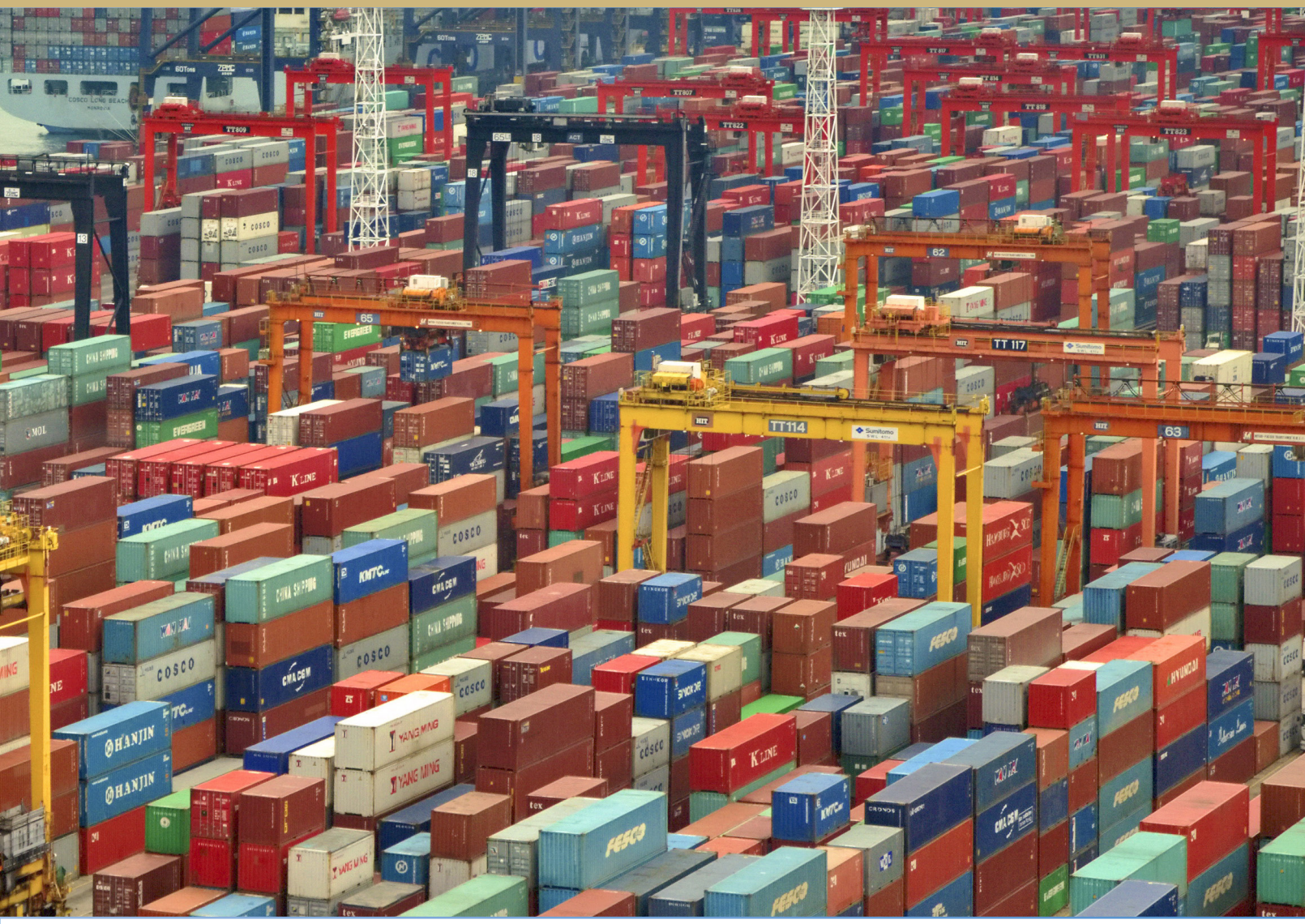
(Preliminary draft)

THE UNSEEN IMPACT OF NON-TARIFF MEASURES:

Insights from a new database



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United Nations publication issued by the United Nations Conference on Trade and Development.

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Acknowledgements

The report is a joint work by UNCTAD and the World Bank, under the supervision of Aaditya Mattoo and Ralf Peters. Santiago Fernandez de Cordoba and Christian Knebel (section 2), Denise Penello Rial and Samuel Rosenow (section 3), and Hiau Kee and Alessandro Nicita (section 4), contributed to this report. The report has been prepared within the UNCTAD – World Bank project "Top 25 Markets", led by Chad Bown and Ralf Peters.

Several partners and donors contributed to the database development. The global data collection is a joint effort coordinated by UNCTAD with the African Development Bank, Economic Research Institute for ASEAN and East Asia, International Trade Centre, Latin American Integration Association (ALADI), National Graduate Institute for Policy Studies (GRIPS), World Bank and World Trade Organisation. Donors are the European Commission, Canada, Japan, Russian Federation, and the United States. The UNCTAD – World Bank project "Top 25 Markets" was financially supported by Japan and the Consortium on Non-Tariff Measures coordinated by GRIPS. The financial contribution is gratefully acknowledged.

The calculated indicators of the disaggregated ad valorem equivalents will be made publicly available for use by researchers and policymakers at i-tip.unctad.org and wits.worldbank.org.

1. Introduction

Non-tariff measures inhabit the grey zone where trade policy meets national regulation. They are generally defined as policy measures other than ordinary customs tariffs that can potentially have an economic effect on international trade. While tariffs are relatively transparent and have been regularly compiled into public databases, non-tariff measures are not always easy to identify and have only been sporadically collected for relatively few countries. With new data, this report sheds new light on the usage and impact of NTMs.

Most traded goods are affected by non-tariff measures. The majority of NTMs are regulatory measures while traditional trade measures such as quotas and non-automatic licensing are now less common. Since most regulations apply equally to domestic products, NTMs affect most of the products that we encounter in our daily lives: packaging requirements and limits on the use of pesticides ensure safe food; restrictions on toxins in toys protect our children; mandatory voltage standards for household plugs enable regional mobility; and emission standards for cars limit climate change.

While tariffs are clear in their intent, the role of NTMs is less straightforward. On the one hand, many regulatory NTMs are indispensable for sustainable development. They aim to protect human, animal or plant health as well as the environment. These objectives are at the core of social and environmental sustainability policies and the measures are legitimate tools in countries' efforts to achieve the Sustainable Development Goals. On the other hand, NTMs can also raise costs and create hurdles for trade and economic development. Private sector surveys indicate that technical regulations as well as related processes pose a significant challenge for trade.

This report confirms firms' perception and shows that NTMs today have a bigger influence on trade than tariffs. The availability of information is a key challenge that also magnifies other challenges, such as the national streamlining of NTMs and regulatory cooperation at the regional and multilateral level to reduce any adverse effects of NTMs. Until recently, systematic information about NTMs was not available for a significant number of countries and a significant share of world trade.

To remedy this gap, UNCTAD and the World Bank launched the "Top 25 Markets"-project in 2014 to collect NTM data for countries that represent a significant share of world trade. In particular, NTM data now covers large importers that serve as main destination markets for developing countries. This information allows us to support exporters in developing country and to assess the development implications of NTMs. Other regional and international organisations also contributed to the data collection.[1] As of December 2017, the data covers 109 countries and 90 per cent of world trade. It has been made publicly available, both at the World Integrated Trade Solution (WITS at *wits.worldbank.org*) and at UNCTAD's Trade Analysis Information System (TRAINS at *i-tip.unctad.org*).

The report is structured as follows. Section 2 of this report describes the methodology that governs the data collection of the NTM database. The conversion of textual information from laws and regulations into a systematic database was achieved with the International Classification of NTMs developed by the Multi Agency Support Team (MAST). The classification is a comprehensive list of all possible NTMs disaggregated into 178 detailed measure codes. For the NTM database, almost 15,000 regulations were analysed in depth and registered with the corresponding NTM codes, affected products and countries, the date of entry, and additional descriptive information. A standardized collection approach ensures a high level of comparability.

Section 3 presents some stylized facts on NTMs usage. Developed countries regulate in general more products and a higher share of imports than least-developed and developing countries. Agricultural products are more often regulated than manufactures and natural resources. Agricultural products are also more intensively regulated, i.e. many distinct measures are applied to agri-food imports while there are fewer measures are applied to manufactured products. The use of export-related measures is also widespread. Almost 40 per cent of all exports are subject to at least one export measure. The indicators are made available at a disaggregated country and product level.

[1] For more information, see partners and donors at unctad.org/ntm.

Section 4 measures the impact of NTMs on trade by estimating their ad valorem equivalents (AVEs). In order to make NTMs and tariff comparable, AVEs express the impact of NTMs in terms of a tariff with the same effect. We show that in almost all sectors NTMs are more important than tariffs. This is particularly the case for agricultural products, but also for wood products, machinery and other manufactures. Technical measures (SPS and TBT) matter more in high-income countries than in middle income countries. They also constitute a relatively high trade barrier in low-income countries despite the fact that the number of measures is relatively lower. This could indicate a less efficient implementation of the technical regulations in the low-income countries. In general, traditional trade policy measures such as quotas and price measures constitute a higher barrier to trade in low-income countries than in middle and high-income countries.

Most NTMs are applied in a de jure non-discriminatory manner equally to domestic and all foreign producers. Yet, they have different effects on different countries and exporters. Low-income countries face on average higher AVEs on their exports than high-income countries. The reasons include costs of compliance, which are often higher for lower income countries as well as the composition of their export baskets which tend to consist of more agricultural and apparel products. This finding has important development implications. The AVEs will be made available at a disaggregated product and country pair level for further analysis.

This report and the underlying databases provide a rich source of information for policymakers, trade negotiators and the private sector. It shows that if policymakers care about sustainable development, they need to care about NTMs. The publicly available data and indicators allow tailor-made analysis that can underpin regulatory cooperation and NTMs streamlining to the benefit of social, environmental and economic development.

2. Identifying non-tariff measures

2.1. Definition and classification of non-tariff measures

Recognizing the proliferation and increasing importance of NTMs, UNCTAD has actively worked on the topic since the 1980s. Given the scarcity of available information, UNCTAD began to identify and classify NTMs in 1994. In 2006, UNCTAD established the Group of Eminent Persons on Non-Tariff Barriers (GNTB) and a Multi-Agency Support Team (MAST).[2] Their main purpose was to develop a definition and classification to facilitate the collection, quantification and understanding of NTMs.

NTMs were defined as policy measures, other than ordinary customs tariffs, that can potentially have an economic effect on international trade in goods, changing quantities traded, or prices or both (UNCTAD, 2009). This concept of NTMs is distinctly neutral. There is no a-priori judgement regarding the impact on trade or welfare, nor the legality of a measure. As this broad definition comprises a wide array of policies, the subsequent step of the MAST was the development of a common language on NTMs: an internationally agreed and recognized classification. The classification is the foundation for data collection and, ultimately, more transparency and a better understanding of NTMs.

