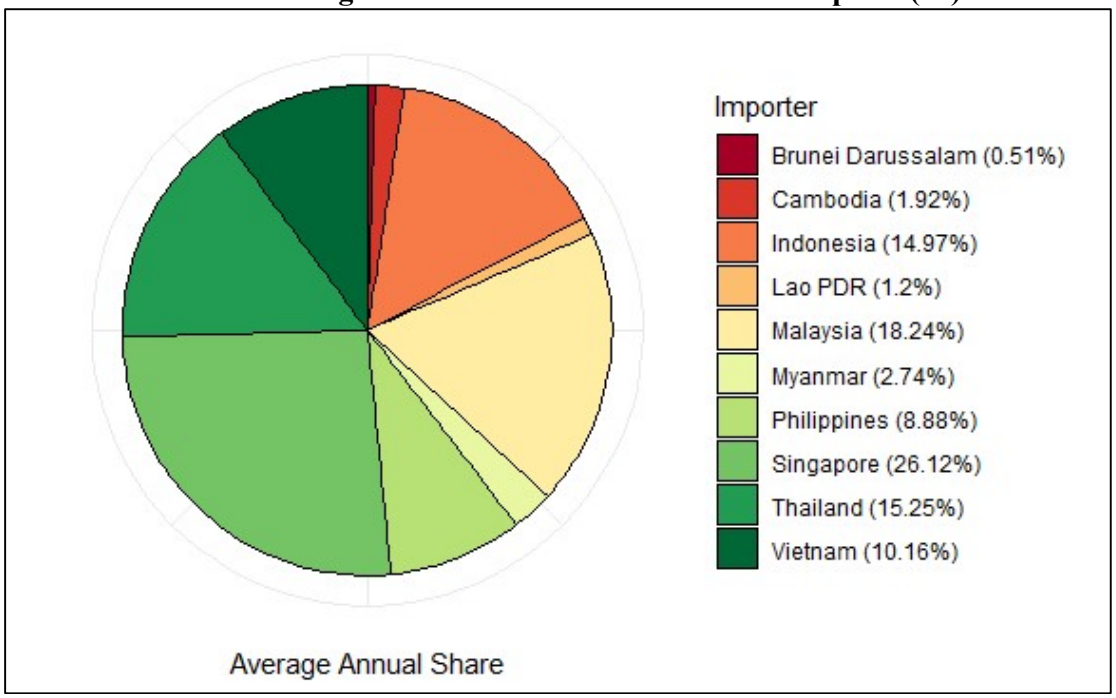
ASEAN imports include mineral fuels and oils (HS 27), vehicles (HS 87), iron and steel (HS 72), and copper (HS 74); these products registered an average annual growth rate of at least 10%.

Figure 1
Intra-ASEAN Imports, 2015-2018 (US$ Billions)



Source: UN Comtrade Database, https://comtrade.un.org; Author's calculations

Figure 2
Average Annual Share in Intra-ASEAN Imports (%)



Source: UN Comtrade Database, https://comtrade.un.org; Author's Calculations

Table 1
Average Annual Growth and Share of Intra-ASEAN to Country's Total Imports, 2015-2018 (%)

Country	Ave. Annual Growth (%)	Share of Intra-ASEAN imports to country's total imports			
		2015	2016	2017	2018
Brunei Darussalam	-2.25	43.01	48.35	43.17	32.35
Indonesia	2.87	27.19	25.58	25.03	24.36
Cambodia	21.66	33.25	37.23	38.46	40.14
Lao PDR	9.18	73.55	74.32	59.35	65.33
Myanmar	2.54	41.54	37.65	39.58	44.80
Malaysia	4.50	26.57	24.58	25.66	25.51
Philippines	16.40	24.29	26.18	26.11	24.92
Singapore	4.90	21.05	21.47	21.65	21.16
Thailand	4.05	18.97	18.81	18.57	18.26
Vietnam	7.29	14.33	13.77	13.30	13.43
ASEAN	**5.55**	**22.22**	**21.80**	**21.77**	**21.53**

Source: UN Comtrade Database, https://comtrade.un.org; Author's Calculations

Table 2
Intra-ASEAN Imports by Product, 2015-2018, Top 15 Products

HS Code	Description	Value of Intra-ASEAN Imports (US$ Billions)				Share in Intra-ASEAN Imports (%)				Ave. Annual Growth (%)
		2015	2016	2017	2018	2015	2016	2017	2018	
27	Mineral fuels, mineral oils and products of their distillation; bituminous substances; mineral waxes	56.14	46.34	63.07	75.77	22.97	19.57	23.03	24.71	10.00
85	Electrical machinery and equipment and parts thereof; sound recorders and reproducers; television image and sound recorders and reproducers, parts and accessories of such articles	52.95	53.20	61.52	67.02	21.66	22.47	22.47	21.86	6.07
84	Nuclear reactors, boilers, machinery and mechanical appliances; parts thereof	26.85	26.55	27.42	29.25	10.98	11.21	10.02	9.54	0.56
87	Vehicles; other than railway or tramway rolling stock, and parts and accessories thereof	11.24	13.52	14.44	16.18	4.60	5.71	5.27	5.27	10.17
39	Plastics and articles thereof	10.19	10.17	11.19	12.65	4.17	4.30	4.09	4.13	4.76

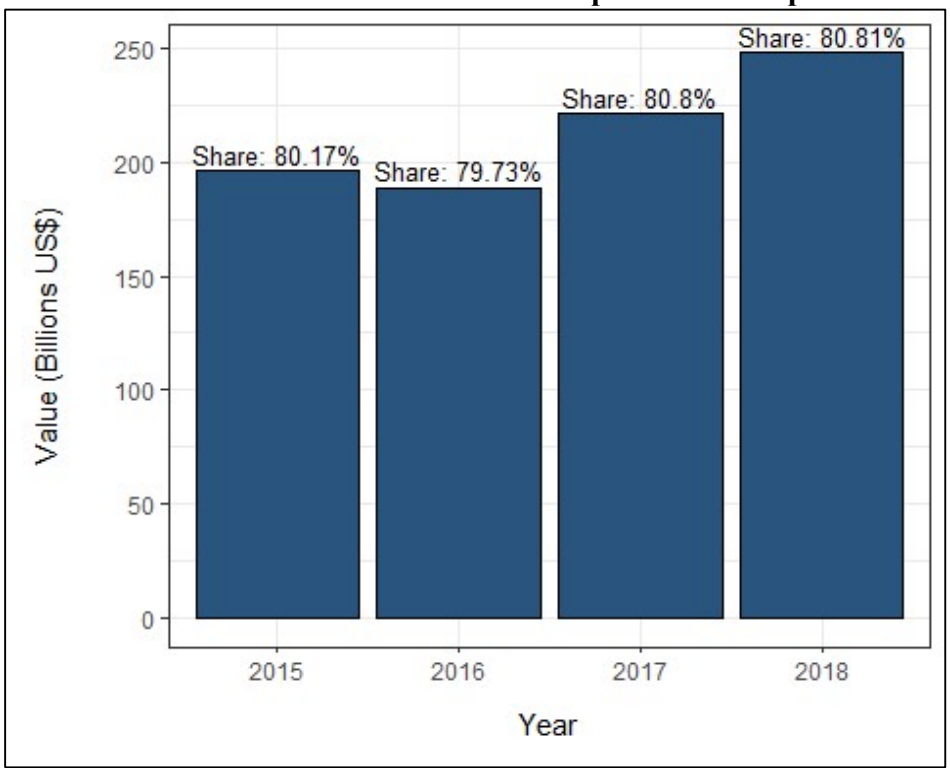
Table 2
Intra-ASEAN Imports by Product, 2015-2018, Top 15 Products (continued)

HS Code	Description	Value of Intra-ASEAN Imports (US$ Billions)				Share in Intra-ASEAN Imports (%)				Ave. Annual Growth (%)
		2015	2016	2017	2018	2015	2016	2017	2018	
71	Natural, cultured pearls; precious, semi-precious stones; precious metals, metals clad with precious metal, and articles thereof; imitation jewelry; coin	6.36	7.51	5.97	6.97	2.60	3.17	2.18	2.27	2.73
29	Organic chemicals	5.40	4.72	6.21	6.43	2.21	1.99	2.27	2.10	4.58
90	Optical, photographic, cinematographic, measuring, checking, medical or surgical instruments and apparatus; parts and accessories	4.43	4.69	5.27	5.55	1.81	1.98	1.93	1.81	5.52
15	Animal or vegetable fats and oils and their cleavage products; prepared animal fats; animal or vegetable waxes	3.78	3.64	4.34	4.10	1.55	1.54	1.58	1.34	0.43
40	Rubber and articles thereof	3.53	3.31	4.18	4.02	1.44	1.40	1.53	1.31	2.76
73	Iron or steel articles	3.69	3.44	3.39	3.63	1.51	1.45	1.24	1.18	-2.82
48	Paper and paperboard; articles of paper pulp, of paper or paperboard	3.35	3.29	3.63	3.92	1.37	1.39	1.32	1.28	2.81
38	Chemical products n.e.c.	2.92	3.14	3.65	4.10	1.19	1.33	1.33	1.34	9.35
72	Iron and steel	2.62	2.46	3.23	4.54	1.07	1.04	1.18	1.48	18.74
74	Copper and articles thereof	2.53	2.76	3.72	3.67	1.04	1.17	1.36	1.20	11.42
Intra-ASEAN Imports (Top 15 Products)		195.97	188.76	221.24	247.81	80.17	79.73	80.80	80.81	5.91
OTHERS		48.47	47.98	52.57	58.85	19.83	20.27	19.20	19.19	4.12
Total Intra-ASEAN Imports		**244.44**	**236.74**	**273.81**	**306.66**	**100.00**	**100.00**	**100.00**	**100.00**	**5.55**

Notes: Product ranking is based on an average annual share in intra-ASEAN imports.
Source: UN Comtrade Database, https:comtrade.un.og; Author's Calculations

Figure 3

Value and Share in Intra-ASEAN Imports of the Top 15 Products, 2015-2018



Source: UN Comtrade Database, https://comtrade.un,org; Author's Calculations

Intra-ASEAN Imports and ASEAN MRAs and Harmonization Agreements

To help facilitate the seamless movement of goods within the region and to minimize trade protection and compliance costs associated with non-tariff measures (NTMs), the ASEAN has been implementing mutual recognition agreements (MRAs) and harmonization agreements as early as 2002 (Table 3). Agreements that are currently implemented cover cosmetics, electrical machinery and electronic equipment, prepared foodstuff, medical equipment, medicinal products, and telecommunications. On the other hand, ongoing work and negotiation on MRAs covering automotive products and building and construction materials are nearing completion.

Table 3
List of MRAs and Harmonization Agreements, ASEAN

Title	Code	Date Signed	HS Codes Covered
Existing MRAs/Harmonization Agreements			
ASEAN Sectoral MRA on Electrical and Electronic Equipment	Electrical Machinery	April 5, 2002	HS 85 (except 8517, 8544)
ASEAN MRA on Inspection and Certification System on Food Hygiene for Prepared Foodstuff	Prepared Foodstuff	April 27, 2018	HS 16-22
ASEAN Sectoral MRA for GMP Inspection of Manufacturers for Medicinal Products	Medicinal Products	April 10, 2009	HS 30
ASEAN Sectoral MRA on Conformity Assessment of Telecommunications Equipment	Telecommunications	-	HS 8517, 8544
Agreement on the ASEAN Harmonised Cosmetic Regulatory Scheme with ASEAN Cosmetic Directive	Cosmetics	September 2, 2003	HS 33-34
ASEAN Medical Device Directive	Medical Devices	November 21, 2014	HS 9018, 9019, 9022
Forthcoming MRAs/Harmonization Agreements			
ASEAN MRA on Type Approval for Automotive Product	Automotive	(for finalization)	HS 87
ASEAN MRA on Building and Construction Materials	Construction	(for finalization)	HS 32, 38, 39, 44, 68, 69, 70, 72, 73, 76

Note: This list includes the MRAs and Harmonization Agreements covered by the study; the HS codes covered were determined by the researchers based on the provisions and scope of each Agreement

Products covered by existing MRAs and harmonization agreements account for about 28% of total intra-ASEAN imports, whereas forthcoming agreements account for 16% (Table 4). However, it is worth noting that a large portion of the region's total imports is intra-ASEAN (Table 4). For example, the share of prepared foodstuff in intra-ASEAN imports is only 3%–4%, but the share of intra-ASEAN to the total imports of the products has increased from 39% in 2015 to 43.4% in 2018. Similarly, although the share of cosmetics products in total intra-ASEAN imports is less than 2%, the region supplies around 28.5% of the region's total imports of the products. A similar pattern can be observed for automotive products. These products represent only 5% of total intra-ASEAN imports, but the share of the total imports of the region went up from 28.45% in 2015 to 34.25% in 2018. Intra-ASEAN imports of electrical machinery account for 22% of the region's total imports of the products.

Table 4
Intra-ASEAN Imports Covered by MRAs or Harmonization Agreements, 2015-2018

MRA	Value of Intra-ASEAN Imports (US$ Billions)				Share in Intra-ASEAN Imports (%)				Ave. Annual Growth (%)
	2015	2016	2017	2018	2015	2016	2017	2018	2015-2018
Existing MRAs and Harmonization Agreements									
Electrical Machinery	45.66	46.49	53.56	58.61	18.68	19.64	19.56	19.11	6.56
Prepared Foodstuff	8.24	9.57	10.02	11.63	3.37	4.04	3.66	3.79	9.27
Medicinal Products	1.00	1.01	1.07	1.05	0.41	0.43	0.39	0.34	-0.99
Telecommunications	7.30	6.71	7.96	8.41	2.98	2.84	2.91	2.74	2.95
Cosmetics	3.16	3.39	3.58	4.10	1.29	1.43	1.31	1.34	6.27
Medical Devices	0.73	0.86	0.83	0.93	0.30	0.36	0.30	0.30	6.39
Forthcoming MRAs and Harmonization Agreements									
Automotive	11.24	13.52	14.44	16.18	4.60	5.71	5.27	5.27	10.17
Construction	26.55	25.79	28.37	32.75	10.86	10.89	10.36	10.68	4.79
Intra-ASEAN Imports Covered by MRAs/Harmonization Agreements	103.88	107.34	119.82	133.67	42.50	45.34	43.76	43.59	6.29
Non-MRA Imports	140.56	129.40	153.99	172.99	57.50	54.66	56.24	56.41	5.12
ASEAN	**244.44**	**236.74**	**273.81**	**306.66**	**100.00**	**100.00**	**100.00**	**100.00**	**5.55**

Source: UN Comtrade Database, https://comtrade.un.org; Author's Calculations

The relative importance of products covered by MRAs and harmonization agreements (both existing and forthcoming) can also be seen from the imports of individual AMS (Table 5). For most of the AMS, the bulk of their imports of these products are sourced from the region. Take the case of prepared foodstuff; the share of intra-ASEAN to the AMS total imports of the products range from a low of 26.7% for Singapore to a high of 94.5% for Laos. For cosmetics, at least 50% of the total imports of Brunei, Cambodia, Laos, Myanmar, and the Philippines are sourced from the region. At least 20% of imports of electrical and electronics products, telecommunications products, and automotive products are also from the region for the majority of the AMS. This could be due to the important role the ASEAN plays as host to the global production networks of these industries.

Table 5
Average Annual Share of Intra-ASEAN Imports to Total Imports by Country, Products Covered by MRAs/Harmonization Agreements, 2015-2018 (%)

Country	COS-ME-TICS	ELEC-TRICAL MACHI-NERY	PRE-PARED FOOD-STUFF	MEDI-CAL DEVI-CES	MEDI-CINAL PRO-DUCTS	TELE-COMM-UNICA-TIONS	AUTO-MOTIVE	CONS-TRUC-TION
Brunei Darussalam	80.84	26.83	82.00	37.61	85.65	31.07	24.17	28.10
Indonesia	30.53	24.56	44.52	14.92	8.25	24.32	32.78	24.42
Cambodia	79.77	38.19	82.50	26.86	27.88	44.98	37.76	34.61
Lao PDR	80.89	66.19	94.52	35.81	63.87	46.14	59.38	58.54
Myanmar	77.14	21.97	60.30	18.32	31.58	19.64	21.80	24.77
Malaysia	36.03	23.74	32.20	19.00	9.46	21.59	33.26	19.90
Philippines	55.83	18.53	51.57	21.60	15.35	21.62	56.22	19.69
Singapore	8.22	26.36	26.68	13.72	4.08	18.27	18.95	20.80
Thailand	27.23	22.21	36.42	8.25	4.54	21.58	19.07	11.96
Vietnam	44.92	10.26	46.58	3.87	5.58	3.12	31.20	11.42
ASEAN	**28.52**	**21.84**	**40.33**	**13.37**	**8.67**	**15.61**	**31.86**	**17.42**

Source: UN Comtrade Database, https://comtrade.un.org; Author's Calculations

Intra-ASEAN Imports and Non-Tariff Measures

The average tariff rate in the region has gone down for most products and in most AMS, reaching 0% for most products in 2018 (Table 6). The exceptions are Cambodia and Thailand, where the average tariff rate is higher than 10% for certain products, like prepared foodstuff, cosmetics, and automotive products. The decline in tariff rate, however, is accompanied by the rising number of NTMs. According to Ing et al. (2016), the major non-tariff measures prevailing in the ASEAN include the following: sanitary and phytosanitary measures (A); technical barriers to trade (B); pre-shipment inspection and other formalities (C); non-automatic licensing, quotas, prohibitions, and quantity control measures other than SPS or TB measures (E); and price control measures including additional taxes and charges (F).

Table 6
Average Tariff Rate per Country by Sector, 2018 (%)

SECTOR	BRN	IDN	KHM	LAO	MMR	MYS	PHL	SGP	THA	VNM
Existing MRAs and Harmonization Agreements										
Electrical Machinery	0.03	0.00	14.66	0.00	0.08	2.93	0.00	0.00	5.51	0.00
Prepared Foodstuff	0.00	9.84	26.30	0.82	1.93	3.08	0.10	0.00	16.38	0.40
Medicinal Products	0.00	0.33	0.00	0.02	0.00	0.00	0.00	0.00	5.68	0.31
Telecommunications	0.00	0.00	4.20	0.00	0.00	4.43	0.00	0.00	2.35	0.00
Cosmetics	0.57	1.82	17.86	0.34	0.12	2.24	0.00	0.00	11.37	0.00
Medical Devices	0.00	0.00	1.83	0.00	0.07	0.00	0.00	0.00	0.65	0.00
Forthcoming MRAs and Harmonization Agreements										
Automotive	0.00	0.00	14.32	0.23	0.14	16.35	0.00	0.00	31.06	0.00
Construction	0.37	0.05	6.92	0.20	0.42	8.90	0.00	0.00	5.28	0.21
No MRA or Harmonization Agreement										
Mineral fuels, oils, and waxes; bituminous substances (HS 27)	0.00	0.00	7.02	0.41	0.39	0.65	0.00	0.00	1.28	1.32
Rubber (HS 40)	0.00	0.00	10.40	0.00	0.10	16.93	0.00	0.00	6.38	1.26
Paper and paperboard (HS 48)	0.00	0.00	6.37	0.65	0.54	11.58	0.00	0.00	4.63	0.05
Copper (HS 74)	0.00	0.00	5.76	0.18	0.59	1.96	0.00	0.00	1.55	0.00
Nuclear reactors, boilers, machinery and mechanical appliances (HS 84)	0.00	0.00	12.59	0.05	0.28	2.87	0.00	0.00	2.24	0.00
Pearls; Precious, Semi-precious stones; Precious metals; Jewelry; Coin (HS 71)	0.00	0.00	1.74	0.00	0.03	0.39	0.00	0.00	0.00	0.00
Organic chemicals (HS 29)	0.00	0.01	5.83	0.03	0.05	0.12	0.00	0.00	0.16	0.00
Optical, photographic, cinematographic instruments and apparatus (HS 90)	0.00	0.00	14.87	0.00	0.02	0.49	0.00	0.00	1.81	0.00
Animal or vegetable fats, oils, and waxes (HS 15)	0.00	0.00	6.57	0.04	0.27	2.63	0.00	0.00	0.82	0.00
OTHERS	0.30	0.08	10.11	0.88	0.37	3.87	0.17	0.00	9.10	0.31

Note: The sectors include those covered by MRA and harmonization agreements, top 15 intra-ASEAN imports which are not covered by the agreements; and Others, which include all other products not among the top 15 and not covered by the agreements.
Source: World Trade Organization Tariff Download Facility, http://tariffdata.wto.org/Default.aspx

Figure 4 to Figure 8 show the frequency index by type of NTM for each of the AMS during the period 2015–2018. The index measures the percentage of tariff lines affected by at least one NTM measure. TBT measures are the most frequent forms of NTMs in the region, whereas pre-shipment inspection measures are the least. At least 60% of tariff lines are affected by TBT in Cambodia, Vietnam, and the Philippines, but the frequency index for the rest of the AMS is less than 40% (Figure 5). Furthermore, the index has increased from 2015 to 2018 for Indonesia, Cambodia, Laos, Myanmar, and the Philippines. On the other hand, pre-shipment inspection is hardly used in Singapore, Brunei, and Cambodia (Figure 6).

Figure 4

Frequency Index (SPS), ASEAN, 2015–2018

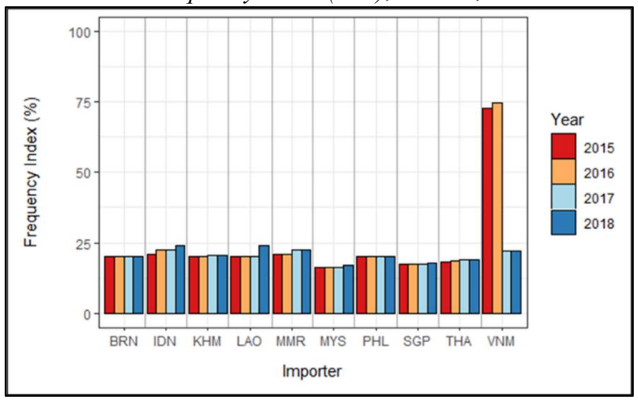


Figure 5

Frequency Index (TBT), ASEAN, 2015–2018

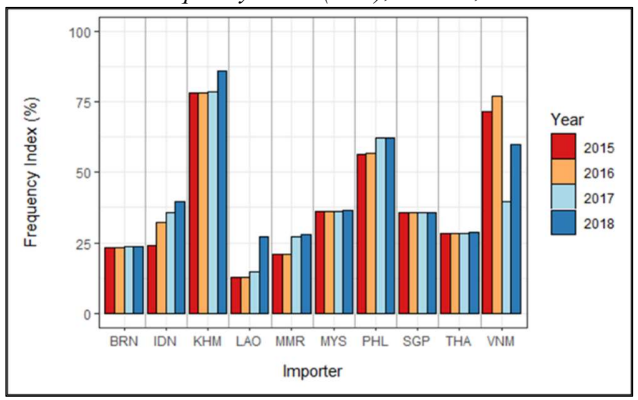


Figure 6

Frequency Index (Pre-Shipment Inspections), ASEAN, 2015–2018

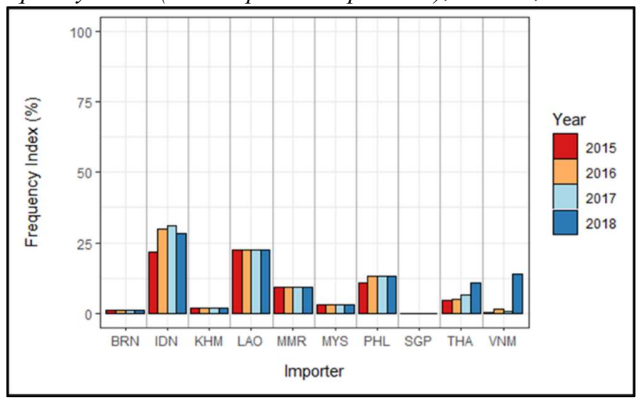


Figure 7

Frequency Index (Quantity Control), ASEAN, 2015–2018

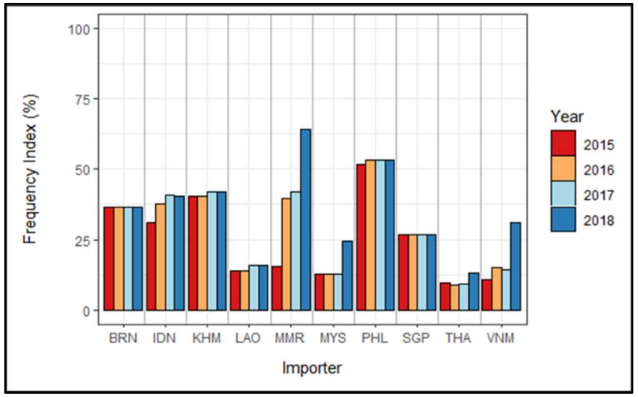
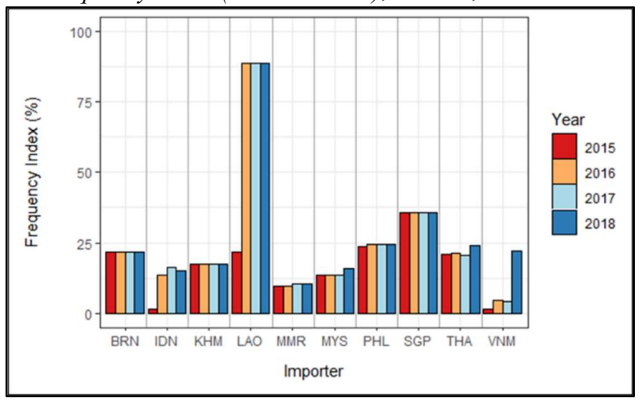


Figure 8

Frequency Index (Price Control), ASEAN, 2015–2018



Source: UNCTAD TRAINS NTMs: The Global Database on Non-tariff Measures, http://asean.i-tip.org/Forms/Analysis.aspx; Author's Calculations
Note: Frequency Index of each NTM type provides the share of tariff lines affected by at least one measure of that NTM type

SPS measures affect about 20% of the tariff lines of AMS, except Malaysia and Singapore with only 17% (Figure 4). The index has not changed from 2015 to 2018, except Vietnam, where there was a substantial decline in 2017. Quantity control measures also affect a greater portion of the tariff lines (Figure 7). The index is more than 35% for Brunei, Indonesia, Cambodia, Myanmar, and the Philippines; 30% for Vietnam, 26% for Singapore, and less than 20% for Laos and Thailand. For price control measures, Laos has the highest percentage of tariff lines affected by the NTM (88%), followed by Singapore (36%) (Figure 8).

Figure 9a to Figure 13b show the NTM frequency index by sectors. TBT, quantity control, and price control measures are the most common forms of NTM in the ASEAN region. The percentage of tariff lines affected by TBT measures range from 83% to 100% across sectors, except telecommunications with 60% (Figure 10a & Figure 10b). On the other hand, the indices range from 60% to 80% for both quantity control measures (Figure 12a & Figure 12b) and price control measures (Figure 13a & Figure 13b). The figures also show that the indices have increased from 2015 to 2017.

As shown in Figure 9a and Figure 9b, the index is also high for SPS but only for prepared foodstuff, medicinal products, cosmetics, medical devices, and animal or vegetable fats (HS15). However, both figures also show that all sectors, except automotive, were initially affected by SPS measures but these were either removed or substantially reduced in some sectors in 2017 and 2018, for example, electrical machinery, telecommunications, paper & cupboards (HS48), copper (HS74), nuclear reactors, boilers, machinery and mechanical appliance (HS84), organic chemicals (HS29), and optical, photographic, cinematographic instruments and apparatus (HS90).

All sectors are affected by pre-shipment inspections, with the following sectors as the most affected: prepared foodstuff, medicinal products, medical devices, automotive, construction, mineral fuels, oils, and waxes (HS27), pearls, precious, semi-precious stones, precious metals, a nd jewelry (HS71), organic chemicals (HS29), and animal or vegetable fats, oils, and waxes (HS15) (Figure 11a & Figure 11b). At least 50% of the tariff lines of these sectors are affected by the NTM.

Figure 9a

Frequency Index (SPS), Sectors with Existing/Forthcoming MRAs, 2015–2018

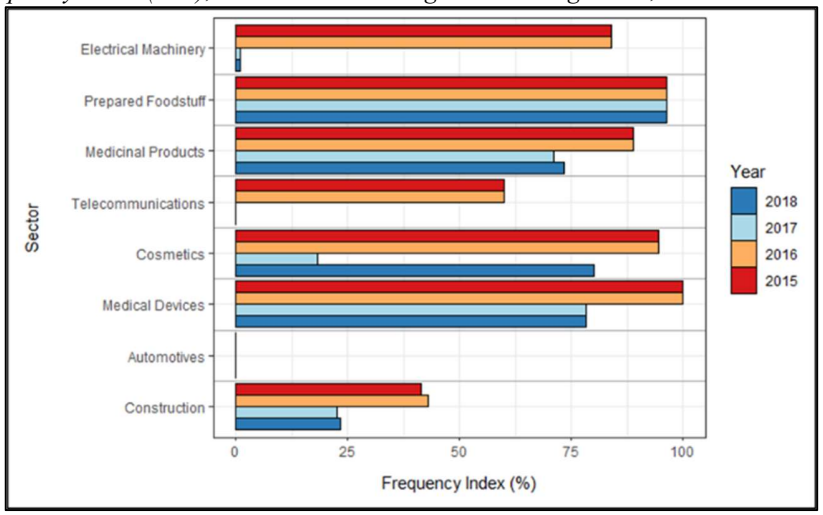


Figure 9b

Frequency Index (SPS), Products not Covered by an MRA, 2015–2018

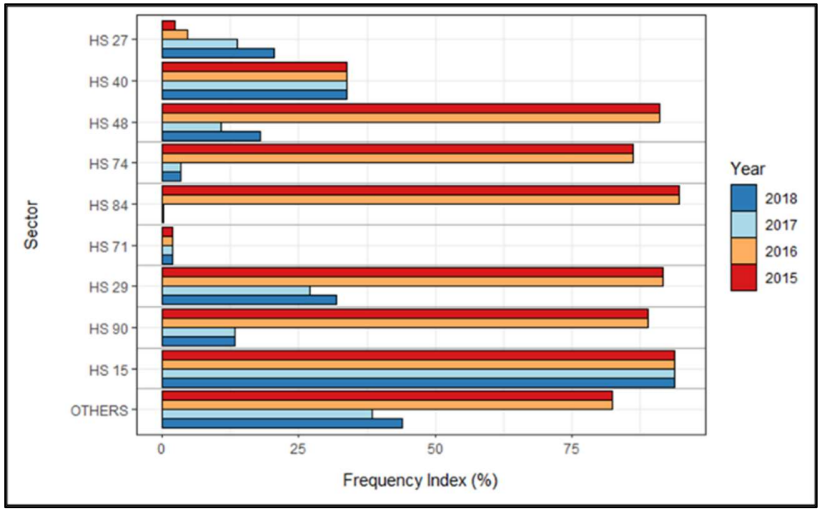


Figure 10a

Frequency Index (TBT), Sectors with Existing/Forthcoming MRAs, 2015–2018

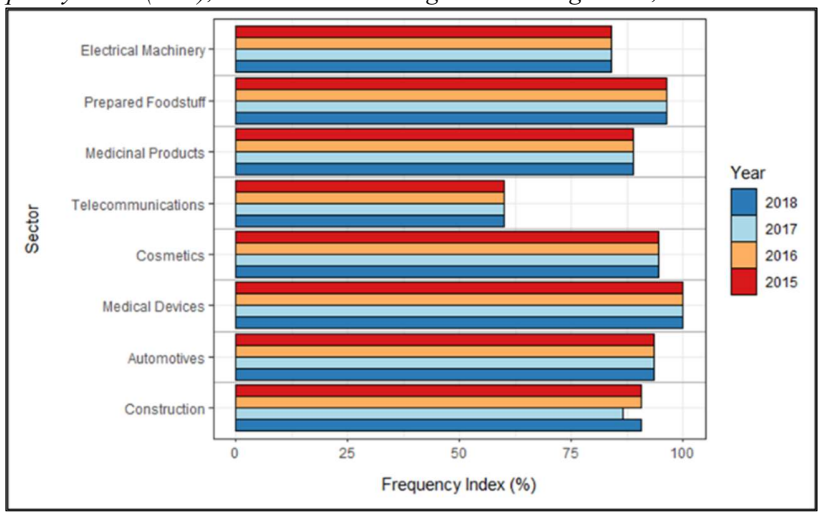


Figure 10b

Frequency Index (TBT), Products not Covered by an MRA, 2015–2018

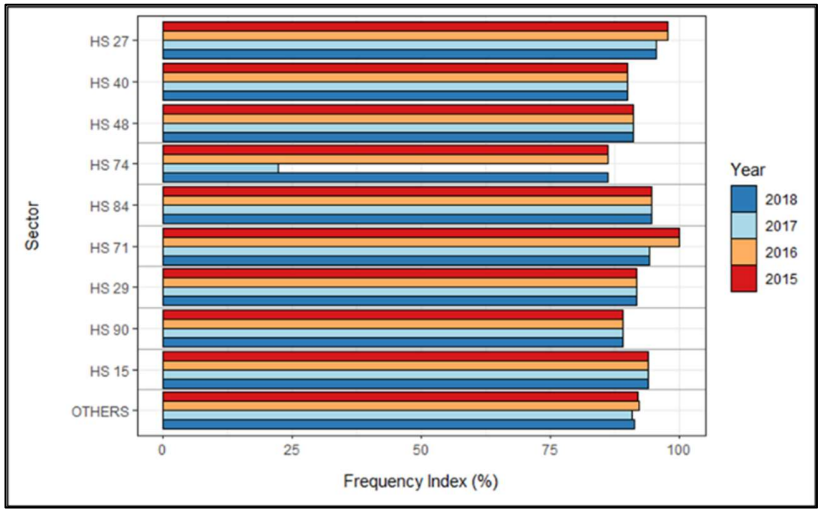


Figure 11a

Frequency Index (Pre-Shipment Inspections), Sectors with Existing/Forthcoming MRAs, 2015–2018

