Chapter 5

Non-Tariff Measures and The Impact of Regulatory Convergence in ASEAN

Christian Knebel and Ralf Peters

August 2019

This chapter should be cited as

Knebel, C. and R. Peters (2019), 'Non-Tariff Measures and The Impact of Regulatory Convergence in ASEAN', in Ing, L.Y., R. Peters and O. Cadot (eds.), *Regional Integration and Non-Tariff Measures in ASEAN.* Jakarta: ERIA, pp.65–89..

CHAPTER 5

Non-tariff Measures and the Impact of Regulatory Convergence in ASEAN

Christian Knebel

Ralf Peters

1. Introduction

Non-tariff measures (NTMs) are increasingly moving to the forefront of 'deep' regional integration efforts. Their overall impact is estimated to be two to three times higher than current tariffs (UNCTAD, 2013; Kee et al., 2009), as explained in Chapters 2 and 4.

NTMs are neutrally defined as policy measures, other than ordinary customs tariffs, that can have an economic effect on international trade (UNCTAD, 2010). NTMs thus include a wide array of policies. On the one hand, traditional trade policy instruments, such as quotas or price controls, which are often termed non-tariff barriers (NTBs). On the other hand, NTMs also comprise sanitary and phytosanitary (SPS) measures and technical barriers to trade (TBT) that stem from important non-trade objectives related to health and environmental protection. These technical NTMs therefore overlap with a wider regulatory realm.

While technical NTMs also, on aggregate, increase trade costs, their primary regulatory objectives make them indispensable. They ensure food safety, protect harvests against pests and invasive species, regulate the trade of hazardous substances and waste, prohibit the trade of endangered species, and regulate many more areas of our life to promote a sustainable future. These policies are necessary and elimination is not an option.

Regulatory convergence is an important way to reduce trade costs while fully maintaining their regulatory benefits. Coordinating non-tariff policy regimes, especially behind-the-border SPS measures and TBT, is a challenge. But regional initiatives can be a more flexible tool than multilateral negotiations to achieve mutually beneficial deep economic integration.

In this chapter, we quantify the price impact of domestic and foreign regulatory frameworks and estimate the mitigating and price-reducing effect of regulatory convergence.

Section 2 of this paper briefly presents the classification and collection of the hard data around which this paper is built. We use a global dataset of comprehensive NTM data that UNCTAD has collected with many partners in recent years. It crucially includes data on the Association of Southeast Asian Nations (ASEAN) Member States that was collected in 2014–2016 in collaboration with ERIA.

Section 4 elaborates on ways to measure regulatory convergence. A recently developed measure of distance in regulatory structures is introduced and visualises the current level of regulatory convergence within ASEAN and with some other large trading partners.

Section 5 estimates the quantitative impact of domestic and foreign technical regulations as well as regulatory convergence. Using a regression model to explain trade unit values, we find that regulatory convergence can substantially reduce the costs effect of NTMs.

Section 6 concludes and provides a policy outlook.

2. Non-tariff Measures Data Classification and Collection

2.1. A Common Language: The UNCTAD–MAST NTM Classification

Recognising the proliferation and increasing importance of NTMs, the United Nations Conference on Trade and development (UNCTAD) has actively worked on the topic since the early 1980s. Given the scarcity of available information, UNCTAD began to identify and classify NTMs in 1994. In 2006, UNCTAD established a Group of Eminent Persons and a Multi-Agency Support Team (MAST)[1] to thoroughly revise the data collection approach to reflect the growing complexity of NTMs. An essential step was the development of an internationally agreed and recognised classification for NTMs. This 'common language' facilitates collection, analysis and dissemination of data on NTMs, with the final objective to increase transparency and understanding about NTMs (UNCTAD, 2014).

The UNCTAD–MAST (2013) classification of NTMs has 16 chapters of different measure categories (left side of Table 5.1). Chapters A to O refer to import-related NTMs, whereas Chapter P covers measures that countries impose on their own exports. Another essential distinction is between technical measures (Chapters A, B and C) and non-technical measures (Chapters D to O).

Technical measures comprise SPS and TBT measures and related pre-shipment requirements. These measures are imposed for objectives that are not primarily trade-related: for example, human, plant, and animal health, and the protection of the environment. Even if equally applied to domestic producers, they nevertheless regulate international trade and are thus considered NTMs. This does not, however, imply any a priori judgement about their impact and legitimacy.

Non-technical measures cover a wide array of policies, including 'traditional' trade policies such as quotas, licences (Chapter E), price controls, and para-tariff measures (Chapter F). The full list is presented in Table 5.1. As most non-technical measures have objectives and mechanisms that discriminate against foreign producers, this specific chapter refers to them as non-tariff barriers (NTBs).

[1] Multi-Agency Support Team: UNCTAD, WTO, World Bank, UNIDO, FAO, ITC and OECD.

Each chapter is further broken down into more detailed measures types (example of SPS measures on the right side of Table 5.1). The 'tree structure' allows for a rather fine-grained classification of measures. For example, the SPS chapter (A) consists of 34 NTM codes at the finest level of detail. In total, the UNCTAD–MAST classification has 178 disaggregated codes.

Table 5.1: UNCTAD–MAST Classification of Non-Tariff Measures

Import-related Measures	Technical measures	A	Sanitary and Phytosanitary (SPS) measures
		B	Technical barriers to trade (TBT)
		C	Pre-shipment inspections and other formalities
	Non-technical measures	D	Contingent trade-protective measures
		E	Non-automatic licensing, quotas, prohibitions and quantity-control measures
		F	Price-control measures, including additional taxes and charges
		G	Finance measures
		H	Measures affecting competition
		I	Trade-related investment measures
		J	Distribution restrictions
		K	Restrictions on post-sales services
		L	Subsidies (excl. export subsidies)
		M	Government procurement restrictions
		N	Intellectual property
		O	Rules of origin
Export-related measures		P	Export-related measures

Tree structure – for example:

A Sanitary and Phytosanitary (SPS) measures

- A1 Prohibitions/restrictions of imports for SPS reasons
    - A11 Temporary geographic prohibition
    - (...)
- A2 Tolerance limits for residues and restricted use of substances
    - (...)
- A3 Labelling, marking, packaging requirements
    - (..)
- A4 Hygienic requirements
    - (...)
- A5 Treatment for the elimination of pests and diseases
    - A51 Cold/heat treatment
    - A52 Irradiation
    - (...)
- A6 Requirements on production / post-production processes
    - (...)
- A8 Conformity assessment
    - A81 Product registration
    - A82 Testing requirement
    - A83 Certification requirement
    - A84 Inspection requirement
    - A85 Traceability requirement
        - A851 Origin of materials and parts
        - A852 Processing history
        - (...)
    - A86 Quarantine requirement
    - A89 Other conformity assessments

Source: Authors' illustration, based on UNCTAD (2013).

2.2. Collected Data in ASEAN and the Rest of the World

On the basis of this classification, UNCTAD leads an international effort with many national, regional and international partners to collect comprehensive data on NTMs. Data already exists for over 60 developed and developing countries. Great progress was made during the 2013–2016 period when a coverage of 80 percent of world trade was reached. A milestone was the collaboration with ERIA that led to the collection in the ASEAN region.

All data is published online and is accessible free of charge through several web-portals.[2] The database also allows quick access to full-text regulations of many countries.

Data about 'official' NTMs is collected by extensively reading and analysing national legislative documents, such as laws, decrees, or directives. Once a relevant regulation is identified, each specific provision is classified into one of the 178 detailed NTM codes. For each measure, the affected products are also classified in detail.[3]

The main focus of this article is on SPS and TBT measures, for which there are 58 distinct types in the NTM classification. Figure 5.1 shows the number of distinct technical measures that are applied to an average agricultural (Figure 5.1a) or manufactured product[4] (Figure 5.1b) in ASEAN. It is clear that there tends to be a variety of different technical requirements for each product, especially in agricultural sectors where SPS measures are frequent. In the rest of this article, we will take advantage of the depth of the NTM data and assess both the intensity of technical regulation as well as the bilateral similarity of regulatory patterns.