The MAST classification of NTMs, version 2013, (UNCTAD, 2015) has 16 chapters of different measure categories (table 1, left). 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 made 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

[2] Besides UNCTAD, these include the Food and Agricultural Organization (FAO), the International Monetary Fund (IMF), the International Trade Centre (ITC), the Organization for Economic Cooperation and Development (OECD), the United Nations Industrial Development Organization (UNIDO), the World Bank and World Trade Organization (WTO).

health, and the protection of the environment. Even if equally applied to domestic producers, they nevertheless regulate international trade and are thus considered NTMs.

Non-technical measures cover a wide array of policies, including traditional trade policies such as quotas and non-automatic licences (chapter E), price controls and para-tariff measures (chapter F) and contingent trade protective (chapter D) measures such as anti-dumping duties. The full list is presented in table 1.

Each chapter is further broken down into more detailed measures types (example of SPS measures, table 1, right). The tree structure allows for a 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 MAST classification has 178 disaggregated codes.

Table 1: 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 (excluding 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 (2015)

Even with 178 distinct types of measure, data analysis involves a significant generalization of the complexity and differences between NTMs, particularly SPS measures and TBT. For product-specific trade negotiations and export decisions, an in-depth review of full-text regulatory documents is necessary. The NTM database also provides direct access to the complete regulations. Still, the classification of measures and affected products provides useful entry point for a wider assessment of the prevalence and impact of NTMs for a comparative perspective across countries and sectors, and for narrowing down of priorities.

2.2. Data collection process

On the basis of the MAST classification, UNCTAD leads an international effort, in close collaboration with the World Bank and other partners, to collect comprehensive data on NTMs. Country coverage and data quality are rapidly increasing, particularly after further improving the data collection approach in 2012 and expanding collaboration with many regional and national partners.

Data on official NTMs are collected by extensively reading and analysing national legislative documents, such as laws, decrees or directives. As mentioned before, this material includes behind-the-border technical regulations that apply to domestic as well as foreign products. The same data collection and classification methodology is used in all countries.

The first step is to establish a national team that will work with UNCTAD staff to collect the data. The team may comprise government officials, think tanks and independent experts. The team is trained through UNCTAD's online course on NTM data collection and in face-to-face workshops. The training courses build national capacity on NTM classification, product classification and on a consistent and comparable data collection approach described in the UNCTAD Guidelines to Collect Data on Official NTMs.[3]

The actual data collection process starts with the identification of sources of regulatory information in each country. All relevant documents are then obtained from these sources. Much effort is devoted to ensure that the data is comprehensive and covers all NTMs applied on imports/exports. Each document and regulation is registered with extensive bibliographical information to ensure that information can be traced back to its source.

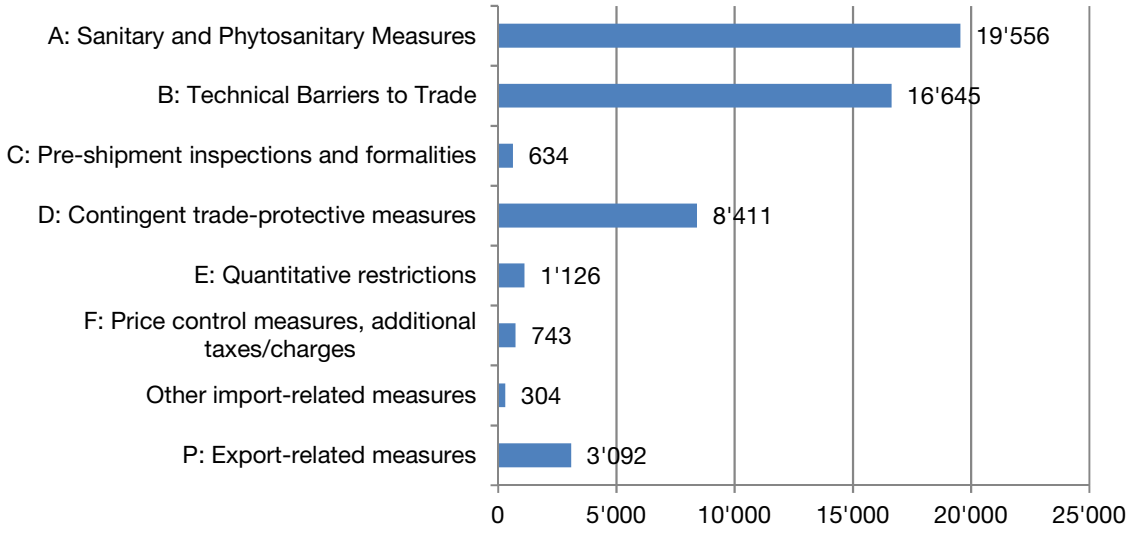
Once a relevant regulation is identified and registered, each specific provision is classified into one of the 178 NTM codes -- along with detailed measure descriptions and further descriptive information. One regulation can contain several different measures, for example, a required maximum residual limit of pesticides as well as a respective inspection requirement. For each measure, the affected countries and products are also classified in detail.[4] To ensure consistency, UNCTAD carries out extensive quality control during and at the end of the data collection process.

Globally, data collectors have reviewed hundreds of thousands of pages of regulatory documents. The database now contains 14 561 different regulations that comprise 50 511 distinct measures. Figure 1 shows that SPS measures and TBT are, by far, the most common measures.

[3] For more information, see http://unctad.org/en/PublicationsLibrary/ditctab2014d4_en.pdf

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

Figure 1: Number of non-tariff measures, by chapter

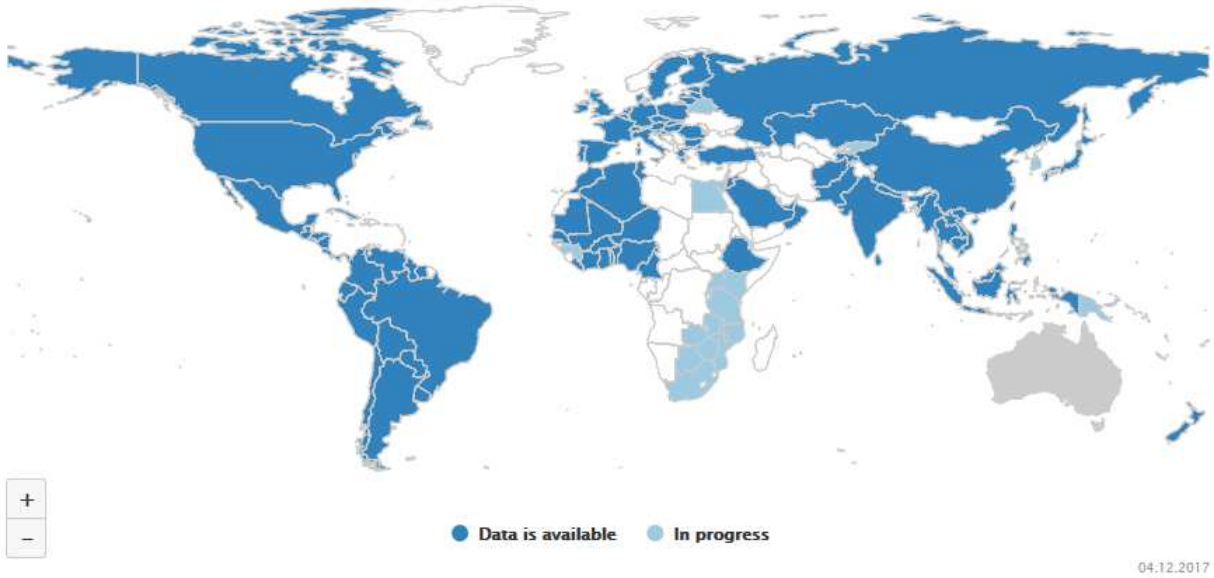


Source: Authors' illustration based on TRAINS

2.3. Data availability and dissemination

As of June 2018, UNCTAD's NTM data includes 109 countries, covering 90 per cent of global trade. The map below illustrates the current country coverage as well as ongoing data collection efforts.

Figure 2: Country coverage of NTM data



Source: Authors' illustration based on TRAINS.

UNCTAD's NTM data is made available through the following two portals:

- Trade Analysis Information System (TRAINS) at i-tip.unctad.org: TRAINS provides data on NTMs at the HS 6-digit product classification. Users can search the database by country, type of NTM, affected product and partner country. It also contains information on the regulatory source and descriptions of the measures. Moreover, researchers interested in NTMs can download a STATA dataset with additional variables.

- World Integrated Trade Solution (WITS) at wits.worldbank.org: WITS integrates TRAINS with other trade-related databases, such as UN COMTRADE, WTO Integrated Data Base (IDB) and WTO Consolidated Tariff Schedules (CTS). As a result, WITS offers an interface that provides access to databases covering imports, exports and protection data — tariff and non-tariff measures — over time.

3. Stylized facts of NTM usage

This section summarizes the usage of NTMs across countries, income levels, sectors and types. All indicators presented in this section draw from the updated TRAINS database, covering 109 countries. The two most basic indicators are the Frequency Index and the Coverage Ratio - now standard measurements of NTM incidence used in the exploration of data (UNCTAD, 2013; WTO 2012). Two additional indicators measure the diversity of NTMs among regulated products. Together, these four indicators help gauge the incidence of NTMs used as policy instruments:

- The **Frequency Index** captures a country's share of traded product lines subject to at least one NTM.[5]

- The **Coverage Ratio** captures a country's share of trade subject to NTMs. Unlike the Frequency Index, it is weighted by import values, rather than using traded product lines.[6]

- The **Prevalence Score** indicates a country's average number of distinct NTMs applied on regulated products. In doing so, it measures the diversity of NTM types applied and provides some indication regarding the intensity of regulating.

- The **Regulatory Intensity** adjusts the Prevalence Score for differences in regulatory intensity and trade importance across products. In doing so, it adjusts for the fact that some products are more traded and regulated than others, for example medicines. Computed as an average for a country, the Regulatory Intensity is normalized by the average number of measures for each product around the world and then weighted by its importance in world trade.

Using these indicators for 109 countries from the updated TRAINS database, Figures 3-9 reveal six stylized facts. First, developed countries regulate a larger share of their imports and use more regulations on each import than developing or Least Developed Countries (LDCs). At the same time, LDCs regulate twice as much their exports than developing or developed countries. Second, NTMs are most widespread in the agro-food sector, both at the intensive and extensive margin (i.e. more NTMs per agro-food product and more agro-food products have NTMs), and across all regions. Third, TBT are the most frequent form of NTMs, affecting 40 per cent of product lines and about 65 per cent of world imports, followed by export measures and sanitary and phytosanitary measures. Fourth, developed countries drive the high global usage of TBT and export measures, while the use of SPS measures is more uniformly distributed. Fifth, countries with a higher level of GDP per capita tend to regulate a larger share of its trade and use more NTMs per regulated product. Lastly, countries with lower tariffs use NTMs more intensively, highlighting the growing importance of policy substitution: NTMs could be used as alternative methods to tariffs in pursuing the countries' trade policy objectives, rather than using them independently to their tariff structure.