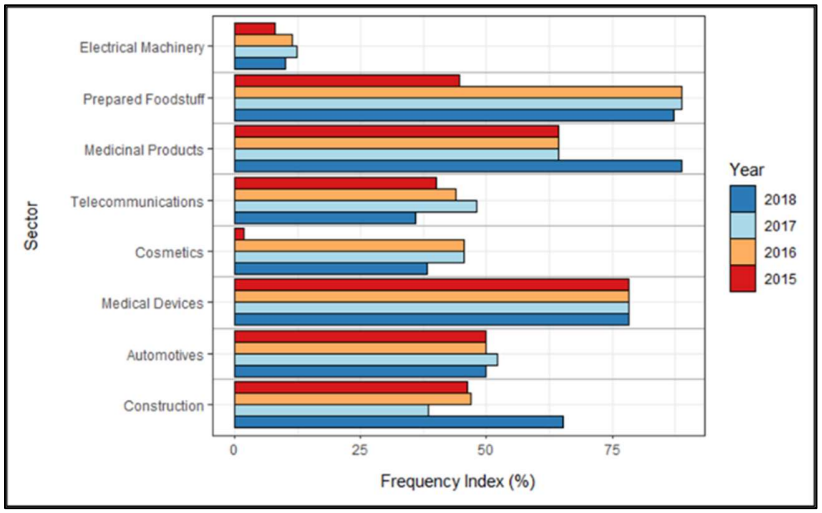


Figure 11b

Frequency Index (Pre-Shipment Inspections), Products not Covered by Existing/Forthcoming MRAs, 2015–2018

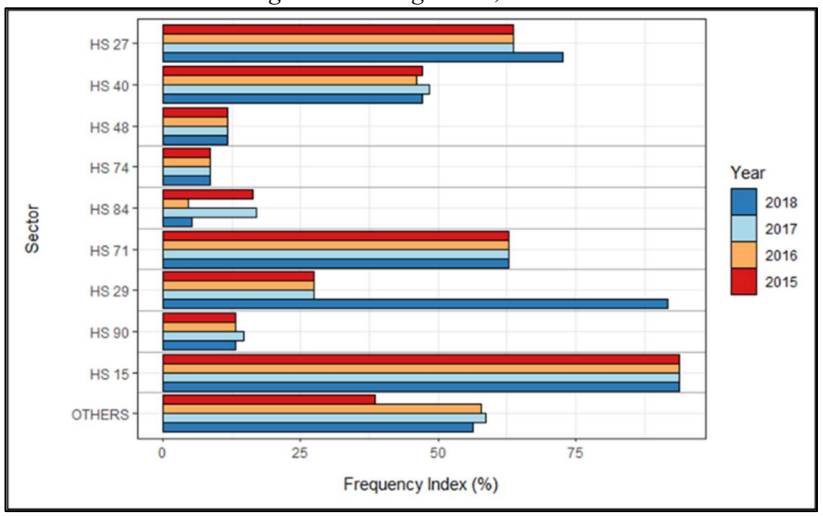


Figure 12a

Frequency Index (Quantity Control), Sectors with Existing/Forthcoming MRAs, 2015–2018

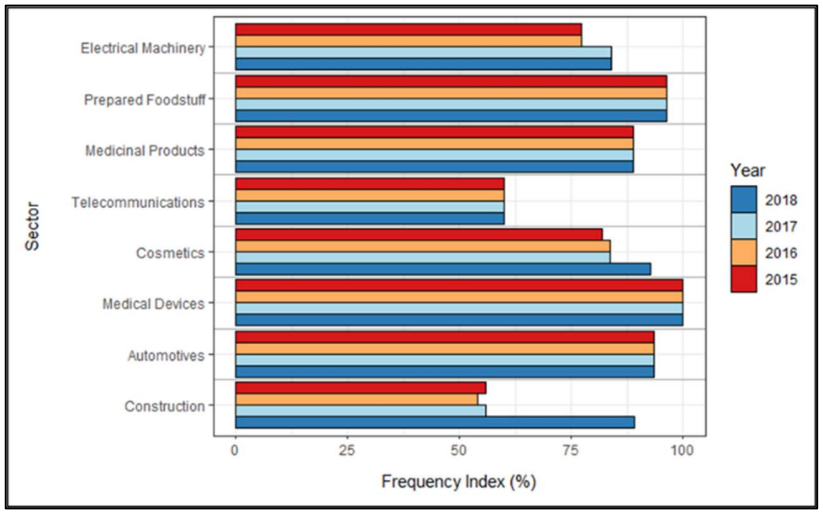


Figure 12b

Frequency Index (Quantity Control), Products not Covered by an MRA, 2015–2018

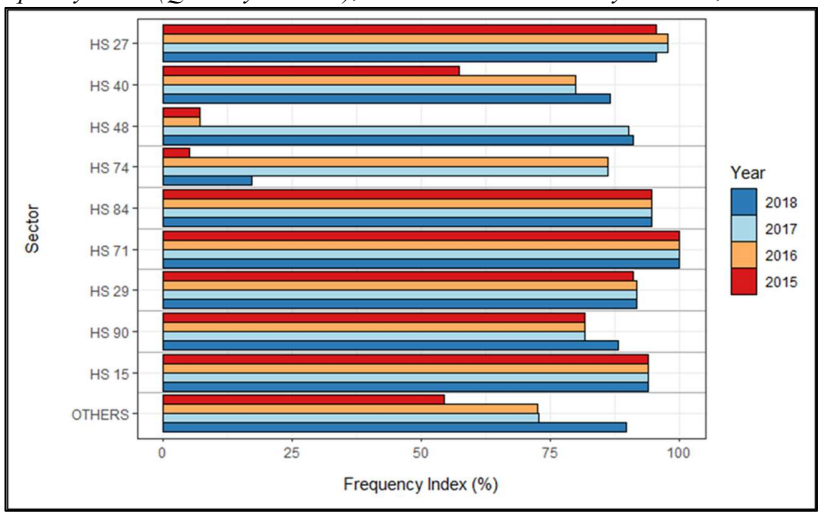


Figure 13a

Frequency Index (Price Control), Sectors with Existing/Forthcoming MRAs, 2015–2018

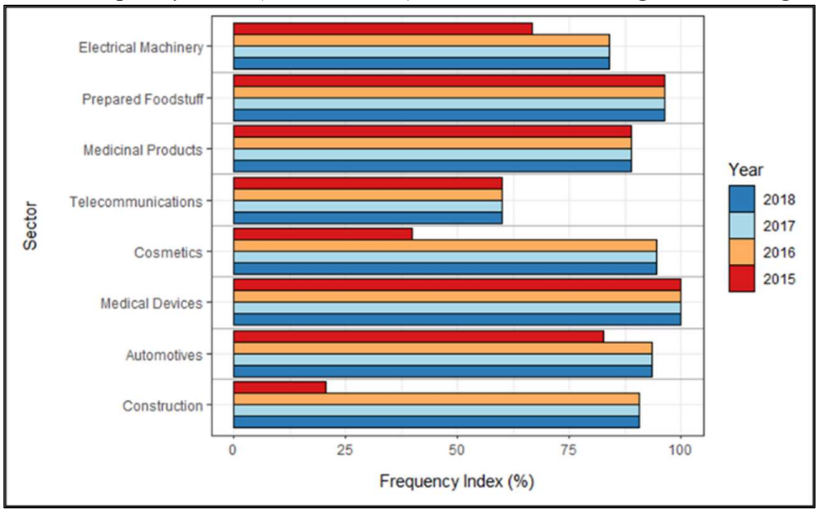
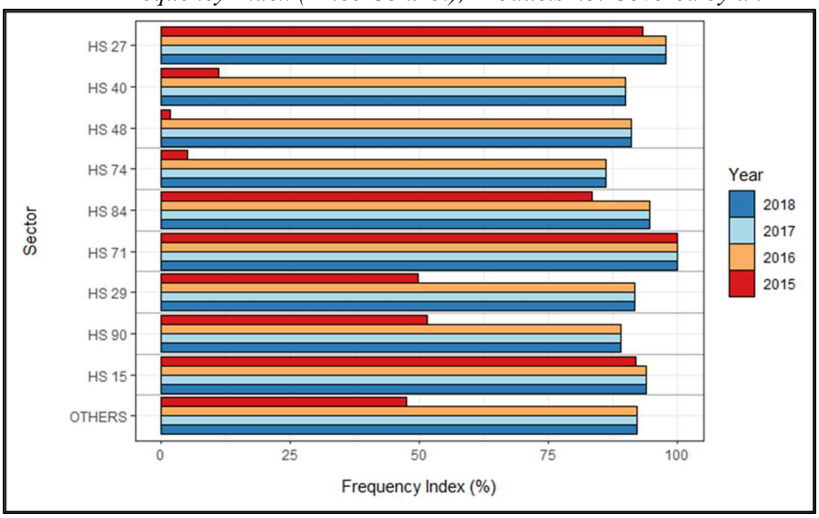


Figure 13b

Frequency Index (Price Control), Products not Covered by an MRA, 2015–2018



Source: UNCTAD TRAINS NTMs: The Global Database on Non-tariff Measures, http://asean.i-tip.org/Forms/Analysis.aspx; Author's Calculations

Note: Frequency Index of each NTM type provides the share of tariff lines affected by at least one measure of that NTM type

The import coverage ratio, which is the percentage of the total value of imports affected by an NTM, confirms the findings above. More than 50% of the value of intra-ASEAN imports were affected by TBT measures during the period 2015–2017 (Table 7). The ratio increased from 39% to 46% for quantity control measures and from 26% to 34% for price control measures. On the other hand, less than 15% of imports are covered by SPS and pre-shipment inspections.

Table 7
Import Coverage Ratio, by NTM Type, Intra-ASEAN Imports, 2015–2018

NTM Type	Value of Intra-ASEAN Imports (US$ Billions)				Import Coverage Ratio (%)			
	2015	2016	2017	2018	2015	2016	2017	2018
(A) SPS	35.83	37.72	33.04	37.89	14.66	15.93	12.07	12.35
(B) TBT	128.78	124.81	142.84	174.96	52.68	52.72	52.17	57.05
(C) Pre-Shipment Inspections	22.22	19.35	23.76	37.61	9.09	8.17	8.68	12.27
(E) Quantity Control Measures	95.11	95.39	116.57	140.73	38.91	40.29	42.57	45.89
(F) Price Control Measures	63.86	66.04	84.07	104.58	26.12	27.89	30.70	34.10
Sub-Total	345.80	343.30	400.28	495.78	141.47	145.01	146.19	161.67
Adjustment to Prevent Double-Counting	-194.03	-194.36	-234.77	-292.53	-79.38	-82.10	-85.74	-95.39
Value of Imports Covered by NTMs	151.77	148.94	165.51	203.25	62.09	62.91	60.45	66.28
Value of Imports Not Covered by NTMs	92.67	87.81	108.31	103.41	37.91	37.09	39.55	33.72
Total Intra-ASEAN Imports	**244.44**	**236.74**	**273.81**	**306.66**	**100.00**	**100.00**	**100.00**	**100.00**

Source: UN Comtrade Database, https://comtrade.un.org; UNCTAD TRAINS NTMs: The Global Database on Non-tariff Measures, http://asean.i-tip.org/Forms/Analysis.aspx; Author's Calculations

The impact of NTMs on ASEAN's imports will be discussed in Section 6 of this paper.

Assessing the Effects of NTMs on International Trade: A Review

Because of the increasing incidence of NTMs, there has been a growing interest in quantifying their effects on international trade. Yet, quantifying their effects has proven to be difficult (Ferrantino, 2006, 2010). Because of their varying objectives, the effects of NTMs are not directly quantifiable, unlike tariffs (Fugazza, 2013).

Nonetheless, the literature has progressed over the years. There is a growing body of empirical work looking at the impacts of NTMs. This was made possible by the development of alternative frameworks, improvement in the availability and accessibility of data, and advances in econometric modeling, all of which allowed new methodologies to be developed (Arita et al., 2015; Ferrantino, 2010; Beghin & Bureau, 2001). Most studies covered technical regulations, especially TBT and SPS, because they have both trade-cost effects and demand-enhancing effects; and also because other NTMs like quantitative restrictions are being phased out under the WTO.

Ferrantino (2006, 2010) and Beghin and Bureau (2001) provided an exhaustive review of earlier works on the impacts of NTMs on trade and welfare, focusing on methodological and estimation issues, data constraints, and implications of research findings. The review done in this

paper focuses only on works that are relevant to the study, the highlights of which are shown in Appendix Table 1.

NTMs affect the price of a good and hence, the demand. Hence, there are two general approaches in quantifying the impacts of NTMs on trade: the price-based approach and the quantity-based approach. Although the two approaches differ in data requirements and estimation techniques, their goal is the same, that is, to estimate the price effects associated with an NTM in terms of tariff equivalent or, more specifically, the ad valorem equivalent (AVE). As the measuring unit, the AVE translates the impact of NTMs into a single metric and thus allows easy comparison with tariff rates.

Price-based Approach

The price-based approach measures the extent to which NTMs increase domestic prices by comparing the price of products affected by NTMs with similar products without NTMs. The measurement is done either econometrically or by direct price-gap comparison. The latter adjusts the price gap for other factors which may influence the price (e.g., taxes, tariffs, transport and distribution costs, wholesale and retail margins, and subsidies). Ferrantino (2006) and Deardorff and Stern (1998) provided a number of price-gap formulae which vary depending on the adjustments made. The estimation is a simple arithmetic exercise, and the estimated price gap is considered as the tariff equivalent.

On the other hand, the econometric method involves a price estimation model where NTM is included as one of the explanatory variables. It looks for proof that the domestic price is higher than it otherwise would be. The AVE is then calculated directly by taking the exponential of the coefficient of NTM.

Among the empirical works that used the econometric approach, the following have made significant contributions to the literature: Dean et al. (2006), Cadot and Gourdon (2015), Ing and Cadot (2017), Cadot et al. (2018), and Vanzetti et al. (2018). Using a differentiated product model of retail prices covering 47 consumer products from 60 countries, Dean et al. (2006) found that NTMs are a significant source of trade restrictiveness for many countries and products. For example, the prices of fruits & vegetables and meats are higher by 44% and 54%, respectively, because of NTMs. Although NTMs are restrictive in many countries, they appear to be less restrictive in Sub-Saharan African, Eastern European, and some Middle Eastern countries; and more restrictive in the E.U., U.S., and some Southeast Asian countries.

Apart from the price effects, Cadot and Gourdon (2015) took account of the role of deeper integration efforts on the impact of NTMs on prices in their estimation framework. This was their main contribution to the literature. Regional trade agreements (RTAs) include clauses on harmonization and mutual recognition arrangements (MRA) of technical regulations (SPS and TBT) and conformity assessment procedures. They are expected to reduce compliance costs and hence, product prices. The findings of the study confirmed that NTMs increase prices; however, harmonization and MRA reduce their price-raising effects by about a quarter. This means that harmonization or MRAs lowers the compliance-cost component of product prices. Unlike Dean et al. (2009), the study disentangled the effects of NTM by types, such as TBT, SPS, and other measures (quantitative restrictions and price measures). The findings showed that different NTMs

affect goods differently. In particular, the AVEs of SPS are high for food and agricultural products, but the AVEs of TBT are high for automobiles.

The paper by Ing and Cadot (2017) differs from Dean et al. (2009) and Cadot and Gourdon (2015) on three areas. First, the paper focused on the ASEAN member economies (AMS). Second, instead of a dummy variable to capture the effects of NTMs, the number of NTMs was employed to capture the cumulative burden of NTMs to exporters. Third, the estimation model allowed country-specific estimates of AVEs, where AVEs are interpreted as tariff equivalents of compliance costs. The results showed that for manufactured products, AVEs for TBT are low for both the AMS (4.5%) and the entire sample economies (5%). In contrast, for agricultural products, AVEs for SPS are slightly higher for both the AMS (6.5%) and the entire sample (6.7%).

The novel contribution of Cadot et al. (2018) in the literature was their attempt to estimate both the price and volume effects of NTMs. That is, they disentangled the trade-cost effects of NTMs from their demand-enhancing effects due to information asymmetries. This was accomplished by employing both the price-based approach for the price effects and the quantity-based approach for the volume effects. Note, though, that the AVE was not calculated for the latter.

The findings of Cadot et al. (2018) showed that AVEs for SPS in agriculture are higher compared to AVEs for TBT in manufacturing. For SPS and TBTs, AVEs are associated with compliance costs. But higher AVEs do not necessarily mean more distortions. It could mean that exporters need to upgrade product quality or product design. NTMs also lower the volume of trade. However, for SPS, although it increases trade costs, it also increases trade volume.

The paper by Vanzetti et al. (2018), apart from the price effects of NTMs, also examined the effect of regulatory distance on trade prices in the ASEAN. Their findings show that similarity in regulations between the importer and exporter can substantially reduce the costs effects of NTMs. In particular, regulatory reform towards convergence, without increasing or decreasing the number of NTMs, could reduce the cost effects of NTMs by 15%–20%.

Quantity-Based Approach

A quantity-based approach is an indirect approach of measuring the impact of NTMs on prices; indirect because the approach involves a two-step process. An import demand function of bilateral flows is first estimated, where NTM is one of the explanatory variables. The estimation looks for evidence that trade with NTMs is lower than what it otherwise would be (Ferrantino, 2006). The quantity impact of NTM is then converted into AVE using import demand elasticities.

Empirical works commonly use the gravity framework to estimate the quantity impact of NTMs. Similar to Newton's law of gravity, the model assumes that bilateral trade flows increase as the economic size of the trading partners increase and decrease as trade costs increase (Arita et al., 2015). Although the framework is similar, the model specification varies depending on the availability of data. The pseudo-Poisson maximum likelihood (PPML) is commonly used to estimate the possibility of zero trade flows, especially for products at very disaggregated levels (Ferrantino, 2006, 2010; Beghin & Bureau, 2001).

Among the pioneering works on the quantity-based approach, the paper by Kee et al. (2009) is the most often cited in the literature because it was the first paper to estimate at the multi-country level and at a very disaggregated product level (HS 6-digit). Using Leamer's comparative advantage framework, the impact of core NTMs and domestic support were estimated. Their findings showed that the importance of NTMs as a protectionist tool is higher than the tariff and that poor countries have more restrictive regimes. Their approach allows the estimation of product-specific AVEs but not for importer-specific AVEs. This limitation was addressed by interacting dummy variables for NTM presence with country characteristics; thus, it allowed them to use the coefficients to estimate the predicted country-specific AVEs.

Ghodsi et al. (2016a) extended the approach of Kee et al. (2009) to a panel analysis, allowing them to improve on the model specification. The estimation allowed for importer-specific AVE for each product, which was done by interacting the NTM variables with importer dummies. The effects of various NTM types were differentiated, but the approach was different. The effect of an NTM type in focus was distinguished while controlling for the effects of all other types of NTMs considered in the model. Instead of dummy, the intensity use of NTM (number of NTMs imposed) was considered similar to Ing and Cadot (2017) and Cadot et al. (2018). Unlike Kee et al. (2009), which restricted NTMs to be trade-reducing, Ghodsi et al. (2016a) considered the ambiguous effects of NTMs due to market imperfections. Thus, NTMs have the potential to increase trade. The use of panel data made it possible for the study to employ lagged policy variables because import demand does not react immediately to policy changes.

With their improved model specification and using more recent estimates of import demand elasticities by Ghodsi et al. (2016b) for the calculation of AVEs, the major findings of Ghodsi et al. (2016a) showed that, in general, SPS and TBT measures have both trade-impending and trade-enhancing effects, depending on the imposing country and product under consideration. Furthermore, the AVEs are smaller for developed countries than less developed countries, despite the former imposing more NTMs than the latter. At the product level, AVEs are highest for NTMs, affecting products related to gross fixed capital formation.

In a more recent paper, Ghodsi et al. (2017), using the same model as Ghodsi et al. (2016a) but with more updated dataset, estimated the effects of NTMs on the quantity of imports only. The AVEs, however, were not estimated. The results show the trade-impending effects of NTMs for about 60% of their estimates. The effects of NTMs differ by the imposing country. Trade-reducing effects are highest for SPS measures and QRs in Sub-Saharan Africa. On the other hand, the most trade-supportive effects are in South Asia for SPS measures and TBTs.

Bratt (2017) further enriched the model specification of earlier empirical works by considering the asymmetric impact of an NTM imposed by a country on trade with its trading partners. That is, the same NTM can affect exporters differently depending on how well they are prepared to respond to the NTMs of their trading partners. The specification, therefore, allows for the estimation of AVEs for each importer-exporter pair by product. The main results showed that the AVEs of high-income importers are lower than those of low-income importers and that high-income exporters are less affected by NTMs than low-income exporters. The paper, however, analyzed the impacts of NTMs in general without differentiating the impacts by NTM type.

There are also empirical studies that deal with the impact of NTMs on specific products or countries for specific NTM types. Arita et al. (2015), for example, examined the impact of SPS and TBT for select agricultural commodities (beef, poultry, pork, corn, soy, fruits, vegetables, nuts, wheat) for the U.S.–E.U. trade. The results showed that SPS and TBT are significant impediments to U.S.–EU agricultural trade. Estimated AVEs of NTMs are larger than existing tariffs and tariff-rate quotas on the same products.

Other studies focused only on the demand effect of NTMs for specific products and specific countries without estimating the AVEs. Examples of these include Disdier et al. (2008) on the impact of NTMs under the SPS and TBT agreements of WTO; Song and Chen (2010) on the impact of food safety regulations on China's agricultural exports; Wei et al. (2012) on food standards on China's exports of tea; and Nguyen (2018) on the impact of SPS on Vietnam's exports of rice. The common finding of these studies attests to the negative effects of NTMs, particularly SPS and TBT, on exports of agricultural products.

Price-based Approach vs. Quantity-Based Approach: Which is the Better Approach?

The debate on which of the two approaches is the most appropriate in examining the effects of NTM on international trade continues. Each approach has its own strengths and limitations. Although the price-based approach allows for the direct calculation of the AVEs from the coefficients in the estimation without the need for the price elasticity of import demand, the key issue is the availability and comparability of price data for a large set of products at a very disaggregated level across countries.

On the other hand, the quantity-based approach is more suitable for large-scale analyses involving multi-country and highly disaggregated product levels (HS 6-digit), primarily because of the availability, accessibility, and comparability of trade data at the global level. However, the calculation of AVEs is highly dependent on the price elasticities of import demand. Recent empirical works used the import demand elasticities taken from the work of Kee et al. (2009). Also, as the effect of NTMs on trade flows may be more of direct interest to policymakers than the effects on prices, the quantity-based approach would be a better approach for policy analysis (Ferrantino, 2006).

Both approaches have one thing in common though; that is, neither takes account of the differences in quality between domestic and imported products. Notwithstanding their strengths and limitations, the results of both approaches largely depend on the validity of the econometric specification (Ferrantino, 2010; Beghin & Bureau, 2001; Bratt, 2017).

Theoretical Framework: Quantifying the Effects of NTMs on Trade

The theoretical framework in assessing the effects of NTMs on trade in the ASEAN and its dialogue partners draws on Bratt (2017) on the asymmetric effects of NTMs on trading partners. The relative condition of a country will have a bearing on how well it can meet the NTMs imposed by its trading partners. For example, similarities in domestic laws and regulations, particularly in technical regulations, between an exporter and importer will give the exporter an edge over another exporter whose domestic laws and regulations differ from the importer's. The regulatory distance

indicator developed by Cadot et al. (2015) measures the similarities in NTM measures between countries and across sectors or products.

Similarities in NTM measures are best exemplified in deep regional integration commitments that include harmonization and mutual recognition agreements (MRAs) on technical measures. These deep integration efforts narrow the "standards divide" between trading partners, most especially between developed and developing countries. Hence, they lower, if not eliminate, compliance costs. An exporter that belongs to the same RTA as the importer will therefore have an advantage over another exporter that is outside of the RTA. As pointed out in the preceding section, the study by Cadot and Gourdon (2015) showed that such deep integration efforts lower the price-raising effects of NTMs.

NTMs that address market imperfections such as externalities and information asymmetries can alter the effects of NTMs on trade. Marette and Beghin (2007) showed, for instance, that NTMs that correct an externality associated with the consumption of a good are pro-trade when foreign producers are more efficient than domestic producers in addressing the externality. Also, an NTM that sets the standard or quality for a particular good lessens information asymmetries and, therefore, reduces the producers' transaction costs. It could also result in an increase in consumer trust. Both outcomes could result in an increase in exports from countries that meet the importing country's standards. Based on the study by Cadot et al. (2018), SPS measures, while they increase trade costs, they also increase trade volume.

To illustrate the theoretical framework, suppose there are two countries exporting the same good, q. As in Bratt (2017), both countries are small and hence, are price-takers, but they differ in their cost functions. Due to its lack of or less rigid regulations, exporter L has a lower cost function than exporter H, which has more rigid regulations. Their profit functions take the following forms:

$$\Pi_L = p * q - \lambda_L \left(c_L * q_L + \frac{1}{2} f_L q_L^2 \right)$$
$$\Pi_H = p * q - \lambda_H \left(c_H * q_H + \frac{1}{2} f_H q_H^2 \right) \quad (1)$$

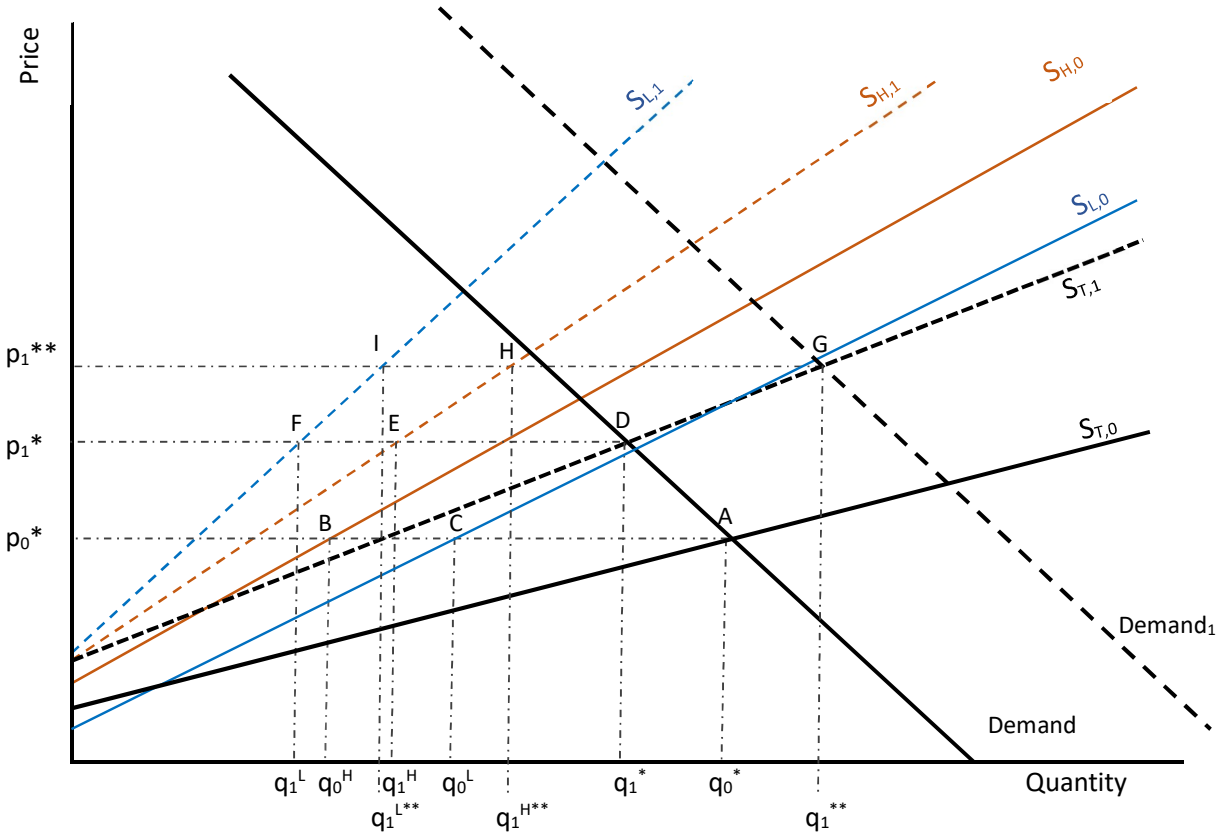
where c and f represent variable costs, where $c_L < c_H$ and $f_L < f_H$. On the other hand, λ represents compliance cost on any NTM, where $\lambda_L = \lambda_H = 1$ implies the absence of NTM. Exporter H is more efficient than exporter L in dealing with NTMs. Hence, $1 \leq \lambda_H \leq \lambda_L$. Profit maximization implies the following supply curves:

$$q_L = \frac{p - \lambda_L c_L}{\lambda_L f_L}$$
$$q_H = \frac{p - \lambda_H c_H}{\lambda_H f_H} \quad (2)$$

The total domestic supply of good q comes solely from both exporters as there are no domestic producers in the importing country. Thus, $q = q_L + q_H$. Demand is linear in prices, $q = a - p$, where a denotes market size.

Figure 14 illustrates the effect on both exporters when the importing country imposes an NTM on good q. Prior to the imposition, the domestic market clears at point A, where the demand curve and total supply curve ($S_{T,0}$) intersects; and q_0^* and p_0^* are the equilibrium quantity and price, respectively. As the low-cost country, exporter L, with a supply curve $S_{L,0}$, exports more than exporter H, with the supply curve $S_{H,0}$, at the equilibrium price p_0^*, that is, $q_0^L > q_0^H$.

Figure 14
Asymmetric Impact of an NTM on Two Exporters



Source: Expanded version of Bratt (2017).

Case 1: Decrease in Demand

Suppose the importing country imposes an NTM with rigid regulations. The NTM increases the costs of both exporters but more so for exporter L ($S_{L,1}$ is higher than $S_{H,1}$). The market clears at point D, with a lower equilibrium quantity q_1^* but a higher equilibrium price p_1^*. With its own rigid standards prior to the imposition of the NTM on its exports, exporter H is now

in a better position than exporter *L* in meeting the rigid regulations of the importing country. This results not only in an increase in exporter *H's* share in the domestic market ($q_1^H > q_0^H$) but also to a higher market share than exporter *L*, that is, $q_1^H > q_1^L$.

Case 2: Increase in Demand

Suppose the NTM imposed by the importing country improves the quality or safety of a product, resulting in an increase in consumers' trust. Instead of a decrease, it increases the demand for the product, as shown by the shift of the demand curve to the right (Demand 1). Both the equilibrium price (p_1^{**}) and quantity (q_1^{**}) are now higher at the equilibrium point *G*. However, the efficient exporter *H* experiences a much higher increase in its exports (q_1^{H**}) and hence, a much higher share in the market while exporter *L* suffers a decline (q_1^{L**}).

Both cases 1 and 2 illustrate the asymmetric impact of NTMs. That is, the effects of NTMs vary across trading partners. Also, although NTMs raise an exporter's costs, it matters how much the increase is relative to the increase in the costs of other exporters.

The above theoretical framework best illustrates the case of the ASEAN member economies, given the differences in their domestic laws and regulations and in their capacities and institutions to meet each other's NTMs. The deep integration efforts in the region through the AEC is a test of how narrow or how wide the "standards divide" is in the region.

Data and Methodology

Model Specification

To account for the asymmetric effects of NTMs, the model specification should allow for the estimation of the quantity effect for each importer-exporter pair and for each product and NTM type. Drawing on Bratt's (2017) framework and methodology, the following gravity model specification is used:

$$m_{nt,ij} = \exp\left[\alpha_n + \sum \alpha_{n,ij} + \sum \alpha_{n,t} + \beta_n \ln GDP_{t,i} + \beta'_n \ln GDP_{t,j} + \sum_k \gamma_n^k CA_{t,i}^k + \sum_k \gamma_n'^k CA_{t,j}^k + \rho_n RD_{nt,ij} + \delta_n t_{nt,ij}^{ave} + \phi_{nt,ij} NTM_{nt,ij}\right] \varepsilon_{nt,inj} \quad (3)$$

The dependent variable in Equation (3) is imports—denoted as m—by the importer i from exporter j, of product n at year t. Products refer to tariff lines at the 6-digit level of the Harmonized System (HS). The α_n, $\alpha_{n,ij}$, and $\alpha_{n,t}$ account for different fixed effects; α_n captures product-specific fixed effects, or the unobserved heterogeneity arising from differences in each product; $\alpha_{n,ij}$ accounts for country-pair specific fixed effects or time-invariant heterogeneity unique to each country-pair, such as whether the country-pair shares a border, shares a common language; $\alpha_{n,t}$ accounts for time-specific fixed effects or the unobserved heterogeneity arising from economic shocks occurring at specific time periods.

β_n and β'_n measure the elasticity of import quantities to the importer's and exporter's GDP in the same year, denoted by $GDP_{t,i}$ and $GDP_{t,j}$ respectively. CA denotes comparative advantage in each factor k, of each country at year t and their impacts on imports of product n are captured by γ_n^k and $\gamma_n'^k$. Following Bratt (2017), the comparative advantage in each factor k is measured as the ratio of each factor—agricultural land, capital, and labor—to the country's GDP, demeaned across the sample of countries.

Meanwhile, ρ_n measures the effect of regulatory distance (RD) between country pairs on product n at time t. On the other hand, $t_{nt,ij}^{ave}$ is the bilateral tariff on product n at time t and its impact is measured by δ_n.

The impact of importer NTMs are given by $\phi_{nt,ij}$. The NTM variable is a dummy variable[2] such that:

$$NTM_{nt,ij} = \begin{cases} 1 & \text{if an NTM has been imposed by the importer on product } n \text{ as of that year} \\ 0 & \text{otherwise} \end{cases} \quad (4)$$

Similar to Bratt's (2017) specification, the coefficient $\phi_{nt,ij}$ varies per product, for each country-pair in a given year. This is done by interacting the importer NTM with the comparative advantage variables, the GDPs of each country, and the regulatory distance between each country pair. As explained in the previous section, the varying effects of NTMs between country-pairs could be explained by how well an exporter is able to meet an importer's NTM, which in turn could be captured by country differences in these factors. Thus, $\phi_{nt,ij}$ is decomposed into:

$$\phi_{nt,ij} = \phi_n + \phi_{n,i}^{GDP} lnGDP_{t,i} + \phi_{n,j}^{GDP} lnGDP_{t,j} + \sum_k \phi_{n,i}^k CA_{t,i}^k + \sum_k \phi_{n,j}^k CA_{t,j}^k + \phi_{nt,ij}^{RD} RD_{t,ij} \quad (5)$$

where ϕ_n captures the product-specific average effect of an NTM imposition by the importer. The coefficients $\phi_{n,i}^{GDP}$ and $\phi_{n,j}^{GDP}$ measure the differential impact on imports of each country's GDP, given an NTM imposition by the importer, while $\phi_{n,i}^k$ and $\phi_{n,j}^k$ capture the differential impact on imports of the comparative advantage variables, given an NTM imposition by the importing country. Similarly, $\phi_{n,ij}^{RD}$ measures the differential impact on imports of the regulatory distance between the trading partners, given an NTM imposition by the importer. The sum of all these coefficients result in $\phi_{nt,ij}$, which is unique to each product and each country-pair trading that product for a given year.

