CHAPTER 2: Data sources and incidence indicators

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A. Overview and learning objectives

This chapter first reviews the sources of information about non-tariff measures (NTMs). Although the availability of data on NTMs remains limited in terms of both time and country coverage, several sources of information exist. The data they contain do not necessarily share a common origin and it is crucial to understand as much as possible how possible differences can be observed. Once information has been collected several indicators can be used to assess the prevalence of each measure applied by some country to some product. This is an important step towards a precise appreciation of the possible impact measures could have on domestic production and especially on international trade. Formulas of some major indicators are presented and discussed. The most common indicators do not necessarily reflect any regulatory stringency and may need to be complemented by additional elements reflecting more qualitative dimensions of a specific measure. Using existing data, procedures and STATA commands are presented in detail in order to generate these indicators for some set of countries in some specific years.

In this chapter you will learn where to find NTM data and how those data are presented in the various databases available. You will all learn how to calculate several measures of the presence and incidence of NTMs and what biases are possibly involved in their calculation.

B. Analytical tools

1. Data sources

Information on NTMs can be used for several purposes. It allows the detection of the existence of different type of NTMs across countries and sectors. There is no database yet, however, that provides on a large and inclusive scale enough information to precisely assess the stringency either in absolute or relative terms, of any measure. The best that can be assessed is the heterogeneity in countries regulatory frameworks which should not be confused with relative regulatory strictness. NTMs information can also be used to assess trade effects of different types of measures. In order to do so, NTMs information must be associated with other trade-related information. Some description of sources of possibly relevant information is provided in the rest of the section.

Main NTMs databases

As discussed in Chapter 1 different sources provide information on NTMs implemented by countries. The type of information may vary with the source used. Surveys of firms may help determine the stringency of different NTMs and eventually their impact on their respective production and exports. Surveys of consumers may help assess the impact of regulations on their consumption choice. Information provided by sources where regulations related to NTMs are identified and classified can be used to assess the prevalence and incidence of the latter.

This section focuses on four of those sources. The oldest is the WTO notifications.[7] According to both the WTO SPS and TBT Agreements, countries must notify their NTMs to the WTO. Such

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[7] The WTO's I-TIP database reports these notifications (https://i-tip.wto.org/goods/).

notifications were often used in the first papers investigating the trade impact of NTMs. However, these data suffer from two main weaknesses: first, some countries do not notify their measures to the WTO and therefore some notifications are missing; and second, the information provided for some notifications is rather scarce (in terms of products affected, etc.). Furthermore, not all NTMs should be notified to the WTO. Countries must notify only those measures that are new or have changed since 1995, that differ from international standards or represent situations where no international standards exist, and that may have a significant impact on trade. Finally, countries have no obligation to notify final NTMs; some notified measures may therefore have been amended before being implemented, or even not implemented at all.

Figure 4 provides the yearly SPS and TBT notifications to the WTO. One can observe an increasing trend over time in the number of NTMs for both types of measures. However, the mechanism underlying these increases (i.e. the increasing number of measures or increased compliance with WTO obligations) cannot be clearly identified.

A second source of data is the historical Trade Analysis Information System (TRAINS) database,[8] developed by the United Nations Conference on Trade and Development (UNCTAD). The historical TRAINS database uses the WTO notifications and other (national) sources and provides information on the notifying country (the importing country), the affected product (at the six-digit level of the Harmonized System – HS), and the NTM's classification code (six core categories). Data are available for the period 1992–2010. However, for some countries, data are available only for a subset of NTM categories and/or a subset of years. Therefore, the coverage of the database is only partial, and for blank cells, the database does not distinguish clearly between missing data or the real absence of NTMs.

To address the weaknesses of the two first sources, a new data collection approach has recently been developed and initiated by UNCTAD. In a global and coordinated effort international organizations, including the African Development Bank, ITC, UNCTAD, the World Bank (forming the Transparency in Trade (TNT) Initiative) in cooperation with other international and regional organizations collect NTMs data. The aim is to accelerate and unify NTM data collection and create a global information source. A Multi-Agency Support Team (MAST)[9] initiated by UNCTAD's Secretary General developed a new classification of NTMs, the International Classification of NTMs shown in Figure 5, with the main novelty of being much more disaggregated on so called technical measures (i.e. SPS measures and TBT). The new classification develops a tree branch structure: NTMs are classified into 16 chapters depending on their scope and/or design (from A to P). Each chapter is further divided into sub-groups (up to three digits) to allow a finer classification of the regulations affecting trade. All chapters (except chapter P, which deals with exports) reflect the requirements of the importing country with regard to its imports.[10] The trade effect of NTMs

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[8] For more information on the TRAINS database, see https://unctad.org/ntm and https://trains.unctad.org/.