---

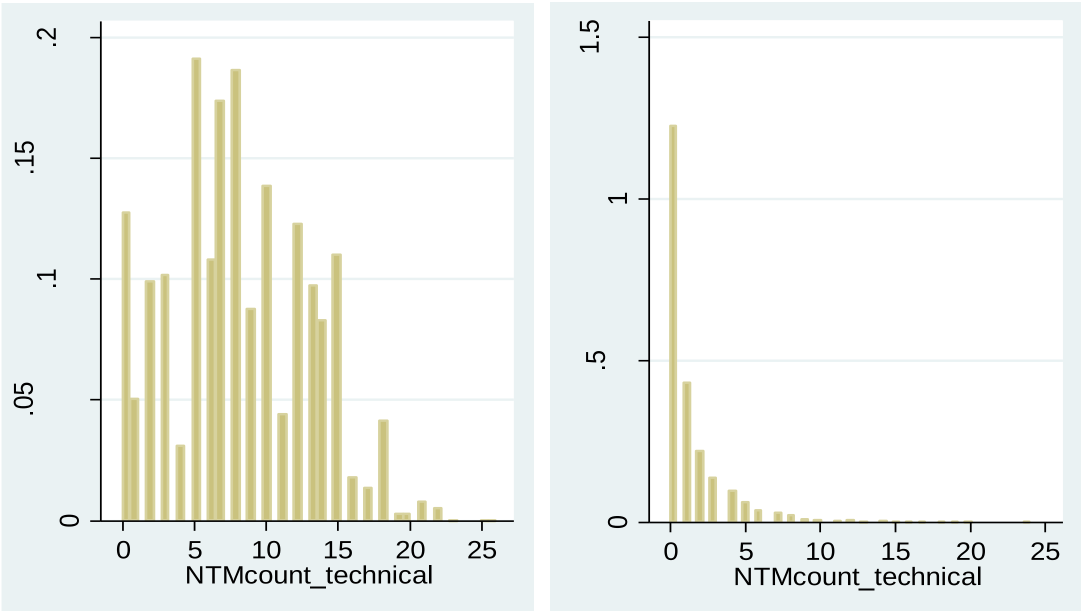
[2] UNCTAD–ERIA asean.i-tip.org, UNCTAD's TRAINS portal trains.unctad.org; World Bank WITS platform at wits.worldbank.org; and ITC MAcMap at www.macmap.org

[3] Product classification is done at the national tariff line level or at 6-digits of the Harmonized System (HS), which distinguishes about 5,200 different products.

[4] At the HS 6-digit level.

Figure 5.1: Distribution of Number of Distinct Technical NTMs in ASEAN

a) only agriculture b) only manufacturing



Source: Authors' calculations.

It should be noted that even 178 distinct measure types remain a generalisation of the sheer limitless complexity of NTMs. For product-specific trade negotiations and export decisions, an in-depth review of full-text regulatory documents is inevitable. However, the categorisation of measures and respective affected products provides an essential entry point for a wider assessment of the prevalence and impact of NTMs. It allows for a comparative perspective across countries and sectors, and helps to narrow down priorities.

3. Assessing 'Regulatory Distance' in ASEAN

3.1. Introducing the Complexity and Dimensions of Regulatory Convergence

Recognising the necessity of SPS measures and TBT to protect health, safety, and environment entails that such NTMs need to be harmonised rather than eliminated. However, due to the complexity of these measures, it is extremely difficult to assess the current level and impact of regulatory convergence or divergence.

Many researchers have investigated the impact of very specific requirements applied to specific products; and they have found some compelling cases. For example, Wilson, Otsuki and Majumdsar (2003) examine the impact of residue limits of tetracycline (an antibiotic) in beef. They found that beef imports are significantly lower for importing countries that have a more stringent residue limit. They estimate that regulatory convergence towards the international standard set by Codex Alimentarius would increase international trade of beef by about USD 3.2 billion.

However, even for a single product there are usually many more requirements. Figure 5.2 helps to visualise the dimensions and complexity of regulatory convergence. The figure illustrates just a few NTMs applied to a specific product across three countries.

Let us stick to the previous example of tolerance limits of residuals of antibiotics in beef. And let us assume that countries X and Y apply such NTMs, and country Z does not. In the UNCTAD–MAST classification, these measures would be classified as NTM code A21 for 'tolerance limits for residues of or contamination by certain substances' (see Section 2). The regulatory pattern across the three countries is summarised in the first row of Figure 5.2.[5]

Figure 5.2: Example of NTM Data Mapping with Respect to 'Regulatory Distance'

NTM types and codes for a specific product at HS-6 level: e.g. beef	Country X	Country Y	Country Z
A21: Maximum residue limit	1	1	0
A62: Animal raising processes	1	1	0
A83: SPS certificate	0	1	0
A14: Special authorisation	0	0	1

b) data-analysis of 'distance in regulatory structures'

a) in-depth analysis of specific regulations to compare the stringency of measures

Source: Authors' illustration.

But there are many other types of NTMs that apply to beef. As shown in Figure 5.1, there is an average of about 10 different SPS and TBT measure types (according to the UNCTAD–MAST classification) applied to any given agricultural product in ASEAN. For a specific beef product, there may be SPS requirements regarding inspection, certification, labelling, packaging, regulations on animal growth processes, and hygienic and transport conditions. Only a few examples are illustrated in the other rows of Figure 5.2

In the next section, we introduce a concept that makes use of the structure visualised in Figure 5.2, providing us with the possibility of a wider sectoral- and country-level perspective on regulatory convergence.

[5] Even within the same NTM type for beef, the residuals of dozens of other substances may be regulated. The regulated substances as well as the stringency for each substance tend to vary across countries. It takes an enormous amount of in-depth analysis of specific regulations to compare the stringency of measures – just for a single product and measure type.

3.2. A Wider Approach: Measuring the Distance in Regulatory Structures

The overall table in Figure 5.2 shows a pattern of NTMs across countries that lets us take a more 'structural' approach to regulatory convergence. The following method of summarising and evaluating these structural patterns in UNCTAD NTM data was introduced by us in Cadot, Gourdon, Asprilla, Knebel and Peters (Cadot et al., 2015). We call it 'distance in regulatory structures', or simply 'regulatory distance'.

The basic concept is quickly understood with the help of Figure 5.2. In the example, countries X and Y both apply maximum residue limits (MRL, A21) of certain substances to the product. Both also require certain animal raising processes (A62). So far, the regulatory structure would appear to be similar. In other words, the 'regulatory distance' is short. However, country Y also requires an SPS certification procedure. With this third measure, the regulatory distance between countries X and Y increases slightly. Finally, country Z regulates imports with a different regulatory approach and requires a special authorisation. This type of discretionary restriction differs substantially from the more specific and transparent criteria that countries X and Y use to regulate the import of the product. Therefore, the regulatory distance is large between country Z and countries X and Y.

The example focuses on a single product and compares three countries, but the method allows seeing the bigger picture as well. The respective average regulatory distance can easily be aggregated to the sector level or across all goods; and comparisons can be made between any number of countries. For each product, the table presented in Figure 5.2 would actually have 58 rows for each type of technical NTM; and a column for each country. In our sample, we have this data for each of the roughly 5,200 distinct products classified in the Harmonized System (HS 6-digit), and for 10 ASEAN countries as well as 36 other countries.

Formally, the **distance in regulatory structures** can be expressed and aggregated as follows.

The specific NTM type (l) applied by an importing country (i) to a specific product (k) coming from an exporting country (j) in a given year (t) is defined as a 'dummy' variable[6]:

$$n_{ijkt}^{l} = \begin{cases} 1, & \text{if country } i \text{ applies NTM type } l \text{ to product } k \text{ from origin } j \text{ in year } t \\ 0, & \text{if no such NTM is applied} \end{cases}$$

The regulatory distance (RD) between two countries *i* and *j* for the same NTM type, product and year is therefore:

$$RD_{ijkt}^{l} = \left| n_{ijkt}^{l} - n_{jikt}^{l} \right| \text{, for } i \neq j$$

[6] It is feasible that an importer applies several different regulations that are classified under the same NTM code (for example, two different certificates – a health certificate and a veterinary certificate). In such cases, still only a '1' is counted for this importer–product–NTM combination.

If both countries apply the same measure, the regulatory distance is *0*; if they do not, the equation yields *1*. To actually analyse regulatory **patterns***,* it has to be aggregated across measures and products. The overall regulatory distance between countries i and j, across all products and measure types in a given year, is then:

$$RD_{ij.t} = \frac{1}{L\,K} \sum_{l}^{L} \sum_{k}^{K} \left| n_{ijkt}^{l} - n_{jikt}^{l} \right|$$

where L is the number of different NTM types that we aggregate, and K the number of different products over which the average is built.[7] As opposed to a possible trade-weighted aggregation, the simple, unweighted aggregation minimises the potential downward endogeneity bias where in the following sub-section, the methodology is applied to ASEAN to illustrate the current state of regulatory distance.