[2] The use of dummy variables to represent NTM presence, instead of NTM count per product, is necessary to enable the interaction with the country-specific variables such as GDP, comparative advantage variables, and regulatory distance. This interaction, in turn, is necessary to obtain country-pair specific estimates for the effect of NTM presence on imports.

To distinguish the effects of each NTM type, Equation (3) is modified following Ghodsi et al. (2016a) and Ghodsi et al. (2017):

$$m_{nt,ij} = \exp\Bigg[\alpha_n + \sum \alpha_{n,ij} + \sum \alpha_{n,t} + \beta_n \ln GDP_{t,i} + \beta'_n \ln GDP_{t,j} + \sum_k \gamma_n^k CA_{t,i}^k + \sum_k \gamma_n'^k CA_{t,j}^k + \delta_n t_{nt,ij}^{ave} + \sum_{h'=1}^{H-1} \eta_n^{h'} RD_{nt,ij}^{h'} + \sum_{h'=1}^{H-1} \sigma_n^{h'} NTM_{nt,ij}^{h'} + \phi_{nt,ij}^{h} NTM_{nt,ij}^{h}\Bigg] \varepsilon_{nt,ij} \quad (6)$$

$$\forall\, h, h' \in \{A, B, C, E, F\}$$
$$\text{where } h \neq h' \text{ and } h \cup h' = H$$

In Equation (6), H is the set of all NTM types; h is a subset containing one element, which is the NTM of choice in the regression; and h' controls for the effects of all other NTM types. The NTMs covered are limited to those which are predominant in the ASEAN based on the findings of Ing et al. (2016). Following the 1-digit MAST classification, this includes the following: sanitary and phytosanitary measures (A); technical barriers to trade (B); pre-shipment inspections and other formalities (C); non-automatic licensing, quotas, prohibitions, and quantity control measures other than SPS or TB measures (E); and, price control measures including additional taxes and charges (F).

Each coefficient $\eta_n^{h'}$ measures the marginal effect of regulatory distance (RD) of an NTM type h' between country-pairs on the imports of product n in a given year. That is, the $RD_{nt,ij}^{h'}$ terms control for the effect of regulatory distance between country-pairs in the other types of NTMs that are not currently the focus of the model.

$NTM_{nt,ij}^{h'}$ is a dummy variable defined in Equation (7), and each coefficient $\sigma_n^{h'}$ quantifies the marginal effect of NTM type h' on the imports of product n in a given year. That is, these variables control for the effects of the other types of NTMs that are not currently the focus of the model.

$$NTM_{nt,ij}^{h'} = \begin{cases} 1 & \text{if an NTM } h' \text{ has been imposed by the importer on product } n \text{ as of that year} \\ 0 & \text{otherwise} \end{cases} \quad (7)$$

The variables $NTM_{nt,ij}^{h}$ is likewise redefined as:

$$NTM_{nt,ij}^{h} = \begin{cases} 1 & \text{if an NTM } h \text{ has been imposed by the importer on product } n \text{ as of that year} \\ 0 & \text{otherwise} \end{cases} \quad (8)$$

This captures the impact of the NTM of choice in the model. Similar to Equation (5), $\phi_{nt,ij}^{h}$ is decomposed into:

$$\phi_{nt,ij}^{h} = \phi_{n}^{h} + \phi_{n,i}^{h,GDP} lnGDP_{t,i} + \phi_{n,j}^{h,GDP} lnGDP_{t,j} + \sum_{k} \phi_{n,i}^{h,k} CA_{t,i}^{k} + \sum_{k} \phi_{n,j}^{h,k} CA_{t,j}^{k} + \phi_{nt,ij}^{h,RD} RD_{t,ij}^{h} \quad (9)$$

Substituting Equation (9) to Equation (6) yields the final operational model:

$$m_{nt,ij} = \exp\Bigg[\alpha_n + \sum \alpha_{n,ij} + \sum \alpha_{n,t} + \beta_n \ln GDP_{t,i} + \beta'_n \ln GDP_{t,j} + \sum_{k} \gamma_n^k CA_{t,i}^k + \sum_{k} \gamma_n'^k CA_{t,j}^k + \delta_n t_{nt,ij}^{ave} + \sum_{h'=1}^{H-1} \eta_n^{h'} RD_{nt,ij}^{h'} + \sum_{h'=1}^{H-1} \sigma_n^{h'} NTM_{nt,ij}^{h'} + \Bigg(\phi_n^h + \phi_{n,i}^{h,GDP} lnGDP_{t,i} + \phi_{n,j}^{h,GDP} lnGDP_{t,j} + \sum_{k} \phi_{n,i}^{h,k} CA_{t,i}^{k} + \sum_{k} \phi_{n,j}^{h,k} CA_{t,j}^{k} + \phi_{nt,ij}^{h,RD} RD_{t,ij}^{h}\Bigg) NTM_{nt,ij}^{h}\Bigg] \varepsilon_{nt,ij} \quad (10)$$

$$\forall\, h, h' \in \{A, B, C, E, F\}$$
where $h \neq h'$ and $h \cup h' = H$

Model Estimation

Equation 10 will be estimated via the PPML method. With the analysis occurring at such a disaggregated product level, the preponderance of zero trade flows for many tariff lines would pose problems in following the common practice of log-linearizing the equation and estimating it via OLS or through other estimators that require a linear model. As an alternative, the equation is preserved at levels, and the PPML method is applied to account for the heteroscedasticity in the data and avoid biased and inconsistent estimates.

The regression is run for each tariff line and repeated for all NTM types of focus. The end results are several estimates for $\phi_{nt,ij}^{h}$ whose values are specific to each product, for each chosen NTM type, and country pair in a given year.

In the absence of data on price elasticities of import demand of the same product categories used in the study, the AVEs were not calculated. On this aspect, this study is similar to the work of Disdier et al. (2008), Song and Chen (2010), Wei et al. (2012), Nguyen (2018), and Ghodsi et al. (2017). Following these earlier studies, emphasis will be made on the effects of NTMs on the trade flows of the AMS rather than on import prices.

Data and Data Sources

The study covers products at the HS 6-digit level for each importer-exporter pair and the period 2015–2018. With 10 AMS, there are 90 importer-exporter pairs and 360 observations for

each regression. A total of 5,715 types of products were imported by at least one ASEAN country across 2015–2018. Thus, the entire dataset for the study includes 2,057,400 observations.

Appendix Table 2 shows the summary of data availability and data sources. Data on imports were taken from UN COMTRADE. GDP data came from the ASEANStats database and was transformed into their natural logarithm values. Data for the gravity variables (geographical distance, contiguity, and common language) were sourced from the CEPII Gravity Database. The study used weighted distance, which is measured as the distance between the country pairs' biggest cities, weighted by the share of those cities in their respective countries' overall populations (Mayer & Zignago, 2006). The rest of the gravity variables are binary variables which take a value of 1 if the country pair shares a border or a common language, and 0 if otherwise.

Data for the comparative advantage variables were taken from the Penn World Tables (Version 9.1) for employment and capital stock and from the World Bank Development Indicators for agricultural land. Each of the variables was divided by GDP and transformed into a natural logarithm. Following Bratt (2017), the values were demeaned to ensure consistency in estimating the coefficients of the NTMs and comparative variables with the inclusion of the interaction terms (Equation 9). Tariffs were sourced from the WTO Tariff Download Facility. The ASEAN CEPT rates were used as tariffs when available. When the CEPT rate is unavailable for a specific product or country, the MFN rate is applied for all its dialogue partners.

Data on NTMs were taken from a collaborative database by ERIA and UNCTAD. The database provides count data on the number of bilateral and multilateral NTMs imposed by the AMS on their imports of products, which are classified using HS 6-digit codes. Information is also provided about when the measures were imposed (Start Date) and, in the case of some measures when they were abolished or repealed (End Date). NTM takes a value of 1 if the NTM of a certain type for a specific product was imposed before the relevant year and either has no listed End Date, or the End Date listed occurs after that year. That is:

$$NTM_{nt,ij}^{h} = \begin{cases} 1 & \text{if number of } NTM_{n,ij}^{h} > 0 \text{ and StartDate} < t < \text{EndDate} \\ 0 & \text{otherwise} \end{cases}$$

Standard deviations were estimated per NTM type across years and across importers to ascertain enough variation in the NTM dummy variable. Estimates show sufficient variation, although there is more variation in the former than in the latter.[3] But because the regression is done at the product level, the variation is sufficient to allow Equation 10 to run. The variability is also

[3] For the time series dimension, the standard deviation of the NTM variable is taken across the country pairs for each year, tariff line and NTM type. Meanwhile, for the cross-section dimension, the standard deviation of the NTM variable is taken across years for each importer, tariff line, and NTM type. Standard deviations greater than zero imply that there is variation in NTM presence. Across the years, the average percentage of tariff lines with a standard deviation greater than zero is 41% for SPS measures, 86% for TBT measures, 44% for pre-shipment inspections, 76% for quantity control measures, and 8% for price control measures. As expected, there is less variation across countries because the NTM presence in each country is not likely to change drastically from one year to another. The percentage of tariff lines with standard deviation greater than 0 is 1% for SPS, 6% for TBT, 3% for pre-shipment, 11% for quantity control, and 10% for price control.

supported by the NTM frequency index discussed in Section 0, where the percentage of tariff lines affected by NTM type varies across sectors and across AMS over the period 2015–2018.

Refer to Aragones (2020) for more details on the data processing and data sources.

Regulatory distance data was taken from the Raw ERIA-UNCTAD NTMs in the ASEAN database.[4] The regulatory distance has a value between 0 and 1. The nearer it is to 1, the more dissimilar the NTM measures are between an importer and exporter. Table 8 provides a summary of the variables used in the study.

Table 8
Variable List

Variable	Variable Name	Description/Measurement
Imports	*m_value*	Annual data on bilateral import flows per product at the HS-6 digit level; measured in current US$
GDP	*gdp*	Annual data on each country's Gross Domestic Product; measured in current US$
Agricultural Land	*land*	Measures arable land in each country in square kilometers
Employment	*emp*	Measures the number of persons engaged in the labor force
Capital Stock	*cap*	Measures the capital stock in each country in current US$ at 2011 PPPs
Comparative Advantage Variables	*cadvland*	Computed by dividing land and employment by current GDP, and capital stock by expenditure-side GDP in current US$ at 2011 PPPs. The ratios are then de-meaned by subtracting the sample mean across countries
	cadvlabor	
	cadvcap	
Geographical Distance (Weighted)	*distw*	Measures geographical distance between a country pair's biggest cities, weighted by the share of those cities in those countries' total population
Contiguity	*contig*	Takes the value of 1 if a country-pair shares a border; 0 if otherwise
Common Language	*comlang_ethno*	Takes the value of 1 if at least 9% of the population in both countries speak a common language; 0 if otherwise
Regulatory Distance	*rd_A, rd_B, rd_C, rd_E, rd_F*	Regulatory distance data from ERIA. Refer to footnote number 4.
Tariff	*t_ave*	Average tariff rate imposed by an importer on a specific product
NTM Variables	*A, B, C, D, E, F*	Dummy Variables to indicate NTM presence (see Section 4.1 for detailed description)

Results and Discussion

Descriptive Statistics

The descriptive statistics for the variables in the model are shown in Table 9. They are reported in three levels, namely, (a) overall (N), which include the entire sample of 2,057,400

[4] This data and computations were shared by Dr. Ha Thi Thanh Doan, Economist, ERIA (2019)

observations; (b) between groups (n), which includes the importer-exporter pairs for all products; and (c) within group (T), which covers the years covered by the study.

The average value of intra-ASEAN imports for the entire sample is US$520,000. The average geographical distance between the AMS is 1,568 kilometers. On the other hand, the average GDP for the AMS is US$270 billion, while its natural logarithm, on average, is 25.46. For the comparative advantage variables, the average arable land is around 133 thousand kilometers; average employment is approximately 31.5 million, whereas average capital stock is US$3,250 billion. The average tariff rate across the AMS for all products during the period covered is less than 3%.

Table 9
Descriptive Statistics

Variable		Mean	Std. Dev	Min	Max	Obs
m_value (in millions)	overall	0.52	20.80	0.00	8,280.00	N = 2,057,400
	between		20.10	0.00	6,190.00	n = 514,350
	within		5.33	-1,780.00	2,090.00	T = 4
distw	overall	1,567.76	653.99	505.54	2,928.05	N = 2,057,400
	between		653.99	505.54	2,928.05	n = 514,350
	within		0.00	1,567.76	1,567.76	T = 4
gdp (in millions)	overall	270,000.00	276,000.00	11,400.00	1,040,000.00	N = 2,057,400
	between		274,000.00	12,500.00	960,000.00	n = 514,350
	within		29,600.00	165,000.00	351,000.00	T = 4
lngdp	overall	25.54	1.48	23.16	27.67	N = 2,057,400
	between		1.47	23.25	27.59	n = 514,350
	within		0.08	25.40	25.71	T = 4
land	overall	133,162.30	159,510.10	6.60	570,000.00	N = 2,057,400
	between		159,508.90	6.60	570,000.00	n = 514,350
	within		647.57	130,982.00	135,872.50	T = 4
emp (in millions)	overall	31.50	34.60	0.20	125.00	N = 2,057,400
	between		34.60	0.20	121.00	n = 514,350
	within		0.96	27.70	35.30	T = 4
cap (in millions)	overall	3,250,000.00	4,960,000.00	114,000.00	19,100,000.00	N = 2,057,400
	between		4,940,000.00	132,000.00	17,400,000.00	n = 514,350
	within		420,000.00	1,590,000.00	4,970,000.00	T = 4
t_ave	overall	2.62	7.05	0.00	226.00	N = 2,057,400
	between		6.51	0.00	135.00	n = 514,350
	within		2.72	-109.88	110.62	T = 4

Source: Author's Calculations

The diversity across the AMS is shown by the relatively higher standard deviations of the overall and between groups than the within group, and this is observed for all the variables in the model. On the other hand, there is less variability across the years covered.

A brief discussion of the imports of the ASEAN and their NTMs over the period covered by the study is presented in Section 2 of the report.

Processing of Estimation Results

The products are grouped by sectors to provide a focus on the analysis. There are 18 sectors classified into three major categories: (a) products covered by existing MRAs and harmonization agreements, which include electrical machinery and equipment, prepared food stuff, medicinal products, telecommunications, cosmetics, and medical devices; (b) products covered in forthcoming MRAs, which include automotive products and building & construction materials; and (c) products which are among the top 15 imports of the ASEAN but are neither covered by existing nor forthcoming MRAs (HS 15, HS 27, HS 29, HS 40, HS 48, HS 71, HS 74, HS 84, HS 90) and all other imports, which are not among the top 15 and also not covered by MRAs.[5]

The model in Equation (10) was estimated for each of the 5,715 products and each of the five NTM types, resulting in a maximum of 28,575 coefficient estimates that could possibly be harvested for each variable in the model. Given the huge number, the study followed the same approach used by past studies on gravity models that covered numerous products at very disaggregated levels (Bratt, 2017; Ghodsi et al. 2017; Head & Mayer, 2014). First, the regression results are presented on an aggregated basis. Second, to ensure that the study's findings are based on robust estimates, only coefficient estimates that are significant at the 10% level are included. Of the significant estimates, the possible effects of estimates with extreme values are eliminated by discarding the top 5% and bottom 5% of the group. Finally, the mean and standard deviations of the remaining coefficients are taken and reported. Note that the mean and standard deviations are reported using the sample of remaining coefficient estimates; the standard deviation, particularly, reports the variation of the remaining coefficients from each other and is not reflective of the standard deviations generated during the estimation. As such, much variation may be expected, especially from product groups or sectors containing too many or too little tariff lines. The proportion of significant estimates to the total possible coefficient estimates are also reported.

Test of Goodness-of-fit

The McFadden R^2 is used as a measure of the goodness-of-fit for each of the operational models in the study, that is, one for each of the 5 NTM types.[6] The means of the McFadden R^2's show a sufficiently high explanatory power of the models (Figure 15). The means are 85.13% for model A, 86.37% for model B, 84% for model C, 86.08% for model E, and 85.78% for model F.[7]

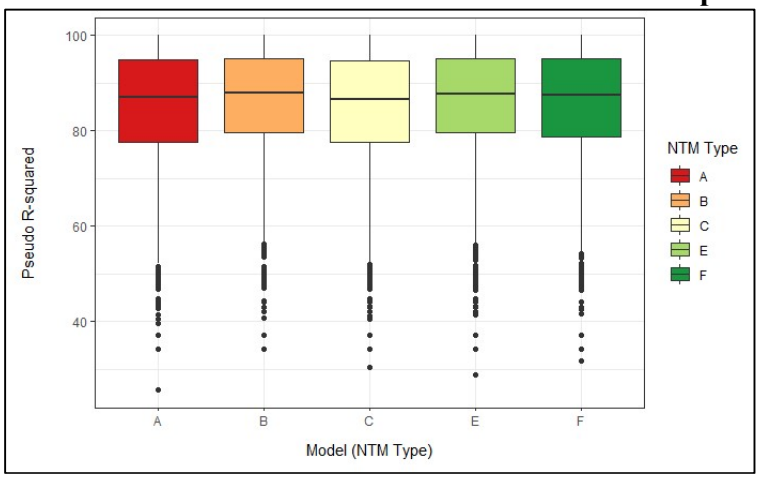
[5] Refer to Appendix Table 3 for the product description of each HS.

[6] The McFadden R^2 is considered a pseudo- R^2 measure because the study uses a nonlinear model and a pseudo-maximum likelihood estimator, this is the proxy for the traditional R^2 measure. As per Faraway (2016), it is obtained by dividing a model's residual deviance by its null deviance and subtracting the quotient from 1

[7] The model type refers to the NTM classification: SPS (A), TBT (B), Pre-shipment inspection (C), Quantity Control Measures (E), and Price Control Measures (F).

Figure 15

Goodness-of-Fit Values per Model



Source: Authors' Calculations

Impact of Traditional Gravity Variables on ASEAN Imports

The results for traditional gravity variables are shown in Table 10 for the average coefficient estimates and in Appendix Table 4 for the proportion of significant estimates.

Country-Pair Specific Variables

Overall, the mean coefficient estimate for distance shows the negative effects of distance on imports between ASEAN trading partners. This is also true for most of the sectors covered. Significant estimates comprised more than 50%–60% of the coefficient estimates for most of the sectors. Sectors where the expected negative correlation is contrary to expectations include electrical machinery and electronics equipment, medicinal products, telecommunications, optical, photographic equipment (HS 90), and animal or vegetables fats and oils (HS 15).

Common language is expected to increase trade between trading partners as they lower trading costs. This is strongly supported by the average coefficient estimates for electrical and electronics equipment, medicinal products, telecommunications, medical equipment, copper and articles thereof (HS 74), optical, photographic equipment (HS 90), organic chemicals (HS 29), and animal or vegetable fats and oils (HS 15). For most of the sectors, significant estimates comprised at least 40% of all the estimates.

The common border is also expected to lower trade costs; however, this is true only for the following sectors: medicinal products, machinery (HS 48), natural or cultured pearls and precious and semi-precious stones (HS 71), and organic chemicals (HS 29).

Economic Size

The average coefficient estimates for GDP show a positive impact of economic size on imports, consistent with a priori expectations. Among the traditional gravity variables, both exporter and importer GDPs have the largest average coefficient estimates and the largest proportion of significant estimates. This means that the economic size of AMS drives imports between ASEAN members more than the other gravity variables for most of the products traded in the region.

The positive impact of exporter GDPs is evident overall and for all sectors. This implies that the larger the economic size of AMS exporters, the more capable they are of meeting the import requirements of their trading partners in the region and hence, increases ASEAN imports. Furthermore, exporter GDPs have a larger impact on imports than importer GDPs. This is shown by the larger average coefficient estimates of the former compared to the latter overall and in 13 out of the 18 sectors. This could mean that the larger capacity of AMS exporters redounds to lower production costs which translate to lower export price; thus, increasing imports between ASEAN trading partners. This effect on imports is greater than the positive influence of the importers' own economic size on their imports.

Importer GDPs also increases ASEAN imports overall and for all sectors, except medicinal products and animal and vegetables fats and oils (HS 15). It is important to note, however, that the standard deviation of significant coefficient estimates for these two sectors are relatively high compared to the other sectors. This could be due to the relatively low proportion of significant estimates at 28% and 33%, respectively.

Comparative Advantage Variables

The comparative advantage variables (land, labor, and capital) determine the trade patterns of the AMS. For the importers' capital stock, labor, and land, the expected sign of the average coefficient estimates is negative. That is, their imports are less in the goods that use intensively the factor where their endowment is high, and vice versa. It follows, therefore, that for the exporter's capital stock, labor, and land, the expected sign is positive. That is, imports by the importers are high in the goods that use intensively the factor where the exporters have abundant supply (while importers have less of the same factor) and vice-versa.

The estimates show negative average coefficients for all three importers' comparative advantage variables, overall and in almost all the sectors, and thus, consistent with theoretical expectations. The same, however, cannot be said of exporters' comparative advantage variables, where the average coefficients are negative, except for land in most sectors. Given these findings, it can be said, to some degree, that the estimates provide evidence of the kind of intra-ASEAN trade existing in the region where an AMS imports from other AMSs the goods where it does not have a comparative advantage and vice-versa.

Tariff

As expected, tariff negatively affects imports between ASEAN members. This is true for almost all the sectors. However, it is important to note that the effect of the tariff is the smallest among the gravity variables, as shown by the magnitude of the mean of the coefficient estimates, overall and in all sectors. This means that tariff is now of less significance than the other variables in influencing their imports from the region. This is strengthened by the relatively low proportion of significant estimates in almost all the sectors. As presented earlier, the average tariff rate in the region is now at less than 3%. Except for highly sensitive products, the tariff is now 0 for most products traded among the AMS. These findings provide evidence to the favorable impact on intra-ASEAN imports of the trade liberalization that has been going on in the region since AFTA in 1992, followed by AEC 2010 and now, towards AEC 2025.

Table 10
Estimation Results for Gravity Variables, Summarized

Variable / Sector	DISTANCE	CONTI-GUITY	COMMON LAN-GUAGE	GDP - IMP	GDP - EXP	LAND - IMP	LAND - EXP	LABOR - IMP	LABOR - EXP	CAPITAL - IMP	CAPITAL - EXP	TARIFF
OVERALL	-1.16	-0.32	-0.79	3.36	3.49	-0.22	0.16	-2.06	-1.93	-7.73	-7.18	-0.54
	(7.48)	(9.73)	(6.91)	(5.07)	(3.56)	(6.97)	(1.98)	(15.08)	(5.07)	(30.48)	(14.90)	(2.27)
Electrical Machinery	0.73	-3.99	0.50	3.08	2.74	0.30	0.14	-2.21	-2.23	-8.52	-6.27	-0.60
	(6.00)	(8.04)	(3.17)	(2.90)	(2.13)	(2.60)	(0.82)	(4.74)	(1.87)	(10.57)	(6.29)	(1.26)
Foodstuff	-2.77	-1.05	-1.20	1.23	3.30	-0.10	0.37	-2.28	-2.10	-5.61	-6.22	-0.05
	(2.64)	(7.05)	(3.55)	(2.30)	(2.68)	(3.83)	(0.82)	(9.05)	(2.51)	(8.89)	(7.21)	(0.17)
Medicine	1.77	3.99	4.11	-27.43	5.05	-14.52	1.09	-53.83	-4.92	-106.78	-11.11	0.46
	(14.76)	(13.37)	(13.45)	(88.14)	(6.98)	(96.03)	(6.35)	(181.63)	(14.43)	(334.18)	(26.20)	(2.54)
Telecommunications	2.92	-10.20	2.65	4.65	5.03	1.33	-0.35	-3.54	-12.32	-11.54	-12.37	-0.20
	(10.02)	(13.08)	(3.18)	(5.48)	(6.56)	(4.35)	(1.40)	(10.12)	(47.85)	(14.69)	(15.20)	(0.26)
Cosmetics	-0.80	-0.44	-0.38	2.28	3.41	-0.42	0.44	-0.44	-2.54	-5.12	-4.79	-0.19
	(4.88)	(3.39)	(2.53)	(3.24)	(3.14)	(3.30)	(0.71)	(2.11)	(1.84)	(9.20)	(7.39)	(0.29)
Medical Devices	-1.26	-0.68	1.54	1.80	1.94	-37.80	-0.03	32.06	-2.49	20.73	-4.95	95.74
	(1.42)	(2.09)	(1.98)	(8.82)	(0.68)	(193.63)	(0.52)	(158.90)	(1.23)	(74.84)	(2.11)	(437.70)
Automotive	-2.92	-1.45	-2.83	3.21	3.12	0.90	0.54	-1.46	-2.30	-4.89	-0.64	-0.03
	(3.89)	(8.43)	(3.98)	(5.11)	(2.87)	(5.88)	(1.05)	(7.17)	(3.46)	(15.36)	(10.95)	(0.23)
Construction	-2.02	-0.79	-1.50	2.57	3.49	-0.16	0.20	-0.44	-1.94	-3.63	-6.32	-0.53
	(3.63)	(7.31)	(3.66)	(2.54)	(2.85)	(1.99)	(0.98)	(5.85)	(2.62)	(11.66)	(7.89)	(1.57)
Mineral fuels, oils, and waxes; bituminous substances (HS 27)	-2.22	-2.73	-9.60	4.77	5.96	-2.15	1.79	9.67	-10.24	-6.34	-67.49	-1.39
	(3.93)	(35.73)	(33.16)	(5.16)	(7.66)	(6.67)	(12.28)	(18.90)	(61.98)	(29.91)	(258.99)	(5.06)
Rubber (HS 40)	-3.26	-1.10	-2.58	2.07	2.55	-0.36	0.51	0.90	-1.86	0.52	-1.80	0.10
	(1.42)	(2.09)	(1.63)	(1.50)	(1.35)	(1.40)	(0.43)	(3.76)	(1.52)	(5.29)	(3.89)	(0.19)
Paper and paperboard (HS 48)	-0.73	0.19	-1.38	2.02	4.36	-0.21	0.13	-0.22	-1.90	-4.93	-5.88	-0.10
	(5.18)	(4.82)	(2.48)	(2.44)	(3.09)	(1.42)	(0.88)	(3.28)	(2.19)	(8.80)	(7.98)	(0.40)
Copper (HS 74)	-1.14	-4.75	0.14	3.16	2.73	0.86	0.49	-2.48	-3.05	-3.97	-4.98	-0.97
	(6.67)	(6.57)	(8.37)	(2.57)	(1.93)	(1.01)	(0.59)	(3.14)	(1.54)	(11.11)	(8.49)	(1.08)
Nuclear reactors, boilers, machinery and mechanical appliances (HS 84)	-2.72	-0.48	-1.91	1.97	2.35	0.41	0.25	-1.81	-2.03	-4.00	-3.51	-0.31
	(2.09)	(4.12)	(2.63)	(1.85)	(1.49)	(3.20)	(0.60)	(5.24)	(1.40)	(8.40)	(5.06)	(1.29)
Pearls; Precious, Semi-precious stones; Precious metals; Jewelry; Coin (HS 71)	-10.11	22.95	-12.64	7.02	3.05	-1.48	-2.16	-2.10	4.45	24.12	14.48	-0.68
	(13.01)	(48.85)	(13.69)	(8.43)	(3.19)	(4.10)	(5.55)	(11.96)	(13.74)	(47.95)	(30.04)	(2.96)
Organic chemicals (HS 29)	-0.66	0.09	0.00	4.46	4.51	-2.80	-0.58	3.92	-5.13	-0.60	-10.50	-3.52
	(19.08)	(21.12)	(15.13)	(10.73)	(5.82)	(21.98)	(5.97)	(50.16)	(21.19)	(66.23)	(51.43)	(11.52)
Optical, photographic, cinematographic instruments and apparatus (HS 90)	1.73	-1.41	2.17	2.71	2.36	-0.15	-0.01	-2.10	-2.44	-7.47	-6.75	0.02
	(8.18)	(4.93)	(6.67)	(3.02)	(1.97)	(2.29)	(0.81)	(4.57)	(1.78)	(11.62)	(7.10)	(0.62)
Animal or vegetable fats, oils, and waxes (HS 15)	0.70	-0.09	4.73	-6.44	3.77	-2.95	1.33	-4.56	-5.65	-18.77	-11.65	-0.27
	(13.22)	(11.09)	(15.49)	(29.20)	(3.86)	(22.73)	(2.69)	(25.12)	(5.88)	(58.72)	(19.24)	(2.12)
OTHERS	-0.43	1.66	-0.73	4.73	4.27	-0.35	0.40	-3.39	-1.78	-11.44	-9.65	-0.40
	(11.82)	(15.81)	(12.00)	(10.06)	(5.93)	(13.52)	(5.04)	(28.51)	(11.90)	(61.70)	(28.60)	(2.39)

Source: Authors' Calculations

Notes: Standard Deviations presented in parentheses

Impact of NTMs on ASEAN Imports at the Sectoral Level

The specific effects of each NTM type on imports between ASEAN countries are estimated using Equation (9), and the results at the sectoral level are summarized in Table 11 to Table 15. For each NTM type, the value of $\phi_{nt,ij}^{h}$ could be positive or negative depending on the impact of the NTM on the product, considering the characteristics of the importer-exporter pairs such as economic size, comparative advantage variables, and regulatory distance. A positive $\phi_{nt,ij}^{h}$ implies that the NTM imposed by importer i enhances its import of the product from exporter j. That is, the NTM enhances imports between ASEAN trading partners. On the other hand, a negative $\phi_{nt,ij}^{h}$ indicates the NTM reduces imports between the trading partners. There are instances when the value of $\phi_{nt,ij}^{h}$ is zero, indicating a neutral NTM-effect, that is, it neither enhances nor reduces trade.

The impact of an NTM type at the sectoral level (ϕ^{h}) is reported as the average of the significant estimates of $\phi_{nt,ij}^{h}$ of products that belong to the sector. Because it is an average, it effectively captures the net effect of an NTM's trade-enhancing and trade-reducing effects on a sector or product group. Given the huge number of product lines covered by the study, it is important to determine the proportion of $\phi_{nt,ij}^{h}$ estimates where the NTM type enhances (+), distorts (-), or is neutral to imports. The proportion or incidence of trade-enhancing or non-trade-enhancing estimates show how many commodities are affected positively or negatively by NTMs; that is, it is possible that NTMs can be trade-enhancing for a large number of commodities, but their overall effect on the sector is still trade-reducing. These are also reported in the tables.

Ideally, the value of $\phi_{nt,ij}^{h}$ can be transformed into the ad valorem equivalent (AVE) of the effect of NTM type for each product. However, as discussed earlier in the model estimation in Section 5, the calculation of AVEs in this paper is not feasible, given the absence of data on price elasticities of import demand of the same product categories.[8] Nonetheless, the estimate of $\phi_{nt,ij}^{h}$ gives an idea of the trade-enhancing or trade-distorting effects of NTMs on intra-ASEAN imports as discussed above.

The value of $\phi_{nt,ij}^{h}$ are reported through mean and standard deviations across sectors. Note that the mean and standard deviations are taken and reported for the sample of $\phi_{nt,ij}^{h}$ within a sector. The standard deviations, in particular, reflect the variation of $\phi_{nt,ij}^{h}$ from each other; these are not reflective of the standard deviations generated by the estimation process.[9]

Sanitary and Phytosanitary (SPS)

Overall, SPS proved to be a significant factor affecting imports between ASEAN trading partners. Forty-one percent of the estimates of $\phi_{nt,ij}^{A}$ are statistically significant (Table 11). In general, SPS reduces imports between ASEAN trading partners, as shown by the negative sign of

[8] Existing estimates of price elasticities, for example by Kee et al. (2009), cannot be used as approximation because these are done much earlier than 2015 and hence, will not reflect the effects of AEC integration.

[9] The standard deviations produced by the regressions for $\phi_{nt,ij}^{h}$ are difficult to report since $\phi_{nt,ij}^{h}$ is a sum of several components, and each component has a corresponding standard deviation.

ϕ^A. However, its effects vary at the sectoral level. Of the significant coefficient estimates, 40.6% show that SPS enhances imports, 51.1% support trade-reducing effects, and 8.3% neutral effects.

At the sectoral level, the relatively large portion (44%–60%) of significant estimates in sectors covered by MRAs and harmonization agreements show a widespread correlation between SPS and imports, except cosmetics, where only 36% of the estimates are significant. In general, the trade-enhancing effects of SPS dominates the trade-reducing effects in ASEAN imports of prepared foodstuff and medicinal products, as indicated by the positive sign of ϕ^A. This means that SPS measures in these two sectors are pro-trade. As SPS measures are intended for consumer safety and protection, the MRAs and harmonization agreements may have lessened information asymmetries and increase consumer trust; hence, increase trade. This is consistent with the findings of Cadot and Gourdon (2015). On the other hand, SPS measures appear to hinder imports of electrical machinery, telecommunications, cosmetics, and medical devices.

For products covered by forthcoming MRAs, less than one third (27) of the estimates of $\phi^A_{nt,ij}$ showed a significant correlation between SPS and imports in construction materials. Nonetheless, where the effect is significant, the finding showed that SPS enhances imports at the sectoral level. Take note that SPS is not imposed on automotive products.

For products not covered by existing and forthcoming MRAs, SPS reduces imports in all sectors, except for organic chemicals (HS 29) and optical, photographic, cinematographic instruments and apparatus (HS 90).