3.1. NTM usage by development status

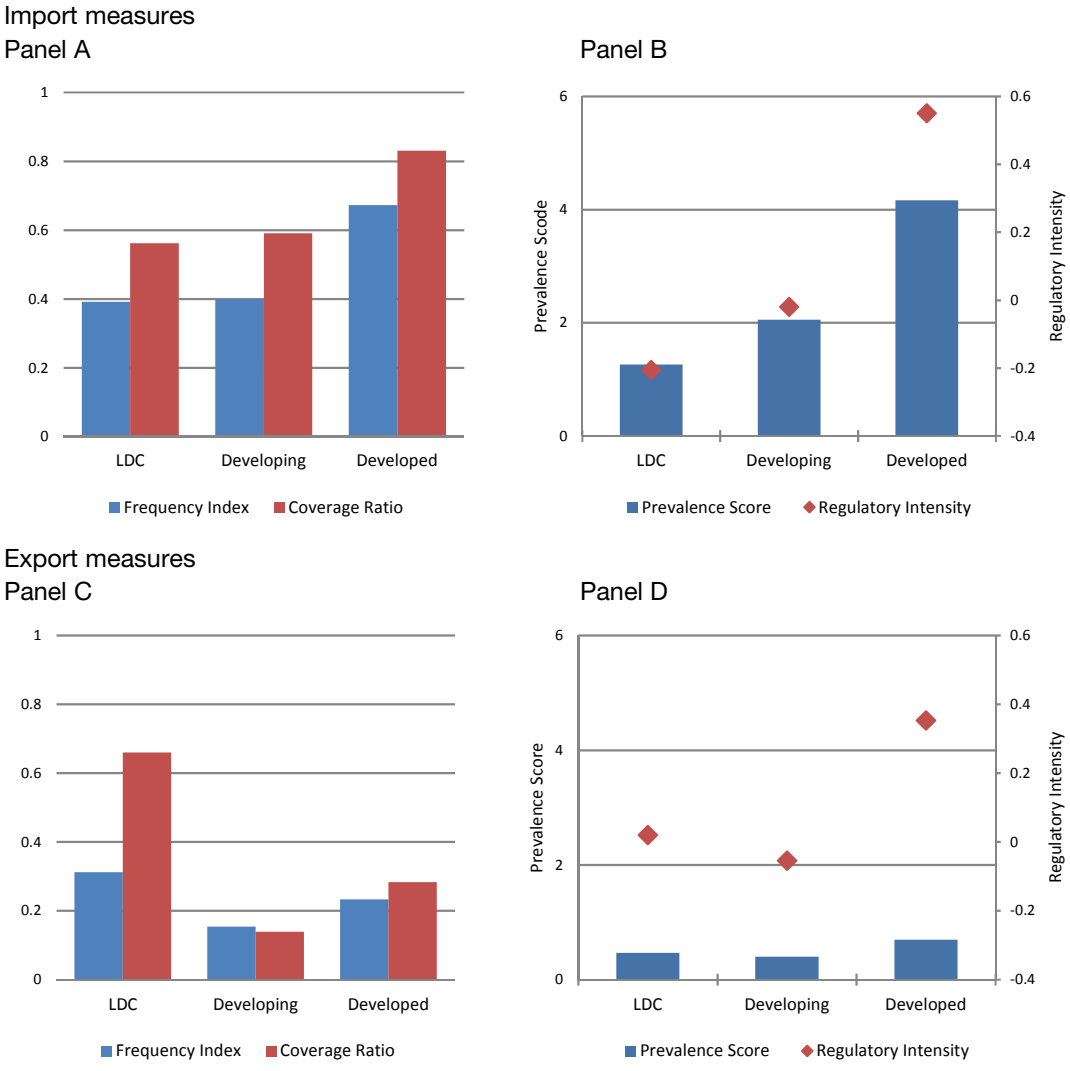
Figure 3 shows the incidence and diversity of NTMs across development status. Panels A and B illustrate import measures while panels C and D refer to export measures. On the import side, three findings stand out. First, NTMs in developed countries affect a higher share of products and trade than in developing countries and in LDCs (panel A). While in LDCs about 40 per cent of imports are on average subject to NTMs, this figure is nearly twice as high in developed countries.

[5] See Appendix A for more detail on the data, assumptions and variable definitions.

[6] Import values are used for NTM import chapters A to I while export values are used for the export chapter P.

Second, countries use NTMs particularly on products that matter disproportionally to their import basket, i.e. highly traded products tend to be more often regulated. That is why the Coverage Ratio is consistently higher than the Frequency Index. Third, while NTMs affect not only more products in developed countries, developed countries apply NTMs more diversely per product (panel B). On average, developed countries use 4 different NTMs on any regulated product, while developing countries apply about 2 and LDCs 1. Another way to measure this is through Regulatory Intensity, which adjusts the Prevalence Score for differences in regulatory intensity and trade importance across products. It confirms that developed countries have a higher intensity of regulation than the other country groups, especially compared to LDCs. Thus, these results suggest that developed countries use NTMs more than developing countries both at the intensive and extensive margin.

Figure 3: NTM usage, by UN development status



Source: authors' calculation based on TRAINS NTM database

For export-related NTMs, three results stand out. First, export NTMs affect more products in LDCs than in developed countries (panel C). This contrasts with the results for import measures (panel A) where developed countries use more NTMs.

Second, LDCs use regulations more strategically for exports than imports. They target with export measures relatively more higher traded goods than with their import measures, as indicated by a higher difference between the corresponding Coverage Ratios and the Frequency Indexes. LDCs apply export measures only

on 30 per cent of products, but those products account for more than 60 per cent of their export value (panel C). In contrast, import regulations affect products and import values similarly in LDCs (panel A). The export measures that LDCs use are mostly those aiming to ensure certain quality levels of their exports, i.e. technical export measures, and export licenses or registration requirements that are often used to control exports of natural goods.

Third, countries use fewer different export measures. For example, developed countries use, on average, less than one export measure on any regulated product, while they apply four different import measures (panels B and D). Overall, while export measures are much less used to regulate trade (with the exception of LDCs), they play an important role in international trade, covering about 20 per cent of world trade.

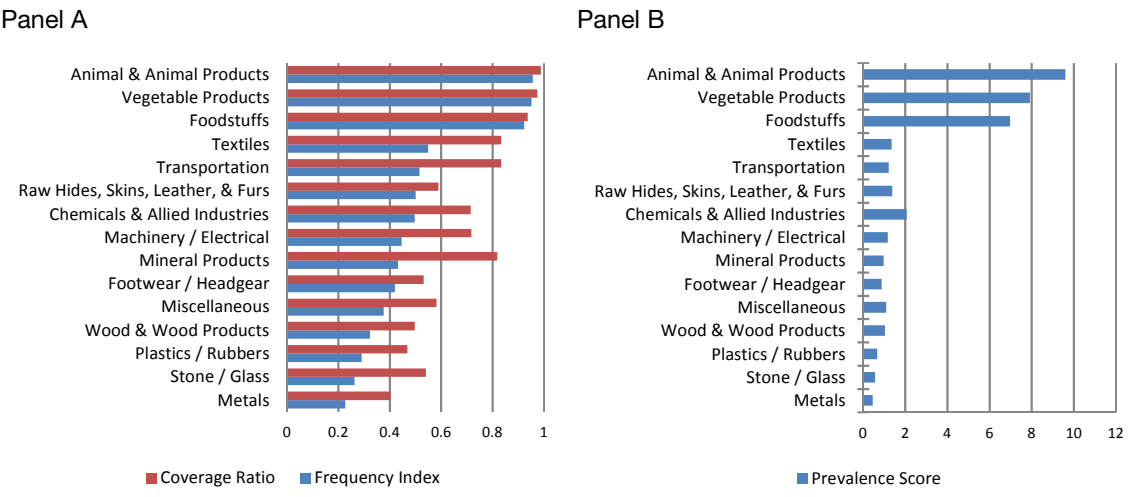
3.2. NTM usage by sector

Figure 4 shows how the NTM incidence varies across sectors. Three findings are noteworthy. First, sectors exhibit great variation in the incidence of regulated trade (panel A). While the three sectors corresponding to agri-food – animal and vegetable products as well as foodstuffs – have almost 100 per cent of imports regulated, the Frequency Index averages around 40 per cent for the other sectors.

Second, agri-food sectors exhibit also the highest number of NTMs per regulated import product. In agri-food, products face on average 8 different NTMs (panel B).[7] This magnitude of regulation is striking; all other sectors exhibit less than 2 NTMs on average. Yet, this does not come as a surprise. NTMs tend to be more common in agriculture than in other sectors. This is because of technical measures, notably SPS, and because of more traditional forms of NTMs, which are also more frequently applied to agriculture, such as quotas or price mechanisms. In sum, panel A and B indicate together that the agri-food sectors witness the greatest NTM incidence, both at the intensive and extensive margin.

Third, countries tend to use NTMs particularly on products that matter disproportionally to their import basket; the Coverage Ratio is consistently higher than the Frequency Index. This difference is most pronounced for the mineral sector.

Figure 4: NTM usage of imports, by sector



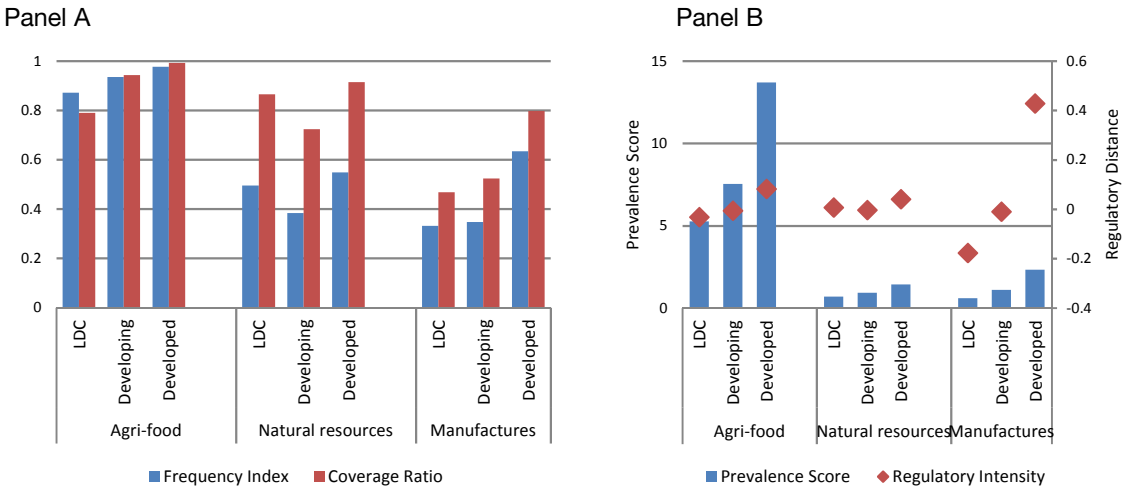
Source: authors' calculation based on TRAINS NTM database, sectors defined by sections of the Harmonized System

[7] If repetitions of the same NTM code for the same product are considered, then the average count of measures rises to 10 on each product in the agri-food sectors.