3.3. Regulatory Distance in ASEAN

The logic of regulatory convergence and therefore the scope of using the regulatory distance measure are only relevant with respect to technical behind-the border measures. Outright 'barriers' could be reduced or eliminated, but not harmonised. In the following, we therefore focus on the regulatory distance of technical measures.

While data for more countries is available, we concentrate our discussion of regulatory distance on ASEAN and a few developed countries for comparative purposes.

A special statistical technique called 'multidimensional scaling' lets us visualise all bilateral regulatory distances between the countries in our sample. Essentially, the aggregation method described in Section 3.2 yields a single figure

e for the regulatory distance between each pair of countries. Figure 5.3 (for agricultural sectors) and Figure 5.4 (for manufacturing sectors) then plot all of these distances onto a two-dimensional graph with the best possible fit. The distance between two country-points in the graph therefore reproduces the calculated regulatory distance measure. The graphs are best understood as maps, where distances between country-points imply regulatory distances just like geographical distance.

It is important to point out that there is no 'more' or 'less' regulation in these graphs, only relative positions of similarity. The absolute position towards the left, right, top, or bottom of a graph therefore has no significance.[8] However, the United States, the European Union, or Japan may be taken as reference points for high levels of regulation. Lao PDR may serve as a reference for rather low levels of NTM prevalence, as discussed in Chapter 2.

---

[7] L refers to the total of all 58 possible SPS and TBT measure types; K refers to all, unweighted products in the respective sectors (all products, agriculture, and manufacturing).

[8] The centre of the graph at coordinates (0;0) represents the point that is 'closest' to the average of countries of the sample. With a limited set of countries in the sample, this point also has little significance. The axis scales are relevant when comparing across different graphs, as they do relate to the absolute values of regulatory distance.

Generally, regulatory distance is much lower in manufacturing sectors. The scaling of the axes in Figure 5.3 and Figure 5.4 is different and therefore exhibits intra-sector patterns rather than allowing for comparisons across figures/sectors. For example, even the distant points of the European Union and the United States in the manufacturing sector (Figure 5.4) only represent a regulatory distance of 0.10. By comparison, the very close points of Malaysia and Thailand in the agricultural sector (Figure 5.3) actually correspond to a slightly larger regulatory distance of 0.11.

Figure 5.3 and Figure 5.4 show certain levels of grouping, i.e. regulatory similarity within the ASEAN region vis-à-vis the three highly regulated markets of the United States, the European Union, and Japan. The large regulatory distance between these developed countries is quite notable. It could be argued that large supply, demand, technology and infrastructure make these countries trade powerhouses, but that regulatory convergence is not a contributing factor. However, particularly in the agricultural sectors (Figure 5.3), we also see significant dispersion between the ASEAN economies. Given the diversity of ASEAN countries in terms of level of development, geography, history, culture and language, this may be expected.

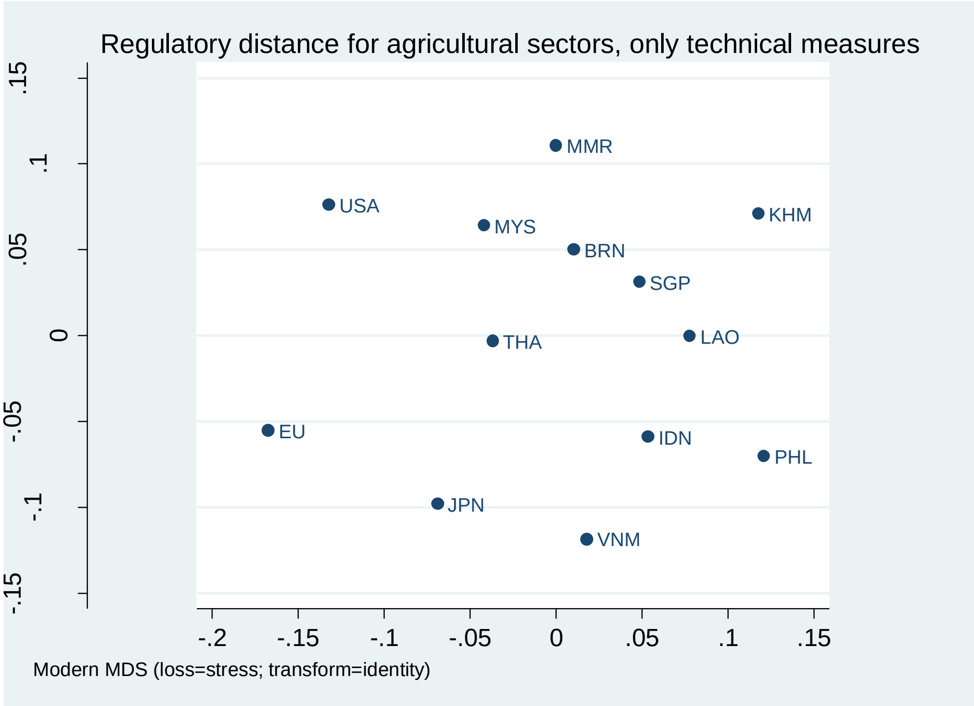
Comparing the agricultural and manufacturing sectors, the closer grouping in the manufacturing sector may indicate that higher regulatory convergence has contributed to the advanced industrial integration and value chains within the region. The fact that ASEAN countries with higher shares of intra-regional trade find themselves more clustered together in Figure 5.3 and Figure 5.4 supports that hypothesis. The ASEAN members with the highest shares of extra-regional trade (Cambodia, the Philippines, Viet Nam and Indonesia), by contrast, exhibit a relatively large regulatory divergence from the rest of the ASEAN group.

It is also notable that the four ASEAN countries that are net exporters of agricultural goods (Thailand, Indonesia, Malaysia and Viet Nam) are found to converge towards the more highly regulated developed countries (United States, European Union and Japan). However, like amongst the three developed countries in our sample, there are no signs of regulatory similarity between the four ASEAN Member States.

Further observations are that the two large, neighbouring, upper-middle-income countries of the region, Thailand and Malaysia, also exhibit higher levels of regulatory similarity across sectors. Singapore and Brunei Darussalam show similarity in agricultural sectors as two small and import-dependent high-income countries. In the manufacturing sector, Singapore's regulatory distance vis-à-vis Japan, the United States and the European Union is just as large as amongst those three developed markets. At the same time, some regulatory similarities with the ASEAN partners are evident.

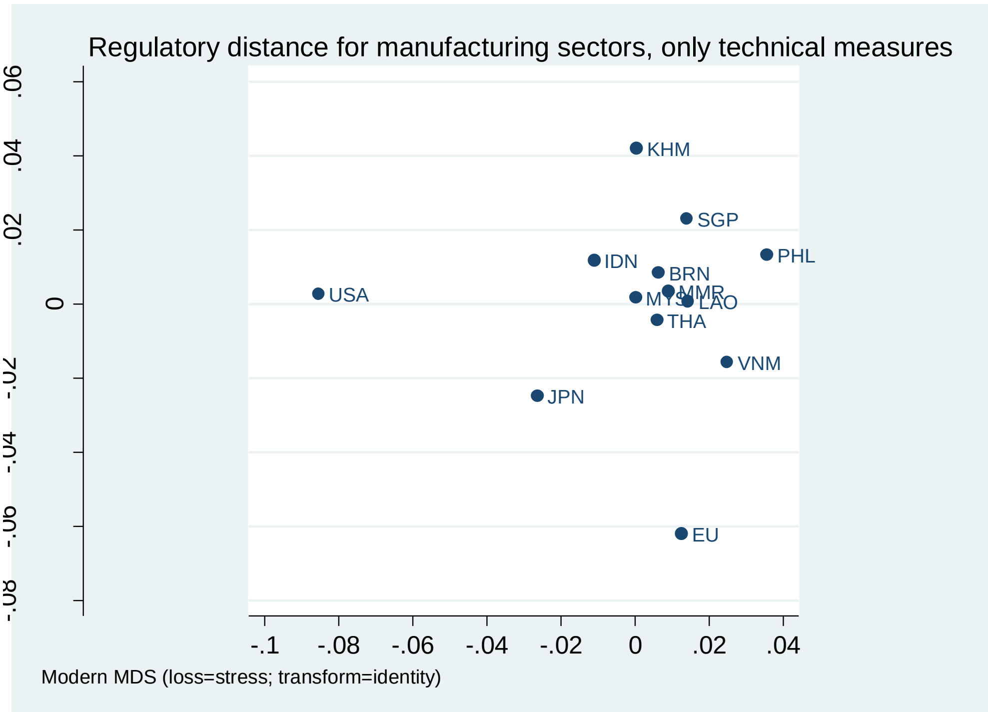
While the above graphs provided an aggregate view at the country- and sector-level, the impact analysis in Section 4 will make use of our data at the fine-grained product level (6-digits with 5,200 products).