Table 11
Distribution and Summary, SPS Effect Estimates by Sector

SECTOR	A: SPS				
	OBS	POS	NEG	ZERO	ϕ^A
OVERALL	855,036 (41.56%)	347,569 (40.65%)	436,608 (51.06%)	70,859 (8.29%)	-18.61 (203.72)
Existing MRAs and Harmonization Agreements					
Electrical Machinery	57,996 (54.06%)	23,457 (40.45%)	34,539 (59.55%)	0 (0.00%)	-19.95 (118.73)
Prepared Foodstuff	30,132 (44.52%)	11,912 (39.53%)	3,725 (12.36%)	14,495 (48.11%)	0.67 (3.35)
Medicinal Products	9,720 (60.00%)	4,625 (47.58%)	4,746 (48.83%)	349 (3.59%)	12.37 (456.11)
Telecommunications	4,536 (50.40%)	1,800 (39.68%)	2,736 (60.32%)	0 (0.00%)	-2.33 (124.14)
Cosmetics	7,128 (36.00%)	3,262 (45.76%)	3,512 (49.27%)	354 (4.97%)	-1.84 (128.31)
Medical Devices	4,860 (58.70%)	2,100 (43.21%)	2,760 (56.79%)	0 (0.00%)	-124.96 (609.33)
Forthcoming MRAs and Harmonization Agreements					
Automotives					
Construction	88,776 (27.10%)	38,963 (43.89%)	47,126 (53.08%)	2,687 (3.03%)	3.02 (143.81)
No MRA or Harmonization Agreement					
Mineral fuels, oils, and waxes; bituminous substances (HS 27)	1,944 (12.27%)	702 (36.11%)	884 (45.47%)	358 (18.42%)	-11.34 (46.68)
Rubber (HS 40)	6,804 (21.24%)	2,641 (38.82%)	4,163 (61.18%)	0 (0.00%)	-17.08 (48.39)
Paper and paperboard (HS 48)	21,060 (52.70%)	8,657 (41.11%)	12,403 (58.89%)	0 (0.00%)	-23.63 (216.29)
Copper (HS 74)	8,424 (40.34%)	3,578 (42.47%)	4,846 (57.53%)	0 (0.00%)	-15.73 (210.81)
Nuclear reactors, boilers, machinery and mechanical appliances (HS 84)	105,300 (53.67%)	41,761 (39.66%)	63,539 (60.34%)	0 (0.00%)	-39.63 (201.22)
Pearls; Precious, Semi-precious stones; Precious metals; Jewelry; Coin (HS 71)	324 (1.76%)	0 (0.00%)	324 (100.00%)	0 (0.00%)	-94.20 (21.23)
Organic chemicals (HS 29)	66,420 (51.25%)	32,177 (48.44%)	33,249 (50.06%)	994 (1.50%)	82.16 (800.62)
Optical, photographic, cinematographic instruments and apparatus (HS 90)	26,568 (54.26%)	10,796 (40.64%)	15,058 (56.68%)	714 (2.69%)	7.09 (175.68)
Animal or vegetable fats, oils, and waxes (HS 15)	5,184 (29.39%)	737 (14.22%)	1,404 (27.08%)	3,043 (58.70%)	-0.12 (1.42)
OTHERS	409,860 (43.19%)	160,419 (39.14%)	201,576 (49.18%)	47,865 (11.68%)	-24.70 (216.45)

Source: Authors' Calculations

Notes: Values in parentheses under the OBS column reflect the relevant ϕ^A estimates as a proportion all possible ϕ^A estimates. Values in parentheses under the POS/NEG/ZERO column reflect the relevant positive/negative/zero-value ϕ^A estimates as a proportion of OBS. Value in parentheses under ϕ^A column reflects the standard deviations.

At the product level, the varying effects of SPS are evident. The proportion of significant estimates showing trade-distorting effects is greater than trade-enhancing effects, regardless of whether the products are covered by MRAs or not. Hence, SPS measures hinder imports between ASEAN trading partners. As discussed above, exceptions are in medicinal products and prepared

foodstuff. For the former, there is almost an equal proportion (48%) of positive and negative estimates. For the latter, almost half (48%) of the estimates support a neutral SPS effect. This implies that, for these sectors, although the proportion with trade-enhancing effects is lower, their effects are stronger than the reducing-effects of the majority of the products.

Technical barriers to trade (TBT)

TBT proved to be a more significant factor than SPS in affecting imports between ASEAN trading partners. This is shown by the larger percentage of significant estimates of $\phi_{nt,ij}^{B}$ in TBT (55%) than $\phi_{nt,ij}^{A}$ in SPS (41%) (Table 12). Overall, TBT measures distort trade, as shown by the negative sign of ϕ^{B}.

However, at the sectoral level, the positive sign of ϕ^{B} shows that TBT enhances intra-ASEAN imports in most sectors covered by MRAs and harmonization agreements, specifically, electrical machinery, prepared foodstuff, telecommunications equipment, and medical devices. This is also supported by the greater proportion of positive significant coefficients than negative coefficients under these sectors. This result is very encouraging, given that TBT has the highest frequency index and coverage ratio among the NTMs in the region. This implies that TBT measures in these sectors facilitate and increases trade between trading partners. This could mean that the demand-enhancing effects of the TBT measures outweigh their price-enhancing effects arising from compliance costs. One common characteristic of these sectors is their link to global production networks operating in the region. It may well be that the similarity in technical and quality standards observed by firms brought about by mutual recognition and harmonization agreements enable products to move seamlessly across the value chain in the AMS. As discussed earlier in Section 2 of the paper, these sectors together account for an average of 26% of intra-ASEAN imports per year; and, they are also the fastest-growing intra-ASEAN imports for the period 2015–2018 (Table 2).

The trade-enhancing effects of TBT are also seen in construction materials but not in the automotive sectors, both of which are covered by forthcoming MRAs. This is similarly supported at the product level by the higher percentage of significant positive estimates compared to negative estimates in construction materials. The trade-reducing effect of TBT measures on automotive is interesting as the AMSs are hosts to the supply chain in the sector. This result, in fact, magnifies the significant role that MRAs and harmonization agreements may have in harnessing intra-ASEAN imports for sectors involved in the regional value chain, as discussed in the preceding paragraph for the case of TBT measures.

On the other hand, for sectors not covered by existing or forthcoming MRAs and harmonization agreements, the opposite is true. TBT reduces imports at the sectoral level. This is further reinforced at the product level, where the negative estimates account for a greater percentage of the significant estimates than the positive estimates.

Table 12
Distribution and Summary, TBT Effect Estimates by Sector

SECTOR	B: TBT				
	OBS	POS	NEG	ZERO	ϕ^B
OVERALL	1,135,944 (55.21%)	515,698 (45.40%)	536,141 (47.20%)	84,105 (7.40%)	-2.50 (173.66)
Existing MRAs and Harmonization Agreements					
Electrical Machinery	68,364 (63.72%)	35,056 (51.28%)	30,342 (44.38%)	2,966 (4.34%)	3.50 (41.19)
Prepared Foodstuff	27,864 (41.17%)	7,639 (27.42%)	6,716 (24.10%)	13,509 (48.48%)	0.27 (6.84)
Medicinal Products	8,748 (54.00%)	4,222 (48.26%)	4,056 (46.36%)	470 (5.37%)	-28.58 (183.48)
Telecommunications	4,212 (46.80%)	2,476 (58.78%)	1,513 (35.92%)	223 (5.29%)	29.40 (81.40)
Cosmetics	14,580 (73.64%)	6,590 (45.20%)	6,132 (42.06%)	1,858 (12.74%)	-13.76 (71.15)
Medical Devices	4,536 (54.78%)	2,076 (45.77%)	1,739 (38.34%)	721 (15.90%)	18.39 (137.70)
Forthcoming MRAs and Harmonization Agreements					
Automotive	20,088 (60.65%)	9,266 (46.13%)	10,400 (51.77%)	422 (2.10%)	-5.88 (68.50)
Construction	196,668 (60.03%)	95,735 (48.68%)	90,351 (45.94%)	10,582 (5.38%)	10.90 (129.13)
No MRA or Harmonization Agreement					
Mineral fuels, oils, and waxes; bituminous substances (HS 27)	7,128 (45.00%)	2,036 (28.56%)	4,238 (59.46%)	854 (11.98%)	-49.82 (169.35)
Rubber (HS 40)	20,736 (64.72%)	7,683 (37.05%)	12,720 (61.34%)	333 (1.61%)	-11.46 (95.74)
Paper and paperboard (HS 48)	28,836 (72.16%)	11,248 (39.01%)	13,748 (47.68%)	3,840 (13.32%)	-6.09 (76.38)
Copper (HS 74)	7,776 (37.24%)	3,036 (39.04%)	4,740 (60.96%)	0 (0.00%)	-140.37 (324.31)
Nuclear reactors, boilers, machinery and mechanical appliances (HS 84)	121,500 (61.93%)	56,110 (46.18%)	57,109 (47.00%)	8,281 (6.82%)	-7.21 (91.31)
Pearls; Precious, Semi-precious stones; Precious metals; Jewellry; Coin (HS 71)	9,396 (51.18%)	3,728 (39.68%)	5,320 (56.62%)	348 (3.70%)	-106.43 (508.28)
Organic chemicals (HS 29)	64,152 (49.50%)	26,225 (40.88%)	32,388 (50.49%)	5,539 (8.63%)	-13.42 (233.64)
Optical, photographic, cinematographic instruments and apparatus (HS 90)	30,132 (61.54%)	14,723 (48.86%)	13,668 (45.36%)	1,741 (5.78%)	32.71 (215.54)
Animal or vegetable fats, oils, and waxes (HS 15)	7,452 (42.24%)	4,060 (54.48%)	2,268 (30.43%)	1,124 (15.08%)	58.39 (195.56)
OTHERS	493,776 (52.03%)	223,789 (45.32%)	238,693 (48.34%)	31,294 (6.34%)	1.67 (329.73)

Source: Authors' Calculations

Notes: Values in parentheses under the OBS column reflect the relevant ϕ^B estimates as a proportion all possible ϕ^B estimates. Values in parentheses under the POS/NEG/ZERO column reflect the relevant positive/negative/zero-value ϕ^B estimates as a proportion of OBS. Value in parentheses under ϕ^B column reflects the standard deviations.

Pre-Shipment Inspections

Among the NTM types, pre-shipment inspections appear to have a weak correlation with imports in almost all sectors, regardless of whether the sector is covered by MRAs or not. This is shown by the small percentage of significant estimates of $\phi^{C}_{nt,ij}$ of less than 50% (Table 13). Exceptions are foodstuff (55%), medicinal products (50%), and medical devices (59%).

However, when pre-shipment inspection significantly affects imports, the estimates of ϕ^{C} show that trade-enhancing effects are evident in foodstuff, telecommunications equipment, and automotive, whereas trade-reducing effects are shown in electronics, medicinal products, cosmetics, medical devices, construction materials, and in almost all the sectors not covered by existing and forthcoming MRAs.

Quantity Control Measures

The significant correlation between imports and quantity control measures is prevalent across all sectors, regardless of whether or not the sector is covered by MRAs and harmonization agreements. This is shown by the sectors' high percentage (40–70%) of significant estimates of $\phi^{E}_{nt,ij}$ (Table 14). Overall, the effect of the NTM measures is to distort trade, given the negative sign of $\boldsymbol{\phi^{E}}$.

However, at the sectoral level, the correlation is trade-enhancing for most sectors as supported by the positive sign of $\boldsymbol{\phi^{E}}$. This is contrary to expectations that the NTM tends to hinder imports. Although most quantity control measures are prohibited under GATT 1994, they can still be applied under the WTO's Agreement on Safeguards. A more detailed research on the nature of these NTM measures in these sectors is necessary to provide an explicit explanation of their positive effects on intra-ASEAN imports.

The trade-enhancing effects of quantity control measures are further strengthened at the product level, where there are existing MRAs and harmonization agreements. That is, in all these sectors, the proportion of significant estimates that are positive is greater than the negative coefficients. The same is true for automotive, which are covered by forthcoming MRAs.

Price Control Measures

Similar to quantity control measures, the findings support a strong correlation between imports and price control measures over all sectors. The proportion of estimates of $\phi^{F}_{nt,ij}$ that are significant ranges from a low of 49% to a high of 74% (Table 15).

Regardless of whether the sector is covered by MRAs or not, price control measures appear to hinder imports between ASEAN trading partners in all sectors, except foodstuff and telecommunications. This is shown by the negative sign of θ^{F} and the greater proportion of negative coefficients of $\theta^{F}_{nt,ij}$ in the sectors.

Table 13
Distribution and Summary, Pre-Shipment Inspection Effect Estimates by Sector

SECTOR	C: Pre-Shipment Inspections				
	OBS	POS	NEG	ZERO	ϕ^C
OVERALL	678,132 (32.96%)	299,272 (44.13%)	360,082 (53.10%)	18,778 (2.77%)	5.89 (361.74)
Existing MRAs and Harmonization Agreements					
Electrical Machinery	13,608 (12.68%)	5,091 (37.41%)	8,517 (62.59%)	0 (0.00%)	-31.27 (91.04)
Prepared Foodstuff	37,260 (55.05%)	17,054 (45.77%)	18,450 (49.52%)	1,756 (4.71%)	23.58 (198.71)
Medicinal Products	8,100 (50.00%)	3,157 (38.98%)	4,943 (61.02%)	0 (0.00%)	-42.20 (829.66)
Telecommunications	3,240 (36.00%)	2,030 (62.65%)	1,210 (37.35%)	0 (0.00%)	25.91 (49.74)
Cosmetics	6,804 (34.36%)	2,919 (42.90%)	3,885 (57.10%)	0 (0.00%)	-41.36 (149.49)
Medical Devices	4,860 (58.70%)	2,508 (51.60%)	2,352 (48.40%)	0 (0.00%)	-970.63 (5,300.54)
Forthcoming MRAs and Harmonization Agreements					
Automotives	7,776 (23.48%)	3,581 (46.05%)	3,837 (49.34%)	358 (4.60%)	151.43 (794.71)
Construction	127,332 (38.87%)	49,529 (38.90%)	74,253 (58.31%)	3,550 (2.79%)	-17.49 (196.03)
No MRA or Harmonization Agreement					
Mineral fuels, oils, and waxes; bituminous substances (HS 27)	5,184 (32.73%)	2,215 (42.73%)	2,613 (50.41%)	356 (6.87%)	-408.13 (3,362.83)
Rubber (HS 40)	9,072 (28.31%)	2,562 (28.24%)	6,154 (67.84%)	356 (3.92%)	-93.45 (449.05)
Paper and paperboard (HS 48)	3,240 (8.11%)	1,666 (51.42%)	1,574 (48.58%)	0 (0.00%)	-300.03 (1,325.11)
Copper (HS 74)	972 (4.66%)	406 (41.77%)	566 (58.23%)	0 (0.00%)	-783.52 (1,246.61)
Nuclear reactors, boilers, machinery and mechanical appliances (HS 84)	23,976 (12.22%)	9,164 (38.22%)	12,666 (52.83%)	2,146 (8.95%)	-27.68 (183.28)
Pearls; Precious, Semi-precious stones; Precious metals; Jewellry; Coin (HS 71)	4,212 (22.94%)	2,219 (52.68%)	1,993 (47.32%)	0 (0.00%)	633.62 (1,665.62)
Organic chemicals (HS 29)	62,532 (48.25%)	23,279 (37.23%)	39,253 (62.77%)	0 (0.00%)	-29.07 (316.24)
Optical, photographic, cinematographic instruments and apparatus (HS 90)	4,536 (9.26%)	1,800 (39.68%)	2,736 (60.32%)	0 (0.00%)	-9.00 (247.98)
Animal or vegetable fats, oils, and waxes (HS 15)	7,776 (44.08%)	3,261 (41.94%)	3,099 (39.85%)	1,416 (18.21%)	130.30 (623.98)
OTHERS	347,652 (36.64%)	166,831 (47.99%)	171,981 (49.47%)	8,840 (2.54%)	31.89 (479.82)

Source: Authors' Calculations

Notes: Values in parentheses under the OBS column reflect the relevant ϕ^C estimates as a proportion all possible ϕ^C estimates. Values in parentheses under the POS/NEG/ZERO column reflect the relevant positive/negative/zero-value ϕ^C estimates as a proportion of OBS. Value in parentheses under ϕ^C column reflects the standard deviations.

Table 14
Distribution and Summary, Quantity Control Measure Effect Estimates by Sector

SECTOR	E: Quantity Control Measures				
	OBS	POS	NEG	ZERO	ϕ^E
OVERALL	1,177,092 (57.21%)	515,390 (43.79%)	598,308 (50.83%)	63,394 (5.39%)	-2.97 (130.45)
Existing MRAs and Harmonization Agreements					
Electrical Machinery	69,336 (64.63%)	35,291 (50.90%)	31,856 (45.94%)	2,189 (3.16%)	1.65 (50.44)
Prepared Foodstuff	48,600 (71.81%)	23,934 (49.25%)	22,174 (45.63%)	2,492 (5.13%)	5.93 (81.17)
Medicinal Products	7,128 (44.00%)	3,022 (42.40%)	2,666 (37.40%)	1,440 (20.20%)	16.42 (163.14)
Telecommunications	4,212 (46.80%)	2,970 (70.51%)	994 (23.60%)	248 (5.89%)	11.46 (37.00)
Cosmetics	14,256 (72.00%)	6,776 (47.53%)	6,687 (46.91%)	793 (5.56%)	-8.57 (99.66)
Medical Devices	4,212 (50.87%)	1,917 (45.51%)	1,599 (37.96%)	696 (16.52%)	99.23 (864.00)
Forthcoming MRAs and Harmonization Agreements					
Automotives	20,088 (60.65%)	10,845 (53.99%)	8,638 (43.00%)	605 (3.01%)	21.64 (103.02)
Construction	193,752 (59.14%)	70,689 (36.48%)	115,168 (59.44%)	7,895 (4.07%)	-9.97 (88.89)
No MRA or Harmonization Agreement					
Mineral fuels, oils, and waxes; bituminous substances (HS 27)	6,480 (40.91%)	2,376 (36.67%)	3,421 (52.79%)	683 (10.54%)	-2.95 (708.99)
Rubber (HS 40)	20,736 (64.72%)	9,493 (45.78%)	10,168 (49.04%)	1,075 (5.18%)	0.49 (100.11)
Paper and paperboard (HS 48)	25,920 (64.86%)	12,856 (49.60%)	11,274 (43.50%)	1,790 (6.91%)	11.10 (162.43)
Copper (HS 74)	11,340 (54.31%)	4,365 (38.49%)	6,616 (58.34%)	359 (3.17%)	-40.29 (303.81)
Nuclear reactors, boilers, machinery and mechanical appliances (HS 84)	127,656 (65.06%)	61,193 (47.94%)	60,791 (47.62%)	5,672 (4.44%)	5.88 (48.74)
Pearls; Precious, Semi-precious stones; Precious metals; Jewellry; Coin (HS 71)	8,748 (47.65%)	4,843 (55.36%)	3,905 (44.64%)	0 (0.00%)	157.21 (476.41)
Organic chemicals (HS 29)	57,996 (44.75%)	27,495 (47.41%)	28,255 (48.72%)	2,246 (3.87%)	-37.84 (489.34)
Optical, photographic, cinematographic instruments and apparatus (HS 90)	30,132 (61.54%)	14,005 (46.48%)	14,511 (48.16%)	1,616 (5.36%)	6.02 (95.11)
Animal or vegetable fats, oils, and waxes (HS 15)	8,748 (49.59%)	4,150 (47.44%)	3,712 (42.43%)	886 (10.13%)	31.15 (267.62)
OTHERS	517,752 (54.56%)	219,170 (42.33%)	265,873 (51.35%)	32,709 (6.32%)	-4.64 (178.32)

Source: Authors' Calculations

Notes: Values in parentheses under the OBS column reflect the relevant ϕ^E estimates as a proportion all possible ϕ^E estimates. Values in parentheses under the POS/NEG/ZERO column reflect the relevant positive/negative/zero-value ϕ^E estimates as a proportion of OBS. Value in parentheses under ϕ^E column reflects the standard deviations.

Table 15
Distribution and Summary, Price Control Measure Effect Estimates by Sector

SECTOR	F: Price Control Measures				
	OBS	POS	NEG	ZERO	ϕ^F
OVERALL	1,150,848 (55.94%)	493,453 (42.88%)	586,771 (50.99%)	70,624 (6.14%)	-26.95 (503.68)
Existing MRAs and Harmonization Agreements					
Electrical Machinery	57,348 (53.46%)	29,623 (51.65%)	25,379 (44.25%)	2,346 (4.09%)	-8.78 (159.14)
Prepared Foodstuff	46,332 (68.46%)	22,385 (48.31%)	20,169 (43.53%)	3,778 (8.15%)	6.21 (50.77)
Medicinal Products	9,720 (60.00%)	5,081 (52.27%)	4,639 (47.73%)	0 (0.00%)	-193.17 (766.96)
Telecommunications	4,536 (50.40%)	2,291 (50.51%)	1,922 (42.37%)	323 (7.12%)	7.81 (69.31)
Cosmetics	14,580 (73.64%)	5,681 (38.96%)	7,593 (52.08%)	1,306 (8.96%)	-43.83 (252.35)
Medical Devices	5,184 (62.61%)	2,236 (43.13%)	2,948 (56.87%)	0 (0.00%)	-18.49 (87.42)
Forthcoming MRAs and Harmonization Agreements					
Automotives	18,792 (56.74%)	8,144 (43.34%)	8,647 (46.01%)	2,001 (10.65%)	-20.32 (97.96)
Construction	178,524 (54.49%)	65,088 (36.46%)	99,952 (55.99%)	13,484 (7.55%)	-74.88 (563.18)
No MRA or Harmonization Agreement					
Mineral fuels, oils, and waxes; bituminous substances (HS 27)	7,776 (49.09%)	3,291 (42.32%)	4,191 (53.90%)	294 (3.78%)	-313.47 (1,734.11)
Rubber (HS 40)	15,228 (47.53%)	4,591 (30.15%)	9,269 (60.87%)	1,368 (8.98%)	-101.08 (515.61)
Paper and paperboard (HS 48)	25,272 (63.24%)	9,457 (37.42%)	14,789 (58.52%)	1,026 (4.06%)	-127.74 (1,314.00)
Copper (HS 74)	10,692 (51.21%)	2,293 (21.45%)	7,715 (72.16%)	684 (6.40%)	-329.47 (1,084.94)
Nuclear reactors, boilers, machinery and mechanical appliances (HS 84)	117,936 (60.11%)	51,687 (43.83%)	55,575 (47.12%)	10,674 (9.05%)	38.02 (471.54)
Pearls; Precious, Semi-precious stones; Precious metals; Jewellry; Coin (HS 71)	10,044 (54.71%)	4,877 (48.56%)	4,825 (48.04%)	342 (3.41%)	-34.37 (754.49)
Organic chemicals (HS 29)	67,716 (52.25%)	24,127 (35.63%)	41,949 (61.95%)	1,640 (2.42%)	-193.10 (1,058.91)
Optical, photographic, cinematographic instruments and apparatus (HS 90)	34,344 (70.15%)	14,939 (43.50%)	17,140 (49.91%)	2,265 (6.60%)	16.23 (309.38)
Animal or vegetable fats, oils, and waxes (HS 15)	8,748 (49.59%)	4,256 (48.65%)	3,707 (42.38%)	785 (8.97%)	-9.50 (96.93)
OTHERS	518,076 (54.59%)	233,406 (45.05%)	256,362 (49.48%)	28,308 (5.46%)	-4.19 (592.20)

Source: Authors' Calculations

Notes: Values in parentheses under the OBS column reflect the relevant ϕ^F estimates as a proportion all possible ϕ^F estimates. Values in parentheses under the POS/NEG/ZERO column reflect the relevant positive/negative/zero-value ϕ^F estimates as a proportion of OBS. Value in parentheses under ϕ^F column reflects the standard deviations.

Impact of NTMs on ASEAN Importer-Exporter pairs

Although the preceding section discusses the variations in the impact of NTMs at the sectoral level, this section discusses the effect of NTMs across ASEAN importer-exporter pairs. The effect of an NTM type for each pair is reported as the average of the significant estimates of $\phi_{nt,ij}^{h}$ of products traded by each bilateral pair. The effects could also vary, depending on the characteristics of the country-pairs. These characteristics (economic size, comparative advantage variables, and regulatory distance) reflect the capacity of the exporters to meet the NTM requirements of the importers, and the capacity of the importers to implement their NTMs. The results are reported in Figure 16 to Figure 25 and Appendix Table 5 to Appendix Table 14. The means and standard deviations of $\phi_{nt,ij}^{h}$ for each importer-exporter pair and NTM type are shown in the Appendix tables. Similar with the previous section, the mean and standard deviations are taken and reported for the sample of $\phi_{nt,ij}^{h}$ per country-pair. The standard deviations, in particular, reflect the variation of $\phi_{nt,ij}^{h}$ from each other; these are not reflective of the standard deviations generated by the estimation process. As such, high variation is to be expected, given that the value of $\phi_{nt,ij}^{h}$ fluctuates greatly across NTM types and across tariff lines.[10]

To better understand the implications of the findings, the incidence of trade-enhancing to trade-reducing effects of each NTM type are normalized across country pairs. These results are shown in Figure 16 to Figure 25. Each point in the graphs refer to the mean $\phi_{nt,ij}^{h}$ per importer-exporter and the NTM incidence.[11] A point lying on Quadrant I (upper right) means that the average $\phi_{nt,ij}^{h}$ is positive and there are more trade-enhancing than trade-reducing effects under the importer-exporter pair. Quadrant II (upper left) means that the average $\phi_{nt,ij}^{h}$ is positive but the trade-enhancing effects are less than the trade-reducing effects. Quadrant III (lower left) means a negative $\phi_{nt,ij}^{h}$ and the trade-reducing effects are less than the trade-enhancing effects. Finally, Quadrant IV (lower right) means that although the average $\phi_{nt,ij}^{h}$ is negative, there are more trade-enhancing effects than trade-reducing effects.

Sanitary and Phytosanitary (SPS)

The estimates of $\phi_{nt,ij}^{A}$ are shown in Appendix Table 5 for overall and Appendix Table 6 for products covered by existing MRAs and harmonization agreements. Both tables show negative estimates across most ASEAN trading partners. This means that SPS measures of AMS decrease their imports from their ASEAN trading partners. A few exceptions exist at the overall level. For Cambodia and Laos, SPS expands imports from all ASEAN trading partners except Brunei, Singapore, and Vietnam. For Brunei, the country's imports also rise, except those coming from Myanmar, the Philippines, Singapore, and Vietnam. However, it is interesting to note that two

[10] For example, the value of $\phi_{nt,ij}^{h}$ for SPS measures may differ greatly when computed for agricultural products than for non-agricultural products – when those are aggregated at the country-level, then that variation becomes apparent. The same goes for all other NTM types.

[11] $Incidence = \frac{POS}{POS+NEG} - 0.5$ where POS and NEG refer to the number of significant estimates with positive and negative signs, respectively.

ASEAN exporters, Thailand and Malaysia, stand out as being favored by the SPS of all their bilateral partners, except each other.

The negative effect of SPS on imports is further shown in Figure 16 and Figure 17. The NTM is generally trade-reducing. Nonetheless, for products covered by MRAs and harmonization agreements, SPS has more trade-enhancing effects than trade-reducing effects for some of the importer-exporter pairs. These include imports of Brunei, Cambodia, Laos, Myanmar, and Singapore from some of the bilateral partners. This means that for these AMS, there are more product lines where their SPS measures enhance their imports as compared to products where SPS reduces their imports.

Figure 16
Average $\phi^{A}_{nt,ij}$ by Country-Pair, Sanitary and Phytosanitary Measures (A), Overall

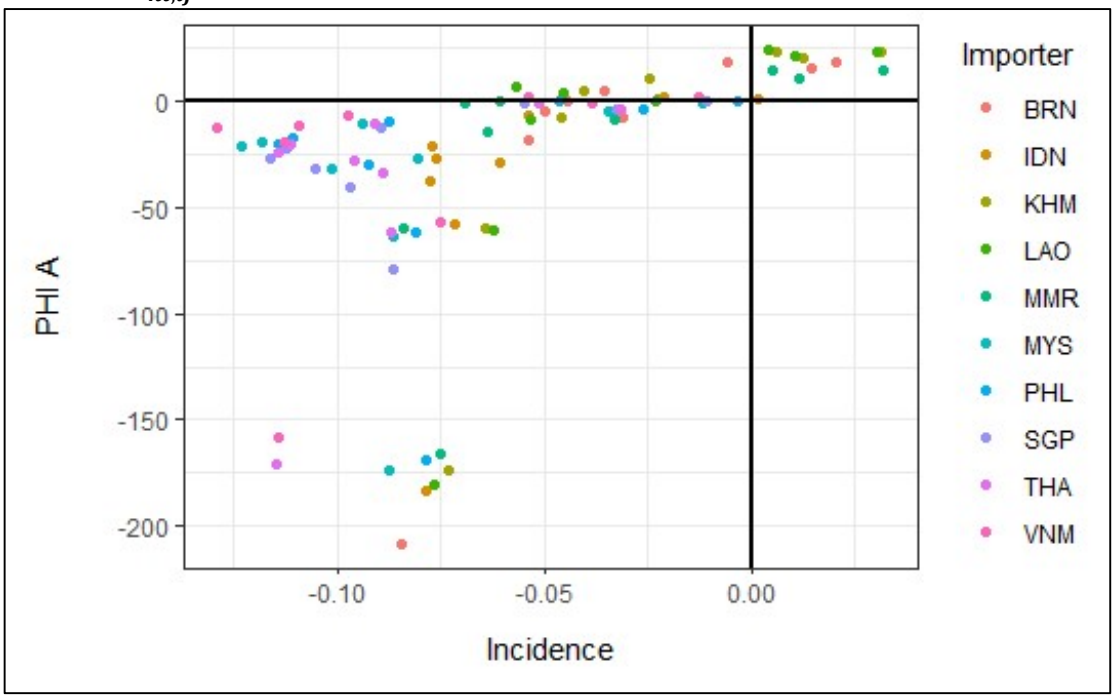
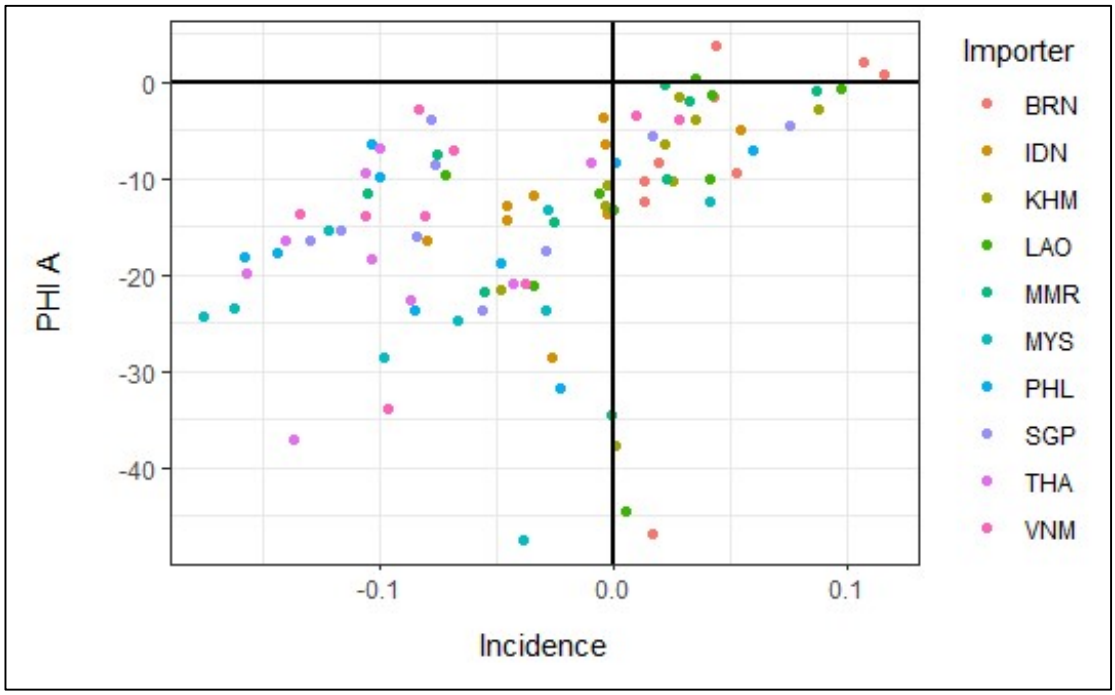


Figure 17
Average $\phi^{A}_{nt,ij}$ by Country-Pair, Sanitary and Phytosanitary Measures (A), With Existing MRA



Technical Barriers to Trade (TBT)

The estimates of $\phi^{B}_{nt,ij}$ in Appendix Table 7 show the impact of TBT on overall imports. TBT hinders imports of all AMS, except Singapore and Brunei. This finding is further supported by Figure 18. For Brunei and Singapore, the average effect of TBT is not only positive, but it is also trade-enhancing for each of their trading partners. Although TBT is a deterrent for the imports of the other AMS, a few bilateral partners show more trade-enhancing effects than trade-reducing effects. These include imports of Indonesia and Vietnam from some of their trading partners. This means that product lines where TBT showed positive effects on imports are greater than product lines that are adversely affected by the NTM.

In contrast, for products under MRAs and harmonization agreements, TBT measures enhance imports of all AMS, except Cambodia, Laos, and Myanmar, from some of their trading partners. This is shown by the positive average estimate of $\phi^{B}_{nt,ij}$ in Appendix Table 8 and Figure 19. However, even for Cambodia, Laos, and Myanmar, where the average effect is negative, the trade-reducing effects appear less prevalent than the trade-enhancing effects for most of their trading partners. This means that for these three countries, there are more product lines where TBT enhances their imports with their trading partners compared to products where the NTM reduces their imports.