[9] Eight international organizations are member of MAST: FAO, IMF, ITC, OECD, UNCTAD, UNIDO, World Bank, WTO, see https://unctad.org/en/Pages/DITC/Trade-Analysis/Non-Tariff-Measures/MAST-Group-on-NTMs.aspx.

[10] For a detailed inventory by country of available NTMs, see https://unctad.org/en/Pages/DITC/Trade-Analysis/Non-Tariff-Measures/NTMs-Data.aspx.

varies across chapters. NTMs in some chapters have clearly restrictive effects, while others have ambiguous trade effects. The Classification is deliberately neutral.

Figure 4: World Trade Organization SPS and TBT notifications, 1995–2017

(a) SPS measures

Regular notifications ■ Emergency notifications ■ Addendum & corrigendum

(b) TBTs

■ New notifications ■ Revisions ■ Addendum & corrigendum

Source: WTO http://spsims.wto.org/en/ and http://tbtims.wto.org/en/.
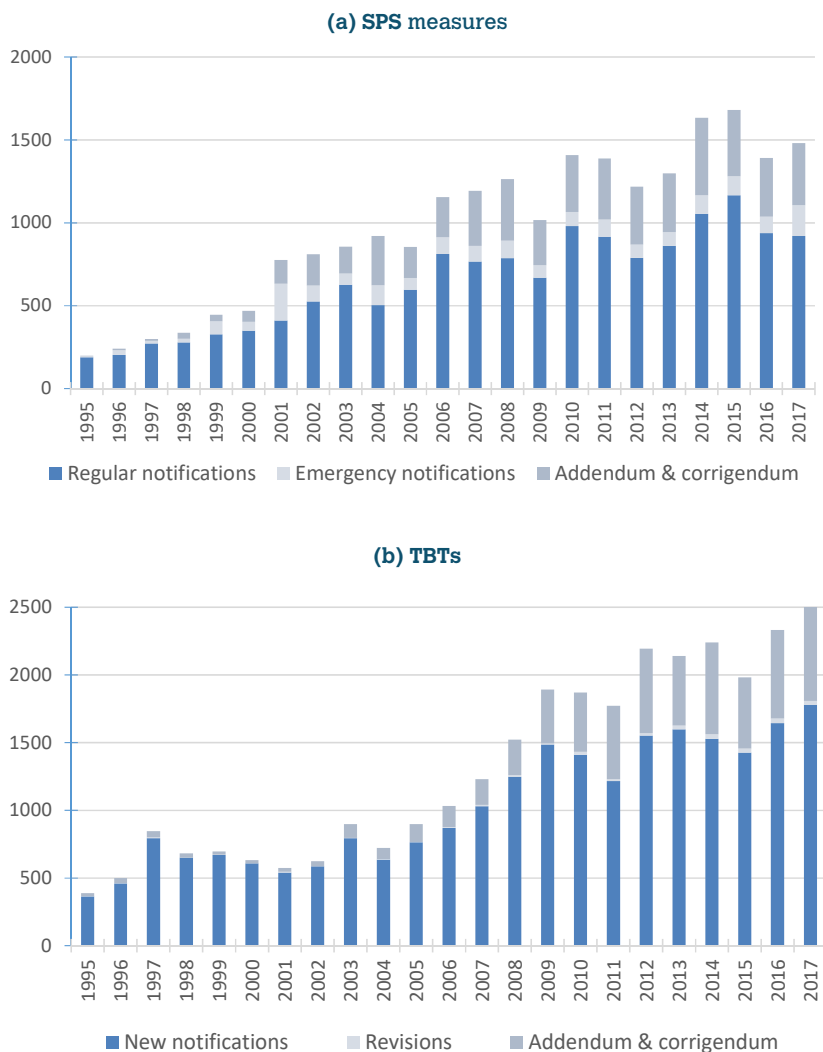
Note: New notifications refer to a new proposed technical regulation or conformity assessment procedure. New notifications can be associated with a previously notified measure (e.g. amending or supplementing an adopted measure or replacing a withdrawn or revoked measure). Revisions are submitted to indicate that a notified measure has been substantially re-drafted prior to adoption or entry into force. A revision replaces the original notification. Addendum and Corrigendum refer to notifications providing additional information related to a notification or the text of a notified measure or to correct minor administrative or clerical errors which do not entail any changes to the meaning of the content of a notified regulation.