Figure 5.3: Bilateral Regulatory Distances, Agricultural Sectors



Source: Authors' calculations.

Figure 5.4: Bilateral Regulatory Distances, Manufacturing Sectors



Source: Authors' calculations.

3.4. Who Has to Travel More of the 'Regulatory Distance'? Looking at 'Regulatory Overlap'

The 'regulatory distance' expresses the level of similarity in regulatory structures between two countries (with respect to technical measures). However, bridging the distance is not equally difficult for each of the two countries.

Take the regulatory distance between Thailand and Lao PDR in the agricultural sector in Figure 5.3. Thailand applies more technical measures than Lao PDR. The intuitive hypothesis is that it is easier for Thailand to access the Lao PDR market than vice versa. Assuming that most SPS and TBT measures are applied in a non-discriminatory way to both domestic and foreign producers, a producer from Thailand already has to comply with a multitude of domestic requirements. Exporting to Lao PDR may then be less of an additional burden. By contrast, with fewer domestic regulations in Lao PDR, a producer is likely to find it harder to upgrade the product for the Thai market.

But it is not only about which country has more or less regulation. Particularly if countries have similar levels of regulatory intensity, their similarity matters. France, Germany, and the United States may all apply similar numbers of NTMs, but requirements between France and Germany are harmonised through the European Union. For a French producer, exports to Germany therefore hardly imply additional costs. By contrast, exports to the United States may be very costly.

Both dimensions matter. The 'regulatory overlap' measure is therefore introduced below. It expresses the share of the importer's NTMs that the exporter is already dealing with at a domestic level.

Again building upon the disaggregated data of NTMs at the product level, Table 5.2 serves best to explain the measure. It appears similar to Figure 5.2, but now takes into account the direction of trade. The table refers to the calculation of the 'regulatory overlap' for a specific product. The left pane of the table shows four different types of technical NTMs. As indicated by a '1' in the respective fields, importer Y applies three of these measure types. Exporter Z applies two.

Both importers and exporters regulate certain maximum residue limits (MRLs), for example of antibiotics in beef. This can be considered a regulatory overlap from the perspective of exporter Z (as indicated by the arrow in the second row).[9] It can be assumed that a producer in country Y is used to domestic MRLs and therefore finds it less difficult to also comply with the MRLs of importer X. However, there is no overlap regarding the other two measures that exporter Z needs to comply with when trading to importer Y (as indicated by the crossed arrows in the other rows). Furthermore, the special authorisation (A14) measure applied by Exporter Z (last row of the table) does not create additional regulatory overlap because this type of NTM is not applied by importer Y.

[9] Following World Trade Organization principles of non-discrimination between domestic and foreign products, most measures applied as import-related NTMs should also be applied domestically for domestic producers.

Table 5.2: Example of NTM Data Mapping with Respect to 'Regulatory Overlap'

NTM types and codes for a specific product at HS-6 level: e.g. beef	Importer Y	Exporter Z	Exporter Z* after reform
A21: Maximum residue limit	1	1	1
A62: Animal raising processes	1	0	0
A83: SPS certificate	1	0	1
A14: Special authorisation	0	1	0
Total number of NTMs	3	2	2
Number of overlapping NTMs	1		1+1=2

Source: Authors' illustration.

If exporter Z wanted to increase the regulatory overlap through domestic reform (exporter Z*), a simple scenario could be imagined. Exporter Z could replace the discretionary 'A14: special authorization' by more transparent SPS certificate. The total number of NTMs in exporter Z* has remained the same. However, now two measures overlap with importer Y.

Certainly, details are particularly crucial with complex technical measures. For example, maximum residue limits may vary substantially between two countries. The proposed regulatory overlap only delivers an approximation with respect to the similarity of regulatory structures and mechanisms. With thousands of products and many countries to compare, a more detailed comparison is not feasible.

4. Measuring the Impact of NTBs, NTMs, and Regulatory Divergence

4.1. Econometric approach to estimating the impact of NTBs, technical measures and 'regulatory overlap'

The basic intuition of our estimation is that cost, insurance, freight (c.i.f.) product prices at the border are 'treated' by different types of NTMs, taking into account regulatory overlap. The estimation is based on a worldwide cross-section of 46 recently collected countries, including ASEAN members, at a disaggregated product-level (HS 6-digits, more than 5,000 products). Appendix Table A.1 reports descriptive statistics for each country in the sample.[10]

Cost, insurance, freight (c.i.f.) unit values are used instead of free on board (f.o.b.) as they are likely to capture more of the NTM-related costs. While unit values at the bilateral and product level are known to be statistically noisy, we use the dataset provided by Berthou and Emlinger (2011), which improves data quality significantly and treats outliers. The estimated effects are

[10] To date, the full UNCTAD NTM database includes about 60 countries, but only more recently collected data was included in this analysis due to significant improvements in data quality in 2012/13.

therefore ad valorem equivalents (AVEs) in terms of the impact on the final c.i.f. unit value goods price. Barriers as well as technical measures are expected to raise prices.

Regarding technical measures (SPS and TBT) we count the number of distinct types of NTMs applied by the importer (*ImpNTM*) and domestically by the exporter (*ExpNTM*). To measure the impact of regulatory convergence, we also count the number of overlapping measures between importer and exporter (*sameNTM*).

Furthermore, control variables are included to capture overall price levels (*log* of exporter's and importer's per capita gross domestic product [GDP]) and transport costs (*log* of distance, landlockedness, and common borders). Product-specific effects are absorbed through product-level fixed effects.

The simple log-linear estimation equation reads as follows with sub-indices for product k, importer l and exporter j:

$$\begin{aligned} \ln(p_{ijk}) = \alpha + \; & \beta_1 \text{ImpNTM}_{ijk} + \beta_2 \text{ExpNTM}_{ijk} + \beta_3 \text{sameNTM}_{ijk} + \beta_4 \text{QR}_{ijk} \\ & + \beta_5 \ln(\text{GDPpc}_i) + \beta_6 \ln\left(\text{GDPpc}_j\right) + \beta_7 \text{landlocked}_i + \beta_8 \text{landlocked}_j \\ & + \beta_9 \ln(\text{distance}_{ij}) + \beta_{10} \text{contig}_{ij} + FE_k + \varepsilon_{ijk} \end{aligned}$$

Specification (1) runs the regression with all NTM variables as level variables and for all product sectors combined.[11] Specifications (2) and (3) run the same regression, but break down the sample into two different sub-samples: only agricultural and food products in (2) and only manufactured products in (3). The regression results are presented in Table 5.3.

Across all specifications, the included control variables show the expected signs: overall price levels (approximated by importer and exporter GDP per capita), distance, and landlockedness raise unit values, whereas common borders reduce prices. As expected, the importance of transport costs (distance, landlockedness, and common borders) is higher in agricultural trade. The estimated price-raising impact of quantitative restrictions is positive as expected, although not statistically significant in specification (2). Apart from the correct signs, it should be noted that the magnitude of the parameters should not be compared with estimates from Gravity-style regressions. Our estimates are impacts on trade unit values, not trade volume.
Most importantly, however, the main explanatory NTM variables show the expected sign, magnitude and statistical significance across all specifications.
First of all, as shown in existing literature and unsurprisingly, NTMs applied by the importing country raise trade unit values. Using the number of distinct NTM types as a measure of regulatory intensity, specification (1) finds an average price-increasing effect of 2.4 percent for a marginal increase of an additional technical NTM.

[11] We also conducted estimations with the log of the three NTM variables. Results vary in magnitude, but confirm the qualitative effects of the estimations using level variables.