Figure 18
Average $\phi^{B}_{nt,ij}$ by Country-Pair, Technical Barriers to Trade (B), Overall

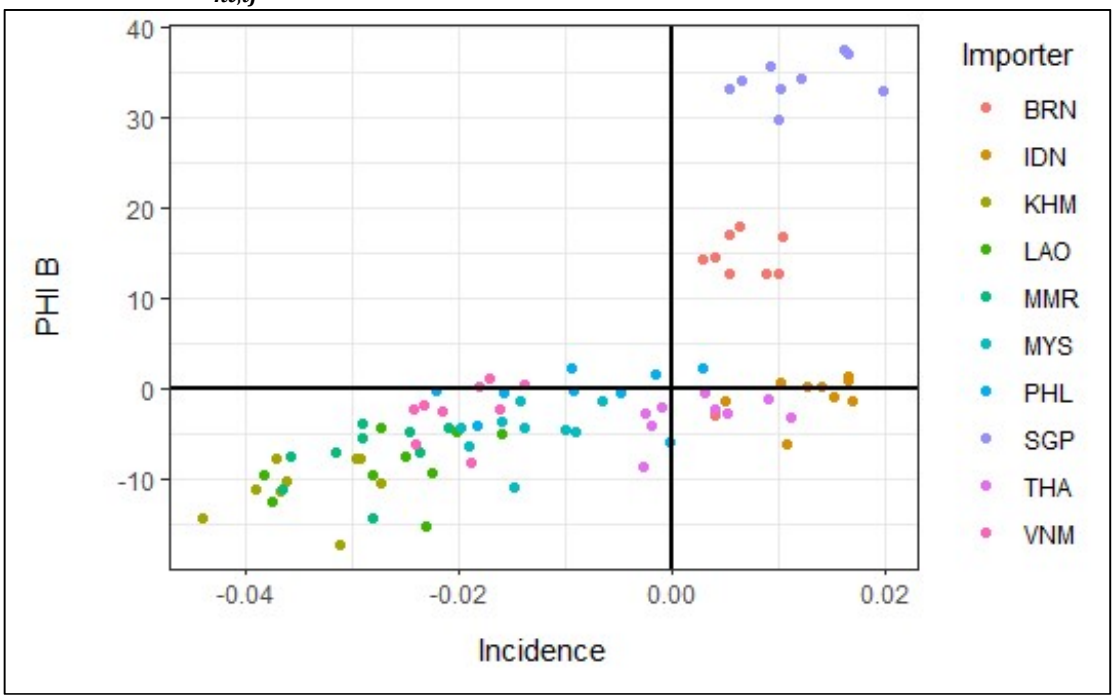
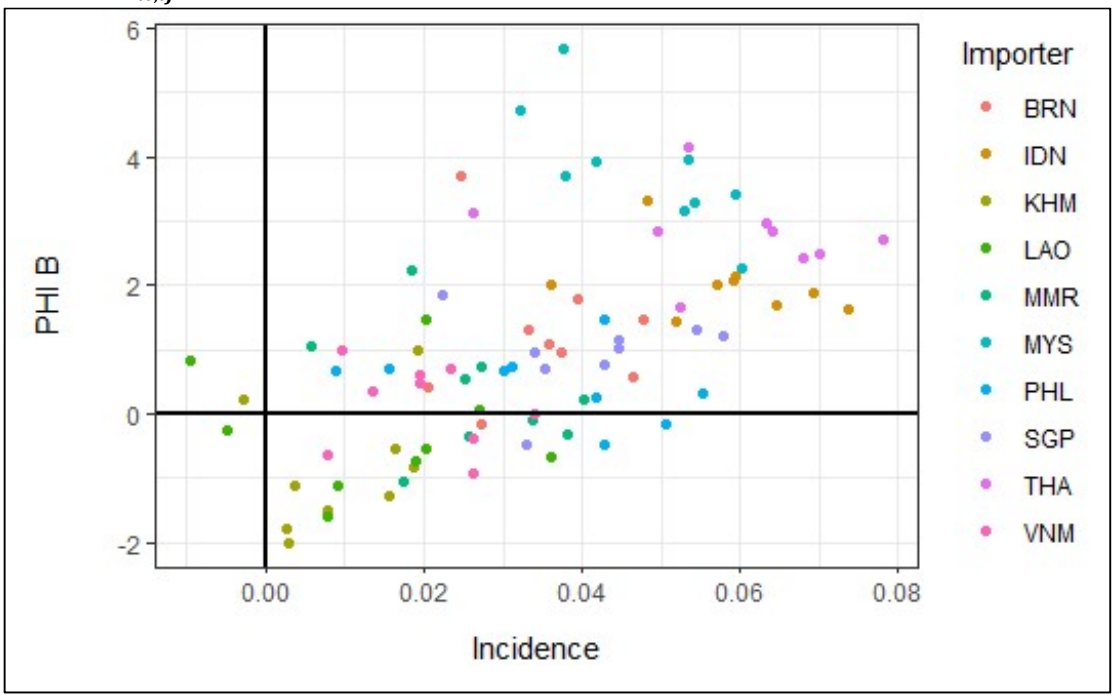


Figure 19
Average $\phi^{B}_{nt,ij}$ by Country-Pair, Technical Barriers to Trade (B), With Existing MRA



Pre-Shipment Inspections

The estimates of $\phi^{C}_{nt,ij}$ in Appendix Table 9 show a positive average impact of pre-shipment inspection on imports between most of the overall trading partners. However, the trade-enhancing effects appear less prevalent than the trade-reducing effects across all trading partners, as shown in Figure 20. That is, there are more products where the effect of the NTM on their trading partners is negative compared to those with positive effects.

For products covered by MRAs and harmonization agreements, the effect of pre-shipment inspection on imports is also favorable but only for the trading partners of Brunei and Singapore and for some partners of Laos and the Philippines (Appendix Table 10). The NTM measures of Brunei are more trade-enhancing rather than trade-reducing (Figure 21). This is also true for the Philippines and Laos for their imports from Singapore. Furthermore, although the average effect of the NTM remains to be negative for all the trading partners of Thailand, Figure 21 shows that, for two of its trading partners, there are more products lines where the effect of the NTM is to enhance imports.

Figure 20
Average $\phi^{C}_{nt,ij}$ by Country-Pair, Pre-Shipment Inspections (C), Overall

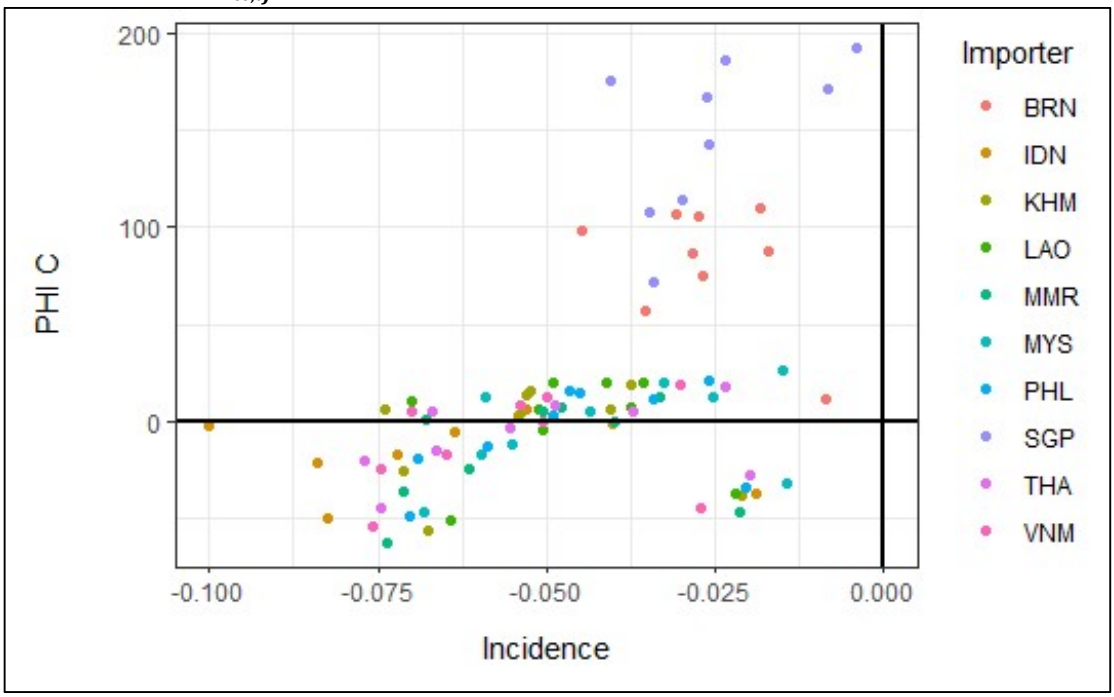
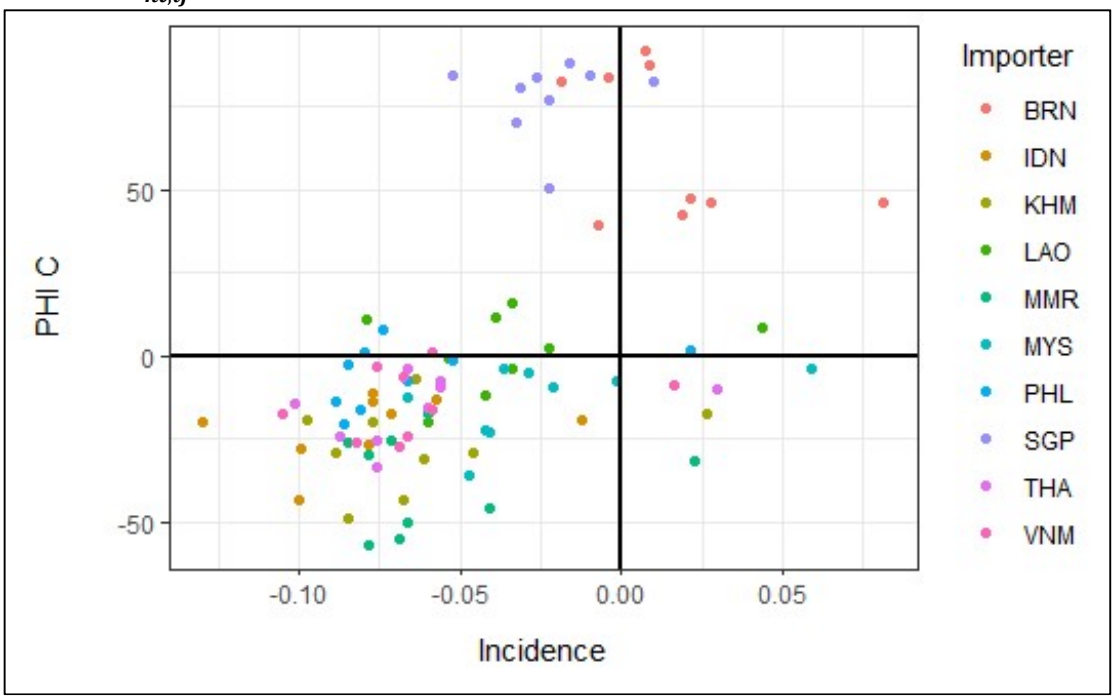


Figure 21
Average $\phi^{C}_{nt,ij}$ by Country-Pair, Pre-Shipment Inspections (C), With Existing MRA



Quantity Control Measures

The estimates of $\phi^{E}_{nt,ij}$ in Appendix Table 11 show the impact of quantity control measures on overall imports. Except for Singapore and Brunei, the effect of the NTM is to hinder imports. However, although the average effect on Singapore and Brunei is positive, the NTM is more trade-reducing than trade-enhancing in these two countries at the individual product level. This is evident from Figure 22. This implies that, for all the bilateral partners of Brunei and Singapore, there are more product lines where the NTM restrain their imports. The effect of the NTM on imports from Malaysia is also positive for all the AMS, except Myanmar. However, in contrast to Singapore and Brunei, the effect is more trade-enhancing than trade-reducing, as shown in Figure 22.

For products covered by MRAs and harmonization agreements, the effect of quantity control measures is to expand imports across most of the bilateral pairs. This can be seen from the positive sign of $\phi^{E}_{nt,ij}$ in Appendix Table 12. This is also reflected in Figure 23, where the impact is more trade-enhancing compared to trade-reducing effects.

Figure 22
Average $\phi^{E}_{nt,ij}$ by Country-Pair, Quantity Control Measures (E), Overall

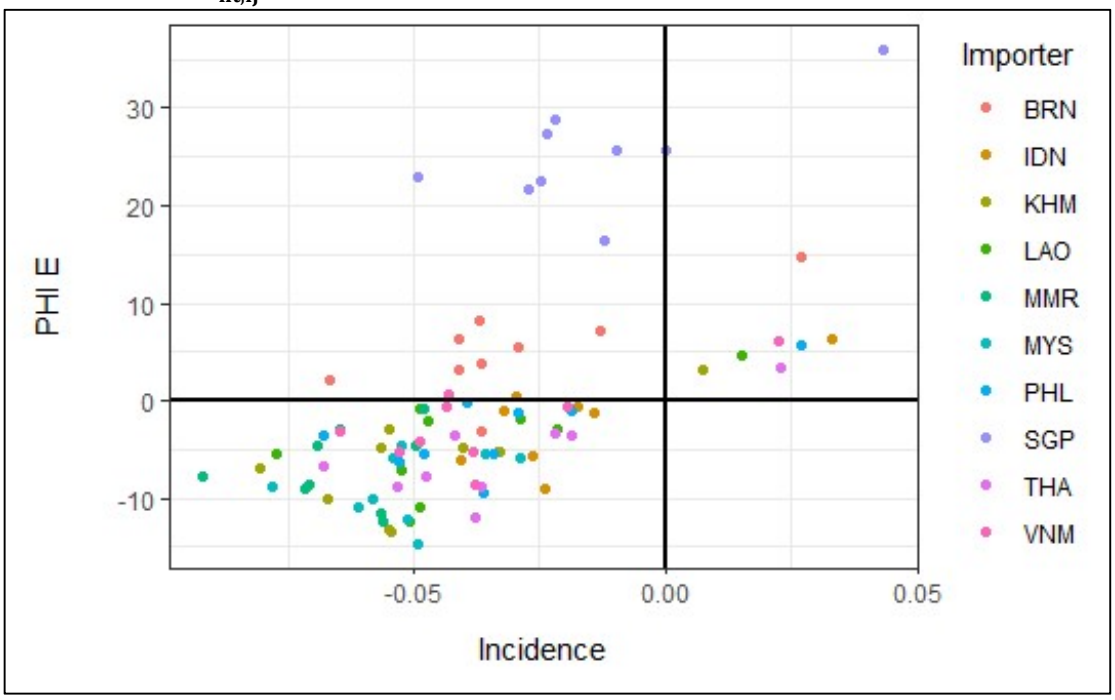
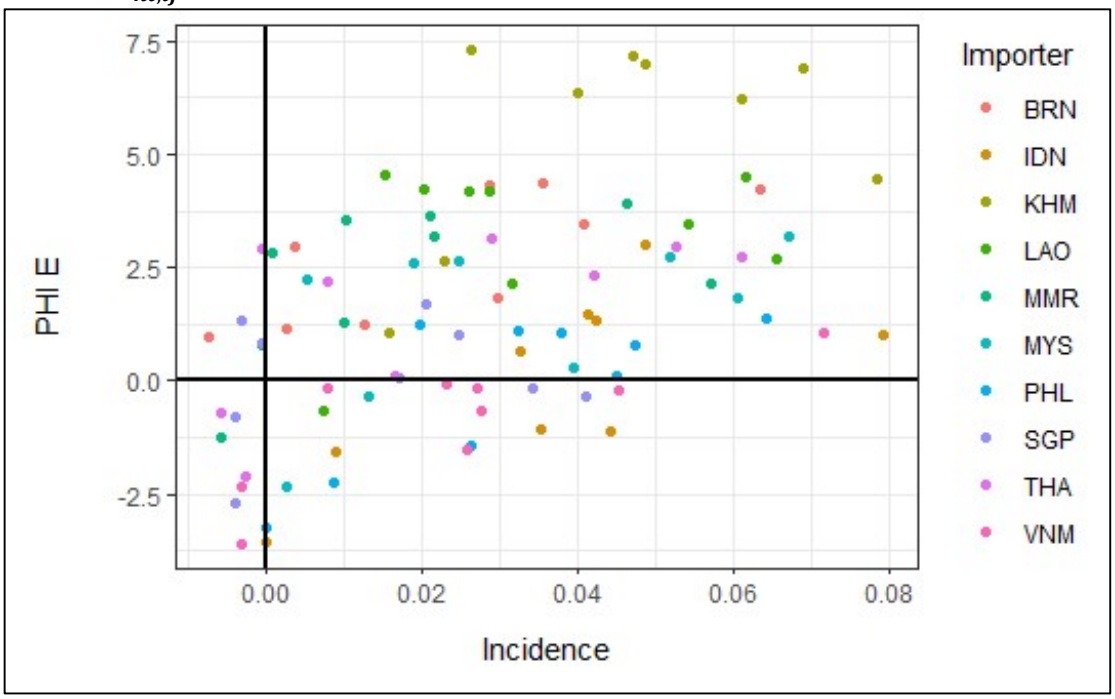


Figure 23
Average $\phi^{E}_{nt,ij}$ by Country-Pair, Quantity Control Measures (E), With Existing MRA



Price Control Measures

Overall, the effect of price control measures is to hinder imports of the AMS from each other, as shown by the negative sign of $\phi^{F}_{nt,ij}$ in Appendix Table 12 and Figure 24. Exceptions are Singapore and Brunei, where the NTM favors imports from all their trading partners, and Cambodia and Laos for some of their trading partners.

On the other hand, for products covered by existing MRAs and harmonization agreements, price control measures appear to strengthen imports across most of the bilateral partners (Appedix Table 14). As shown in Figure 25, the effects are also more trade-enhancing, even for bilateral pairs where the average effect is negative.

Figure 24
Average $\phi^{F}_{nt,ij}$ by Country-Pair, Price Control Measures (F), Overall

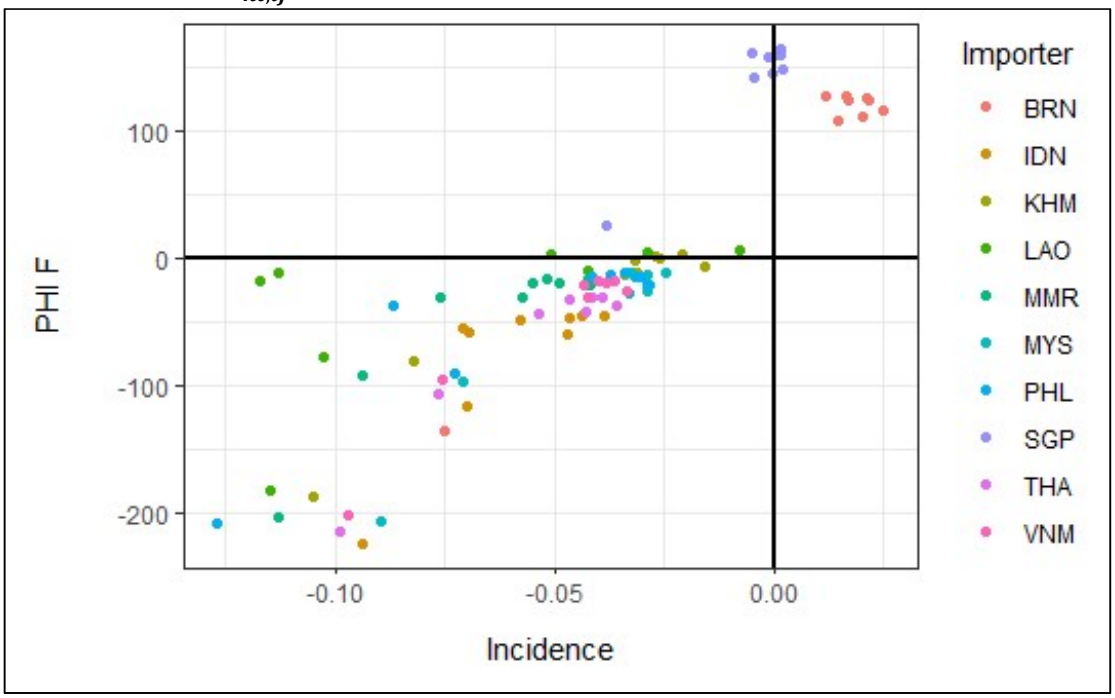
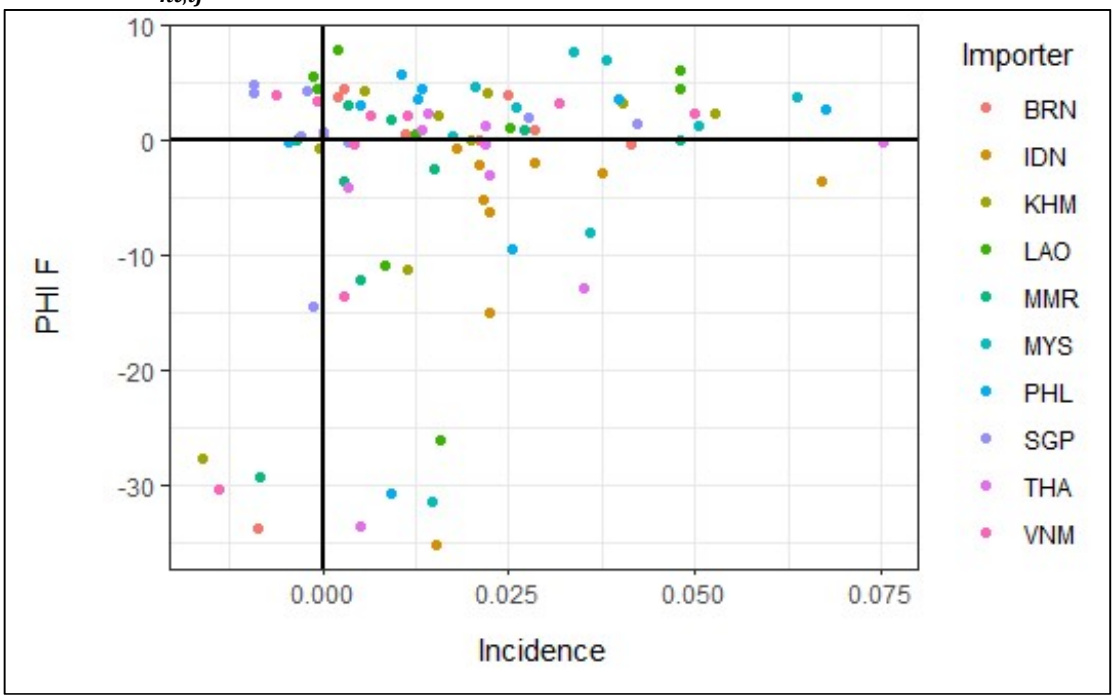


Figure 25
Average $\phi^{F}_{nt,ij}$ by Country-Pair, Price Control Measures (F), With Existing MRA



Effects of NTMs and MRAs and Harmonization Agreements

A comparison of the effects of NTMs on imports across all products classified by MRA status can be seen from Figure 26 to Figure 30. Strengthening the findings earlier on the impact of NTMs at the sectoral level and importer-exporter pairs, the evidence from the figures shows that the five NTM types are generally trade-enhancing for products covered by existing MRAs and harmonization agreements compared to products that are not covered by such agreements (forthcoming or none). This is most pronounced with TBT (Figure 27), quantity control measures (Figure 29), and price control measures (Figure 30). For products covered by existing agreements, the average effect is positive for most importer-exporter pairs, and the proportion of products with positive effects is greater than those with negative effects. This could imply that agreements by the AMS to mutually recognize and harmonize their NTMs may have increased the similarity, if not uniformity, of their NTM measures, and thus, are more likely to enable exporters to meet the NTM requirements of importers.

Figure 27 further confirms the earlier discussion on the impact of TBT for products to be covered by forthcoming MRAs and harmonization agreements. The figure shows a mixture of positive and more trade-enhancing effects as well as negative and more trade-reducing effects. The former is true for construction materials and the latter for automotive products. Thus, for construction materials, the forthcoming agreements should be designed in a way that will further enhance the existing favorable effects of TBT measures in this sector.

Figure 26
Average $\phi^{A}_{nt,ij}$ by MRA Status, (Sanitary and Phytosanitary Measures (A)

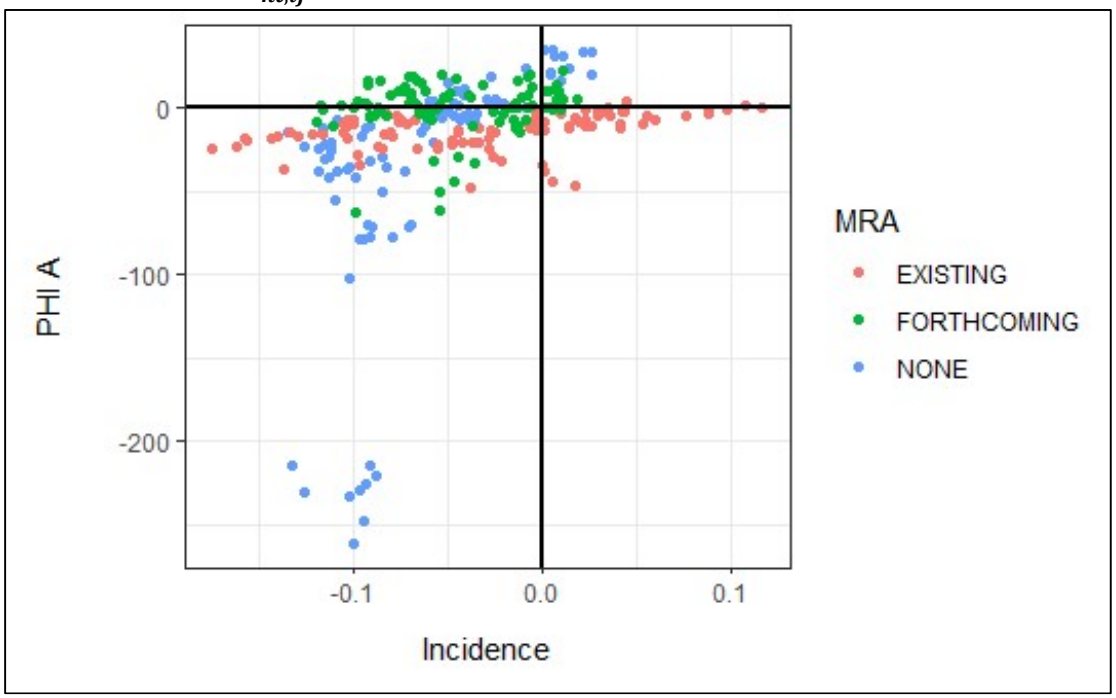


Figure 27
Average $\phi^{B}_{nt,ij}$ by MRA Status, Technical Barriers to Trade (B)

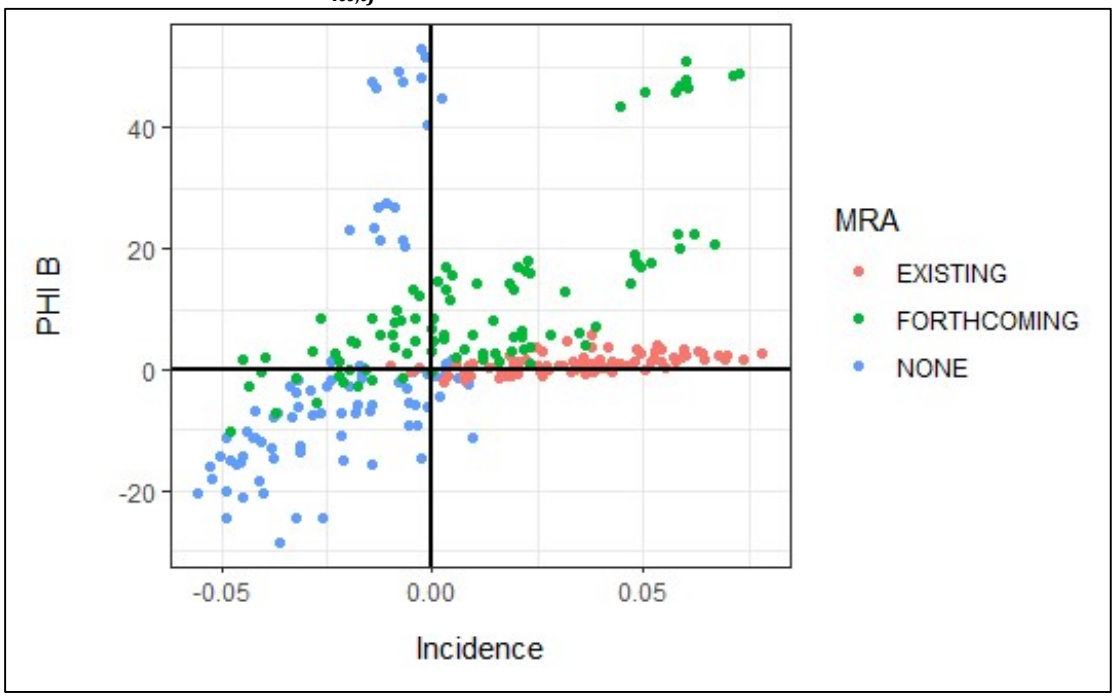


Figure 28
Average $\phi^{C}_{nt,ij}$ by MRA Status, Pre-Shipment Inspections (C)

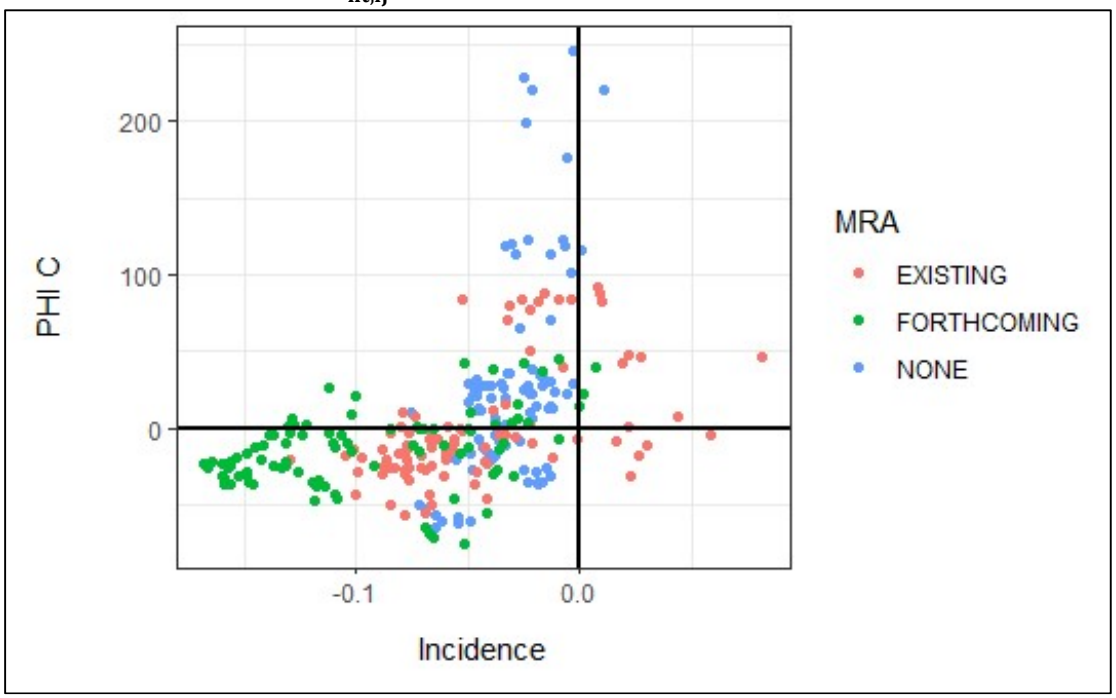


Figure 29
Average $\phi^{E}_{nt,ij}$ by MRA Status, Quantity Control Measures (E)

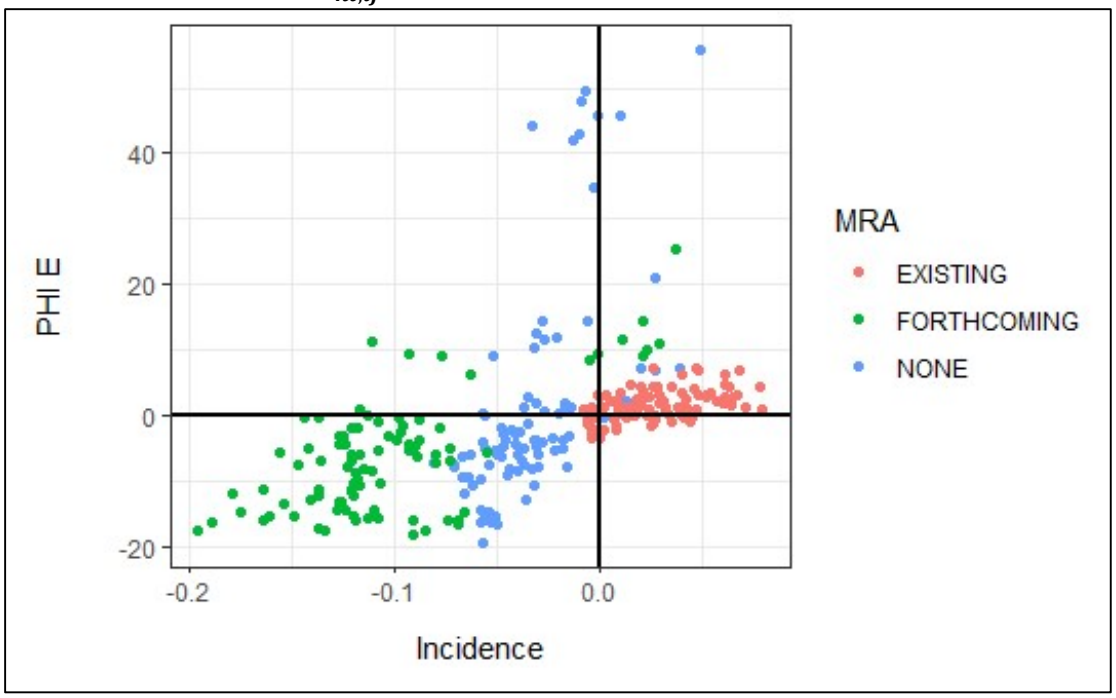
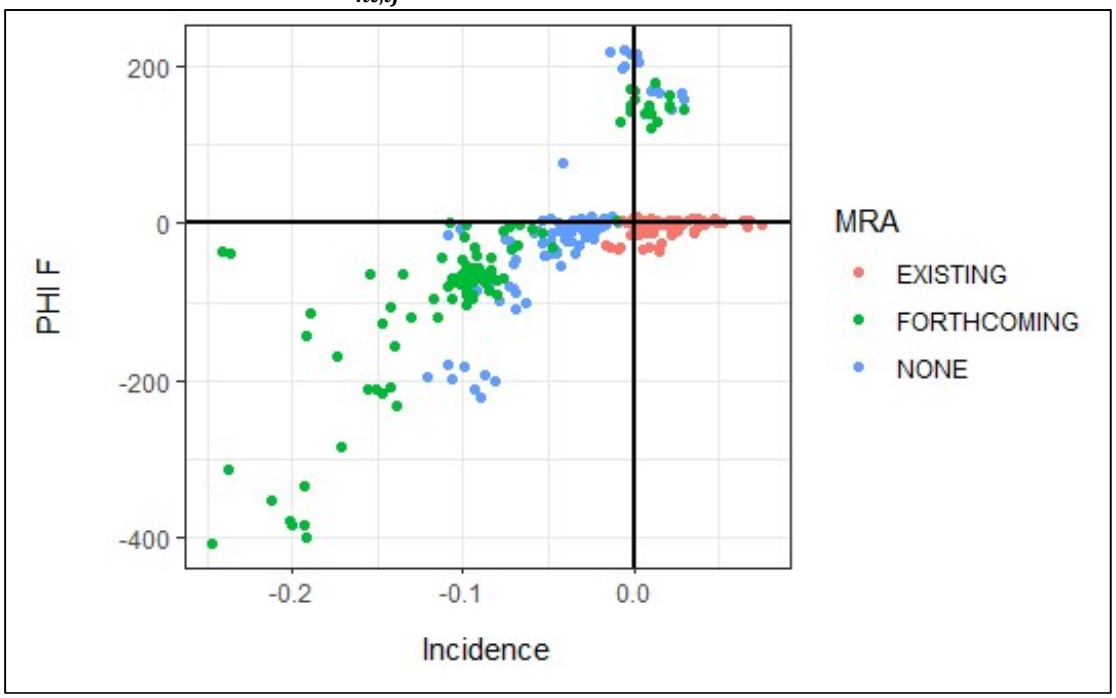


Figure 30
Average $\phi^{F}_{nt,ij}$ by MRA Status, Price Control Measures (F))



Effect of Regulatory Distance on the impact of NTMs on ASEAN Importer-Exporter Pairs

The effects of an NTM type on imports, which are attributable to the regulatory distance (RD) between importer-exporter pairs, can be estimated from Equation (9). That is, the estimate of $\phi^{h,RD}_{nt,ij} RD^{h}_{t,ij}$ is the component of the equation that accounts for the contribution of regulatory distance on the effects of an NTM type to imports. The estimate is also symmetric for each bilateral pair for each NTM type. For example, the estimate for Thailand-Singapore is the same for Singapore-Thailand.