Interestingly, agri-food[8] is the most regulated sector across all development statuses, both at the intensive and extensive margin. In all country groups, both Frequency Index and Coverage Ratio cover at least 80 per cent of imported agri-food, with developed countries regulating the most (Figure 5, panel A). Moreover, agri-food exhibits also the most measures per regulated product groups across all groups (Figure 5, panel B).

Some other findings are noteworthy. Developed countries regulate a larger share of products and use more measures than the rest, in all three broad sectors, but especially in manufactures (Figure 5, panel A). Furthermore, the Regulatory Intensity is highest in developed countries, and this difference is most pronounced for manufactures (Figure 5, panel B). Moreover, the Coverage Ratio is much higher than the Frequency Index in manufactures and natural resources across all development levels (Figure 5, panel A). Countries in all groups tend to use regulations on products that are more highly imported.

Figure 5: NTM usage of imports, by broad product groups and UN development status



Source: authors' calculation based on TRAINS NTM database

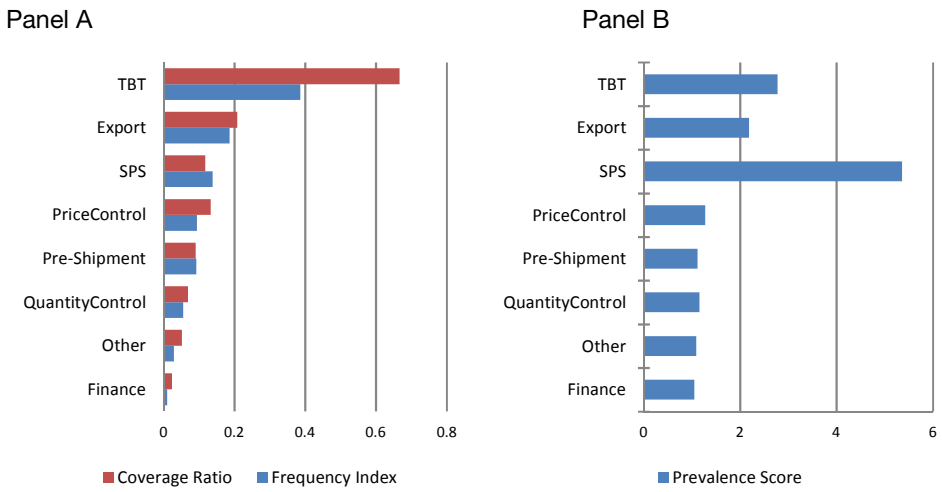
3.3. NTM usage by chapter

TBT measures are the most frequent form of NTMs, affecting around 40 per cent of product lines and about 65 per cent of world imports (Figure 6, panel A).[9] TBT measures specify technical requirements for products, such as certification, testing and inspection, and associated conformity assessment procedures. Export measures are the second most frequent form of NTMs, affecting 20 per cent of product lines and world exports. Export measures comprise export licences, restrictions or prohibitions, but also registrations and technical measures such as certification or inspection. SPS measures come in third place, covering almost 20 per cent of world imports. The fact that SPS measures tend to be concentrated on agri-food products can explain this relative low coverage of products and associated import values. Yet, the high Prevalence Score (Figure 6, panel B) suggests that SPS measures matter disproportionally for regulated products – the intensive margin: the number of SPS measures applied is the highest compared to other NTM types. Specifically, countries use on average almost six SPS measures and around three TBT on any regulated product. Other types of NTMs are less frequently used and cover a lower share of trade; pre-shipment, quantity and price measures affect about 10 per cent of world imports.

[8] Broad product groups are defined by the Harmonized System (HS) at 2-digit: Agriculture corresponds to HS 1-24, Natural Resources to HS 25-27, and Manufacturing to 28-97

[9] For these computations, the world averages represent the simple average of national values. Since developing countries outnumber the two other groups, the global average is close to that of the developing countries.

Figure 6: NTM usage, by chapter



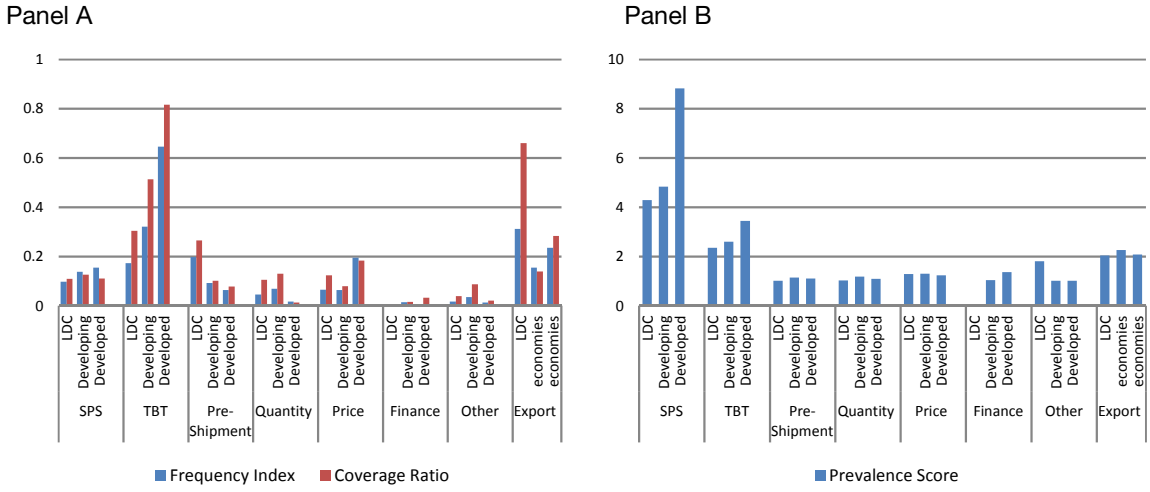
Source: authors' calculation based on TRAINS NTM database

These global trends of NTM type usage mask important variations. In particular, developed countries use TBT measures more than other regions. They apply them both on more imported products (Figure 7, panel A) and per regulated import (Figure 7, panel B). Indeed, developed countries use TBT three times as much as LDCs to regulate imports. The usage of TBT by developed countries is even more pronounced when considering the Coverage Ratio, which accounts for the importance of products in a country's import basket.

On the other hand, LDCs use export measures most widely: they regulate products of specific export importance compared to other regions, reflected in its high Coverage Ratio. Yet, LDCs use a similar number of export measures per regulated export. The Prevalence Score for LDC export measures is similar compared to other country groupings.

Interestingly, breaking the almost universal rule that the Coverage Ratio is higher than the Frequency Index, in developing and developed countries, the SPS Frequency Index is higher than the corresponding Coverage Ratio (Figure 7, panel A). In agriculture almost all products are regulated by SPS measures for safety reasons irrespective of whether those products are imported or only domestically produced (see also figure 6). It could also indicate that some measures may be too restrictive and deter trade in some cases.

Figure 7: NTM usage, by chapter and UN development status



Source: authors' calculation based on TRAINS NTM database

3.4. NTM usage by GDP and tariff level

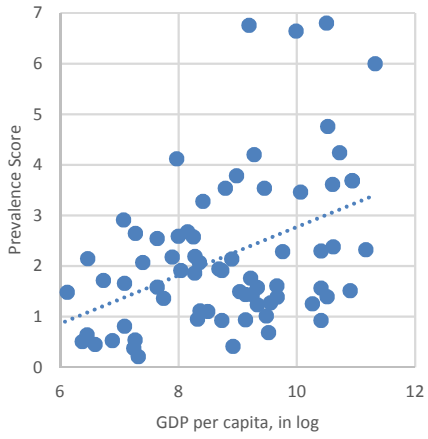
Policymakers voice concern to which extent NTMs are correlated with outcome measures, such as GDP per capita, and trade variables, including tariffs or product quality. The descriptive statistics in this sector provide a preliminary assessment to this end.[10] We focus on NTM incidence measures that are plotted against GDP per capita (Figure 8) and tariff levels (Figure 9). The following trends emerge: First, countries with higher level of GDP per capita tend to regulate a larger share of its trade (Figure 8, panel A). Second, richer countries also use more NTMs per regulated product (Figure 8, panel B). Together, both results reflect regulatory expansion as economies grow richer and consumers value higher product quality and variety, to which regulatory agencies respond.[11] Third, the positive correlation between NTMs usage and per capita GDP is more pronounced at the intensive margin (steeper line in panel B than in A, figure 8). At the same time, GDP per capita does not seem to be a good predictor of NTM usage; across all income levels there is great variance in the use of NTMs.

Figure 8: NTM usage and GDP per capita

Import measures

Panel A: Coverage Ratio and GDP per capita

Panel B: Prevalence Score and GDP per capita



Source: authors' calculation based on TRAINS database and World Development Indicators

Policy substitution underlies the growing importance on NTMs. This suggests that countries may use NTMs as alternative methods to tariffs in pursuing their trade policy objectives, rather than using them independently to support their tariff structure. Panel B in Figure 9 illustrates results that support empirically this argument, even if they must be taken with care. Countries making most use of NTMs tend to be those that have less restrictive tariffs. Conversely, countries that levy more restrictive tariffs are also those that use NTM the least. Interestingly, this negative relationship between NTM usage and tariffs is less pronounced at the extensive margin (panel A). A word of caution, the variance in the use of NTMs is large at all levels of tariffs and graphs are based on cross country data and not time series data.

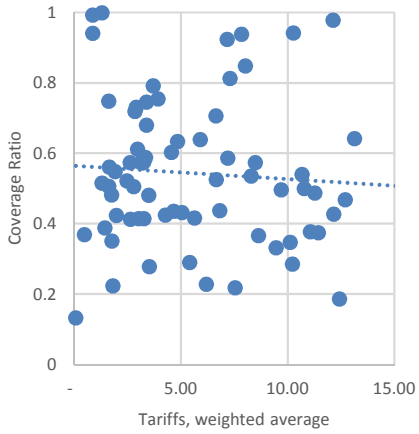
[10] While informative, the results are unconditional correlations and thus need to be treated with caution. Econometric methods are better equipped to take care of likely confounders, such as spurious correlation and omitted variable bias.

[11] Although not shown here, country level Coverage Ratio and Prevalence Score are also positively correlated, indicating that those countries that have larger share of its trade affected by NTMs, also use more NTMs on average on every product.

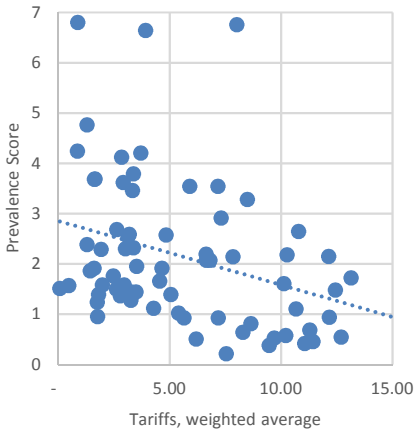
Figure 9: NTM usage and tariffs

Import measures

Panel A. Tariffs and Coverage Ratio



Panel B. Tariffs and Prevalence Score



Source: authors' calculation based on TRAINS database and World Development Indicators

4. The Impact of NTMs on International Trade

Incidence indicators are useful to describe the landscape of regulations across products, sectors and countries. However, such statistics provide no information about the actual impact of NTMs on international trade. This section complements the analysis of the previous section by providing estimates of the costs of NTMs in the form of ad-valorem equivalents. For illustrative purposes, the estimates are presented by broad categories of products and by country groupings.