Figure 5: Non-tariff measures classification in the Transparency in Trade Initiative

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

Source: UNCTAD (2017).

Note: SPS = sanitary and phytosanitary; TBT = technical barriers to trade.

The MAST initiative also introduces "procedural obstacles," i.e. issues related to the process of NTM implementation (e.g. a slow or costly certification). Nine broad categories of procedural obstacles are considered: (a) administrative burdens, (b) information/transparency issues, (c) inconsistent or discriminatory behaviour of officials, (d) time constraints, (e) payment, (f) infrastructural challenges, (g) security, (h) legal constraints, and (i) others. Information on these obstacles is collected through surveys or mechanisms that record complaints.

Using the UNCTAD TRAINS data on NTMs, the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII) has built various indicators measuring the incidence of such measures.[11] These indicators are computed for each country at different levels of aggregation and cover the first five categories of NTMs listed in Figure 5.[12]

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[11] For more information on the CEPII mapping, http://www.cepii.fr/CEPII/fr/bdd_modele/presentation.asp?id=28.

[12] Based on recently updated data, UNCTAD has also calculated similar indices. For more information see unctad.org/ntm and https://trains.unctad.org/Forms/Analysis.aspx.

Finally, the last source of information on NTMs implemented by countries deals with what are called specific trade concerns (STCs).[13] Countries can indeed raise concerns at the WTO's SPS and TBT Committees about measures put in place by other countries and deemed to restrict trade. However, not all concerns raised relate to perceived trade restrictions, as countries sometimes only seek clarification on a measure adopted by a partner, or remind a partner of missing notifications.

Between 1995 and 2017, 434 SPS-STCs and 548 TBT-STCs were raised at the WTO. Figure 6 shows the numbers of concerns raised between 1995 and 2017. This figure shows an increase in the number TBT-STCs raised to the WTO over time. As to SPS-STCs the trend is more mitigated with clear ups but also clear downs. This increase may signal an increasingly adverse effect of measures or an increasing participation of countries in the specific trade concern mechanism. The figure does not allow to disentangle between these two potential explanations.

**Figure 6:** SPS-specific and TBT-specific trade concerns, 1995–2017

Source: WTO http://spsims.wto.org/en/ and http://tbtims.wto.org/en/.
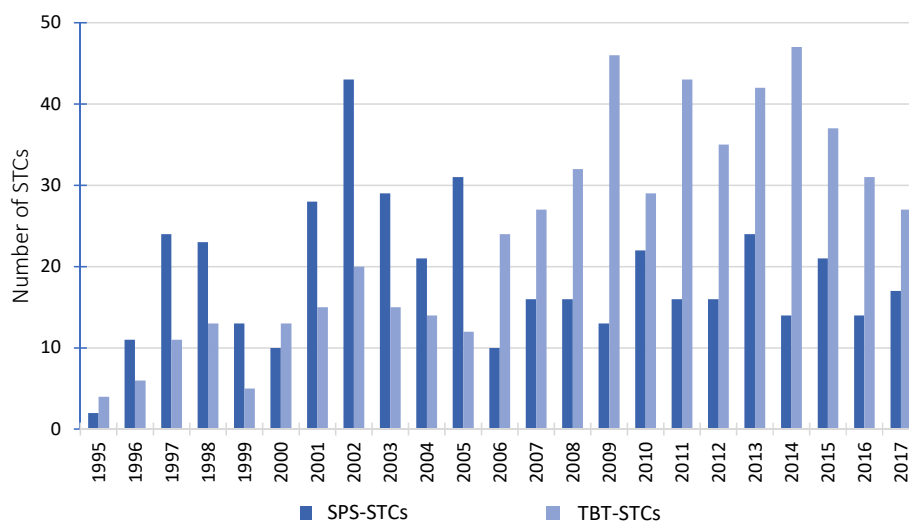
Note: We consider only new STCs; those already raised in the past are not included in the calculations.