Table 5.3: Regression Results

Dependent variable: log (c.i.f. trade unit value)

	(1)	(2)	(3)
	all Sectors	only Agriculture	only Industry
Importer's *total number* of technical NTMs	0.024***	0.012***	0.034***
	(0.00)	(0.00)	(0.00)
Exporter's/domestic *total number* of technical NTMs	0.021***	0.0093***	0.029***
	(0.00)	(0.00)	(0.00)
Pairs of *overlapping* NTMs in exporter & importer	-0.023***	-0.0086**	-0.026***
	(0.00)	(0.03)	(0.00)
Importer quantitative restrictions dummy	0.032***	0.021	0.029***
	(0.01)	(0.02)	(0.01)
log (Importer GDP per capita)	0.20***	0.25***	0.19***
	(0.00)	(0.01)	(0.00)
log (Exporter GDP per capita)	0.21***	0.18***	0.21***
	(0.00)	(0.01)	(0.00)
log (distance)	0.19***	0.074***	0.20***
	(0.00)	(0.00)	(0.01)
1 for common border	-0.054***	-0.22***	-0.031***
	(0.01)	(0.02)	(0.01)
1 if importer is landlocked	0.12***	0.19***	0.11***
	(0.01)	(0.02)	(0.01)
1 if exporter is landlocked	0.20***	0.089**	0.22***
	(0.02)	(0.04)	(0.02)
Observations	412,911	43,662	369,249
Adjusted R^2	0.714	0.616	0.697

log = logarithm; c.i.f. = cost, insurance, freight; NTMs = non-tariff measures; GDP = gross domestic product.

Notes: Clustered standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Fixed effects regressions with product-specific (HS-6 digit) fixed effects.

Source: Authors' estimations.

A crucial addition to our set of variables is the inclusion of the number of technical NTMs applied by the exporting country. Founded on General Agreement on Tariffs and Trade (GATT) and World Trade Organization (WTO) agreements and the principle of equal regulatory treatment of foreign and domestic producers, we assume that NTMs applied by the exporting country would also hold for domestic production. We find that domestic NTMs increase trade unit values by virtually the same magnitude as foreign NTMs. The estimated marginal effect of 2.1 percent for an additional domestic NTM is only slightly below the effect of a foreign NTM (2.4 percent). The difference may represent economies of scale that reduce the cost of domestic NTMs.

The third NTM variable counts the number of overlapping NTMs: a pair of one NTM applied by the importer and a second NTM applied by the exporter/domestically, but overlapping in specific NTM type. The finding is quite remarkable: the estimated price-reducing effect (minus 2.3 percent) is also very similar to the price-increasing impact of an additional NTM applied by importer (plus 2.4 percent) or exporter (plus 2.1 percent). Breaking down all NTMs into these three variables allows us to distinguish between a 'gross' effect of NTMs (ignoring the overlapping NTMs variable) and a 'net' effect (taking into account the overlapping NTMs variable).

Let us take a simple example to illustrate the meaning of this result: one NTM applied by the importer and one NTM applied by the exporter increase the trade unit value by 2.4 percent plus 2.1 percent, a total of 4.5 percent. However, if these two NTMs happen to overlap, the effect would be reduced by 2.3 percent. Regulatory overlap reduces the total effect from 4.5 percent to 2.2 percent. One could also say that the 'net effect' of a foreign NTM is cancelled out if the exporter applies an overlapping NTM domestically.

Testing the same set of variables with the agricultural sub-sample in specification (2) shows the same pattern, just with lower estimates for each variable. Many more NTMs, especially SPS, are applied in the agricultural sector, but their marginal effect is lower at about 1 percent (1.2 percent for importer's NTMs and 0.9 percent for domestic NTMs). Again, regulatory overlap almost cancels out the 'net effect' of an additional foreign NTM.

We also find this effect in the manufacturing sub-sample (specification 3). Here, with a generally lower incidence of NTMs, the respective marginal effects are higher (3.4 percent for importer's NTMs, 2.9 percent for domestic NTMs, and minus 2.6 percent in case of overlapping measures).

When comparing the estimates in the agricultural sector with the manufacturing sector, the marginal effects need to be seen in conjunction with the frequency of NTMs in the respective sectors. The estimated marginal effect of an additional NTM in the agricultural sector is only about 1 percent, but there is an average of seven NTMs per product. While the marginal effect of an NTM in the manufacturing sector is almost three times larger, the average number of NTMs per product is only one. The aggregate effect of technical NTMs is therefore significantly larger in the agricultural sector, which is consistent with the literature (see Li and Beghin, 2012). Linear extrapolations will be discussed in Section 4.2.

Of course, the regressions remain based on the binary distinction between non-overlapping and overlapping measures. As mentioned above, however, details matter: amongst overlapping measures, there may be very significant differences between the specific measures. Likewise, non-overlapping measures may be highly restrictive or very easy to comply with. Therefore, the actual impact of NTMs will always vary very substantially on a case-by-case basis. But for our large sample with many countries and product-level observations across all products, there is currently no available data that would allow a more detailed assessment.

Another caveat is the fact that the estimation relies exclusively on the intensive margin, i.e. only observations are taken into account where there is positive trade at a bilateral and product-specific level. At this level of disaggregation, trade only occurs in 4 percent of all observations. Ideally, a Heckman selection model would be used to remedy this issue and assess NTM impacts at the intensive and extensive margin of trade and unit prices. However, finding at robust exclusion restriction at this high level of data disaggregation with wide country- and product-coverage remains a challenge.

Moreover, there is a natural and significant correlation between the total number of NTMs and the number of overlapping NTMs. But post-estimation diagnostics show that it is below critical levels: the variance inflation factors for the NTM variables are between 3.15 and 4.15; and correlation coefficients between the variables do not exceed 0.7.

Still, more work is needed to test the robustness of the results presented above. Further tests showed mixed results. The most rigorous specification, a Poisson Pseudo Maximum Likelihood estimator with importer–product, exporter–product, and import–exporter-pair fixed effects, corroborates the validity of the core NTM variables. While the interpretation of parameters of NTMs applied by the importer and exporter is different (only the effect of discriminatory measures is measured), this specification confirms that the cost-reducing impact of regulatory overlap is highly significant. However, several other specifications using fixed effects for importer, exporter or importer–exporter pairs (in addition to product fixed effects) remained inconsistent. This suggests that cross-country variation, rather than by cross-product variation, is driving the results. Furthermore, presumably significant noise in the data on NTMs and trade unit values interferes with the results.

4.2. An Extrapolation: The Impact of Technical Measures and 'Regulatory Overlap' in ASEAN

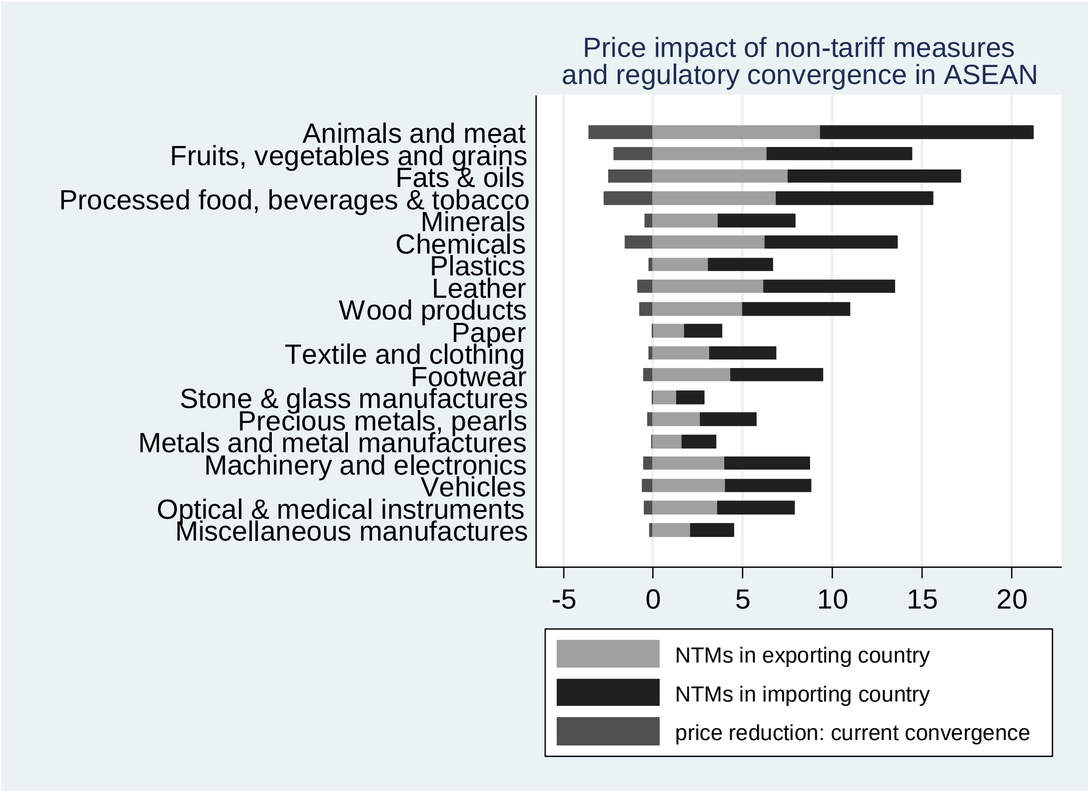
To approximate the order of magnitude of the aggregate impact of technical NTMs and regulatory convergence in ASEAN, we take the marginal regression results to conduct a linear extrapolation of the marginal results.