The estimates for SPS ($\phi^{A,RD}_{nt,ij} RD^{A}_{t,ij}$) and TBT ($\phi^{B,RD}_{nt,ij} RD^{B}_{t,ij}$) are positive for almost all bilateral partners and those covered by MRAs and harmonization agreements (Appendix Table 15 to Appendix Table 18). This means that regulatory distance on SPS and TBT measures between bilateral pairs increases imports, regardless of the average effect of the NTMs on imports. This implies that in cases when the average effect of SPS and TBT on imports is negative, regulatory distance lessens the negative effects.

As shown in Figure 31 to Figure 34, these effects are also more trade-enhancing than trade-reducing, implying that there are more products traded between the bilateral partners where regulatory distance increases imports compared to products adversely affected by it. Furthermore, the trade-enhancing effect is higher when there are MRAs and harmonization agreements, as could be seen from Figure 32 for SPS and Figure 34 for TBT. This finding strengthens earlier discussions

on the likely effects of MRAs and harmonization agreements in enhancing imports between bilateral partners.

Figure 31

Average $\phi_{nt,ij}^{A,RD} RD_{t,ij}^{A}$ by Country-Pair, Sanitary and Phytosanitary Measures (A), Overall

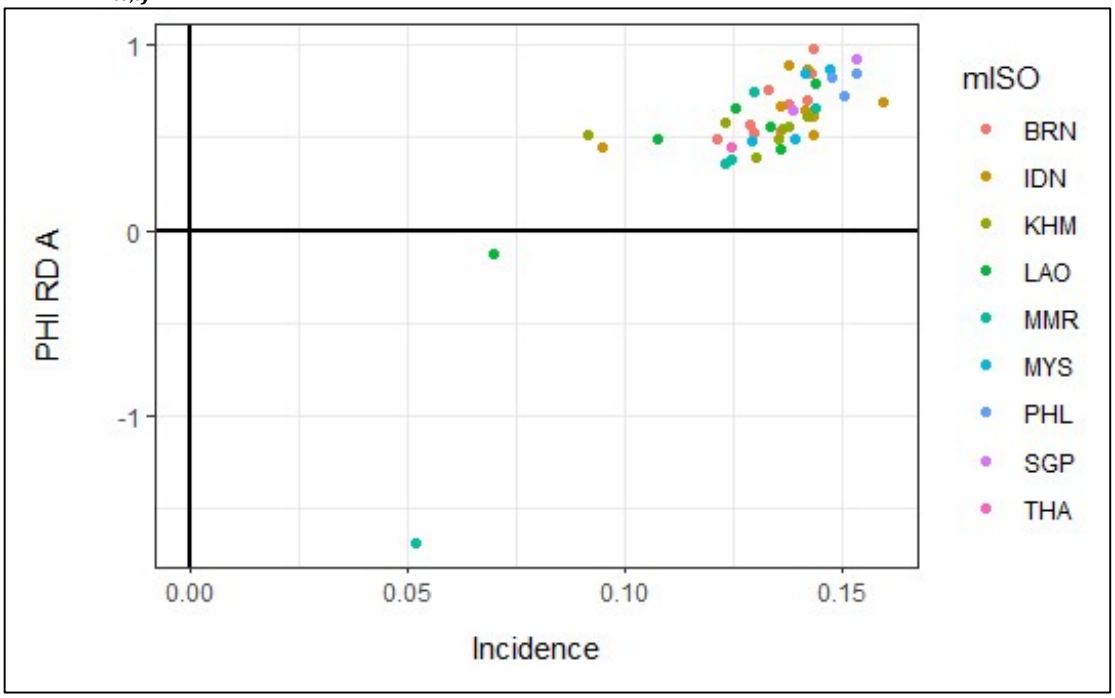


Figure 32
Average $\phi^{A,RD}_{nt,ij} RD^{A}_{t,ij}$ by Country-Pair, Sanitary and Phytosanitary Measures (A), With Existing MRA

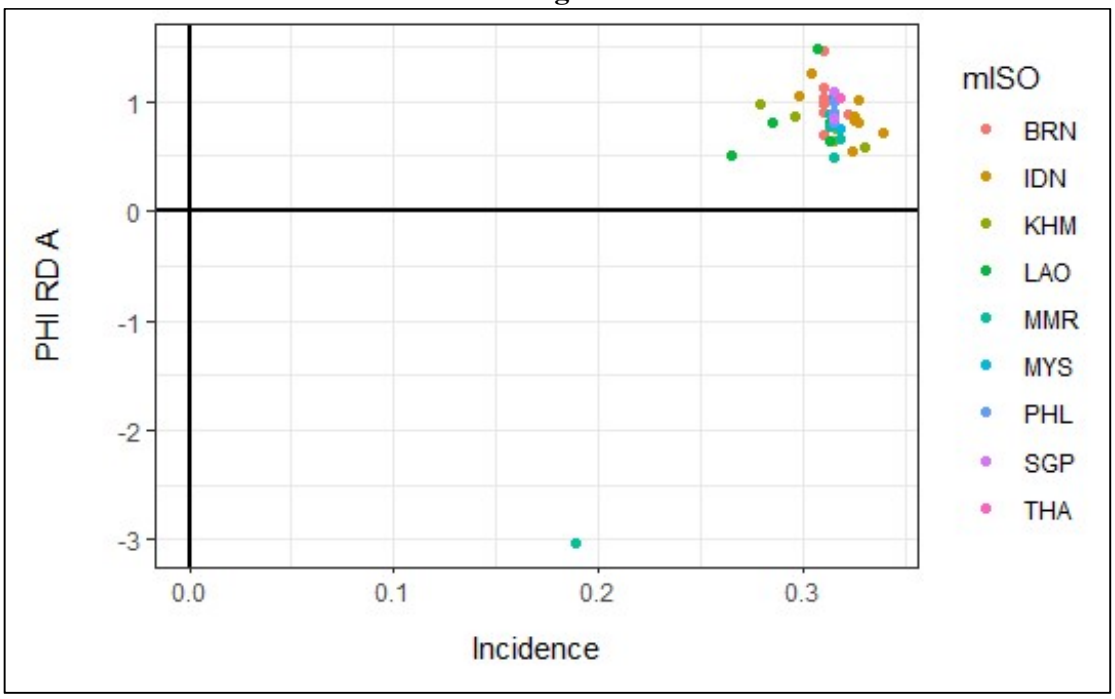


Figure 33
Average $\phi^{B,RD}_{nt,ij} RD^{B}_{t,ij}$ by Country-Pair, Technical Barriers to Trade (B), Overall

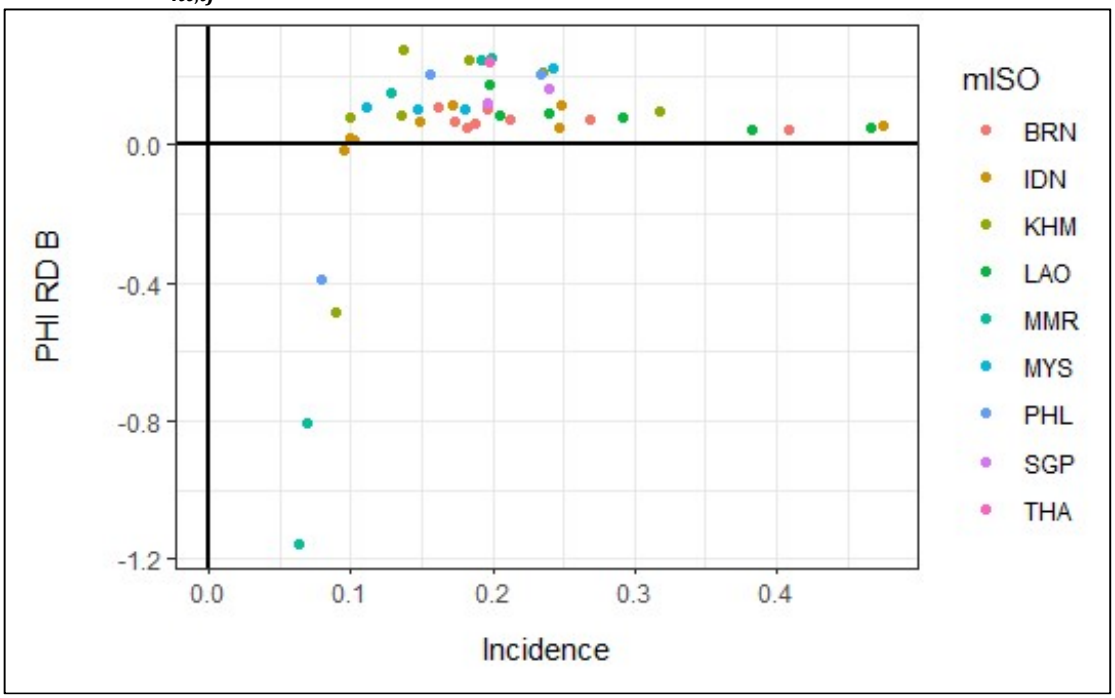
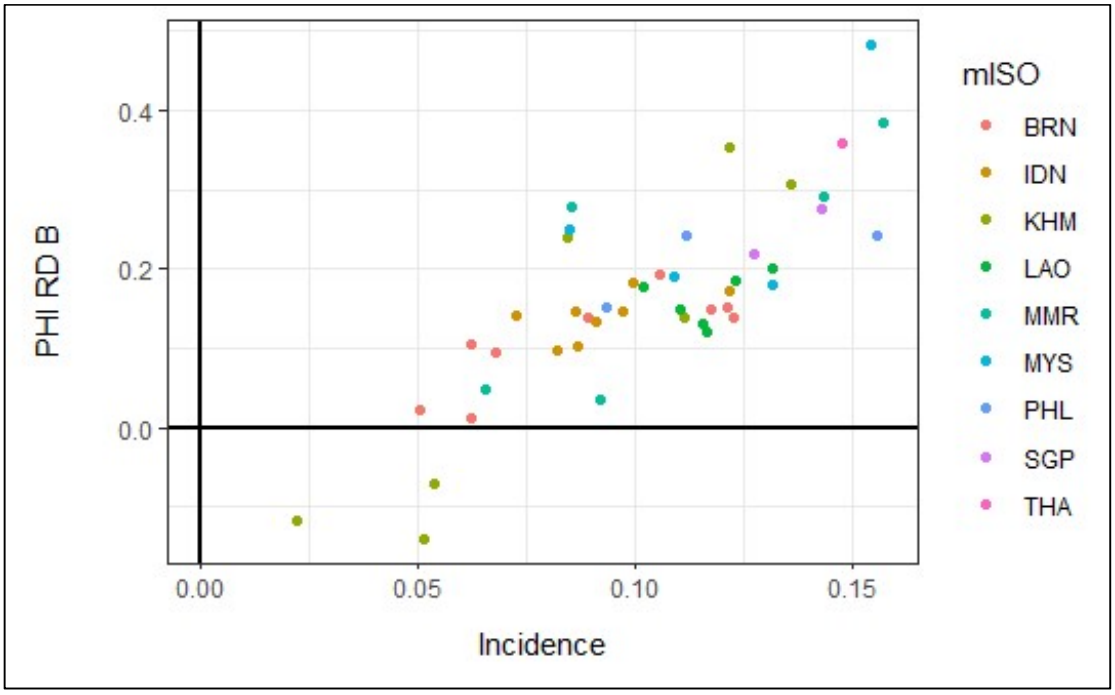


Figure 34
Average $\phi^{B,RD}_{nt,ij} RD^{B}_{t,ij}$ by Country-Pair, Technical Barriers to Trade (B), With Existing MRA



For pre-shipment inspection, the estimates of $\phi^{C,RD}_{nt,ij} RD^{C}_{t,ij}$ are zero for almost all trading partners, except for a few bilateral partners where the sign is negative (Appendix Table 19, Appendix Table 20, Figure 35, and Figure 36). This means that regulatory distance on pre-shipment inspection neither increases nor decreases the imports of bilateral pairs from each other. But when it does, the effect is to reduce imports.

For quantity control measures and price control measures, the estimates of $\phi^{E,RD}_{nt,ij} RD^{E}_{t,ij}$ and $\phi^{F,RD}_{nt,ij} RD^{F}_{t,ij}$ are negative and trade-reducing for most of the AMS, overall (Appendix Table 21 and Appendix Table 23). However, for products covered by MRAs and harmonization agreements, the trade-enhancing effects of regulatory distance between trading partners became dominant (Figure 38 and Figure 40).

Figure 35

Average $\phi_{nt,ij}^{C,RD} RD_{t,ij}^{C}$ by Country-Pair, Pre-Shipment Inspections (C), Overall

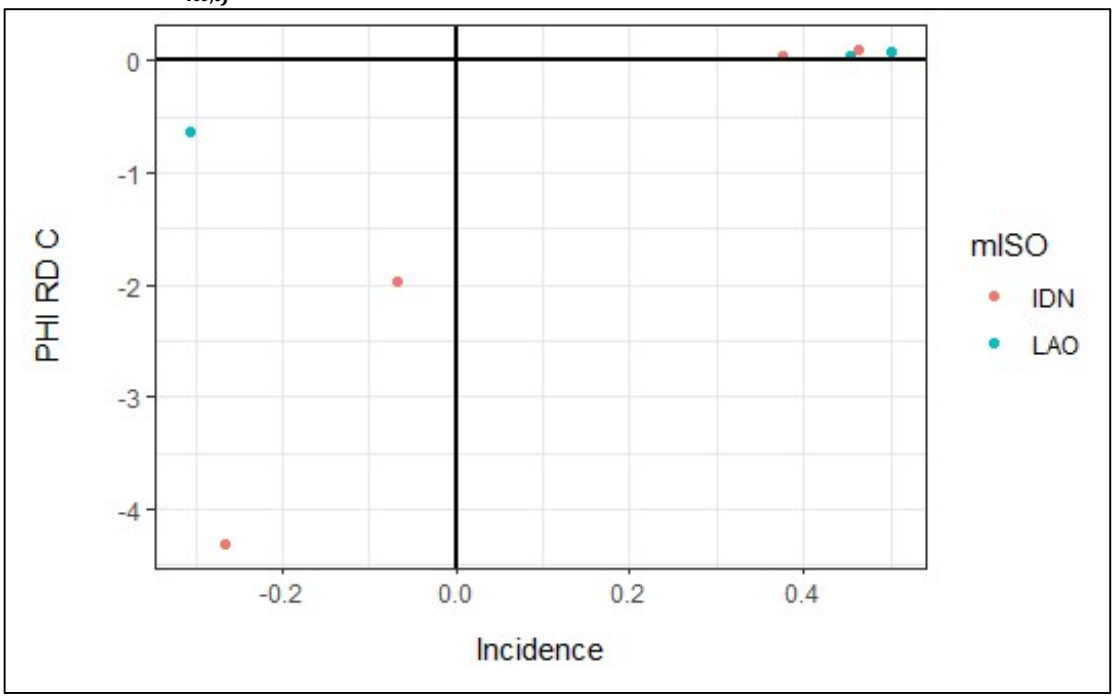


Figure 36

Average $\phi_{nt,ij}^{C,RD} RD_{t,ij}^{C}$ by Country-Pair, Pre-Shipment Inspections (C), With Existing MRA

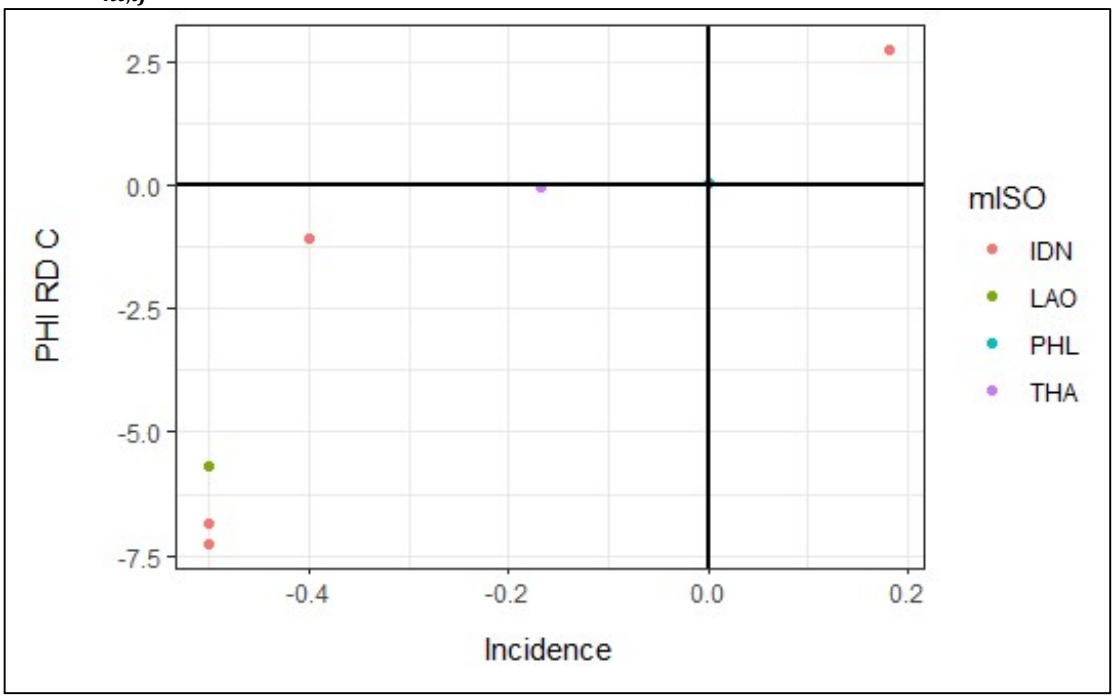


Figure 37
Average $\phi_{nt,ij}^{E,RD} RD_{t,ij}^{E}$ by Country-Pair, Quantity Control Measures (E), Overall

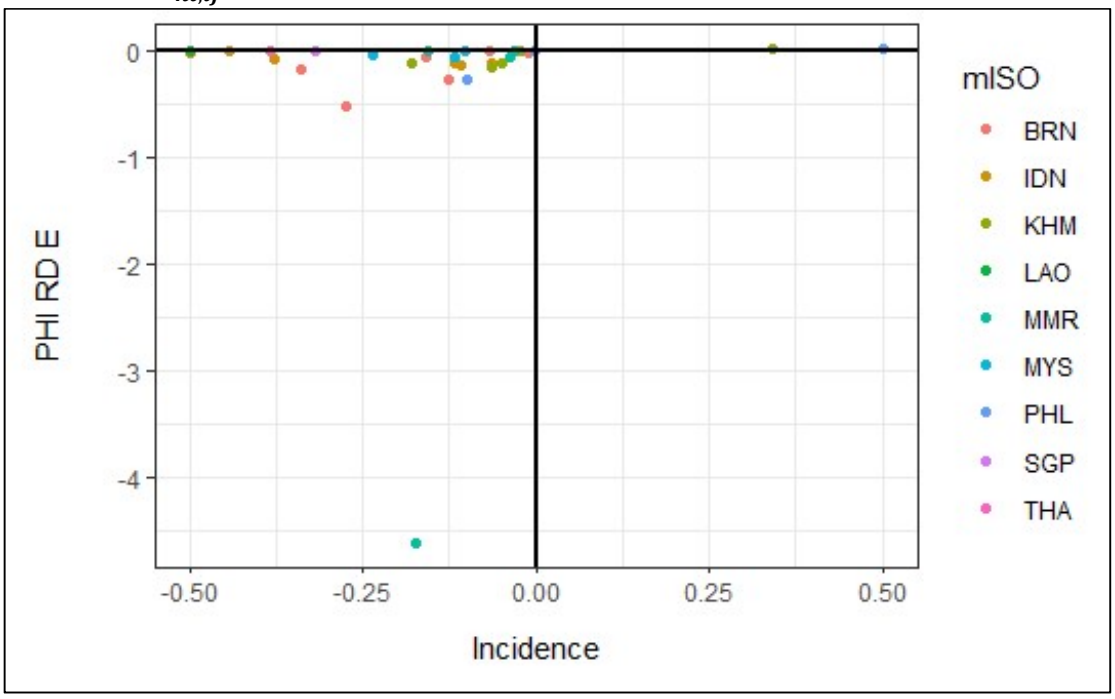


Figure 38
Average $\phi_{nt,ij}^{E,RD} RD_{t,ij}^{E}$ by Country-Pair, Quantity Control Measures (E), With Existing MRA

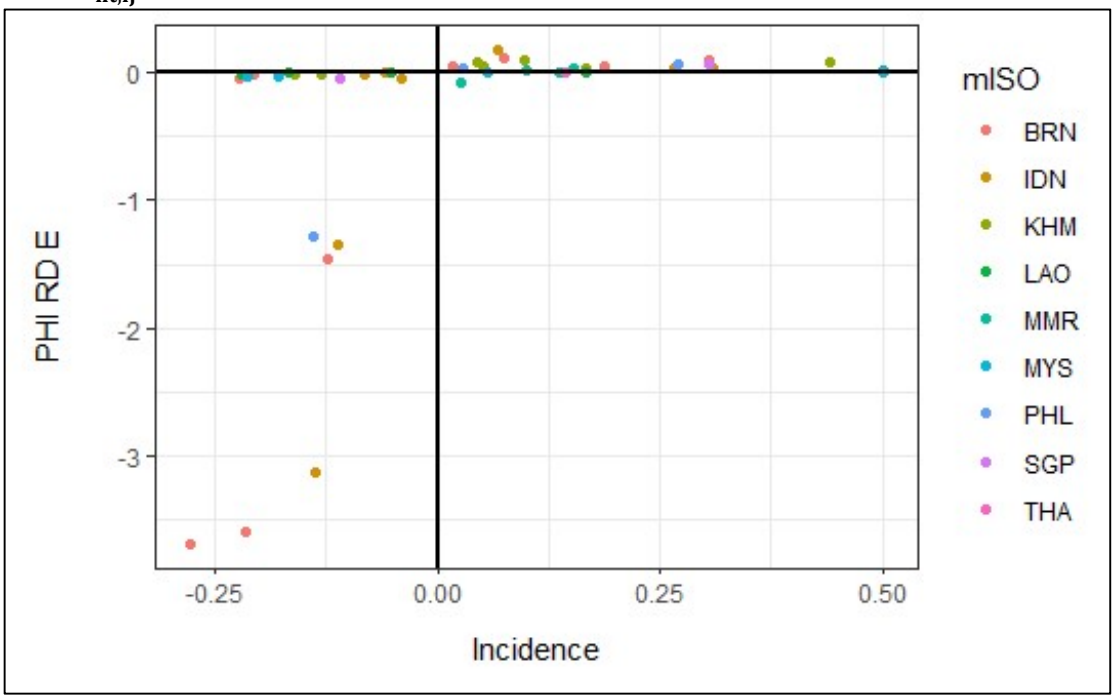


Figure 39
Average $\phi_{nt,ij}^{F,RD} RD_{t,ij}^{F}$ by Country-Pair, Price Control Measures (F), Overall

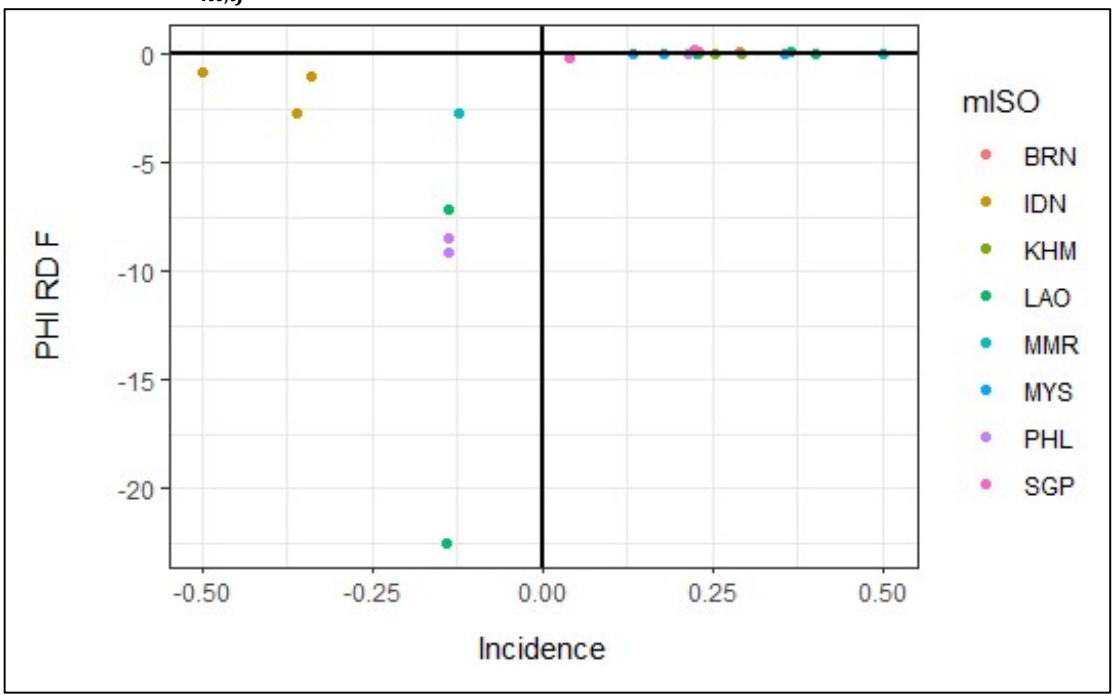
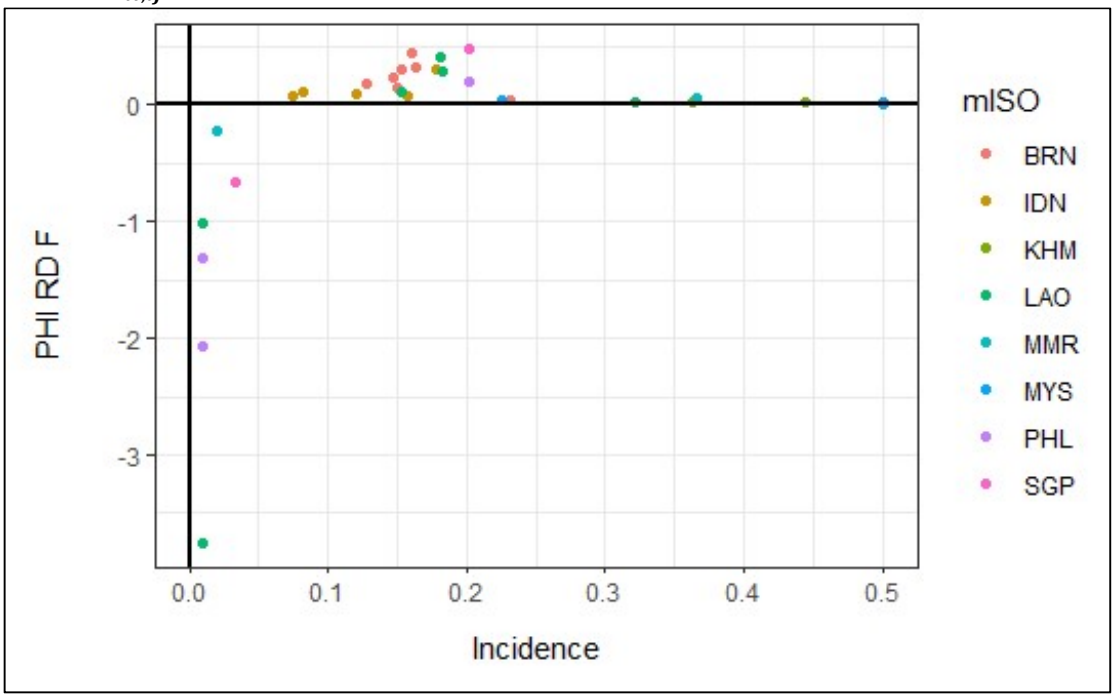


Figure 40
Average $\phi_{nt,ij}^{F,RD} RD_{t,ij}^{F}$ by Country-Pair, Price Control Measures (F), With Existing MRA



Conclusions and Recommendations

This study examined the impact of NTMs on intra-ASEAN imports. Although the methodology is similar to Bratt (2017) and Ghodsi et al. (2016, 2017), this study differs in three areas. First, it differentiates the effects by NTM type and across products, sectors, and bilateral partners. Bratt (2017) and Ghodsi et al. (2016, 2017) also differentiated NTM effects but not in all aspects covered by this paper. Second, this study took into account the role of the regulatory distance between ASEAN bilateral pairs in determining the effects of NTMs. Third, the analysis differentiates the NTM effects on products/sectors covered by existing mutual recognition agreements (MRAs) and harmonization agreements from products/covered not subject to such agreements. Mutual recognition and harmonization are some of the deep integration efforts in the region towards achieving AEC 2025 but at the same time addresses the variations in NTMs across the AMS. Therefore, the study is timely and relevant given the high-frequency index and import coverage ratio in most of the products traded in the region.

The findings show that all the five NTMs most prevalent in the region are significant factors affecting intra-ASEAN imports. In general, the NTMs distorts trade between ASEAN trading partners. However, the effects vary at the sectoral level, by pairs of trading partners, and by MRA status.

By and large, SPS measures negatively affect imports and are trade-reducing, regardless of whether the products are covered by MRAs and harmonization agreements or not. The findings across AMS importer-exporter pairs also support this. Exceptions are prepared foodstuff and medicinal products, both of which are covered by existing MRAs and harmonization agreements. The positive effects of SPS measures on intra-ASEAN imports of these two sectors provide evidence that measures that ensure safety and protection increase consumer trust and promotes trade.

TBT measures are also deterrent to imports, in general. However, they promote imports and are trade-enhancing for products covered by MRAs and harmonization agreements such as electrical machinery and equipment, prepared foodstuff, telecommunications equipment, and medical devices. As most of the AMS are hosts to the global production networks of these sectors, the TBT measures may have facilitated the movement of products across the AMS. The findings across bilateral partners also confirm this. In contrast, TBT measures hamper imports for products and sectors not covered by MRAs and harmonization efforts, except construction materials.

Quantity control measures, in general, are also trade-reducing. However, for products covered by MRAs and harmonization agreements, the effects are found to expand intra-ASEAN imports at the sectoral level and across most bilateral pairs. On the other hand, regardless of whether the sector is covered by MRAs or not, price control measures appear to hinder imports, except for foodstuff and telecommunications. The effects of pre-shipment inspection on imports are mixed, both at the sectoral level and in bilateral pairs. That is, the NTM enhances imports for some sectors and bilateral pairs, but it restrains imports for other sectors and bilateral pairs.

Regulatory distance between AMS contributes positively to the effects of SPS and TBT. This means that when an SPS or TBT measure is a deterrent to imports, regulatory distance lessens

the negative effect. Although such is not the case for quantity control and price control measures, the trade-enhancing effects of regulatory distance on these NTMs become dominant for products covered by MRAs and harmonization agreements.

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The above findings have significant policy implications to make NTMs more trade-enhancing than trade-reducing and promote deeper economic integration of the AEC. This study recommends the following:

First, the top intra-ASEAN imports, as well as products where the AMS are hosts to global production networks, should be covered by MRAs and harmonization agreements. These agreements not only increase similarity but also transparency and predictability of NTM measures among the AMS. Similarity reduces compliance cost, whereas transparency and predictability reduce information asymmetry; thus, promote trade. These agreements are key ingredients to the AEC becoming a production base for sectors involved in the global value chain. Currently, the top five imports comprise 66% of intra-ASEAN imports. However, less than 22% (electrical machinery and telecommunications) are covered by MRAs and harmonization agreements. The other products covered by existing agreements are not among the top five or top 15 intra-ASEAN imports, although the bulk of AMS imports of some of these products (prepared foodstuff and cosmetics) are sourced from the region.

Second, the design of NTM measures should be product- or sector-specific as the effects of NTMs differ across products and sectors. This implies that the standard model of "one-size-fits-all" policymaking is no longer appropriate and could be dangerous.

Third, a review should be undertaken for NTMs that were found to restrain imports. The review should be country-specific as the effects of NTMs differ across bilateral pairs. An NTM found to impede trade by design should be eliminated. Also, the actual implementation of NTMs needs to be examined. When actual practice differs from good or best practices in NTM implementation or deviates from WTO trade disciplines on NTMs, the capacity of the AMS to implement its NTMs should be strengthened.

Finally, further research should be undertaken on the following:

(i) A more detailed research on the nature of quantity control measures of AMS is necessary to understand their trade-enhancing effects and provide policy directions.