Figure 7 shows the number of countries raising trade concerns about SPS measures and TBTs by income group. An issue can be raised by more than one country and each country is counted separately. Therefore, the number of complainants is larger than the number of issues (Figure 6). Developed countries participate more in the trade concerns mechanism than developing and least developed ones. However, the number of issues raised by developing countries is increasing over time, meaning that these countries are becoming important users of the mechanism. The number of issues raised by least developed countries is still marginal.

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[13] Information on these trade concerns is available in the WTO I-TIP database at https://i-tip.wto.org/goods.

Figure 7: Specific trade concerns presented by countries, by development level, 1995–2017

(a) SPS measures

(b) TBTs
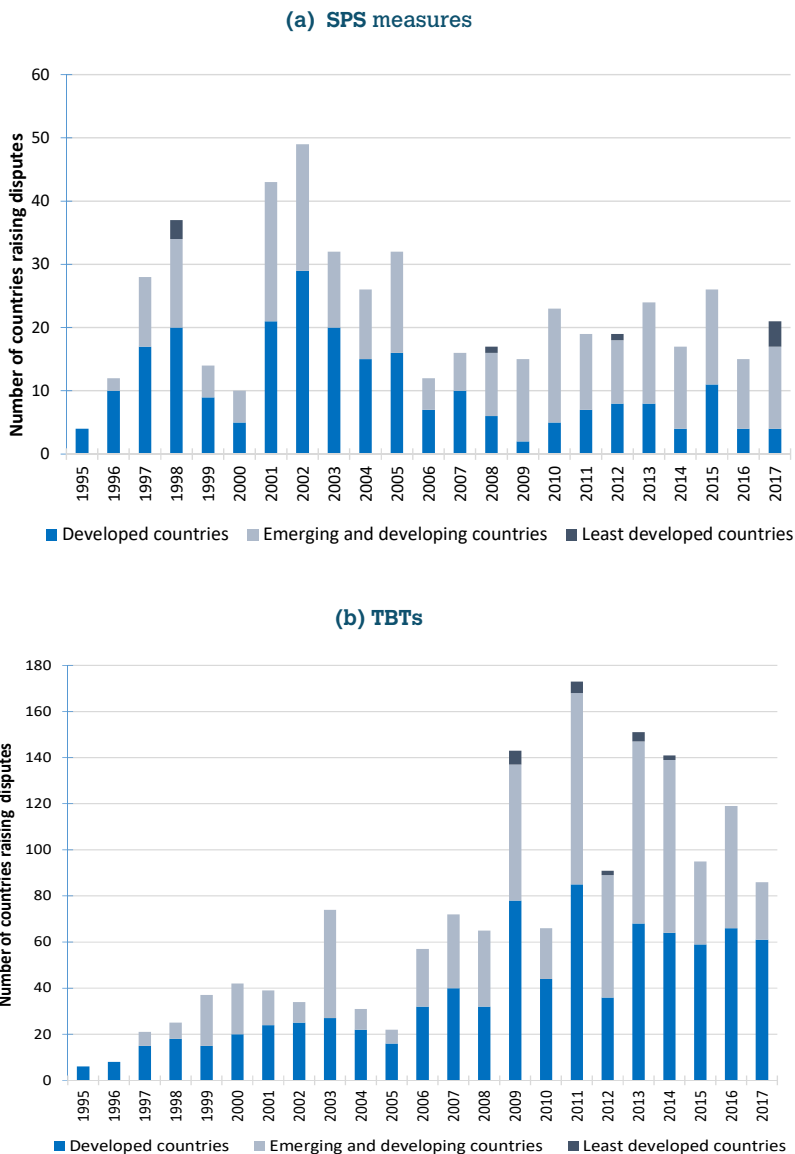
Source: WTO http://spsims.wto.org/en/ and http://tbtims.wto.org/en/.
Note: the number of countries raising STCs is larger than the number of STCs shown in Figure 6 because an STC can be raised by more than one country. The European Union is aggregated into one country.