4.1. Overview of the data and methodology

There are several analytical approaches in order to tackle the challenging task of quantification of NTMs. These methodologies are broadly distinguished between price-gap measures and econometric methods which further vary depending on the assumptions adopted and on estimation approaches. The ad-valorem equivalents (AVEs) of NTMs presented in here are based on the estimation method developed in Kee and Nicita (2017), which in turn, builds on the work of Kee, Nicita and Olarreaga (2009). The AVE of an NTM indicates the proportional rise in the domestic price of the goods to which it is applied, relative to a counterfactual where it is not applied. Although there are substantial advantages in the econometric approaches in the quantification of NTMs, there are also a number of drawbacks. One valid critique is that econometrically mass-produced AVE as the one presented in here cannot precisely reflect the very different conditions which are present across products and markets. Clearly, a more specific quantification would try to model product markets and countries characteristics in a more ad-hoc and precise manner. However, the high data requirements and the needs to model the functioning of markets in a specific manner, make these kinds of analysis quite complex and very difficult to replicate.

It is also important to highlight that the precise quantification of the effects of NTMs on international trade are subject to a number of econometric challenges (zero trade flows, measurement errors, difficulty to control for omitted variables and endogeneity). Although these issues are controlled for by employing specific econometric techniques, the estimate they provide may not be always reliable at the very disaggregated level. Of importance is also the fact that collinearity among the various NTM measures makes it difficult to estimate the effects of specific NTMs. In practice, there is a trade-off between the precision of estimates and the level of aggregation. Overall, though less informative than desired, the aggregate estimates provided below are likely to be the most reliable.

A detailed discussion of the estimation framework to quantify AVEs of NTMs stays with Kee and Nicita (2017). A technical annex to this section summarizes the procedure. The estimates are based on a cross section gravity model where dummy variables capture the proportionate change in quantity imported due to the presence of NTMs. This change is then converted into an AVE by using the elasticity of trade with respect to one percentage point increase in the tariff (also estimated within the model). The model is used for simultaneously estimating two AVEs. One assessing the overall costs associated with technical NTMs and one assessing the overall costs for the remainder of NTMs.The AVE presented below are these of measures imposed on imported goods. NTMs that affect exports are not considered.

The AVE estimation is based on data in the TRAINS database. To minimize time inconsistencies, the analysis utilizes a reduced sample of NTMs data collected between 2012 and 2016. The data is transformed in a cross-section database spanning about 40 importing countries plus the European Union, about 200 exporting countries. AVEs are estimated at the HS 6 digit classification and on a bilateral basis. Additional data required for the estimation originates from TRAINS (tariffs), the UN Comtrade database (trade flows) and from the World Development Indicators database.

As for interpreting the AVEs of NTMs, the interpretation is similar to that of a tariff: AVEs represent the additional costs that the presence of NTMs has on imports. Note that, contrary to a tariff, these costs do not need to be alike across identical NTMs as compliance costs may differ across products and trading partners. In practice, the effect of identical NTMs on trade may be different because of a host of factors which include the implementation methods, stringency, and enforcement mechanisms. The impact of a specific NTM can also be different across exporters because compliance costs are generally different.

In relation to the interpretation of the AVEs it is also important to note that, different from tariffs, the costs associated with many types NTMs do not generally or necessarily have to favour domestic industries. This is a matter of importance for negotiation processes. In practice, many NTMs serve specific policy objectives (e.g. consumers' health and environmental protection) and thus cannot be negotiated away without affecting the very purpose they serve. Indeed, for the large majority of NTMs, trade agreements do not seek to eliminate NTMs (as in the case of tariffs) but seek only to prevent the protectionist use of NTMs.12

4.2. Cost estimates of NTMs

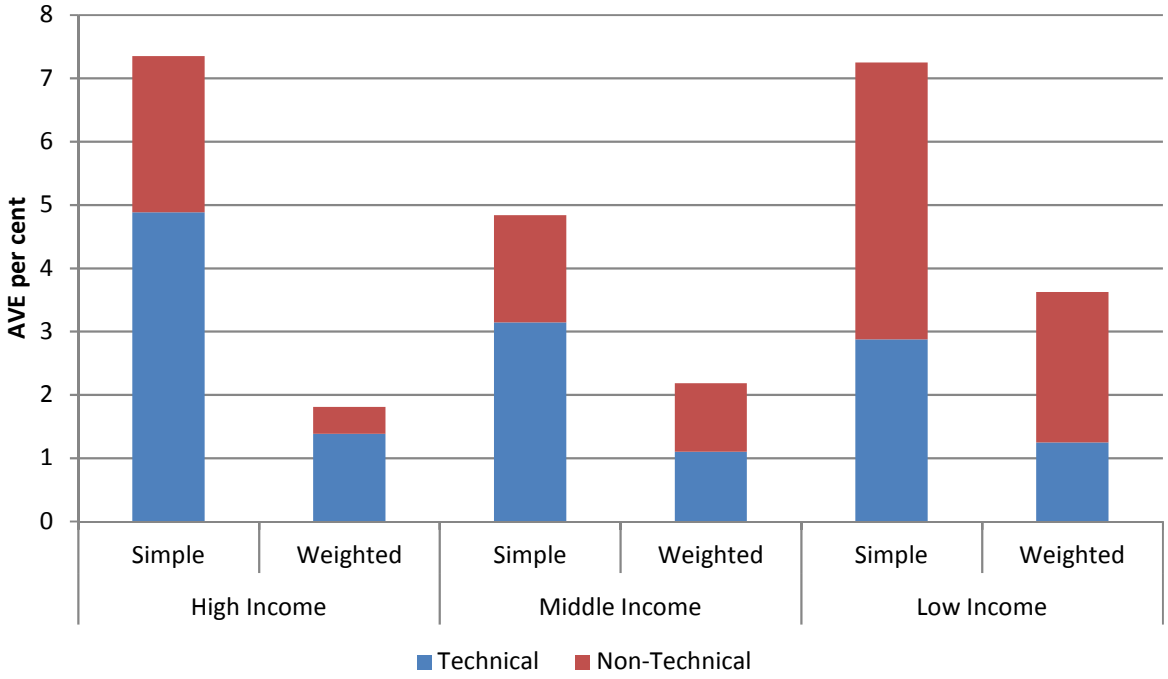
What follows provides a description of cost estimates of NTMs as measured by the AVEs. Overall, the estimation of the AVEs produced about 350,000 non-zero AVEs for technical measures and about 200,000 non-zero AVEs for other type of measures. The average AVE of NTMs is about 11 per cent for technical measures, and about 9 per cent for other types of measures. Both distributions show a standard deviation of about 60. The median is about 3 for technical measures and 2 for other NTMs. These statistics indicate that, although most AVEs are low, their distribution is quite dispersed, with some relatively high values.13 Also note that the above statistics represent the additional costs that NTMs have on trade flows for which NTMs are present (i.e. they do not take into account trade flows in which NTMs are absent). As NTMs do not affect all international transactions, the costs imposed from NTMs on overall trade are smaller.

The basic statistics provided above indicate the average costs associated with NTMs are not extremely large. In most cases, the overall impact of NTMs on traded products stays below 3 percent. Still, a question of importance is how these costs are distributed across products and countries. Indeed, by examining the AVE in more detail, they show some notable patterns. To illustrate some of these patterns, Figure 10 depicts the simple average and import weighted average of AVEs for three country groupings (high, middle and low income).

[12] For implications related to the treatment of NTMs in international trade agreements see Hoekman and Nicita, (2017).

[13] To control for outliers, in the statistics presented here we exclude the 0.5 % of both tails of the distribution.

Figure 10: Ad Valorem Equivalents of NTMs on imports, by income group



Source: Authors calculations

Of importance in the analysis of AVEs is the distinction between simple and weighed averages. AVEs of NTMs can be estimated only when a product is imported. Therefore simple averages are to be interpreted as the average additional cost across the universe of imported products. Trade weighted averages, by giving more importance to products which imports are larger, are to be interpreted as the additional burden that the presence of NTMs imposes on overall imports. On a simple average basis, the cost of NTMs is quantified at about 7 per cent for the products imported by high and low income countries, and about 5 per cent for middle income countries. These statistics are much lower when considering import weighted averages. This is to be expected because the presence of NTMs itself tends to restrict trade.14 Overall NTMs represent a cost of about 2 per cent to total imports of high and middle income countries, and about 3.5 percent for low income countries. The substantial difference between simple and weighted averages is also informative as it suggests that NTMs can result in nearly prohibitive costs.

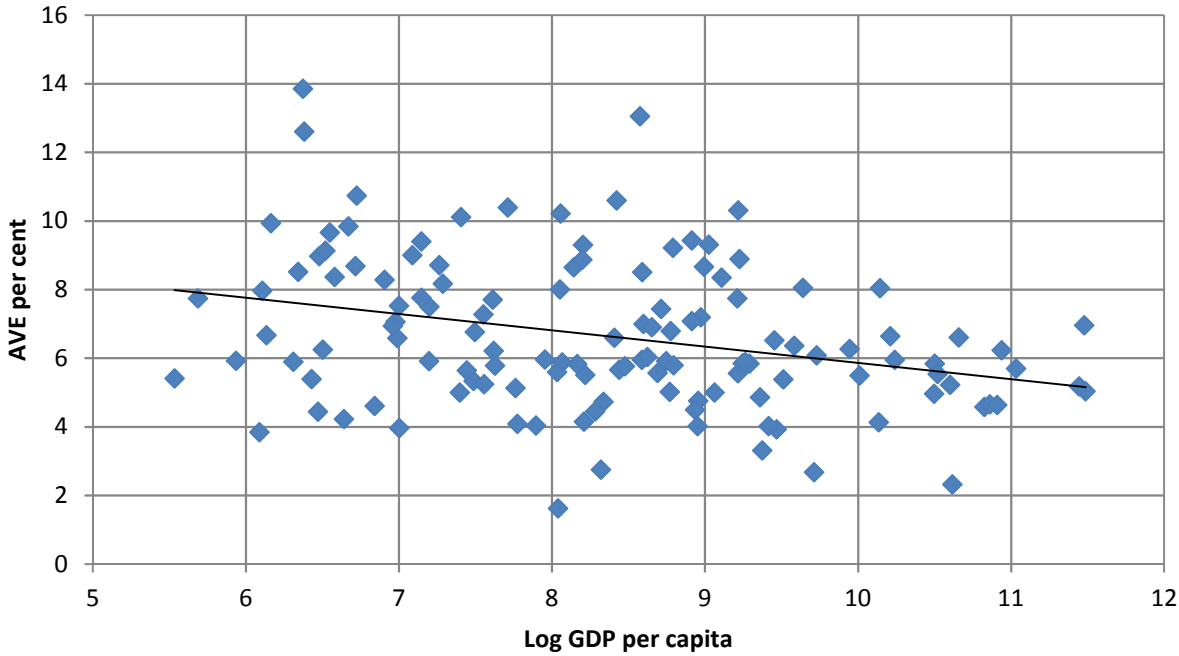
Of interest is also that, while simple averages are similar between high and low income countries, their composition differs. In both high income and middle income countries the effects of NTMs are mostly due to technical measures (SPS and TBTs). On the other hand, non-technical measures represent the main source of trade costs in low income countries. This is the result of high income countries relying more on technical measures for public policy objectives (e.g. consumers' health and environmental protection). Another reason is that the stringency of the requirement is generally higher in countries with higher level of income. On the other hand, lower income countries tend to rely relatively more on traditional types of NTMs such as price mechanisms and quantity controls, while their technical measures are relatively less stringent. All these factors are reflected in the relative magnitude of the AVE across countries.