We simply multiply the marginal effects from specifications (2) and (3) for agriculture and manufacturing (see Table 5.3) with the respective observations of three variables: the numbers of technical measures applied by the importer and exporter, and the overlapping measures. Certainly, this extrapolation is based on the imperfect implicit assumption that the marginal effects are valid linearly and irrespective of the number of measures. The extrapolation results should therefore only be seen as approximate.

Figure 5.5 shows the total 'gross' price-increasing impacts of domestic/exporter's and foreign NTMs on the right of the axis, and the respective price-reducing effects of current regulatory overlap on the left of the axis. Across sectors, the overall impacts are as expected, with larger effects in agricultural sectors than in manufacturing sectors. Taking the sum of domestic and foreign NTMs, they range between 17 percent and 22 percent in agricultural sectors and between 3 percent and 14 percent in manufacturing sectors.

On the other side of the axis, we observe that the current level of regulatory overlap has a relatively low price-reducing effect, ranging between 3 percent and 4 percent in agriculture and less than 1 percent in most manufacturing sectors. While the two indicators cannot be compared directly, the 'regulatory distance' illustrated in Figure 5.3 and Figure 5.4 already indicated a relatively low level of regulatory convergence in the region. In Section 4.3 we will briefly explore the potential for increased convergence through a regulatory reform.

Figure 5.5: Regional Average Price Impact of NTMs and Regulatory Convergence



NTMs = non-tariff measures; ASEAN = Association of Southeast Asian Nations.
Source: Authors' calculations.

On average, price increases due to domestic measures are naturally in the same order of magnitude as the impact of foreign measures. At the bilateral level, this is different as shown in Figure 5.6 and Figure 5.7 for agriculture and manufacturing, respectively.

For each exporter, the effect of domestic measures is the same for all destinations. We then show the bilateral 'net' effect, which refers to the impact of foreign NTMs minus the price reductions through regulatory overlap.[12]

[12] Overlapping measures could be viewed primarily as domestic requirements that add costs of production before exporting. But when the producer starts exporting, the overlapping measures abroad only have a minimal impact. From this perspective, the real challenge for exporters lies principally with foreign non-overlapping measures.

For example, we can observe that the moderate domestic regulatory intensity of Thailand raises agricultural product prices by about 8 percent when exporting (Figure 5.6). In addition, foreign market regulations raise unit values by 1 percent to 6 percent, depending on the regulatory intensity of the destination market and after deducting the price-reducing effect of regulatory overlap. For Thailand, Lao PDR tends to be a very easy market to access with only a 1 percent premium to adapt domestic products to the requirements of Lao PDR. By contrast, unit prices increase by around 6 percent when of preparing a product for the markets in the the Philippines or Viet Nam.

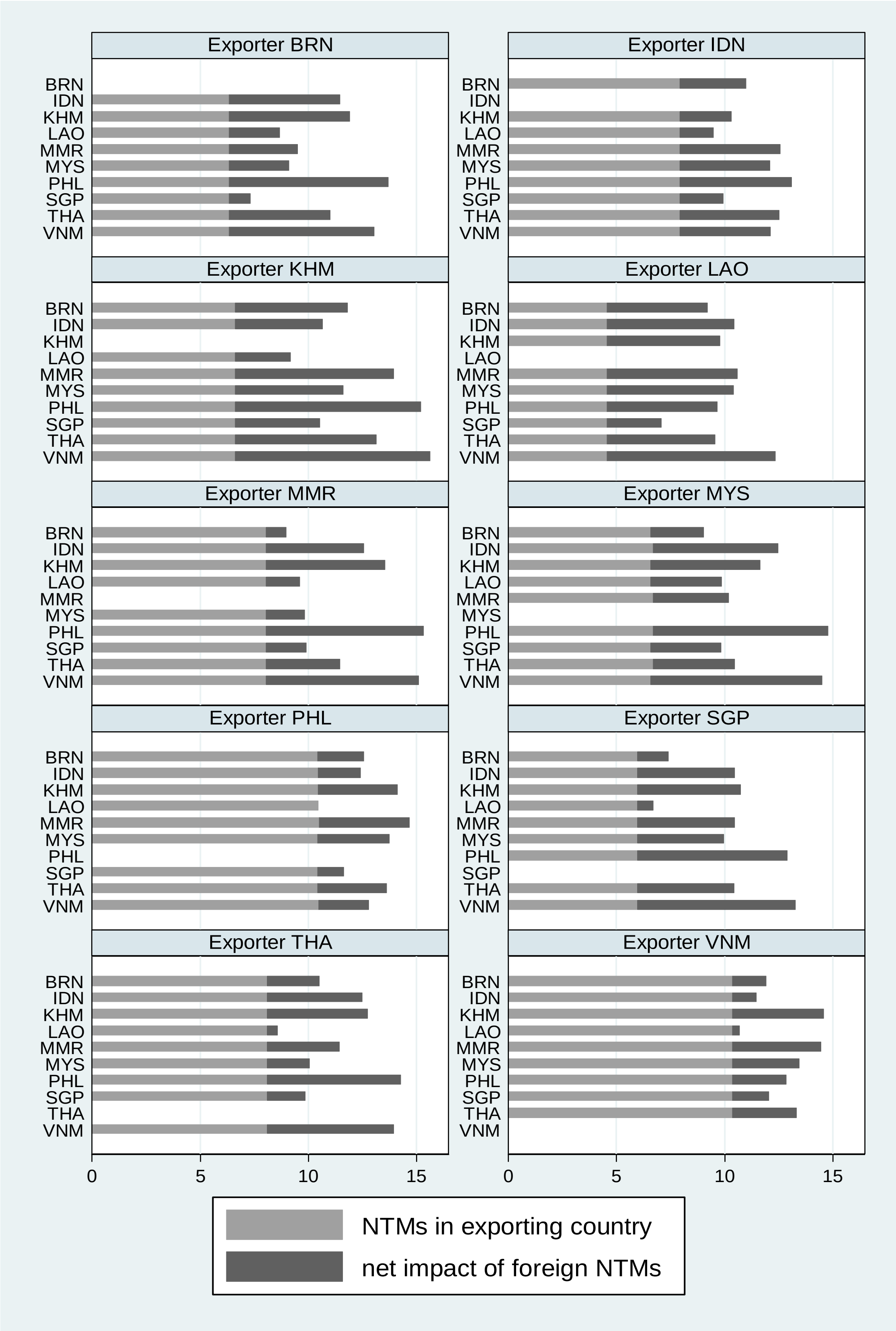
Certainly, the number of NTMs applied by the destination country plays a predominant role. However, regulatory overlap can be significant, as the following example shows:

In comparison to the previous case of Thailand, Cambodia is less regulated domestically. Domestic regulation raises trade unit values by about 6 percent, compared to Thailand's 8 percent. However, when competing with Thailand for the Malaysian market, the regulatory overlap becomes significant. The same NTMs applied by Malaysia have a net effect of only 2 percent for exporters from Thailand, but a 5 percent net effect for exporter from Cambodia. Malaysian regulations overlap more with Thailand than with Cambodia. This implies that products coming onto the Malaysian market from Thailand tend to be lower priced (8 percent plus 2 percent) than those coming from Cambodia (6 percent plus 5 percent), despite the lower levels of domestic regulation in Cambodia. The illustration in Figure 5.3 had already shown that Cambodia has a relatively high regulatory distance from Thailand and several other ASEAN countries. This is reflected in the extrapolation of the regression results with relatively high net effects of NTMs.