Other trade policy databases

Tariff data can be extracted from the UNCTAD TRAINS database (through WITS), or from the Market Access Map (MAcMap) database developed by the ITC.[14] The TRAINS database provides MFN applied tariffs and preferential tariffs at the HS 6-digit level including ad valorem equivalent (AVE) tariffs for specific and compound duties for almost all countries from 1988 to 2017. WITS also includes bound rates (WTO CTS database) and statistics on tariffs such as simple and trade weighted averages and number of duty free lines. The MAcMap database provides the AVE of applied border protection at the HS six-digit level. It covers almost all countries but few years (2001, 2004, and 2007). MAcMap covers all regional trade agreements (RTAs) in force and, incorporates tariff rate quotas and AVEs of specific duties. In addition, it uses an original aggregation method based on reference groups, which limits endogeneity issues.[15]

Trade agreements are not exclusively about preferential tariff cuts. Member countries of any trade agreement can not only undertake additional obligations in policy areas covered by the WTO such as customs administration or contingent protection. But they can also commit to policy reform in domains that are not regulated by the WTO, such as investment and competition policy. Information on RTAs (trade agreements based on reciprocal concessions) and PTAs (trade agreements based on non-reciprocal concessions) notified to the WTO is available in a raw format in the WTO-RTA[16] and WTO-PTA[17] databases. A mapping of the content of these agreements has been conducted by a team at the World-Bank and reported in a specific database publicly available. The "Content of Deep Agreements" dataset[18] maps 52 provisions in 279 agreements notified at WTO signed between 1958 and 2015. It also includes information about legal enforceability of each provision.

Merchandise trade flows databases

The above data can be used to assess the impact of NTMs on trade flows and on prices of traded goods. In order to do so NTM data could be merged with trade, tariffs, and other types of data in order to analyse their trade impact. The main sources for trade data are the United Nations Commodity Trade Statistics (UN Comtrade) database[19] and the CEPII world trade database (*Base*

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[14] The TRAINS database can be accessed through UNCTAD-TRAINS at https://trains.unctad.org/, the World Integrated Trade Solution at wits.worldbank.org and the Market Access Map database can be accessed at either http://www.macmap.org/ or http://www.cepii.fr/anglaisgraph/bdd/macmap.htm.

[15] In the "reference-group" method, each country is assigned to one of the five world regions (the reference groups) that share similar characteristics, using hierarchical clustering analysis. The weight for the flow is ultimately the share of good k in imports of the entire reference group originating from country i, scaled by the size of country j's imports in its reference group. The main interest of such weights, compared to a simple weighting scheme, is to take into account at least part of the prohibitive level of certain transaction costs: a measure that would completely prevent trade would result in a null contribution to a trade-weighted average, whereas it would imply a positive contribution to the reference-group-weighted aggregate (Bouët *et al.*, 2004).

[16] RTAs contents are accessible at http://rtais.wto.org/UI/PublicMaintainRTAHome.aspx.

[17] PTAs contents are accessible at http://ptadb.wto.org/.

[18] The dataset is accessible at https://datacatalog.worldbank.org/dataset/content-deep-trade-agreements.

[19] The UN Comtrade database is available at http://comtrade.un.org/.

pour l'Analyse du Commerce International - BACI).[20] The UN Comtrade statistics provide bilateral import and export flows for all countries at the product level (six-digit level of the HS classification) from 1962 until 2017. Despite its large coverage, this dataset suffers from some quality issues. In particular, one cannot disentangle between zero flows and missing observations. The CEPII BACI dataset solves this issue. It uses original procedures to harmonize data: evaluation of the quality of country declarations to average mirror flows, evaluation of cost, insurance and freight (CIF) rates to reconcile import and export declarations, etc. The BACI data are available at the product level (HS six-digit) and for all countries over the 1995–2016 period.

Databases on other relevant variables

Finally, some authors estimate a tailored gravity model[21] to investigate the trade effects of NTMs (see chapter 3). In such applications, countries' size and wealth may be proxied using gross domestic product (GDP) and GDP per capita from the World Bank's World Development Indicators.[22] Other traditional gravity variables, such as geographical distance, common border, common language, and colonial links, may be obtained from the CEPII.[23] Administrative, environmental, legal system, and corruption data are available from the World Bank's Doing Business Report[24] or the Worldwide Governance Indicators Project.[25]

2. Incidence indicators

What is the share of products and trade affected by NTMs? Different incidence indicators help answer this question. However, no ideal indicator exists. They all suffer from some weaknesses and their respective strengths often complement each other. This implies that analyzing the incidence of NTMs should rely on more than one indicator to be able to draw meaningful insights. This section focuses on three of them: the frequency index, coverage ratio, and prevalence ratio. They are relatively easy to compute, and their precision depends on the disaggregation level of information used for the computation. If they are updated on a regular basis, they can help keep track of the evolution of the relative incidence of different types of NTMs.