Another question of importance in the analysis of NTMs is whether developing countries exports are more sensitive to the presence of NTMs. In other words, whether the costs associated to NTMs are higher for products when imported from developing countries relative to similar products imported from developed countries. This proposition may seem counterintuitive as NTMs are often identically applied to imports regardless of their origin. However, one of the findings of the economic literature is that, even when identically applied, NTMs may still have differing distortionary effects on trade, with effects that are often harsher for small

[14] The argument here is similar to that of a simple average tariff and import weighted average tariff.

firms and for low income countries.15 There are two factors behind the relatively larger impact of NTMs for lower income countries (UNCTAD, 2018). First, the cost of compliance with many types of NTMs is generally higher for exporters in low income countries due to weaker infrastructural, organizational, administrative and technical capabilities. Second, NTMs tend to be more widespread in agriculture, an economic sector whose relative importance is higher for low income countries.

Figure 11: Ad Valorem Equivalents of NTMs on exports, vs. GDP per capita



The relatively larger effect of NTMs for low income countries' exports is evident in the estimated AVEs. Figure 11 plots the simple averages of the AVEs on the exports of each country against its GDP per capita. 16 The negative correlation illustrated in Figure 11 suggests that the average costs of NTMs tend to be higher for countries with lower per capita GDP. In numbers, there is a difference of about three percentage points between the average AVEs of the lower versus the higher income countries.

The reasons behind the larger impact of NTMs for lower income countries are not only about compliance costs, but also because low income countries' exports baskets are relatively more intensive in agricultural products. Agricultural markets are generally more regulated than other categories of products. This is both because of technical measures, SPS in particular, but also because of more traditional forms of NTMs, which are more frequently applied to agriculture (e.g. quotas, price mechanisms).

[15] Disdier et al. (2008), Essaji (2008), Xiong and Beghin (2015), Fontagné et al. (2015), Murina and Nicita (2017), and Nicita and Seiermann (2017). All these studies find that regulatory burdens have a disproportionate effect on the export capacities of low-income countries and smaller firms.

[16] To clarify, the statistics of Figure 11 and well as those of Figure 14 are not the costs related to export measures but are to be intended as the average costs faced by the exporting countries, given the AVE that the importing country imposes on the trade from the exporting country.

Figure 12: AVEs of NTMs, by broad category of products

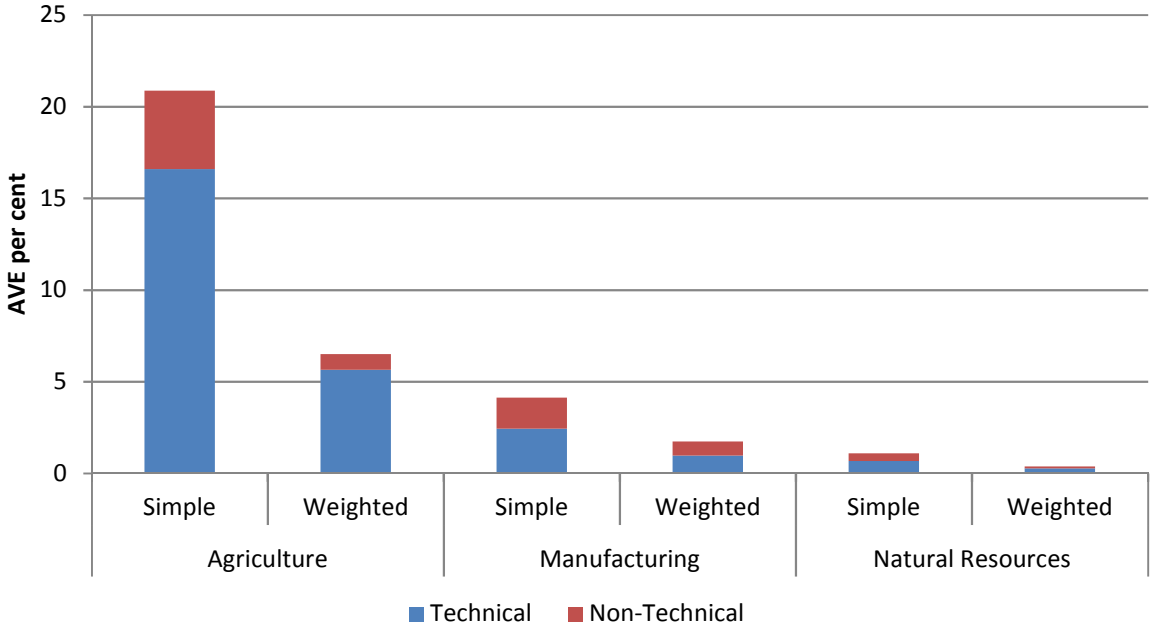


Figure 12 shows the average AVEs for the agricultural sector vis-a-vis that of the manufacturing and natural resources sectors. NTMs add substantial costs with regard to the international trade of agricultural products, about 20 percent in simple average terms. On a weighted basis, the costs of NTMs represent about 6 percent of the value of world agricultural trade. In value terms, these costs are about 75 billion US dollars. On average these costs are mostly due to technical NTMs. The impact of non-technical NTMs on agricultural trade is relatively less important. With regard to manufacturing trade, the impact of NTMs is less severe but still significant. In simple average terms, the AVE of NTMs for manufacturing is about 4 per cent. On a weighted average basis, the cost of NTMs represents about 2 per cent of manufacturing trade. Given that the international trade in manufacturing is much larger than that of agriculture, the costs of NTMs in manufacturing sectors account for about 250 billion US dollars. The impact of NTMs is minimal in relation to products categorized under natural resources.

The larger differences in the impact of NTMs across broad sectors persist at the more disaggregated level. Indeed, the impact of NTMs is heterogeneous not only across countries, but more so across products. Looking beyond broad aggregates, Figure 13 reports average AVEs across 25 economic sectors: 5 agricultural sectors and 20 industrial sectors as defined by the ISIC classification. Among the industrial sectors, AVEs tend to be relatively higher in the sectors of apparel, motor vehicles, electrical machinery, communication equipment, and wood and paper. For these categories, the simple average AVEs are more than 5 per cent. In regard of agriculture, the sectors of oils and fats, vegetable and animal products register the highest AVEs, with a simple average above 20 per cent.

Figure 13: Tariffs and AVEs of NTMs, by economic sector

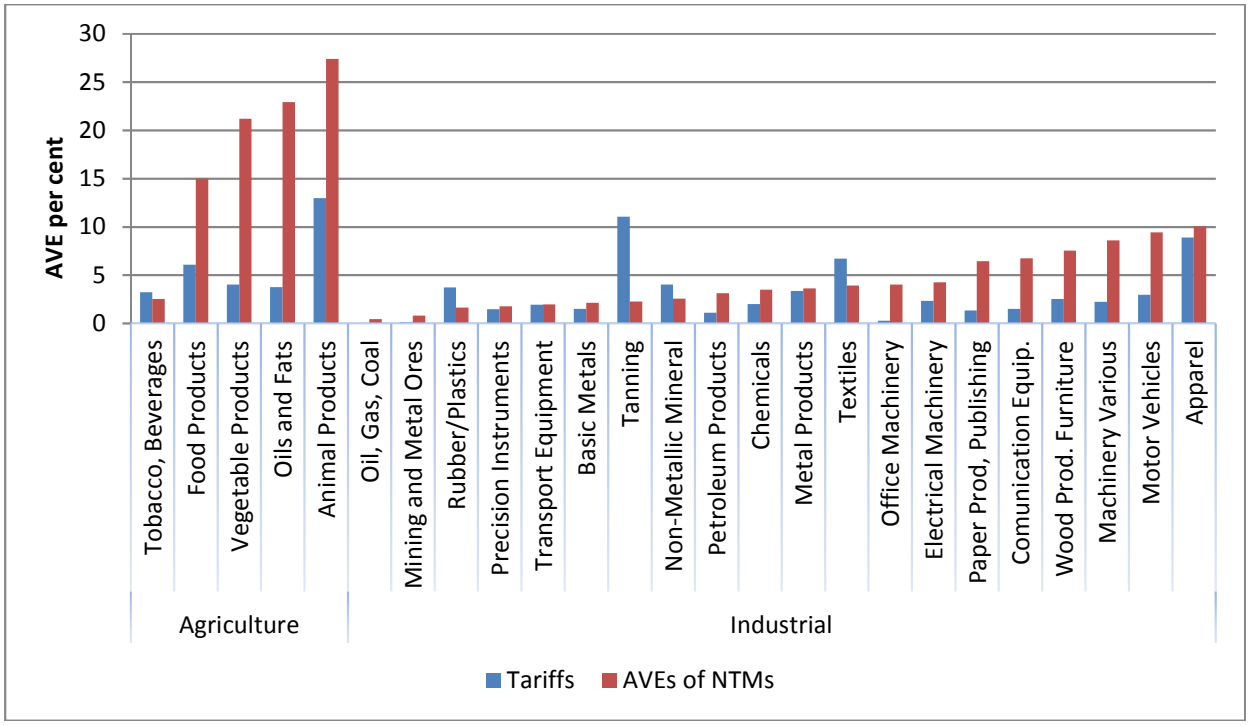


Figure 13 also reports simple average tariffs by sector, therefore allowing the comparison of the effects of NTMs with the magnitude of tariffs. For the large majority of economic sectors, NTMs result in a higher restrictiveness relative to tariffs. This is most evident in the agricultural sectors, but also in some of the industrial sectors such as those related to motor vehicles, machinery and electronics. The only sectors where tariffs are dominant to NTMs are tanning, textiles, rubber/plastics and non-metallic minerals.

Finally, this section provides an assessment of the importance of NTMs on exports. Figure 14 illustrates the average costs that NTMs add to the exports for each country in the world as measured by its export weighted average AVEs.