(ii) This study compared the effects of NTMs on products covered by MRAs and harmonization agreements with products that are not subject to such agreements. Although the analysis points to some positive correlation, it cannot be concluded that the agreements caused the favorable effects of NTMs on intra-ASEAN imports. Thus, the causality relationship should be empirically established to understand better the effects of these agreements on ASEAN trade and integration and guide policy direction.

To conclude, NTMs are expected to remain not only because of their trade-related objectives but, more importantly, because of the strategic policy objectives to guarantee safety and protect

human, animal, and plant life and the environment. When the latter objectives are attained, NTMs could promote intra-ASEAN trade.

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Appendix

Appendix Table 1
Review of Approaches Quantifying the Impacts of NTMs on Trade

A. *Price-based Approach*

Studies	Data Sources	Econometric Specification	Level of Disaggregation	Country Coverage	General Findings
Dean et al. (2006; 2009)	UNCTAD TRAINS and USITC for NTMs; EIU city data for retail price data.	Price-gap differentiated product model; Least-squares estimation; random-effects estimation; Instrumental Variable (IV) regression Dependent variable: Retail price gap in 2001 Independent variables: Ex-factor prices; retail mark-up (GDP per capita, wage & rent); transport cost (distance); specific tariff; NTM rent NTMs as dummy Cross-section	47 consumer products	157 cities (60 countries)	NTMs matter significantly in explaining trade restrictiveness in the products examined. For example, prices of fruits & vegetables and meats are higher by 44% and 54%, respectively, because of NTMs. NTMs are highly restrictive in many countries. But, they appear to be less restrictive in Sub-Saharan African, Eastern European, and some Middle Eastern countries; and more restrictive in the E.U., U.S., and some Southeast Asian countries.
Cadot & Gourdon (2015)	CEPII database for trade unit values TRAINS for NTMs	Gravity-like model Dependent variable: Trade unit values Independent variables: NTMs, RTAs, tariff, gravity variables (distance, common language, common border), factor endowments (capital, labor, land), GDP per capita NTMs as dummy	HS 6-digit (4,575 products)	65 countries	AVEs of SPS are high for food and agricultural products. For TBT, AVEs are high in automobiles. RTAs with provisions on harmonization or MRA of standards dampen the price-raising effects of NTMs by about a quarter. This means that harmonization or MRAs lowers the compliance-cost component of product prices.

Studies	Data Sources	Econometric Specification	Level of Disaggregation	Country Coverage	General Findings
		Estimation by product; Cross-section			
Ing & Cadot (2017)	ASEAN-ERIA UNCTAD for NTMs of ASEAN; and WITS for other countries CEPII's TUV database for trade unit values	Gravity-like model; OLS Dependent variable: Trade unit value (CIF) Independent variables: Tariff, NTMs, gravity-like variables, GDP per capita, NTM are count numbers Cross-section (only single-year data)	HS 2-digit	ASEAN; other countries	Low AVEs for TBT measures on manufactured products both for the ASEAN countries (4.5%) and the entire sample countries (5%). Higher AVEs of SPS measures on agricultural and food products for the ASEAN countries (6.5%) and the entire sample countries (6.7%)
Cadot et al. (2018)	UNCTA-MAST for NTMs	Gravity model; OLS for price-based approach; PPML for quantity-based approach Dependent variables: CIF Unit value (price) per product (for price-based approach) CIF Unit quantity per product (for quantity-based approach) Independent variables: NTM (SPS, TBT, QRs, border control measures), gravity variables (distance, contiguity, common language, RTA membership NTM as count number Cross-section No estimation of AVEs for the quantity-based approach	HS 6-digit (5000 products)	80 countries	*Price-based approach*: AVEs for SPS in agriculture are higher compared to AVEs for TBT in manufacturing. For SPS and TBTs, AVEs are associated with compliance costs. But higher AVEs do not necessarily mean more distortions. It could mean that exporters need to upgrade product quality or product design. *Quantity-based approach* In general, NTMs are found to reduce trade. However, for SPS, whereas NTMs are found to increase trade costs, it also increases trade volume.

B. Quantity-based Approach

Studies	Data Sources	Econometric Specification	Level of Disaggregation	Country Coverage	General Findings
Kee et al. (2009)	COMTRADE for imports (average of 2001-2003 to smooth year-specific shock) UNCTAD TRAINS for NTMs; MAcMap database for tariffs; EU's Standard's Database Kee et al. (2008) for import demand elasticities	Gravity model; two-stage Heckman procedure Dependent variable – imports (values) Independent variables: NTM (core and domestic support); tariffs; and country characteristics: factor endowments (land capital and labor) & GDP. NTM as dummy for the core and value ($) for domestic support AVE is restricted to be non-negative by construction	HS 6-digit (4,575 products)	78 developing and developed countries	Poor countries have more restrictive regimes and face higher barriers to their exports. The importance of NTBs as a protectionist tool is substantial. AVE of core NTB is higher than the tariff. AVE of all products affected by NTM is 45%; 32% when weighted by import values. AVEs vary across products and across countries. AVEs for agriculture products (27%) are higher than for manufacturing goods (10%). AVEs are highest for low-income countries in Africa.
Bratt (2016, 2017)	TRAIN database for NTMs; COMTRADE for imports (average for 2001-2003); WTO-IDB and TRAINS for tariffs; CEPII for bilateral gravity variables; World Development Indicators Database for labor, agricultural land, and GDP; Penn World for capital stock	Gravity model; PPML but econometric specification allows for NTM impact at the bilateral level. Dependent variable – imports Independent variables: GDP, distance, contiguity, common official language, colonial relationship, common colonizer, common RTA, bilateral tariff; comparative and	HS 6-digit (5,111 products)	81x81 bilateral trading partners	Low-income countries tend to impose more restrictive NTMs than middle- and high-income countries. AVEs of high-income importers are lower than those of low-income importers. High-income exporters are less affected by NTMs than low-income exporters. NTMs for South-South trade are more trade-restrictive than NTMs faced by developing countries in developed countries.

Studies	Data Sources	Econometric Specification	Level of Disaggregation	Country Coverage	General Findings
	Kee et al. (2008) for import demand elasticities	factor endowments (capital, labor, agricultural land); NTM by type NTMs as dummy variable Estimation by product; Cross-section AVE varies by good and exporter-importer pair			
Ghodsi et al. (2016a)	WTO Integrated Trade Intelligence Portal (I-TIP) for NTMs. COMTRADE and TRAINs for imports TRAIN and WITS for tariffs Penn World and WDI database for factor endowments and GDP CEPII for gravity variables Ghossi et al. (2016b) for import demand elasticities	Gravity model; PPML estimation Panel estimation, 2002-2011 Dependent variable – imports (quantity) Independent variables: Tariff, NTMs (9 types), market potential (GDP, factor endowments); gravity variables NTMs are count numbers (intensity measure) Estimation by importer-product pair.	HS-6 digit (5,221 products)	118 countries	Overall, SPS and TBT have both trade-impending and trade-enhancing effects, depending on the imposing country and product under consideration. AVEs are smaller for developed countries than less developed countries, despite the former imposing more NTMs than the latter. AVEs are highest for NTMs affecting products related to gross fixed capital formation.
Ghodsi et al. (2017)	WTO Integrated Trade Intelligence Portal (I-TIP) for NTMs.	Gravity model; PPML estimation	HS 6-digit (5,049 products)	131 countries	About 60% of estimates show trade-impending effects of NTMs on imports.

Studies	Data Sources	Econometric Specification	Level of Disaggregation	Country Coverage	General Findings
	COMTRADE and TRAINs for imports TRAIN and WITS for tariffs Penn World and WDI database for factor endowments and GDP CEPII for gravity variables	Panel estimation, 1995-2014 Dependent variable – imports (quantity) Independent variables: Tariff, NTMs (9 types), market potential (GDP, factor endowments); gravity variables NTMs are count numbers (intensity measure) Estimation by importer-product pair. **Note: AVE was not estimated**		(Exclude intra-EU trade flows)	Trade-reducing effects are highest for SPS measures and QRs in Sub-Saharan Africa For SPS, a positive effect on the demand side compensates for the negative impact on the supply side. Trade-impending effects of SPS decrease with higher-income countries. Overall, TBTs are trade-restricting, particularly for high-income countries in Europe and Africa
Arita et al. (2015)	COMTRADE for trade MAcMaps for tariffs CEPII	Gravity model; PPML Dependent variable: Exports (annual average, 2010-2012) Independent variables: EU NTMs (select TBT/SPS), tariff, distance, shared border, common language, FTA, EU membership Exporter- and exporter-level characteristics were not included as control variables.	Select agricultural commodities (beef, poultry, pork, corn, soy, fruits, vegetables, nuts, wheat).	20-35 importing and exporting countries	SPS and TBT are significant impediments to U.S.-E.U. trade on agricultural trade. Estimated AVEs are larger than existing tariffs and tariff-rate quotas on the same products.

Studies	Data Sources	Econometric Specification	Level of Disaggregation	Country Coverage	General Findings
Disdier et al. (2008)	WTO notifications on NTMs BACI on imports CEPII database on gravity variables Market Access Map (MAcMap) database on tariffs	Gravity model; Dependent variable: Imports (2004) Independent variables: NTMs, tariff, GDP, distance as a proxy for transport cost, common border, common language as a proxy for cultural proximity, colonial relationship NTMs captured either as a dummy, frequency index, or AVE (considered separately) Cross-section **Note: AVE was not estimated**	HS 4-digit (690 products)	154 importing countries and 183 exporting countries (Exclude intra-EU trade flows)	SPS and TBT negatively affect trade on agricultural trade. OECD exporters are not significantly affected by SPS and TBT in their exports to other OECD countries. Exports of developing and least developing countries to OECD countries are significantly affected by these regulations. SPS and TBT of EU countries are more trade-impending than those of other OECD countries, even if the former has fewer SPS and TBT notifications.
Song & Chen (2010)	*(i) Econometric Estimation* China's Ministry of Commerce on agricultural exports WTO SPS notifications on food safety regulations World Development Indicators and US Census Bureau for other gravity variables	(i) Gravity model, GLS fixed, and random effects estimation Dependent variable: Exports (China), 2002-007 Independent variables: Current food safety regulations; lagged food safety regulations, income, and GDP per capita, distance, agricultural production; a dummy for RTA	Agricultural exports	22 trading partners	Current regulations have a negative and significant effect on exports. Lagged regulations, on the other hand, have a positive and significant effect on exports. Although Chinese exporters may struggle with meeting newly implemented standards, they can adapt in the long run. Total compliance cost raised by SPS measure Domestic firms are at a disadvantage and pay more than foreign-owned firms to comply with standards

Studies	Data Sources	Econometric Specification	Level of Disaggregation	Country Coverage	General Findings
	Firm-level survey: First stage – 90 enterprises, 3 years Second stage – categories & levels of compliance costs	**Note: AVE was not estimated** (ii) Firm-level survey			Small-scale enterprises are at a disadvantage compared to large-scale enterprises
Nguyen (2017)	I-TIP for NTM COMTRADE for exports WTO-WDI Database, CEPII, and FAO for gravity variables	Gravity model, Random Effect Model (REM); PPML Dependent variable: Rice exports (Vietnam), 2000-2015 Independent variables SPS (dummy), GDP, population, distance, land, rice production, relative price ratio, tariff **Note: AVE was not estimated**	Product (rice)	20 trading partners	SPS reduces trade. Trade-reducing effects of SPS on Vietnam's exports decrease as importer's GDP increases
Wei et al. (2012)	NTMs: CODEX database; UK Health and Safety Executive Database; COMTRADE for exports WB-WDI Database National Bureau of Statistics of China TRAINS	Gravity model; OLS and Fixed Effects Model Dependent variable: Tea exports (China) Independent variables: Safety standard (dummy), GDP, tea production (lagged), distance, tariff, and time dummy to reflect changes in pesticides coverage over time.	Commodity (tea)	31 trading partners	As MRLs of endosulfan and fenvalerate decrease (i.e., safety standards become stricter), China's tea exports also decrease. Expanded coverage of pesticides reduces China's tea exports

Studies	Data Sources	Econometric Specification	Level of Disaggregation	Country Coverage	General Findings
		Note: AVE was not estimated			

Appendix Table 2
Summary of Data Sources and Availability

Variable	Database	Data Source	Database Link	Country Coverage	Data Availability			
					2015	2016	2017	2018
Imports	United Nations Comtrade Database	UNSD/DESA	https://comtrade.un.org/	ASEAN				
GDP	ASEANStats	ACSS	https://data.aseanstats.org/indicator/AST.STC.TBL.5	ASEAN				
Agricultural Land	World Bank Data Indicators	World Bank	https://data.worldbank.org/indicator/AG.LND.AGRI.K2?view=chart	ASEAN				
Employment	Penn World Tables ver. 9.1	Feenstra et al. (2015)	https://www.rug.nl/ggdc/productivity/pwt/	ASEAN				
Capital Stock	Penn World Tables ver. 9.1	Feenstra et al. (2015)	https://www.rug.nl/ggdc/productivity/pwt/	ASEAN				
Gravity Variables	CEPII Gravity Database	Centre d'Etudes Prospectives et d'Informations Internationales	http://www.cepii.fr/CEPII/fr/bdd_modele/presentation.asp?id=8	ASEAN				
Tariff	World Trade Organization	World Trade Organization	http://tariffdata.wto.org/ReportersAndProducts.aspx	BRN				
				KHM				
				IDN				
				LAO				
				MYS				
				MMR				
				PHL				
				SGP				
				THA				
				VNM				
Regulatory Distance	Raw ERIA-UNCTAD NTMs in ASEAN database	Shared by Dr. Ha Thi Thanh Doan for this study	-	ASEAN				

NTMs	ERIA-UNCTAD NTM Database	ERIA	http://asean.i-tip.org/Forms/Analysis.aspx	ASEAN				

Notes:

1. Green boxes indicate that data for the indicator, country/region, and year were available as of the time this report was conducted; red boxes indicate otherwise
2. As the data in this report was sourced from publicly available databases, the databases may have been expanded on or revised by the organizations maintaining them after the data was extracted. This report only considers data extracted from these databases as of May 16, 2020

Appendix Table 3
HS-2 Codes and Commodity Descriptions

HS Code	Description
01	Live animals
02	Meat and edible meat offal
03	Fish and crustaceans, mollusks, and other aquatic invertebrates
04	Dairy produce; birds' eggs; natural honey; other edible products of animal origin
05	Products of animal origin, not elsewhere specified
06	Trees and other plants, live; bulbs, roots and the like; cut flowers and ornamental foliage
07	Edible vegetables and certain roots and tubers
08	Edible fruit and nuts; peel of citrus fruit or melons
09	Coffee, tea, mate, and spices
10	Cereals
11	Products of the milling industry; malt, starches, inulin, wheat gluten
12	Oil seeds and oleaginous fruits; miscellaneous grains, seeds, and fruit, industrial or medicinal plants; straw and fodder
13	Lac; gums, resins, and other vegetable saps and extracts
14	Vegetable plaiting materials; other vegetable products
15	Animal or vegetable fats and oils
16	Preparations of meat, fish, or crustaceans
17	Sugars and sugar confectionery
18	Cocoa and cocoa preparations
19	Preparations of cereals, flour, starch, or milk; bakers' wares
20	Preparations of vegetables, fruit, or nuts
21	Miscellaneous edible preparations
22	Beverages, spirits, and vinegar
23	Residues and waste from the food industries
24	Tobacco and manufactured tobacco substitutes
25	Salt; sulfur; earth and stone; plastering materials, lime, and cement
26	Ores, slag, and ash
27	Mineral fuels, mineral oils, and products of their distillation
28	Inorganic chemicals
29	Organic chemicals
30	Pharmaceutical products
31	Fertilizers
32	Tanning or dyeing extracts
33	Essential oils and resinoids; perfumery, cosmetic, or toilet preparations
34	Soap, organic surface-active agents
35	Albuminoidal substances; modified starches; glues; enzymes
36	Explosives; pyrotechnic products; matches
37	Photographic or cinematographic goods

38	Miscellaneous chemical products
HS Code	**Description**
39	Plastics and articles thereof
40	Rubber and articles thereof
41	Raw hides and skins (other than fur skins) and leather
42	Articles of leather; saddlery and harness; travel goods, handbags, and similar containers; articles of animal gut (other than silkworm gut)
43	Fur skins and artificial fur; manufactures thereof
44	Wood and articles of wood; wood charcoal
45	Cork and articles of cork
46	Manufactures of straw, of esparto, or of other plaiting materials
47	Pulp of wood or other fibrous cellulosic material; recovered (waste and scrap) paper or paperboard
48	Paper and paperboard; articles of paper pulp, paper, or paperboard
49	Printed books, newspapers, pictures, and other products of the printing industry; manuscripts, typescripts, and plans
50	Silk
51	Wool, fine or coarse animal hair; horsehair yarn and woven fabric
52	Cotton
53	Vegetable textile fibers; paper yarn and woven fabrics of paper yarn
54	Man-made filaments; strips and the like of man-made textile materials
55	Man-made staple fibers
56	Wadding, felt and nonwovens, special yarns; twine, cordage, ropes and cables, and articles thereof
57	Carpets and other textile floor coverings
58	Special woven fabrics; tufted textile fabrics; lace, tapestries; trimmings;
59	Impregnated, coated, covered, or laminated textile fabrics
60	Knitted or crocheted fabrics
61	Apparel and clothing accessories; knitted or crocheted
62	Apparel and clothing accessories; not knitted or crocheted
63	Textiles, made-up articles; sets; worn clothing and worn textile articles; rags
64	Footwear; gaiters and the like; parts of such articles
65	Headgear and parts thereof
66	Umbrellas, sun umbrellas, walking-sticks, seat sticks, whips, riding crops; and parts thereof
67	Prepared feathers and down and articles made of feathers or of down
68	Stone, plaster, cement, asbestos, mica, or similar materials; articles thereof
69	Ceramic products
70	Glass and glassware
71	Natural, cultured pearls; precious, semi-precious stones; precious metals, metals clad with precious metal, and articles thereof; imitation jewelry; coin
72	Iron and steel
73	Iron or steel articles

74	Copper and articles thereof
HS Code	**Description**
75	Nickel and articles thereof
76	Aluminum and articles thereof
78	Lead and articles thereof
79	Zinc and articles thereof
80	Tin and articles thereof
81	Other base metals; cermets; articles thereof
82	Tools, implements, cutlery, spoons and forks, of base metal; parts thereof, of base metal
83	Metal; miscellaneous products of base metal
84	Nuclear reactors, boilers, machinery, and mechanical appliances; parts thereof
85	Electrical machinery and equipment and parts thereof; sound recorders and reproducers; television image and sound recorders and reproducers, parts and accessories of such articles
86	Railway or tramway locomotives, rolling-stock and parts thereof
87	Vehicles other than railway or tramway rolling stock
88	Aircraft, spacecraft, and parts thereof
89	Ships, boats, and floating structures
90	Optical, photographic, cinematographic, measuring, checking, medical or surgical instruments and apparatus; parts and accessories
91	Clocks and watches and parts thereof
92	Musical instruments; parts and accessories of such articles
93	Arms and ammunition; parts and accessories thereof
94	Furniture; bedding, mattresses, cushions, and similar stuffed furnishing
95	Toys, games, and sports requisites; parts and accessories thereof
96	Miscellaneous manufactured articles
97	Works of art; collectors' pieces and antiques
99	Commodities not specified according to kind

Source: UNCTAD (2020)

Appendix Table 4
Proportion of Significant Estimates for Traditional Gravity Variables

Sector \ Variable	DIS-TANCE	CONTI-GUITY	COMMON LAN-GUAGE	GDP - IMP	GDP - EXP	LAND - IMP	LAND - EXP	LABOR - IMP	LABOR - EXP	CAPITAL - IMP	CAPITAL - EXP	TARIFF
OVERALL	14,461 (50.61%)	10,927 (38.24%)	12,131 (42.45%)	13,914 (48.69%)	17,027 (59.59%)	9,613 (33.64%)	11,446 (40.06%)	10,139 (35.48%)	12,787 (44.75%)	10,021 (35.07%)	11,378 (39.82%)	8,468 (29.63%)
Electrical Machinery	889 (59.66%)	660 (44.30%)	706 (47.38%)	936 (62.82%)	1,080 (72.48%)	448 (30.07%)	690 (46.31%)	468 (31.41%)	819 (54.97%)	591 (39.66%)	707 (47.45%)	371 (24.90%)
Prepared Foodstuff	481 (51.17%)	381 (40.53%)	376 (40.00%)	419 (44.57%)	595 (63.30%)	355 (37.77%)	428 (45.53%)	376 (40.00%)	454 (48.30%)	360 (38.30%)	387 (41.17%)	266 (28.30%)
Medicinal Products	98 (43.56%)	84 (37.33%)	92 (40.89%)	64 (28.44%)	122 (54.22%)	85 (37.78%)	91 (40.44%)	74 (32.89%)	102 (45.33%)	65 (28.89%)	86 (38.22%)	56 (24.89%)
Telecommunications	76 (60.80%)	67 (53.60%)	55 (44.00%)	76 (60.80%)	90 (72.00%)	33 (26.40%)	60 (48.00%)	21 (16.80%)	47 (37.60%)	57 (45.60%)	74 (59.20%)	15 (12.00%)
Cosmetics	156 (56.73%)	118 (42.91%)	142 (51.64%)	170 (61.82%)	193 (70.18%)	113 (41.09%)	139 (50.55%)	125 (45.45%)	153 (55.64%)	115 (41.82%)	119 (43.27%)	78 (28.36%)
Medical Devices	52 (45.22%)	36 (31.30%)	46 (40.00%)	34 (29.57%)	65 (56.52%)	26 (22.61%)	37 (32.17%)	21 (18.26%)	43 (37.39%)	19 (16.52%)	55 (47.83%)	22 (19.13%)
Automotive	233 (50.65%)	178 (38.70%)	226 (49.13%)	205 (44.57%)	280 (60.87%)	171 (37.17%)	215 (46.74%)	158 (34.35%)	215 (46.74%)	158 (34.35%)	208 (45.22%)	181 (39.35%)
Construction	2,552 (56.09%)	1,746 (38.37%)	2,094 (46.02%)	2,458 (54.02%)	2,948 (64.79%)	1,511 (33.21%)	1,990 (43.74%)	1,603 (35.23%)	2,268 (49.85%)	1,672 (36.75%)	1,961 (43.10%)	1,496 (32.88%)
Mineral fuels, oils, and waxes; bituminous substances (HS 27)	82 (37.27%)	63 (28.64%)	69 (31.36%)	71 (32.27%)	96 (43.64%)	49 (22.27%)	87 (39.55%)	39 (17.73%)	78 (35.45%)	53 (24.09%)	52 (23.64%)	36 (16.36%)
Rubber (HS 40)	281 (63.15%)	184 (41.35%)	236 (53.03%)	248 (55.73%)	306 (68.76%)	180 (40.45%)	215 (48.31%)	164 (36.85%)	239 (53.71%)	127 (28.54%)	169 (37.98%)	170 (38.20%)
Paper and paperboard (HS 48)	307 (55.32%)	261 (47.03%)	290 (52.25%)	325 (58.56%)	384 (69.19%)	190 (34.23%)	244 (43.96%)	202 (36.40%)	247 (44.50%)	215 (38.74%)	251 (45.23%)	172 (30.99%)
Copper (HS 74)	162 (55.86%)	117 (40.34%)	143 (49.31%)	160 (55.17%)	178 (61.38%)	81 (27.93%)	119 (41.03%)	105 (36.21%)	143 (49.31%)	125 (43.10%)	112 (38.62%)	95 (32.76%)
Nuclear reactors, boilers, machinery and mechanical appliances (HS 84)	1,447 (53.10%)	968 (35.52%)	1,172 (43.01%)	1,420 (52.11%)	1,772 (65.03%)	817 (29.98%)	1,027 (37.69%)	823 (30.20%)	1,327 (48.70%)	794 (29.14%)	990 (36.33%)	632 (23.19%)
Pearls; Precious, Semi-precious stones; Precious metals; Jewellry; Coin (HS 71)	108 (42.35%)	65 (25.49%)	92 (36.08%)	90 (35.29%)	107 (41.96%)	70 (27.45%)	73 (28.63%)	82 (32.16%)	71 (27.84%)	57 (22.35%)	68 (26.67%)	75 (29.41%)
Organic chemicals (HS 29)	726 (40.33%)	660 (36.67%)	721 (40.06%)	791 (43.94%)	893 (49.61%)	619 (34.39%)	736 (40.89%)	654 (36.33%)	758 (42.11%)	640 (35.56%)	634 (35.22%)	580 (32.22%)
Optical, photographic, cinematographic instruments and apparatus (HS 90)	341 (50.15%)	306 (45.00%)	308 (45.29%)	429 (63.09%)	493 (72.50%)	235 (34.56%)	284 (41.76%)	232 (34.12%)	381 (56.03%)	278 (40.88%)	382 (56.18%)	215 (31.62%)
Animal or vegetable fats, oils, and waxes (HS 15)	89 (36.33%)	84 (34.29%)	76 (31.02%)	83 (33.88%)	103 (42.04%)	72 (29.39%)	85 (34.69%)	78 (31.84%)	100 (40.82%)	72 (29.39%)	77 (31.43%)	47 (19.18%)
OTHERS	6,367 (48.31%)	4,937 (37.46%)	5,269 (39.98%)	5,921 (44.92%)	7,308 (55.45%)	4,544 (34.48%)	4,910 (37.25%)	4,896 (37.15%)	5,322 (40.38%)	4,605 (34.94%)	5,032 (38.18%)	3,941 (29.90%)

Source: Authors' Calculations

Notes: Proportions presented in parentheses

Appendix Table 5
Average $\phi^{A}_{nt,ij}$ by Country-Pair, Sanitary and Phytosanitary Measures (A), Overall

EXP / *IMP*	BRN	IDN	KHM	LAO	MMR	MYS	PHL	SGP	THA	VNM
BRN		16.13 (311.51)	0.60 (325.51)	5.25 (301.45)	-4.61 (341.31)	19.17 (310.65)	-7.54 (321.34)	-208.23 (685.52)	18.41 (312.36)	-17.63 (336.23)
IDN	-57.33 (261.73)		-21.37 (217.30)	-6.61 (208.11)	-26.58 (224.79)	2.29 (196.23)	-28.68 (219.97)	-183.41 (648.78)	1.47 (197.31)	-37.15 (239.38)
KHM	-59.48 (287.39)	21.02 (245.48)		11.34 (239.95)	5.26 (267.84)	23.90 (247.33)	0.97 (255.07)	-173.72 (602.36)	23.51 (248.39)	-7.06 (262.00)
LAO	-60.89 (300.07)	21.29 (260.76)	7.06 (274.04)		3.79 (284.85)	24.65 (261.44)	0.13 (269.86)	-180.29 (618.96)	23.84 (262.38)	-8.74 (280.98)
MMR	-59.45 (238.90)	11.41 (165.96)	-0.20 (176.21)	0.51 (165.95)		14.68 (168.33)	-7.99 (172.99)	-166.25 (572.42)	14.94 (168.47)	-14.28 (182.05)
MYS	-63.65 (227.84)	-4.27 (121.22)	-19.38 (143.60)	-10.50 (132.28)	-21.37 (146.13)		-26.63 (152.82)	-173.47 (586.86)	-0.34 (123.63)	-31.89 (167.02)
PHL	-61.61 (218.53)	-3.33 (111.71)	-17.38 (134.00)	-9.02 (122.14)	-19.59 (135.70)	0.39 (113.20)		-168.66 (576.28)	0.45 (114.61)	-30.04 (155.20)
SGP	-78.58 (284.35)	-3.81 (151.40)	-22.19 (180.28)	-12.02 (165.33)	-27.08 (196.11)	-0.88 (152.82)	-31.34 (190.64)		0.24 (153.48)	-40.18 (223.22)
THA	-61.78 (230.85)	-3.71 (138.62)	-20.40 (157.00)	-9.88 (147.68)	-23.68 (162.07)	-0.78 (138.91)	-28.12 (164.22)	-171.12 (582.17)		-33.08 (181.16)
VNM	-56.98 (201.73)	-0.41 (86.52)	-11.22 (110.84)	-6.62 (98.87)	-12.55 (111.54)	2.61 (87.87)	-19.27 (114.31)	-158.56 (542.02)	2.14 (86.59)	

Note: Positive $\phi^{A}_{nt,ij}$ and corresponding standard deviations are highlighted in green

Source: Author's Calculations

Appendix Table 6
Average $\phi^{A}_{nt,ij}$ by Country-Pair, Sanitary and Phytosanitary Measures (A), With Existing MRA

EXP / *IMP*	BRN	IDN	KHM	LAO	MMR	MYS	PHL	SGP	THA	VNM
BRN		0.73 (144.42)	-8.32 (159.44)	-1.68 (144.72)	-10.33 (165.75)	3.75 (141.51)	-9.42 (159.11)	-46.88 (268.63)	1.97 (142.82)	-12.50 (169.21)
IDN	-16.52 (107.25)		-11.74 (105.70)	-6.38 (97.56)	-12.84 (101.77)	-3.81 (90.61)	-13.66 (100.47)	-28.64 (146.82)	-5.06 (92.66)	-14.35 (101.89)
KHM	-21.51 (128.95)	-3.94 (111.60)		-6.49 (109.54)	-10.63 (122.21)	-1.53 (109.89)	-10.28 (120.09)	-37.80 (200.33)	-2.91 (111.68)	-12.92 (122.91)
LAO	-21.06 (145.47)	-1.45 (117.69)	-9.56 (131.80)		-11.56 (135.89)	0.39 (115.83)	-10.01 (129.51)	-44.56 (236.73)	-0.66 (118.12)	-13.27 (138.25)
MMR	-21.85 (122.71)	-1.96 (85.78)	-11.53 (97.03)	-7.52 (88.61)		-0.35 (85.03)	-10.16 (97.31)	-34.62 (185.75)	-1.02 (86.04)	-14.61 (104.09)
MYS	-28.54 (128.30)	-13.31 (87.40)	-23.56 (112.67)	-15.42 (96.19)	-24.32 (111.81)		-23.66 (108.23)	-47.41 (206.12)	-12.37 (87.23)	-24.73 (111.55)
PHL	-23.71 (113.84)	-8.33 (75.86)	-17.72 (95.81)	-9.90 (82.88)	-18.20 (95.43)	-6.38 (73.65)		-31.72 (152.84)	-7.08 (75.73)	-18.79 (95.08)
SGP	-23.73 (142.99)	-5.53 (104.31)	-15.36 (125.45)	-8.55 (113.17)	-16.47 (126.92)	-4.00 (102.76)	-16.08 (123.67)		-4.57 (104.50)	-17.63 (131.29)
THA	-22.63 (117.50)	-8.37 (86.68)	-16.53 (105.00)	-9.55 (94.95)	-19.77 (106.00)	-6.82 (84.83)	-18.36 (99.68)	-37.05 (167.40)		-20.92 (106.25)
VNM	-20.90 (109.59)	-4.00 (63.51)	-13.90 (87.40)	-7.14 (73.44)	-13.80 (83.67)	-2.96 (62.73)	-13.98 (83.02)	-33.94 (165.54)	-3.59 (63.74)	

Note: Positive $\phi^{A}_{nt,ij}$ and corresponding standard deviations are highlighted in green
Source: Author's Calculations

Appendix Table 7
Average $\phi^{B}_{nt,ij}$ by Country-Pair, Technical Barriers to Trade (B), Overall

EXP / *IMP*	BRN	IDN	KHM	LAO	MMR	MYS	PHL	SGP	THA	VNM
BRN		17.13 (302.17)	12.76 (289.30)	14.50 (289.53)	12.76 (294.47)	16.91 (303.28)	14.38 (296.26)	-2.86 (311.24)	17.90 (302.10)	12.64 (296.71)
IDN	-1.23 (152.68)		0.19 (151.26)	0.63 (151.09)	-0.96 (151.30)	0.90 (150.93)	0.20 (150.64)	-6.07 (161.15)	1.48 (151.79)	-1.24 (150.63)
KHM	-14.25 (135.40)	-7.59 (126.75)		-10.98 (131.71)	-11.26 (132.08)	-7.59 (127.88)	-10.28 (127.59)	-17.12 (146.34)	-7.66 (125.69)	-10.42 (127.88)
LAO	-12.40 (141.02)	-4.31 (138.90)	-9.43 (138.10)		-9.44 (139.57)	-4.86 (137.83)	-7.40 (136.51)	-15.25 (154.72)	-4.66 (138.15)	-9.21 (139.18)
MMR	-11.05 (159.16)	-3.71 (153.78)	-7.09 (155.02)	-7.39 (154.79)		-4.67 (153.50)	-5.39 (153.08)	-14.31 (171.14)	-4.19 (153.34)	-6.90 (158.38)
MYS	-6.34 (163.29)	-1.38 (161.16)	-4.24 (161.15)	-4.21 (160.98)	-4.51 (162.77)		-3.59 (161.12)	-10.84 (176.61)	-1.34 (161.46)	-4.72 (163.28)
PHL	-3.96 (136.30)	2.28 (132.82)	-0.41 (132.43)	-0.27 (131.97)	-0.09 (133.73)	1.67 (133.58)		-5.93 (146.07)	2.27 (132.86)	-0.53 (135.04)
SGP	29.71 (556.19)	35.73 (568.62)	33.23 (568.00)	33.18 (564.44)	34.33 (571.21)	37.48 (573.33)	34.14 (570.91)		37.00 (571.12)	32.88 (573.40)
THA	-4.02 (142.10)	-0.39 (140.03)	-2.21 (139.61)	-2.06 (138.97)	-2.75 (139.45)	-1.09 (139.47)	-2.79 (138.34)	-8.67 (151.52)		-3.06 (140.20)
VNM	-5.99 (143.05)	1.08 (138.68)	-2.40 (139.82)	-2.17 (139.98)	-2.18 (139.76)	0.55 (137.74)	-1.69 (136.77)	-8.03 (153.51)	0.29 (136.88)	

Note: Positive $\phi^{B}_{nt,ij}$ and corresponding standard deviations are highlighted in green
Source: Author's Calculations

Appendix Table 8
Average $\phi^{B}_{nt,ij}$ by Country-Pair, Technical Barriers to Trade (B), With Existing MRA