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[20] The BACI database is available at http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=1.

[21] The gravity model of international trade is the canonical empirical model used to identify the components of bilateral trade as well as to estimate the effects of some policy reform or instrument. An extensive presentation and discussion is provided in Chapter 3 of UNCTAD-WTO (2012) practical guide.

[22] The World Bank's World Development Indicators are available at http://data.worldbank.org/data-catalog/world-development-indicators.

[23] Available from CEPII at http://www.cepii.fr/CEPII/en/bdd_modele/bdd.asp.

[24] Available at http://www.doingbusiness.org/.

[25] The Worldwide Governance Indicators Project can be accessed at:
http://info.worldbank.org/governance/wgi/#home

The frequency index provides the share of products affected by one or more NTMs. Formally, the frequency index of NTMs imposed by country j is:

$$F_j = \left[\frac{\sum_i D_i M_i}{\sum_i M_i} \right] *100$$

(2.1)

where D_i is a dummy variable reflecting the presence of one or more NTMs on product i (i.e. it takes the value one if at least one NTM is imposed on product i and zero otherwise), and M_i is a dummy variable indicating whether there are imports of product i. The frequency index suffers from two main drawbacks. First, it accounts only for the presence of NTMs and not for their stringency;[26] second, it does not indicate the effects of NTMs on prices, production of exporters, and international trade. Moreover, the index may suffer from a downward bias if imports drop to zero because of the measure itself. This could happen if the implementation of the regulation would lead to a prohibitive increase in production costs.

The coverage ratio reports the share of imports affected by one or more NTMs in total imports. Formally, the coverage ratio of NTMs applied in country j can be written as:

$$C_j = \left[\frac{\sum_i D_i V_i}{\sum_i V_i} \right] *100$$

(2.2)

where D_i is defined as previously, and V_i is the value of imports of product i. Two weaknesses affect its computation. First, it may suffer from endogeneity: if NTMs reduce imports, the coverage ratio is downward-biased. Moreover, it does not indicate the effects of NTMs on prices, production of exporters, and international trade.

Finally, the prevalence ratio, which is used less often, accounts for the fact that a large number of products have more than one regulatory measure applied to them. This ratio captures the average number of NTMs affecting an imported product. Formally, the prevalence ratio for NTMs applied in country j is:

$$P_j = \left[\frac{\sum_i N_i M_i}{\sum_i M_i} \right] *100$$

(2.3)

where N_i is the number of NTMs on product i, and M_i is defined as previously. The prevalence ratio is a trade-free indicator and thus would not suffer form any downward bias. However, it should

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[26] The stringency of a measure refers to the strictness imposed by the regulation for instance on pesticides Maximum Residue Levels (MRLs) legally tolerated in or on food or feed. A more stringent measures can be expected to increase the costs of production.

not be interpreted as an indicator of stringency although a larger number of measures applying to the same product could reflect a stricter regulatory framework. This may be the case if one compares prevalence ratios across products within a broad sector and within the same country. An interpretation of differences in prevalence ratios across countries may not be that straightforward as they may express divergence in the regulatory approach.

Figure 8 reports the frequency index and coverage ratio by NTM category. The figure comes from the World Bank and UNCTAD (2018). The sample includes 109 countries. Data are disaggregated at the six-digit level of the HS classification (more than 5,000 products). The figure shows the distribution of NTMs across eight categories of NTMs for all countries pooled together. It suggests that TBTs are the most widely used NTMs, with about 40 per cent of products and about 67 per cent of trade affected by them. For SPS measures, these percentages are around 12–14 per cent. The large incidence of SPS measures and TBTs raises concerns for developing countries' exports. These measures may impose quality and safety standards that often exceed international standards. Even if they are not protectionist per se, these measures may exclude small developing country producers from the export market (because of adaptation costs that are too high). Pre-shipment inspections affect approximately 10 per cent of trade and products. Price-control measures affect a small share of goods. These measures are largely related to anti-dumping and countervailing duties. Finally, quantity controls affect 6 per cent of products and 7 per cent of trade. Today, these measures often involve non-automatic licensing. They used to take the form of quotas and export restrictions, but this is no longer the case because most of these quantitative restrictions are now prohibited by WTO rules.