Figure 14: Importance of NTMs in adding costs to exports

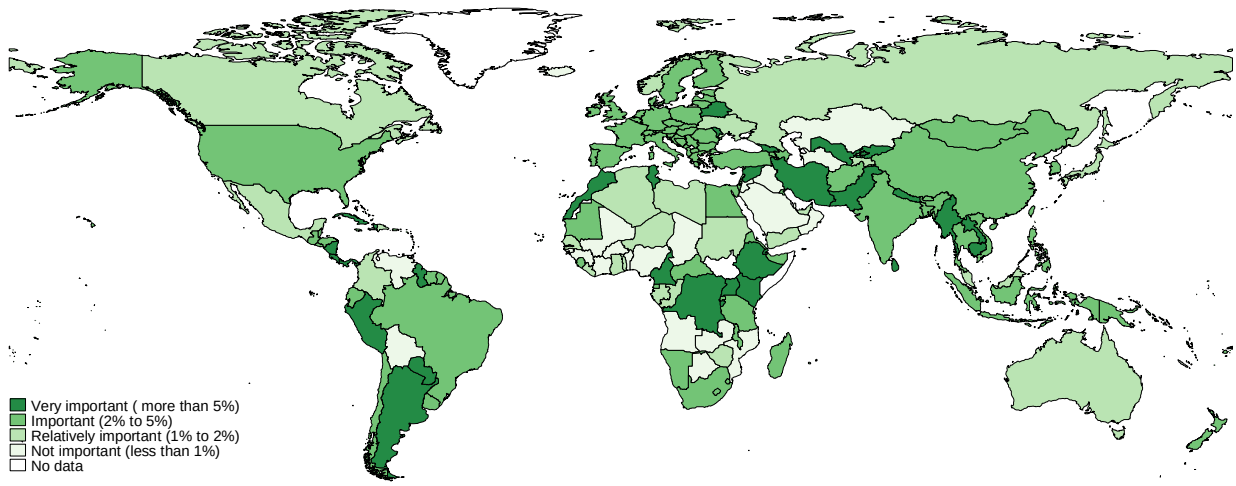


Figure 14 shows substantial heterogeneity. As discussed above, the effect of NTMs on a country's exports depends both on its capability in complying with NTMs as well as on the structure of its economy. Consistent with the patterns described above, NTMs tend to be more relevant for countries whose export basket is tilted towards agricultural products (e.g. many Latin America, East African, South Asian countries) and less so for those countries whose exports are oriented towards natural resources, especially those exporting energy products (transition economies, Middle Eastern countries, and a number of African countries). Still, NTMs add substantial costs to exports originating in most countries, both developed and developing, including most of the emerging economies.

This section has provided an assessment of the impact on NTMs on trade costs. The general findings indicate that NTMs significantly contribute to trade costs, especially for developing countries. From a policy angle, addressing the costs associated with NTMs should be seen as part of the approach to help improve market access conditions for developing countries. An issue of fundamental importance is whether policy options associated with reducing the costs of NTMs are feasible to implement. In this regard, reducing costs associated with NTMs and therefore their distortionary effects would require a more complex approach than in the case of tariff or other traditional forms of trade policy. Many forms of NTMs serve public policy objectives and are often instruments of domestic economic policy. Their effect on trade, although substantial, is indirect and therefore these measures cannot be eliminated without disrupting the very purpose they serve. In this regard, minimizing the negative impacts of NTMs on international trade has to originate not from the removal of NTMs but from helping developing countries to comply with them at a cost-efficient basis.

5. Conclusions

The UNCTAD – World Bank “Top 25 Markets” project contributed to the TRAINS NTMs database and developed indicators of the prevalence and impact of NTMs. The database contains an inventory of official NTMs for more than 100 countries and covering more than 90 per cent of world trade. It covers, in principle, all policy measures, other than tariffs, that can have an economic effect on international trade in goods.

NTMs are linked to sustainable development in two ways. On the one hand, most NTMs are designed to pursue non-trade objectives. Technical measures are directly linked to social and environmental objectives such as safe food, clean water, climate protection, or responsible consumption and production. These NTMs help to achieve sustainable development goals. On the other hand, NTMs impact affect trade costs and hence market access. Thus, through the resulting impact on trade, NTMs affect economic growth and sustainability objectives.

The database and analysis in this report create a foundation for policy makers to address the opportunities and challenges that NTMs bring. They support the following policy observations:

1. Enhancing the transparency of trade related regulations is necessary
    - NTMs are widespread, varied and complex. To understand the opportunities and challenges, information about the use and impact of NTMs is indispensable. Exporters need to know the requirements they must comply with in their potential destination markets. Likewise, importers inserted in global value chains need information about the requirements for intermediate inputs. Gathering this information constitutes a hidden cost to trade, in addition to the cost of compliance with these requirements. Larger firms may have the resources for intelligence services, but this is not an option for smaller firms and firms in lower-income countries. Transparency in NTMs contributes to equality of access and fairness in trade.
    - Governments require structured information on NTMs for policy design and regulatory cooperation at the national, regional and multilateral level. Information provided by the NTMs database contributes to identifying target areas and assessing the burden and complexity of regulation in certain sectors in home market as well as in partners’. Thus, the international community and national governments should place transparency in trade related regulations high on their agenda.

- The database is suitable to build statistical indicators and variables that can be used for economic analysis to assess the impact on trade and welfare. Impact analysis is only possible based on a neutral and objective dataset. The availability of data will stimulate the development of more sophisticated methods of analysis and the conclusions thereof will also help governments to better design policies.

2. Getting it right now: Governments and the international community need to make a decisive effort today to improve the design and implementation of NTMs
    - Rising incomes will lead to the introduction of additional NTMs to satisfy consumer demands and to achieve the sustainable development goals. Higher income countries use technical NTMs more extensively. The descriptive NTM statistics attest to this trend. For example, the coverage of SPS measures in agriculture in developed countries is nearly 100 per cent. Furthermore, developed countries use three times as many TBT measures as developing countries: 6 products out of 10 face at least one TBT if exported to a developed country, often several, while only 2 to 3 products out of 10 face at least one TBT in developing and least-developed countries. However, even though developing, and in particular LDCs, impose fewer NTMs, their trade restrictiveness measured by ad valorem equivalents is high. Thus, countries that improve their regulatory systems should not simply add new measures but should develop a comprehensive and coherent national strategy that includes streamlining of existing measures and observing good regulatory practices in the design of NTMs. Once poorly designed, NTMs are difficult to reform. Furthermore, the implementation of the measures matters. The high variance of AVEs indicates significant differences in the implementation of regulations. Some countries known to have high safety standards have relatively low AVEs. Technical measures pursuing non-trade goals, such as safety and protection of the environment, should be designed and implemented in a way that achieves their goals at the lowest possible cost for traders. The work of and active broad-based participation in international standard-setting bodies such as Codex Alimentarius is important.
    - Developing countries have a frequency index of less than or equal to 50 per cent. And, it is particularly low for technical measures that address objectives such as safety, quality, or environment. This indicates that countries may have gaps in their consumer and environmental protection and thus may potentially be underregulated. There is room for improvement in trade control policies, including those in sanitary and technical.
    - Policymakers should pay attention to little traded products as well: the consistently lower frequency index than coverage ratio (lower share of traded products affected vs. higher share of trade affected) shows that regulations are concentrated on highly traded products. This is probably because countries focus their regulation efforts on sectors that are relevant for their import basket. At the same time, a much higher AVE based on simple average than trade-weighted, indicates that the (fewer) measures on less traded goods are much more burdensome. The AVE is an assessment of cost for the measures in place. The results support the perception that some of the measures could be restricting trade considerably. In fact, many NTMs may (unintentionally) be prohibitive. There is no qualitative information on appropriateness of policy design to pursue non-trade objectives, but this finding suggests that there could be room for streamlining such measures and reducing costs.

3. Support low-income countries and small producers to help them comply with regulatory requirements. This support is needed more than the special treatment granted in tariffs.
    - NTMs hurt low-income countries and smaller producers disproportionately. Average AVEs on exports are higher, the lower the GDP per capita ratio. The study identified two underlying reasons: a relatively higher prevalence of measures in sectors of export interest to developing countries, such as agriculture and apparel, and a lower ability by exporters in developing countries to comply with these requirements. Indeed, many producers in developing countries and in particular in LDCs do not have experience in complying with such measures. Furthermore, conformity verification costs are relatively higher for small countries and small producers, as they are often fixed costs and many smaller and low-income countries lack accredited laboratories. Tariffs, on the contrary, are proportionate to the value of exports and,

in addition, many LDCs benefit from preferential access. The cost of NTMs is more difficult to measure, but is arguably higher than tariffs, and relatively independent from the price of the good. Thus, low-income countries need support from developed countries and the international community to better cope with NTMs. This support should include technical cooperation and capacity building to both support compliance and also enhance production capacities, and certification and accreditation schemes.

4. Regulatory cooperation should be pursued at multiple levels
    - The high costs associated with NTMs relate both to the level of protection that is considered appropriate to protect consumers and the environment, but also to the (often unnecessary) differences in regulations and the way of implementation. i.e. the multiplicity of incompatible regulatory systems adds cost by itself. Much can be done on this matter. Regulatory cooperation can significantly reduce compliance costs stemming from different regulations at similar levels of stringency. The challenging and yet unsuccessful TTIP negotiations have revealed that countries even at similar levels of development and safety protection find it difficult to harmonize or mutually recognize their regulations. Challenges are even higher for countries at different levels of development. However, the difficult task of regulatory cooperation at the multilateral and regional level is worth the effort. The potential benefits from regulatory cooperation are significantly higher than those from tariff liberalization (e.g. Vanzetti et al., 2017).
    - Regulatory cooperation may be pursued at the multilateral level, but regional agreements can be building blocks, especially if they aim to promote the use of international standards. It is important, however, that countries develop regional systems that are in line with their development status, in particular for low-income countries. National alignment with the practices in developed countries may bring implementation difficulties and disruptions in trade with other developing countries that are not yet aligned. Still, progressive (non-mandatory) compliance alignment could be a positive signal on the capacity and quality of the productive capacities of the country.
    - Such regulatory cooperation should also include export measures. The use of export measures is significant; coverage ratio is about 20 per cent in developing and developed countries and above 60 per cent in LDCs. The measures used by LDCs are mostly technical measures and registration requirements ensuring a minimum quality standard of exports. These measures should be closely aligned with corresponding import measures in the destination markets.