The above example illustrates a point that is valid for all bilateral trade relationships: trade unit values are increased by domestic as well as foreign technical measures. This also impacts competitiveness based on prices. However, regulatory overlap can reduce the price increasing effect of NTMs and thus also increase competitiveness. On the import side, regulatory convergence would reduce consumer prices. On the export side, regulatory overlap would reduce export prices and lead to a competitive 'push effect' (see also Mangelsdorf et al., 2012).

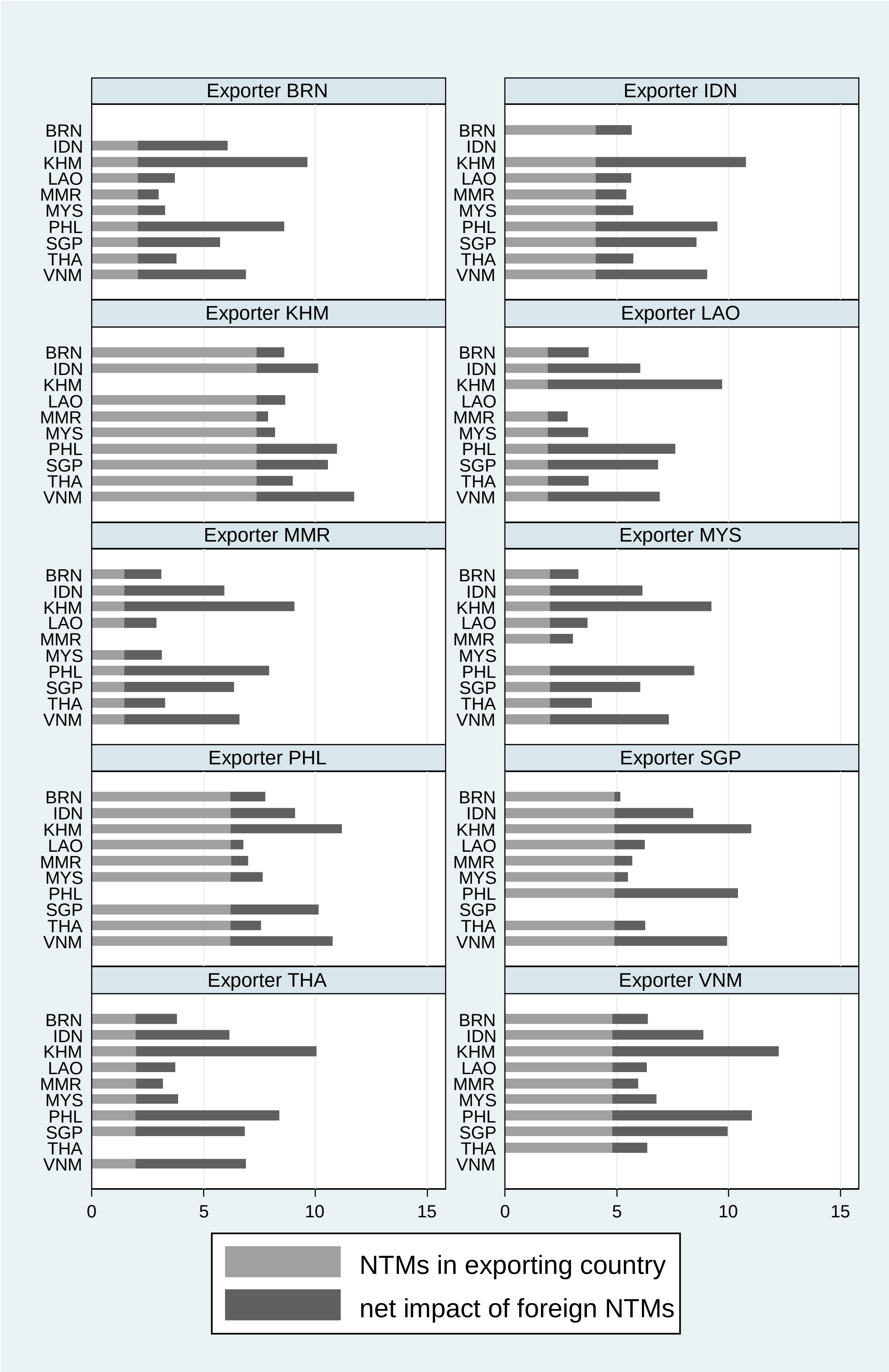
Such patterns as well as disparities in regulatory intensity and overall price increases are also seen in manufacturing sectors (see Figure 5.7).

Figure 5.6: Bilateral Net Effect of Technical Measures in Agricultural Sectors



NTMs = non-tariff measures.
Source: Authors' calculations.

Figure 5.7: Bilateral Net Effect of Technical Measures in Manufacturing Sectors



NTMs = non-tariff measures.
Source: Authors' calculations.

4.3. The Potential for Regulatory Reform to Increase Convergence in ASEAN

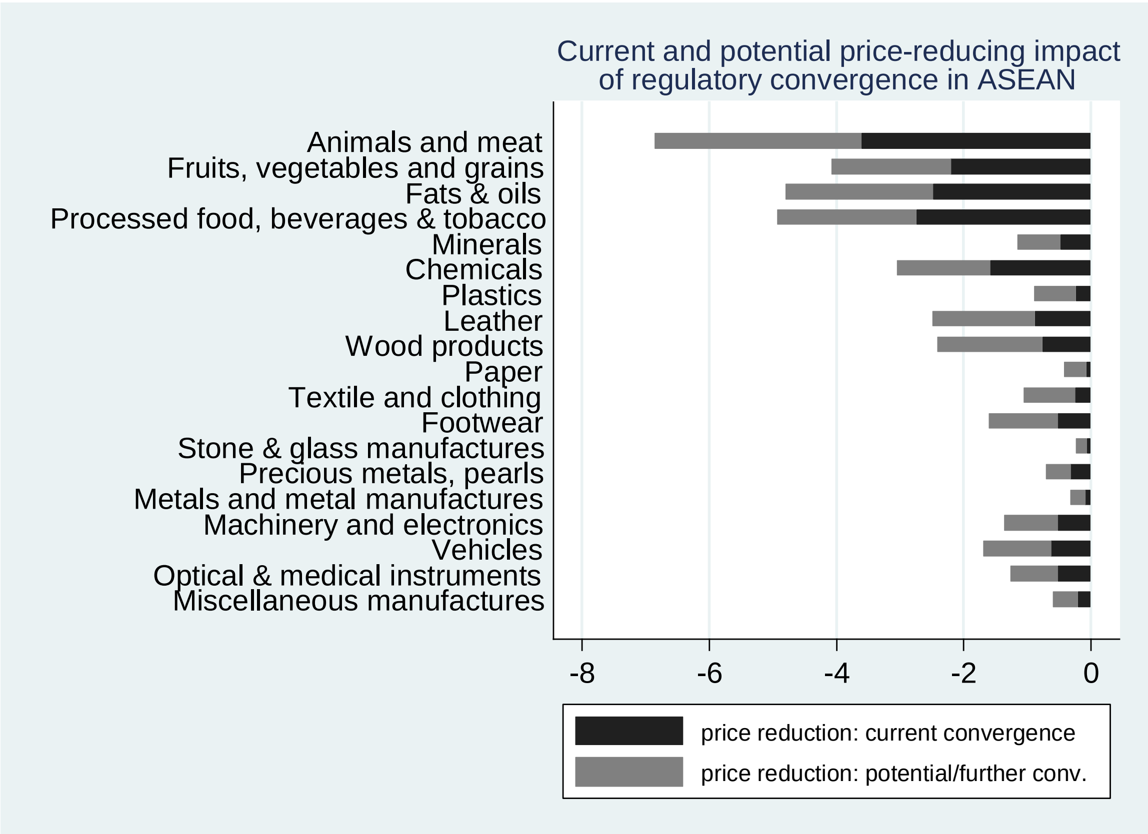
We also simulate the potential of price reductions through a modest regulatory reform. The reform scenario does not increase nor decrease the number of NTMs in any country. Instead, only a realignment of existing measures takes place.

This approach recognises that countries at different levels of development may need different levels of technical regulation. Despite this careful approach, the extrapolated price-reducing effect of regulatory overlap can be doubled in agricultural sectors and increased about three-fold in most manufacturing sectors.