Figure 8: Frequency index and coverage ratio, by non-tariff measure category, various years between 2014 and 2018 (share)
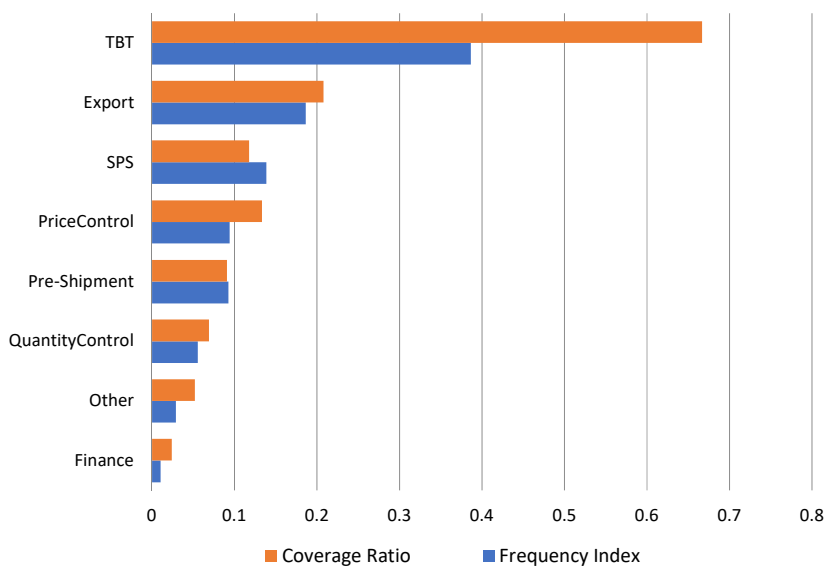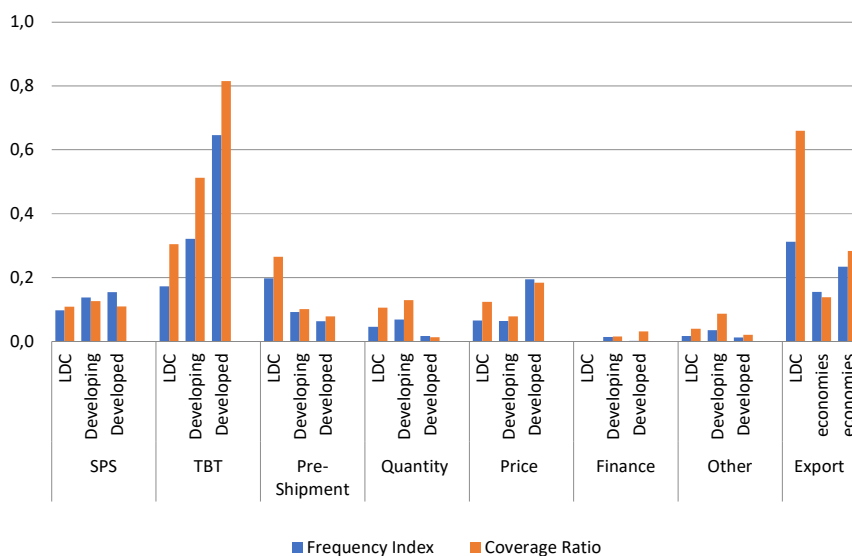

Source: World Bank and UNCTAD (2018) based on UNCTAD TRAINS-NTMS.
Note: UNCTAD's NTM data includes 109 countries, covering 90 per cent of global trade.

Figure 9 describes the frequency index and coverage ratio by NTM category and income group. We observe some differences in the incidence of each type of NTM across income groups. While developed countries use more intensively TBTs than developing countries and LDCs, the incidence of SPS measures is similar across country groups. Pre-shipment inspections appear to be more present in LDCs. While price control measures are intensively implemented by developed countries this is not the case for other types of countries which would rather use quantity controls. Export measures are also quite present amongst LDCs as compare to developed and other developing countries. Looking at the details of data presented in Figure 9 reveals that SPS measures and TBTs are extensively used by countries in Latin America, Africa, and high-income countries. They are less used by Asian countries. Latin American and African countries also employ a large number of quantitative restrictions, with African countries tending to regulate their imports relatively more than other countries. According to Nicita and Gourdon (2013), these SPS and TBT regulations may originate in part from an effort to harmonize African regulations with those of their main trading partner (the European Union). Pre-inspection shipments are also widely applied. These measures are often implemented to fight corruption and facilitate customs procedures.[27]

Figure 9: Frequency index and coverage ratio, by non-tariff measure category and region, 2010 (share)

Source: World Bank and UNCTAD (2018) based on UNCTAD TRAINS-NTMS.
Note: UNCTAD's NTM data includes 109 countries, covering 90 per cent of global trade.