5. Regulatory reassessment at the national level is important to ensure coherent policy measures
    - This study has shown a generally high prevalence score, suggesting that NTMs are used pervasively across countries. All relevant stakeholders should be involved in the design and streamlining of NTMs. Various ministries and agencies issuing regulations may benefit from knowing all the regulations that relate to a certain product, and in relation to a particular objective. In this way, it is possible to identify undesired bureaucratic costs or overlapping processes and requirements. In most countries, such transparency does not exist, in particular for technical measures where mostly non-trade agencies such as the ministries of health, agriculture, or environment are involved. The emergence of national Trade Facilitation Committees in compliance with the WTO Trade Facilitation Agreement provide a promising opportunity to gather around the same table all stake-holders. The close study and scrutiny of the present NTM database and the analysis resulting from it, has been successfully used as a starting point for improving national regulation schemes to the benefit of all traders within a country.
    - The cost to trade may also be reduced when governments cooperate at the regional and international level towards harmonization of requirements, mutual recognition or conformity assessment cooperation.
    - A finding is that those products with lower average tariffs are regulated by a higher number of NTMs. This fact supports the concern that NTMs are used as an alternative to tariffs. Greater transparency could help address this issue.

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Appendix

Data

TRAINS features NTM data at the reporter-year-partner-HS6-NTM (at 3 digits) level. It includes NTM data recorded up to the end of 2017, providing a snapshot in each country at the time of the latest data collection. Note that TRAINS includes bilateral NTM data, recording measures applied to the world and those applied bilaterally to one or more countries. UNCTAD processed the raw NTM data, mostly collected at national tariff line level (beyond HS6 level), to ensure cross-country consistency. This cleaning process affects the data used for statistical analysis only – the whole data are preserved in TRAINS online – and it involves:

1.) Horizontal NTMs – measures that apply to all products alike in a country – are dropped. Specifically, UNCTAD defines horizontal NTMs as a single measure affecting at least 95% of products in a country. An example would be a generic import licence for any imported product.
2.) Partial NTMs – measures that cover a HS6 product only partially in a country – are dropped. Specifically, UNCTAD defines partial NTMs as measures covering only some of the national tariff lines at 8, 10 or more digits per HS6 product under consideration. This implies that measures with partial coverage at the tariff line level are also dropped.
3.) NTMs for products beyond HS6 980000 are dropped. The reason is that HS chapters 98 and 99 are not harmonized; they are reserved for national use only and therefore are not comparable between countries.

To compute the Coverage Ratio and Regulatory Intensity, UNCTAD relies on the South-South Trade Database (SSTdb), developed in-house, for export and import values. SSTdb provides estimates of bilateral trade flows at HS6 level for all countries and periods where actual trade flows are missing (see Annex in UNCTAD, 2009b). Drawing from UN COMTRADE, UNCTAD Globstat and IDB, SSTdb uses mirroring, replication, averaging, interpolation and extrapolation of trade flows. Export and import values from SSTdb are then averaged over years 2014, 2015 and 2016 to adjust for year-specific fluctuations. Note that to compute indicators aggregating over several countries, chapters or sectors, the simple unweighted average is used.

Variable definition

1.) Frequency Index: $$F_i = \frac{\sum_{j=1}^{J}\sum_{p=1}^{HS} NTM_{ijp} D_{ijp}}{\sum_{j=1}^{J}\sum_{p=1}^{HS} D_{ijp}} \; x\; 100$$

where subscript p denotes product and i denotes the country imposing the NTM. NTM_{ijp} is a dummy variable denoting the presence of a (import) NTM in country i and product p of the selected HS aggregation level (typically HS6) and applied to imports from country *j*. D_{ijp} is a dummy variable taking the value 1 when country i imports any quantity of product p from country *j*, and zero otherwise. Thus, the denominator measures the number of imported products

Note that the Frequency Index sums over each partner j to account for the fact that some NTMs are bilateral, i.e. applied to some countries only. When calculating the Frequency Index for export measures (associated with MAST NTM chapter P), D_{ijp} takes exports instead of imports, and NTM_{ijp} denotes the presence of an export NTM in country to country *j*.

2.) Coverage Ratio: $$C_i = \frac{\sum_{j=1}^{J}\sum_{p=1}^{HS} NTM_{ijp} V_{ijp}}{\sum_{j=1}^{J}\sum_{p=1}^{HS} V_{ijp}} \; x\; 100$$

where subscript p denotes product and i denotes country imposing the NTM. As in the Frequency Index, NTM_{ijp} is a dummy variable denoting the presence of a NTM in country i and product p of the selected HS aggregation level (typically HS6), and applied to imports from country *j*. Thus, the denominator measures the value of

imported products. V_{ijp} represents the import value of country i in product p used for import measures. When calculating the Coverage Ratio for export measures, V_{ijp} takes export values instead of import values.

3.) Prevalence Score: $$P_i = \frac{\sum_{j=1}^{J}\sum_{p=1}^{HS} NTM_{ijp}\#NTM_{ijp}D_{ijp}}{\sum_{j=1}^{J}\sum_{p=1}^{P} D_{ijp}}\ x\ 100$$

where subscript p denotes product and i denotes country imposing the NTM. $\#NTM_{ijp}$ represents the number of distinct NTMs (at 3 digits) country i has in product p of the selected HS aggregation level (typically HS6) and applied to imports from country *j*. As in the Frequency Index, NTM_{ijp} is a dummy variable denoting the presence of a NTM in country i and product p of the selected HS aggregation level (typically HS6) and D_{ijp} is a dummy variable taking the value 1 when country *i* imports any quantity of product *p* from country *j,* and zero otherwise. Thus, the denominator measures the number of imported products.

When calculating the Prevalence Score for export measures, D_{ijp} takes exports instead of imports. The Prevalence Score computed over different aggregations represents the unweighted average number of distinct (import) measures at the HS6 level for that aggregation, for example, manufactures.

4.) Regulatory Intensity: $$RI_i = \sum_{p=1}^{HS} s_p^w \frac{\frac{\sum_{j=1}^{J}\#NTM_{ijp}}{\sum_{j=1}^{J} D_{ijp}} - \overline{\#NTM_p}}{\sigma\#NTM_p}$$

where $\overline{\#NTM_p}$ and $\sigma\#NTM_p$ measure the mean and standard deviation of the number of NTMs per product p, respectively, to control for product-specific regulatory differences across countries. The standardized number of NTMs per product p is then averaged across all imported products in a given country, weighted by the share of product p in world trade. Using global trade data in s_p^w reduces endogeneity concerns while giving more importance to products where trade flows are larger.

The Regulatory Intensity computed for import measures uses the mean and standard deviation of the number of measures applied to imported products. Conversely, the Regulatory Intensity computed for export measures uses the mean and standard deviation of the number of measures applied to exported products.

The Regulatory Intensity for a region is the simple average of the Regulatory Intensity for each country in its region. For the disaggregation per sector and region, the regional averages are computed on the Regulatory Intensity for every sector and country.

Other data for indicator calculation

The data on GDP and tariffs are downloaded from World Bank Open Databases.

GDP per capita (current US$). Source Note: GDP per capita is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in current U.S. dollars.

Simple averages for years 2015 to 2016

Tariff rate, applied, weighted mean, all products (%). Source Note: Weighted mean applied tariff is the average of effectively applied rates weighted by the product import shares corresponding to each partner country. Data are classified using the Harmonized System of trade at the six- or eight-digit level. Tariff line data were matched to Standard International Trade Classification (SITC) revision 3 codes to define commodity groups and import weights. To the extent possible, specific rates have been converted to their ad valorem

equivalent rates and have been included in the calculation of weighted mean tariffs. Import weights were calculated using the United Nations Statistics Divisions Commodity Trade (Comtrade) database. Effectively applied tariff rates at the six- and eight-digit product level are averaged for products in each commodity group. When the effectively applied rate is unavailable, the most favored nation rate is used instead.

Simple averages for years 2015 to 2016

Measurement of Ad-Valorem equivalents

The ad-valorem equivalents of NTMs presented in here are based on the estimation method developed in Kee and Nicita (2017), which in turn, builds on the seminal work of Kee, Nicita and Olarreaga (2009). As with most of the econometric literature estimating AVEs, the effects of NTMs on international trade are isolated using incidence measures of NTMs as explanatory variables. Following Kee and Nicita (2017), the AVEs are computed as the equivalent tariff that would be necessary to impose in order to obtain the same proportionate change in quantity imported due to the presence of NTMs. In short, the estimation method seeks to identify the instantaneous semi-elasticity of trade with respect to differences in the observed tariffs, and apply this elasticity to the estimated effects of NTMs on the quantity of trade. Bilateral variations in the AVE estimates are calculated on the assumption that trade costs associated to NTMs are a function of importers' and exporters' market power. The econometric model controls for issues related to the estimation of gravity type equations at the disaggregated level. Zero-inflated maximum likelihood estimation takes into account the large presence of zero in the bilateral trade statistics, while two-stage instrumental variable techniques address the endogeneity of tariffs and NTMs. An important point of consideration is that the estimation of AVEs cannot account for prohibitive NTMs, as they result in zero trade. Therefore these estimates are to be intended as lower bounds.[17] In more formal terms the second stage quantity estimation equation takes the form:

$$\ln E\left(Q_{nij}|X\right) = \beta_n + \beta_{nij}^{t}\hat{t}_{nij} + \beta_{nij}^{NTM}\widehat{NTM}_{nij} + \gamma Z_{ij} + e_{nji}$$

where

$$\beta_{nij}^{t} = \beta_n^{t} + \beta_1^{t} share_{ni} + \beta_2^{t} share_{nj}$$

and

$$\beta_{nij}^{NTM} = \beta_n^{NTM} + \beta_1^{NTM} share_{ni} + \beta_2^{NTM} share_{nj}.$$

Where Q denotes quantities, t tariffs, and NTM the presence of an NTM. These explanatory variables are denoted by "hat" as they are instrumented using the average tariff or NTM of the three closest countries; and where n denotes products, i importing country and j exporting country. The variable share denotes the import market share of country i in world trade of product n, and denotes export market share of country j in world trade of product n. Z_{ij} are the standard gravity variables: the log of the gross domestic product (GDP) of the importer and the exporter, bilateral distance between the importer and the exporter, landlocked indicators for the importer and the exporter, and common border indicator.

In this setup the elasticity of trade with respect to tariff is:

$$\hat{\beta}_{nij}^{t} = \frac{\partial \ln(E\left(Q_{nij}|X\right)}{\partial t_{nij}},$$

and the AVE measuring the ad-valorem tariffs that induce the same proportionate change in quantity as the presence of an NTM is:

$$AVE_{nij}^{NTM} = \frac{\exp\left(\hat{\beta}_{nij}^{NTM}\right)-1}{\exp\left(\hat{\beta}_{nij}^{t}\right)-1} \cong \frac{\hat{\beta}_{nij}^{NTM}}{\hat{\beta}_{nij}^{t}} \quad \text{for small } \hat{\beta}_{nij}^{t} \text{ and } \hat{\beta}_{nij}^{NTM}\ .$$

[17] Also note that the estimation strategy does not account for the positive effects of NTMs on international trade. Positive effects may happen when NTMs address information issues, or guarantee quality of products. In these cases the AVE of NTMs is set to zero, rather than to a negative value.

In more intuitive terms, to measure the AVE of NTMs the first step is to construct the proportionate change in quantity imported due to the presence of NTMs, and then use the elasticity of trade with respect to one percentage point increase in the tariff to convert the proportionate change in quantity imported due to NTMs in terms of ad valorem equivalents.

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