For example, the current gross effect of foreign NTMs in the fruits, vegetables, and grains sector was estimated at 12.5 percent. Currently, regulatory overlap within the ASEAN region reduces this effect by about 2.5 percent to a net effect of 10 percent (Figure 5.8). The net effect could be further brought down by 2 percent through this reform (Figure 5.8).

Across most sectors, a cut of 15 percent to 25 percent of current net impacts of foreign NTMs could be achieved without decreasing or increasing the number of NTMs in any country.

Figure 5.8: Current and Potential Price-reducing Impact of Regulatory Convergence



ASEAN = Association of Southeast Asian Nations.
Source: Authors' calculations.

5. Policy Implications and Conclusions

Chapter 4 conducted by Ing and Cadot, shows the importance of NTMs in ASEAN and beyond in determining market access and market entry conditions. This chapter has emphasised and quantified the importance of regulatory convergence in ASEAN. Costs of compliance with technical NTMs depend not only on the stringency and number of measures abroad, but also significantly on the similarity of the foreign measures with domestic market requirements. Regulatory cooperation is therefore rightly on the agenda of ASEAN Member States as well as with important trading partners in the Regional Comprehensive Economic Partnership (RCEP) group.

SPS and TBT measures have significant price-raising effects that exceed those of traditional non-tariff barriers. Due to their important regulatory functions to protect health and the environment, they cannot be eliminated. However, estimations show that their actual burden is substantially reduced by regulatory convergence.

Each additional technical measure increases prices of trade goods by about 2 percent at the margin. However, if the additional foreign NTM overlaps with domestic regulation, the price-increasing effect practically vanishes. Thus, two ASEAN countries that have similar regulations to protect health and the environment would not increase trade costs by more than the costs of domestic compliance.

Countries neither need to be concerned about export price competitiveness when they chose to use technical measures to protect their population – if these measures are designed in a smart way, i.e. coordinated and overlapping with their trading partners.

A regulatory reform to realign existing NTMs and to maximise regulatory overlap, but without increasing or decreasing the number of NTMs in any country, could reduce the current net effects of NTMs by 15 percent to 25 percent.

Since ASEAN countries are generally well integrated into global value chains, using international standards is the first best option to achieve regulatory convergence towards a common benchmark. Regulatory convergence with particular countries, for example in mega-regional agreements, could further reduce trade costs with these trading partners. However, polarised convergence may hamper competitiveness with other export destinations across the *globe.*

References

Berthou, A. and C. Emlinger (2011), 'The Trade Unit Value Database', *International Economics*, 128, pp.97–117.

Cadot, O., A. Asprilla, J. Gourdon, C. Knebel, and R. Peters (2015), 'Deep Regional Integration and Non-tariff Measures: A Methodology for Data Analysis'. UNCTAD/ITCD/TAB/71. Geneva: United Nations.

Kee, H.L., A. Nicita, and M. Olarreaga (2009), 'Estimating Trade Restrictiveness Indices', *Economic Journal*, 119, pp.172–99.

Li, Y. and J.C. Beghin (2012), 'A Meta-analysis of Estimates of the Impact of Technical Barriers to Trade'. *Journal of Policy Modelling*, 34, pp. 497–511.

Mangeldorf, A., A. Portugal–Perez, and J.S. Wilson (2012), 'Food standards and exports: evidence for China', *World Trade Review*, 11(3), pp.507–26.

UNCTAD (2010). 'Non-Tariff Measures: Evidence from Selected Developing Countries and Future Research Agenda', UNCTAD/DITC/TAB/2009/3, Geneva: United Nations.

UNCTAD (2013), Classification of Non-Tariff Measures, February 2012 Version, UNCTAD/DITC/TAB/2012/2, United Nations, New York and Geneva, 2013. Available at http://unctad.org/en/PublicationsLibrary/ditctab20122_en.pdf

UNCTAD (2013), 'Non-Tariff Measures to Trade: Economic and Policy Issues for Developing Countries', UNCTAD/DITC/TAB/2012/1, Geneva: United Nations.

UNCTAD (2014), 'Guidelines to Collect Data on Official Non-tariff Measures'. United Nations, UNCTAD/DITC/TAB/2014/4, Geneva: United Nations.

Wilson, J.S, T. Otsuki, and B. Majumdsar (2003), Balancing Food Safety and Risk: Do Drug Residue Limits Affect International Trade in Beef? *Journal of International Trade & Economic Development*, 12(4), pp. 377–402.

Appendix

Table A1: Descriptive Statistics and Country Coverage

Reporter	Year	Number of Distinct Technical Measures							
		Agricultural sectors				*Manufacturing sectors*			
		Mean	*Std.Dev.*	*Min*	*Max*	*Mean*	*Std.Dev.*	*Min*	*Max*
Argentina	2014	7.81	2.82	0	13	0.97	1.72	0	13
Benin	2014	5.26	4.30	0	17	0.11	0.44	0	10
Burkina Faso	2012	2.47	1.18	0	6	0.21	0.71	0	6
Bolivia, Plurinational State of	2014	3.39	1.43	0	9	0.38	1.15	0	11
Brazil	2014	8.60	3.40	0	16	1.77	2.21	0	20
Brunei Darussalam	2015	6.81	3.77	0	17	0.72	1.52	0	10
Canada	2015	9.14	6.34	0	29	1.91	2.18	0	19
Chile	2014	4.89	2.67	0	14	1.01	1.49	0	12
Côte d'Ivoire	2012	0.20	0.44	0	4	0.06	0.26	0	3
Colombia	2014	7.93	3.08	0	14	0.45	1.03	0	8
Cabo Verde	2014	8.28	4.35	0	16	0.22	0.72	0	14
Costa Rica	2015	5.55	4.34	0	17	0.41	0.88	0	8
Ecuador	2014	5.03	2.99	0	20	1.10	1.63	0	8
Ethiopia	2015	6.59	2.89	0	14	0.65	1.36	0	15
European Union	2014	15.10	6.06	0	28	4.46	3.06	0	30
Ghana	2014	9.16	4.42	0	13	1.41	2.54	0	11
Guinea	2012	3.26	1.25	0	6	0.98	0.62	0	5
Gambia, the	2013	11.65	10.33	0	36	0.11	1.10	0	33
Guatemala	2015	10.22	3.36	0	21	0.38	1.72	0	12
Honduras	2015	7.34	3.97	0	14	0.51	1.31	0	9
Indonesia	2015	8.50	6.53	0	22	1.41	1.97	0	20
Japan	2015	10.57	4.69	0	25	3.04	3.70	0	21
Cambodia	2015	7.12	5.84	0	18	2.56	3.14	0	18
Lao PDR	2015	4.90	1.98	0	11	0.67	1.79	0	13
Liberia	2014	6.87	3.43	0	13	0.38	1.17	0	11
Mexico	2014	4.27	2.94	0	14	0.75	1.04	0	7
Mali	2014	3.46	1.60	0	8	0.15	0.53	0	5
Myanmar	2015	8.65	3.93	0	19	0.51	1.52	0	13
Malaysia	2015	7.21	3.52	0	15	0.70	1.38	0	12
Niger	2014	2.60	1.20	0	6	0.13	0.51	0	5
Nigeria	2013	7.50	4.38	0	12	0.51	1.17	0	10
Nicaragua	2015	9.39	5.78	0	24	0.20	0.78	0	8
New Zealand	2015	12.24	6.03	0	22	0.65	1.41	0	19
Panama	2015	5.87	3.06	0	15	0.28	1.02	0	11
Peru	2014	5.48	2.53	0	18	0.51	1.44	0	20
The Philippines	2015	11.25	3.77	0	26	2.16	2.86	0	24
Paraguay	2014	3.44	2.74	0	13	0.31	0.93	0	8
Senegal	2012	2.42	1.63	0	7	0.04	0.25	0	5

Singapore	2015	6.42	4.33	0	18	1.71	1.63	0	10
El Salvador	2015	3.89	2.91	0	12	0.47	0.99	0	12
Togo	2014	0.62	1.19	0	3	0.10	0.45	0	6
Thailand	2015	8.70	4.97	0	19	0.68	1.84	0	16
Uruguay	2014	5.13	2.63	0	13	0.85	1.29	0	10
United States	2014	12.55	5.78	0	29	6.30	4.86	0	24
Venezuela, Bolivarian Republic of	2014	3.85	2.63	0	12	0.32	0.83	0	6
Viet Nam	2015	11.13	4.04	0	18	1.67	1.39	0	14

Std.Dev. = standard deviation.

Source: Authors' calculations.