EXP / *IMP*	BRN	IDN	KHM	LAO	MMR	MYS	PHL	SGP	THA	VNM
BRN		-0.14 (46.79)	1.10 (44.50)	1.78 (45.10)	0.95 (45.16)	1.31 (44.99)	0.57 (44.75)	3.71 (46.45)	0.41 (45.41)	1.47 (44.78)
IDN	2.01 (46.80)		2.03 (45.48)	2.15 (45.62)	2.07 (44.95)	1.70 (44.61)	1.62 (44.44)	3.33 (46.25)	1.45 (44.77)	1.87 (44.10)
KHM	0.23 (41.98)	-2.00 (41.28)		-0.54 (41.11)	-1.10 (40.90)	-1.27 (41.94)	-1.80 (40.98)	1.01 (43.04)	-1.50 (41.95)	-0.83 (41.53)
LAO	0.85 (39.38)	-1.58 (37.24)	-0.27 (36.88)		-0.55 (38.57)	-0.74 (38.43)	-0.66 (37.13)	1.48 (40.53)	-1.11 (38.18)	0.07 (37.82)
MMR	1.06 (43.06)	-1.04 (40.88)	0.74 (40.39)	0.56 (40.60)		-0.33 (42.46)	-0.31 (41.50)	2.24 (45.07)	-0.09 (43.09)	0.24 (42.28)
MYS	4.73 (49.85)	2.27 (45.32)	3.93 (45.30)	3.69 (45.68)	3.95 (45.22)		3.29 (45.76)	5.69 (48.99)	3.16 (46.57)	3.43 (46.23)
PHL	0.69 (44.30)	-0.47 (41.04)	0.72 (41.02)	0.70 (41.07)	0.69 (40.62)	0.27 (40.69)		1.47 (42.57)	-0.15 (41.37)	0.33 (42.59)
SGP	1.86 (62.96)	-0.48 (60.91)	0.77 (60.88)	0.95 (60.46)	1.16 (61.05)	1.02 (60.86)	1.30 (61.67)		0.71 (62.74)	1.23 (62.40)
THA	3.15 (46.72)	1.66 (43.41)	2.98 (44.57)	2.85 (43.94)	2.84 (43.80)	2.42 (42.36)	2.48 (42.62)	4.16 (44.41)		2.71 (43.81)
VNM	0.36 (44.18)	-0.93 (41.26)	0.60 (40.61)	0.49 (41.29)	0.70 (40.73)	-0.38 (40.72)	0.01 (41.11)	1.01 (41.79)	-0.65 (40.67)	

Note: Positive $\phi^{B}_{nt,ij}$ and corresponding standard deviations are highlighted in green
Source: Author's Calculations

Appendix Table 9
Average $\phi_{nt,ij}^{C}$ by Country-Pair, Pre-Shipment Inspections (C), Overall

EXP / *IMP*	BRN	IDN	KHM	LAO	MMR	MYS	PHL	SGP	THA	VNM
BRN		109.93 (801.56)	75.19 (784.56)	56.59 (761.70)	87.08 (798.60)	106.53 (776.42)	97.94 (782.65)	12.04 (860.45)	105.89 (781.42)	87.56 (790.26)
IDN	-49.06 (266.43)		-16.60 (238.01)	-20.81 (246.60)	-5.31 (225.68)	3.14 (205.28)	-2.03 (205.30)	-36.81 (269.21)	6.22 (205.75)	-0.53 (215.09)
KHM	-56.07 (350.10)	18.77 (319.31)		-25.73 (309.82)	4.78 (310.90)	15.96 (301.39)	6.75 (309.50)	-38.10 (398.88)	13.92 (305.51)	6.80 (318.60)
LAO	-50.57 (315.81)	20.53 (286.52)	-4.37 (279.04)		6.79 (287.68)	19.83 (275.80)	11.03 (280.87)	-37.18 (369.33)	20.03 (273.68)	7.91 (291.03)
MMR	-61.84 (338.65)	13.17 (310.15)	-23.84 (295.83)	-35.54 (307.47)		5.43 (285.31)	1.50 (292.65)	-46.01 (375.82)	7.47 (294.11)	-0.39 (303.69)
MYS	-46.49 (304.11)	26.20 (278.28)	-11.04 (273.33)	-16.83 (273.00)	5.72 (266.53)		12.64 (264.94)	-31.53 (346.78)	20.33 (263.11)	13.15 (277.77)
PHL	-48.37 (283.68)	21.58 (256.24)	-12.77 (255.87)	-19.14 (258.78)	3.34 (245.39)	14.42 (226.85)		-33.31 (309.80)	16.13 (237.65)	11.52 (250.43)
SGP	71.36 (1545.63)	192.27 (1560.42)	114.24 (1553.51)	107.77 (1546.01)	142.84 (1507.04)	166.96 (1518.57)	175.47 (1525.89)		185.45 (1533.10)	171.48 (1539.87)
THA	-44.62 (242.92)	17.55 (211.58)	-14.21 (208.58)	-20.03 (213.90)	-2.89 (195.24)	8.61 (184.43)	5.14 (195.92)	-27.73 (261.25)		5.11 (204.26)
VNM	-53.67 (319.21)	19.37 (294.36)	-16.50 (280.62)	-24.33 (286.14)	0.41 (269.53)	8.94 (262.68)	5.33 (272.87)	-44.45 (357.01)	13.00 (272.78)	

Note: Positive $\phi_{nt,ij}^{C}$ and corresponding standard deviations are highlighted in green
Source: Author's Calculations

Appendix Table 10
Average $\phi^{C}_{nt,ij}$ by Country-Pair, Pre-Shipment Inspections (C), With Existing MRA

EXP / *IMP*	BRN	IDN	KHM	LAO	MMR	MYS	PHL	SGP	THA	VNM
BRN		84.07 (421.28)	42.56 (308.74)	39.50 (326.73)	47.57 (303.62)	92.03 (420.15)	82.69 (396.97)	46.38 (362.11)	87.87 (416.49)	46.02 (304.84)
IDN	-43.35 (204.87)		-26.65 (159.61)	-28.30 (165.03)	-17.43 (142.82)	-11.18 (128.07)	-20.22 (142.64)	-19.30 (149.04)	-13.69 (136.79)	-13.32 (135.62)
KHM	-43.52 (213.32)	-29.26 (206.28)		-49.31 (223.96)	-31.25 (196.45)	-6.99 (190.36)	-19.54 (187.07)	-17.57 (210.64)	-19.96 (185.72)	-29.11 (203.83)
LAO	-20.16 (183.48)	-0.52 (171.33)	-11.76 (172.06)		-4.15 (173.96)	15.74 (176.47)	10.62 (169.89)	8.34 (183.07)	11.32 (162.40)	2.30 (174.18)
MMR	-50.31 (222.54)	-30.10 (198.60)	-55.54 (256.95)	-56.89 (240.93)		-17.44 (175.15)	-26.38 (185.03)	-31.48 (227.51)	-25.74 (183.85)	-45.99 (263.68)
MYS	-36.06 (213.94)	-4.19 (167.93)	-23.37 (177.26)	-22.28 (182.88)	-9.18 (170.26)		-12.38 (175.08)	-3.73 (179.22)	-5.09 (169.75)	-7.50 (184.10)
PHL	-20.64 (148.73)	0.77 (110.79)	-16.59 (142.27)	-14.05 (137.07)	-7.43 (132.14)	7.76 (105.07)		1.47 (119.07)	-2.44 (115.92)	-1.73 (125.77)
SGP	50.64 (661.74)	80.63 (637.28)	77.18 (628.96)	70.09 (637.02)	84.21 (605.33)	88.39 (630.04)	84.37 (625.98)		84.11 (630.57)	82.94 (594.46)
THA	-33.88 (167.83)	-7.49 (119.40)	-25.81 (145.97)	-24.35 (144.47)	-15.90 (132.27)	-3.75 (105.50)	-14.33 (126.78)	-10.38 (125.86)		-9.26 (123.12)
VNM	-27.35 (187.91)	-3.29 (139.97)	-24.57 (154.15)	-25.92 (153.61)	-16.45 (152.32)	1.08 (133.05)	-17.40 (142.21)	-8.94 (163.27)	-6.43 (122.43)	

Note: Positive $\phi^{C}_{nt,ij}$ and corresponding standard deviations are highlighted in green
Source: Author's Calculations

Appendix Table 11
Average $\phi^{E}_{nt,ij}$ by Country-Pair, Quantity Control Measures (E), Overall

EXP / *IMP*	BRN	IDN	KHM	LAO	MMR	MYS	PHL	SGP	THA	VNM
BRN		2.17 (183.30)	3.84 (181.14)	3.09 (177.67)	7.15 (182.83)	14.74 (183.14)	6.26 (179.40)	-3.20 (193.95)	8.19 (179.40)	5.51 (182.20)
IDN	-8.95 (125.15)		-5.30 (119.96)	-6.06 (120.53)	-1.19 (118.33)	6.31 (118.29)	-1.08 (117.05)	-5.63 (126.31)	0.48 (116.16)	-0.68 (117.88)
KHM	-13.30 (117.27)	-6.91 (112.14)		-10.17 (111.48)	-5.15 (109.96)	3.17 (111.80)	-4.76 (107.62)	-13.41 (123.61)	-2.84 (107.95)	-4.93 (109.93)
LAO	-12.48 (117.11)	-5.51 (115.35)	-7.11 (109.94)		-3.01 (111.81)	4.64 (113.34)	-2.13 (109.82)	-10.99 (123.34)	-0.74 (110.42)	-1.86 (111.60)
MMR	-12.43 (106.50)	-7.80 (95.79)	-8.66 (97.08)	-9.06 (97.37)		-0.86 (95.55)	-4.67 (94.25)	-11.63 (108.92)	-3.03 (92.62)	-4.69 (95.32)
MYS	-14.64 (122.31)	-8.75 (117.57)	-10.07 (117.90)	-10.97 (118.44)	-5.88 (116.26)		-5.90 (115.23)	-12.20 (124.57)	-4.62 (114.41)	-5.46 (116.08)
PHL	-9.42 (112.75)	-3.67 (107.37)	-5.42 (108.36)	-6.41 (108.52)	-1.05 (107.02)	5.62 (106.42)		-5.56 (115.35)	-0.23 (104.33)	-1.17 (108.04)
SGP	16.35 (367.28)	23.02 (377.72)	22.48 (373.50)	21.63 (371.31)	25.66 (375.80)	36.01 (378.12)	27.31 (373.44)		28.90 (373.47)	25.65 (372.79)
THA	-12.02 (116.78)	-6.70 (110.84)	-7.67 (110.64)	-8.79 (110.96)	-3.61 (109.13)	3.34 (108.69)	-3.58 (109.08)	-8.92 (119.43)		-3.34 (109.80)
VNM	-8.59 (119.81)	-3.08 (114.49)	-4.21 (114.97)	-5.24 (115.84)	-0.68 (114.27)	6.18 (113.77)	-0.54 (113.36)	-5.19 (123.41)	0.64 (111.86)	

Note: Positive $\phi^{E}_{nt,ij}$ and corresponding standard deviations are highlighted in green
Source: Author's Calculations

Appendix Table 12

Average $\phi^{E}_{nt,ij}$ by Country-Pair, Quantity Control Measures (E), With Existing MRA

EXP / *IMP*	BRN	IDN	KHM	LAO	MMR	MYS	PHL	SGP	THA	VNM
BRN		0.96 (69.38)	1.82 (67.17)	1.16 (66.46)	3.46 (67.34)	4.39 (65.15)	2.98 (67.81)	4.21 (65.91)	4.34 (65.72)	1.25 (68.74)
IDN	-3.58 (61.31)		-1.13 (62.54)	-1.55 (61.58)	1.32 (60.23)	3.00 (61.00)	0.66 (62.46)	1.03 (62.39)	1.48 (61.04)	-1.07 (63.13)
KHM	1.07 (58.92)	7.32 (56.34)		2.65 (57.78)	6.24 (56.62)	7.02 (56.08)	6.36 (56.94)	4.44 (61.87)	7.18 (56.56)	6.91 (56.62)
LAO	-0.64 (64.07)	4.57 (65.52)	2.13 (62.47)		3.47 (65.45)	4.20 (65.70)	4.23 (65.36)	2.71 (67.71)	4.19 (65.58)	4.51 (65.03)
MMR	-1.25 (57.19)	2.84 (54.69)	1.29 (55.00)	0.78 (55.16)		3.20 (55.05)	3.54 (55.82)	2.13 (58.87)	3.63 (54.60)	3.93 (55.37)
MYS	-2.32 (60.30)	2.22 (59.17)	0.28 (61.96)	-0.33 (61.17)	2.76 (59.84)		2.58 (60.84)	1.82 (62.41)	2.64 (59.34)	3.19 (60.50)
PHL	-3.26 (60.30)	1.25 (61.34)	-1.41 (60.96)	-2.24 (61.76)	0.79 (58.92)	1.10 (59.20)		1.39 (59.69)	1.08 (60.83)	0.11 (62.03)
SGP	-2.70 (132.95)	0.83 (126.19)	0.06 (124.26)	-0.82 (126.60)	-0.16 (122.01)	1.70 (127.65)	1.33 (124.38)		1.01 (127.69)	-0.35 (123.44)
THA	-2.12 (59.63)	2.20 (59.17)	0.11 (60.21)	-0.68 (60.24)	2.32 (58.76)	3.14 (58.87)	2.94 (59.99)	2.74 (60.13)		2.97 (59.89)
VNM	-3.59 (60.70)	-0.07 (62.26)	-1.52 (61.37)	-2.32 (61.86)	-0.21 (59.26)	-0.17 (61.19)	-0.16 (62.21)	1.07 (59.31)	-0.66 (62.08)	

Note: Positive $\phi^{E}_{nt,ij}$ and corresponding standard deviations are highlighted in green

Source: Author's Calculations

Appendix Table 13
Average $\phi^{F}_{nt,ij}$ by Country-Pair, Price Control Measures (F), Overall

EXP / *IMP*	BRN	IDN	KHM	LAO	MMR	MYS	PHL	SGP	THA	VNM
BRN		125.42 (1036.79)	124.63 (1030.64)	116.67 (1016.27)	125.93 (1039.17)	127.94 (1043.89)	111.80 (1023.69)	-134.95 (1057.09)	128.51 (1043.04)	108.85 (1023.69)
IDN	-116.04 (568.88)		-44.85 (479.89)	-55.12 (493.42)	-47.60 (469.38)	-46.03 (473.51)	-58.01 (483.02)	-223.92 (720.56)	-44.50 (474.72)	-59.23 (479.37)
KHM	-80.79 (373.42)	0.52 (285.82)		-6.52 (298.33)	3.81 (284.98)	-0.81 (281.84)	-11.32 (288.82)	-187.99 (583.25)	1.75 (281.51)	-12.18 (290.68)
LAO	-77.77 (272.45)	3.35 (159.23)	5.63 (165.29)		-11.01 (169.99)	3.04 (156.59)	-16.74 (172.33)	-182.72 (503.95)	6.22 (156.93)	-9.12 (169.62)
MMR	-92.47 (370.80)	-18.40 (283.10)	-15.81 (285.51)	-21.16 (292.75)		-18.90 (281.02)	-30.55 (290.20)	-203.51 (597.77)	-16.62 (279.54)	-31.13 (292.66)
MYS	-97.10 (539.29)	-13.43 (462.99)	-12.46 (457.71)	-20.18 (465.36)	-11.12 (450.51)		-25.52 (467.29)	-206.07 (703.67)	-11.21 (456.31)	-27.85 (464.00)
PHL	-90.92 (522.68)	-12.33 (443.23)	-14.15 (440.24)	-20.40 (448.95)	-13.94 (434.85)	-13.69 (443.85)		-208.59 (679.29)	-10.97 (440.46)	-36.80 (445.07)
SGP	25.53 (1844.93)	159.81 (1924.72)	158.80 (1914.57)	149.06 (1894.06)	159.85 (1929.16)	162.87 (1921.73)	145.33 (1912.24)		165.55 (1923.74)	142.59 (1911.99)
THA	-105.61 (533.15)	-30.01 (444.15)	-30.04 (442.36)	-36.48 (451.34)	-29.81 (432.53)	-31.54 (437.67)	-41.30 (444.73)	-214.54 (695.17)		-43.90 (441.17)
VNM	-94.35 (517.22)	-17.60 (434.92)	-18.98 (437.35)	-25.32 (447.29)	-17.83 (428.85)	-20.05 (434.94)	-30.36 (438.60)	-202.30 (675.58)	-16.96 (430.39)	

Note: Positive $\phi^{F}_{nt,ij}$ and corresponding standard deviations are highlighted in green
Source: Author's Calculations

Appendix Table 14
Average $\phi^{F}_{nt,ij}$ by Country-Pair, Price Control Measures (F), With Existing MRA

EXP / *IMP*	BRN	IDN	KHM	LAO	MMR	MYS	PHL	SGP	THA	VNM
BRN		0.51 (174.81)	4.59 (172.46)	4.03 (166.32)	3.84 (177.70)	-0.32 (168.68)	0.05 (173.04)	-33.65 (202.65)	0.89 (170.19)	0.61 (176.11)
IDN	-14.89 (142.12)		-0.60 (131.62)	-1.96 (130.53)	-2.15 (128.90)	-3.53 (127.22)	-5.22 (125.10)	-35.07 (189.23)	-2.74 (126.11)	-6.11 (126.52)
KHM	-11.25 (125.67)	2.22 (110.03)		4.18 (109.97)	4.28 (111.39)	2.36 (105.57)	0.11 (109.65)	-27.56 (163.77)	3.21 (107.07)	-0.61 (114.63)
LAO	-10.78 (109.75)	4.48 (81.97)	7.93 (80.81)		5.61 (82.42)	4.51 (78.02)	0.65 (83.37)	-26.08 (149.07)	6.13 (77.57)	1.06 (87.43)
MMR	-12.18 (126.33)	-0.01 (110.89)	3.08 (111.10)	1.81 (111.49)		0.03 (106.88)	-2.40 (110.05)	-29.27 (172.96)	1.00 (107.69)	-3.60 (114.72)
MYS	-7.97 (119.23)	2.97 (115.50)	7.75 (115.92)	7.00 (115.46)	4.66 (114.11)		1.30 (113.31)	-31.40 (170.96)	3.71 (115.16)	0.41 (116.54)
PHL	-9.38 (117.12)	3.15 (109.29)	5.71 (108.96)	3.67 (110.39)	4.43 (108.89)	2.76 (107.17)		-30.67 (160.21)	3.70 (105.86)	-0.06 (108.30)
SGP	-14.37 (202.25)	0.44 (211.70)	4.90 (214.36)	4.07 (209.77)	4.33 (214.87)	1.55 (207.54)	0.83 (210.53)		2.00 (210.12)	-0.19 (212.98)
THA	-12.83 (132.20)	-0.31 (116.99)	2.46 (123.36)	1.33 (122.34)	0.97 (115.98)	-0.15 (117.07)	-3.01 (113.09)	-33.49 (177.81)		-4.06 (114.92)
VNM	-13.45 (128.98)	2.16 (114.20)	3.93 (115.69)	2.25 (117.51)	3.45 (112.05)	2.41 (110.11)	-0.36 (108.91)	-30.38 (169.33)	3.27 (111.19)	

Note: Positive $\phi^{F}_{nt,ij}$ and corresponding standard deviations are highlighted in green
Source: Author's Calculations

Appendix Table 15

Average $\phi_{nt,ij}^{A,RD} RD_{t,ij}^{A}$ by Country-Pair, Sanitary and Phytosanitary Measures (A), Overall

EXP / *IMP*	BRN	IDN	KHM	LAO	MMR	MYS	PHL	SGP	THA	VNM
BRN		0.54 (3.34)	0.49 (2.81)	0.52 (3.30)	0.75 (4.73)	0.98 (5.31)	0.70 (4.00)	0.85 (4.35)	0.57 (3.40)	0.68 (3.81)
IDN			0.44 (9.70)	0.67 (4.39)	0.64 (3.72)	0.61 (3.35)	0.89 (6.33)	0.69 (3.32)	0.51 (2.92)	0.87 (5.20)
KHM				0.40 (3.41)	0.52 (3.85)	0.56 (3.12)	0.55 (4.40)	0.61 (2.73)	0.49 (2.59)	0.58 (3.55)
LAO					0.49 (5.04)	0.56 (2.77)	0.66 (5.41)	0.79 (3.75)	0.44 (2.53)	-0.12 (7.39)
MMR						0.75 (4.53)	0.36 (3.27)	0.66 (3.07)	0.38 (3.96)	-1.68 (21.66)
MYS							0.50 (3.38)	0.86 (4.57)	0.49 (3.98)	0.85 (4.66)
PHL								0.85 (3.95)	0.73 (4.26)	0.82 (5.45)
SGP									0.65 (3.67)	0.92 (4.39)
THA										0.44 (4.84)
VNM										

Note: Negative $\phi_{nt,ij}^{A,RD} RD_{t,ij}^{A}$ and corresponding standard deviations are highlighted in red

Source: Author's Calculations

Appendix Table 16
Average $\phi_{nt,ij}^{A,RD} RD_{t,ij}^{A}$ by Country-Pair, Sanitary and Phytosanitary Measures (A), With Existing MRA

EXP / *IMP*	BRN	IDN	KHM	LAO	MMR	MYS	PHL	SGP	THA	VNM
BRN		0.89 (1.48)	0.69 (1.17)	0.97 (1.59)	1.13 (1.88)	1.46 (2.45)	0.90 (1.46)	1.04 (1.81)	0.99 (1.61)	0.97 (1.64)
IDN			1.05 (2.12)	0.72 (1.13)	0.54 (0.85)	0.82 (1.27)	1.26 (2.34)	0.81 (1.28)	1.02 (1.62)	0.86 (1.35)
KHM				0.57 (1.08)	0.87 (1.36)	0.75 (1.17)	0.97 (3.11)	0.85 (1.29)	0.64 (1.10)	0.64 (1.09)
LAO					0.50 (1.02)	0.63 (1.04)	1.48 (2.48)	0.87 (1.42)	0.81 (1.31)	0.80 (1.51)
MMR						0.88 (1.47)	0.48 (0.72)	0.77 (1.28)	0.65 (1.03)	-3.02 (20.16)
MYS							0.75 (1.17)	1.00 (1.67)	1.04 (1.62)	1.05 (1.74)
PHL								0.81 (1.29)	1.00 (1.58)	0.91 (1.42)
SGP									1.08 (1.78)	0.85 (1.47)
THA										1.02 (1.68)
VNM										

Note: Negative $\phi_{nt,ij}^{A,RD} RD_{t,ij}^{A}$ and corresponding standard deviations are highlighted in red
Source: Author's Calculations

Appendix Table 17
Average $\phi_{nt,ij}^{B,RD} RD_{t,ij}^{B}$ by Country-Pair, Technical Barriers to Trade (B), Overall

EXP / *IMP*	BRN	IDN	KHM	LAO	MMR	MYS	PHL	SGP	THA	VNM
BRN		0.05 (0.41)	0.07 (0.48)	0.04 (0.23)	0.06 (0.43)	0.07 (0.36)	0.11 (0.72)	0.10 (0.58)	0.07 (0.42)	0.12 (0.79)
IDN			0.12 (0.80)	0.05 (0.28)	0.02 (1.20)	0.06 (0.53)	-0.02 (1.29)	0.05 (0.30)	0.11 (0.56)	0.02 (1.70)
KHM				0.10 (0.44)	0.08 (1.79)	0.08 (0.68)	0.28 (2.99)	0.25 (1.30)	0.21 (0.86)	-0.48 (9.90)
LAO					0.08 (0.51)	0.04 (0.22)	0.09 (0.49)	0.05 (0.25)	0.08 (0.38)	0.17 (1.08)
MMR						0.15 (1.20)	-0.80 (6.05)	0.25 (1.33)	0.25 (1.49)	-1.15 (10.32)
MYS							0.10 (0.69)	0.10 (0.68)	0.22 (1.09)	0.11 (1.26)
PHL								0.20 (1.34)	0.20 (0.82)	-0.39 (6.10)
SGP									0.16 (0.81)	0.12 (0.58)
THA										0.24 (1.17)
VNM										

Note: Negative $\phi_{nt,ij}^{B,RD} RD_{t,ij}^{B}$ and corresponding standard deviations are highlighted in red

Source: Author's Calculations

Appendix Table 18
Average $\phi_{nt,ij}^{B,RD} RD_{t,ij}^{B}$ by Country-Pair, Technical Barriers to Trade (B), With Existing MRA

EXP / *IMP*	BRN	IDN	KHM	LAO	MMR	MYS	PHL	SGP	THA	VNM
BRN		0.11 (1.06)	0.01 (0.82)	0.14 (0.77)	0.09 (0.91)	0.15 (0.65)	0.02 (0.91)	0.15 (0.76)	0.19 (0.83)	0.14 (1.08)
IDN			0.15 (0.99)	0.10 (0.87)	0.14 (1.12)	0.15 (0.96)	0.13 (0.91)	0.10 (0.92)	0.17 (0.91)	0.18 (1.23)
KHM				0.14 (0.72)	-0.12 (1.60)	0.24 (1.51)	-0.14 (2.61)	0.35 (1.42)	0.31 (1.15)	-0.07 (2.26)
LAO					0.13 (0.78)	0.12 (0.66)	0.15 (0.84)	0.20 (0.86)	0.18 (0.77)	0.18 (1.20)
MMR						0.28 (2.01)	0.03 (1.29)	0.29 (1.44)	0.38 (1.62)	0.05 (1.92)
MYS							0.19 (0.76)	0.18 (1.06)	0.48 (1.94)	0.25 (2.08)
PHL								0.24 (1.11)	0.24 (0.71)	0.15 (1.68)
SGP									0.28 (1.23)	0.22 (0.77)
THA										0.36 (1.07)
VNM										

Note: Negative $\phi_{nt,ij}^{B,RD} RD_{t,ij}^{B}$ and corresponding standard deviations are highlighted in red
Source: Author's Calculations

Appendix Table 19
Average $\phi_{nt,ij}^{C,RD} RD_{t,ij}^{C}$ by Country-Pair, Pre-Shipment Inspections (C), Overall

EXP / *IMP*	BRN	IDN	KHM	LAO	MMR	MYS	PHL	SGP	THA	VNM
BRN		0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
IDN			0.00 (0.00)	-1.97 (12.96)	0.00 (0.00)	0.05 (0.45)	-4.31 (13.00)	0.00 (0.00)	0.10 (0.61)	0.00 (0.00)
KHM				0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
LAO					0.00 (0.00)	0.05 (0.48)	-0.64 (3.46)	0.00 (0.00)	0.09 (0.57)	0.00 (0.00)
MMR						0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
MYS							0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
PHL								0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
SGP									0.00 (0.00)	0.00 (0.00)
THA										0.00 (0.00)
VNM										

Note: Negative $\phi_{nt,ij}^{C,RD} RD_{t,ij}^{C}$ and corresponding standard deviations are highlighted in red
Source: Author's Calculations

Appendix Table 20

Average $\phi_{nt,ij}^{C,RD} RD_{t,ij}^{C}$ by Country-Pair, Pre-Shipment Inspections (C), With Existing MRA

EXP / *IMP*	BRN	IDN	KHM	LAO	MMR	MYS	PHL	SGP	THA	VNM
BRN		0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
IDN			0.00 (0.00)	-6.84 (10.91)	0.00 (0.00)	0.00 (0.00)	-7.25 (14.20)	0.00 (0.00)	2.74 (11.34)	-1.09 (4.44)
KHM				0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
LAO					0.00 (0.00)	0.00 (0.00)	-5.68 (11.37)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
MMR						0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
MYS							0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
PHL								0.00 (0.00)	0.00 (0.00)	0.04 (1.16)
SGP									0.00 (0.00)	0.00 (0.00)
THA										-0.02 (0.50)
VNM										

Note: Negative $\phi_{nt,ij}^{C,RD} RD_{t,ij}^{C}$ and corresponding standard deviations are highlighted in red

Source: Author's Calculations

Appendix Table 21
Average $\phi_{nt,ij}^{E,RD} RD_{t,ij}^{E}$ by Country-Pair, Quantity Control Measures (E), Overall

EXP / *IMP*	BRN	IDN	KHM	LAO	MMR	MYS	PHL	SGP	THA	VNM
BRN		-0.18 (0.82)	-0.12 (0.85)	0.00 (0.00)	-0.01 (0.22)	-0.06 (0.47)	-0.27 (1.28)	-0.02 (0.53)	0.00 (0.00)	-0.52 (2.28)
IDN			-0.11 (1.03)	0.00 (0.00)	-0.02 (0.16)	-0.09 (0.46)	-0.15 (0.83)	-0.01 (0.09)	0.00 (0.00)	-0.13 (0.85)
KHM				0.00 (0.00)	-0.01 (0.20)	-0.11 (0.74)	-0.13 (1.05)	-0.01 (0.22)	0.00 (0.05)	-0.15 (1.18)
LAO					0.00 (0.00)	0.00 (0.00)	0.00 (0.03)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
MMR						-4.61 (12.55)	-0.06 (0.61)	0.00 (0.14)	0.00 (0.00)	0.00 (0.07)
MYS							-0.07 (0.51)	-0.01 (0.17)	0.00 (0.00)	-0.04 (0.28)
PHL								-0.01 (0.29)	0.02 (0.11)	-0.28 (1.52)
SGP									0.00 (0.00)	-0.01 (0.11)
THA										0.00 (0.03)
VNM										

Note: Negative $\phi_{nt,ij}^{E,RD} RD_{t,ij}^{E}$ and corresponding standard deviations are highlighted in red

Source: Author's Calculations

Appendix Table 22

Average $\phi_{nt,ij}^{E,RD} RD_{t,ij}^{E}$ by Country-Pair, Quantity Control Measures (E), With Existing MRA

EXP / *IMP*	BRN	IDN	KHM	LAO	MMR	MYS	PHL	SGP	THA	VNM
BRN		-3.59 (9.35)	0.12 (1.16)	-0.02 (0.20)	0.04 (0.30)	-0.05 (0.27)	-1.45 (3.98)	0.05 (1.35)	0.10 (0.46)	-3.68 (9.89)
IDN			0.18 (1.46)	-0.01 (0.20)	0.04 (0.24)	-0.01 (0.18)	-1.34 (3.91)	-0.05 (0.56)	0.04 (0.23)	-3.13 (8.98)
KHM				-0.01 (0.22)	0.04 (0.28)	-0.02 (0.28)	0.08 (1.42)	0.05 (0.66)	0.08 (0.28)	0.10 (0.71)
LAO					0.00 (0.07)	0.00 (0.05)	0.00 (0.15)	-0.02 (0.17)	0.00 (0.00)	-0.01 (0.10)
MMR						-0.09 (1.74)	0.01 (0.26)	0.03 (0.22)	0.01 (0.08)	0.01 (0.12)
MYS							-0.04 (0.24)	-0.04 (0.22)	0.00 (0.04)	0.00 (0.09)
PHL								0.03 (0.65)	0.07 (0.30)	-1.27 (3.58)
SGP									0.07 (0.32)	-0.05 (0.32)
THA										0.00 (0.12)
VNM										

Note: Negative $\phi_{nt,ij}^{E,RD} RD_{t,ij}^{E}$ and corresponding standard deviations are highlighted in red

Source: Author's Calculations

Appendix Table 23

Average $\phi_{nt,ij}^{F,RD} RD_{t,ij}^{F}$ by Country-Pair, Price Control Measures (F), Overall

EXP / *IMP*	BRN	IDN	KHM	LAO	MMR	MYS	PHL	SGP	THA	VNM
BRN		0.00 (0.00)	0.01 (0.11)	0.08 (0.44)	0.01 (0.08)	0.03 (0.22)	0.09 (0.54)	0.12 (0.65)	0.03 (0.19)	0.10 (0.62)
IDN			0.00 (0.00)	-2.66 (8.62)	-0.84 (3.72)	0.00 (0.00)	-1.02 (3.31)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
KHM				0.06 (0.35)	0.01 (0.09)	0.00 (0.00)	0.04 (0.26)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
LAO					-22.50 (45.25)	0.01 (0.06)	-7.12 (15.59)	0.09 (0.47)	0.04 (0.22)	0.07 (0.47)
MMR						0.00 (0.00)	-2.67 (7.23)	0.00 (0.00)	0.00 (0.00)	0.02 (0.14)
MYS							0.03 (0.56)	0.09 (1.03)	0.00 (0.00)	0.09 (0.55)
PHL								-9.10 (19.31)	0.09 (0.51)	-8.49 (17.49)
SGP									0.25 (1.37)	-0.18 (2.20)
THA										0.00 (0.00)
VNM										

Note: Negative $\phi_{nt,ij}^{F,RD} RD_{t,ij}^{F}$ and corresponding standard deviations are highlighted in red

Source: Author's Calculations

Appendix Table 24
Average $\phi_{nt,ij}^{F,RD} RD_{t,ij}^{F}$ by Country-Pair, Price Control Measures (F), Existing

EXP / *IMP*	BRN	IDN	KHM	LAO	MMR	MYS	PHL	SGP	THA	VNM
BRN		0.18 (0.96)	0.03 (0.22)	0.32 (1.33)	0.04 (0.20)	0.00 (0.03)	0.31 (1.24)	0.44 (1.66)	0.15 (0.62)	0.24 (1.09)
IDN			0.01 (0.11)	0.11 (1.52)	0.10 (0.64)	0.00 (0.00)	0.08 (0.94)	0.08 (0.43)	0.00 (0.00)	0.31 (1.35)
KHM				0.02 (0.14)	0.01 (0.05)	0.00 (0.00)	0.02 (0.14)	0.00 (0.00)	0.00 (0.00)	0.00 (0.02)
LAO					-3.75 (14.22)	0.03 (0.19)	-1.01 (5.96)	0.29 (1.16)	0.12 (0.49)	0.40 (1.52)
MMR						0.00 (0.00)	-0.21 (1.47)	0.00 (0.00)	0.00 (0.00)	0.06 (0.24)
MYS							0.04 (0.30)	0.02 (0.14)	0.02 (0.15)	0.03 (0.22)
PHL								-2.07 (9.14)	0.20 (0.60)	-1.31 (6.40)
SGP									0.49 (1.46)	-0.66 (5.11)
THA										0.00 (0.00)
VNM										

Note: Negative $\phi_{nt,ij}^{E,RD} RD_{t,ij}^{E}$ and corresponding standard deviations are highlighted in red
Source: Author's Calculations