In Figures 8 and 9, frequency index and coverage ratio provide similar conclusions. However, coverage ratios are often larger than frequency indices. Two reasons may explain this result. First,

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[27] See Anson, Cadot and Olarreaga (2006) for a theoretical treatment and empirical assessment of the possible relationship between pre shipment inspections and the occurrence of fraud.

this result may come from an import composition effect. Countries (especially developing ones) often import larger volumes of products (agriculture) for which NTMs are more extensively used. Second, NTMs may be applied to products that are most traded. This is often observed in developed countries.

3. Complementarity versus substitutability between tariffs and non-tariff measures

Do countries implementing high tariffs also apply NTMs more frequently? Do tariffs and NTMs complement or substitute for each other as trade policy instruments? If a positive relationship emerges between the use of NTMs and the level of tariffs, this may suggest that the instruments complement one another.[28] However, the existing literature provides mixed results.

According to Bagwell and Staiger (2001), Bajona and Ederington (2009), Copeland (1990), and Ederington (2001), as tariffs are reduced NTMs may become attractive tools to replace them and to protect import-competing industries. Broda *et al.* (2008) also show that due to contraints on the use of tariffs imposed by the GATT/WTO commitments, the United States set significantly higher NTMs in import-competing sectors. Using Colombian data for the mid-1980s and early 1990s, Goldberg and Pavcnik (2005) find a positive correlation between tariffs and NTMs, suggesting some complementarity between the two trade policy instruments. On the other hand, Kee *et al.* (2009) find some evidence of substitution between tariffs and NTMs. Using data for 91 countries in the early 2000s, the authors report that the overall level of protection decreases with GDP per capita. However, the average AVE of NTMs increases with GDP per capita. Similarly, Limao and Tovar (2011) also report some substitution effects. Using Turkish data, they underline that the reductions of tariffs imposed via multilateral and preferential commitments increase the probability of the use of NTMs. Nevertheless, this substitution is not perfect: tariff cuts are partially but not totally offset by higher NTMs.

Nicita and Gourdon (2013) investigate the policy complementarity between NTM prevalence and most-favoured-nation (MFN) tariffs at the country level (Figure 10 panel (a)) and at the sector level (Figure 11) using the UNCTAD TRAINS databases. At the country level, the authors find a positive relationship between the average number of NTMs per product and tariffs. The correlation is rather strong, suggesting that countries where tariffs are high also apply a large number of NTMs per product. An analysis based on more recent NTMs data that include a lager country coverage, suggests that the positive relationship does not hold any more and is even reverted when prevalence, corresponding to the average number of NTMs per product is considered, as reported in Figure 10 panel (b).

At the sector level as depicted by Figure 11, Nicita and Gourdon (2013) find that the correlation is rather weak and largely driven by four agricultural product groups (live animals, vegetables, fats and oils, and prepared food).

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[28] Note that concluding for a positive relationship would require an empirical investigation that goes beyond the computation of simple correlation coefficients. Econometric techniques should be used to identify precisely a causal link between tariff levels and NTM incidence indicators.
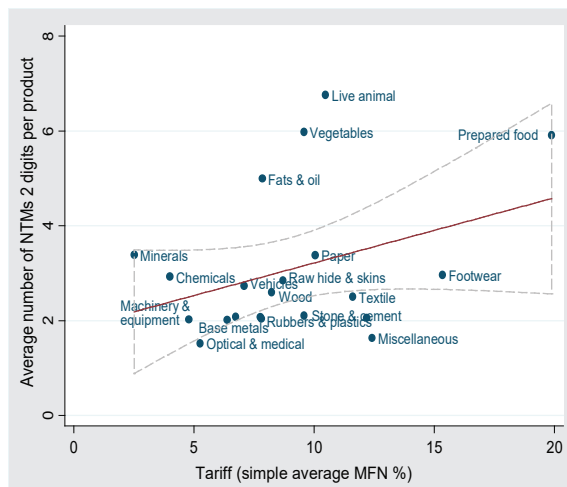
Figure 10: Prevalence of non-tariff measures versus most-favoured-nation tariffs

(a)

(b)
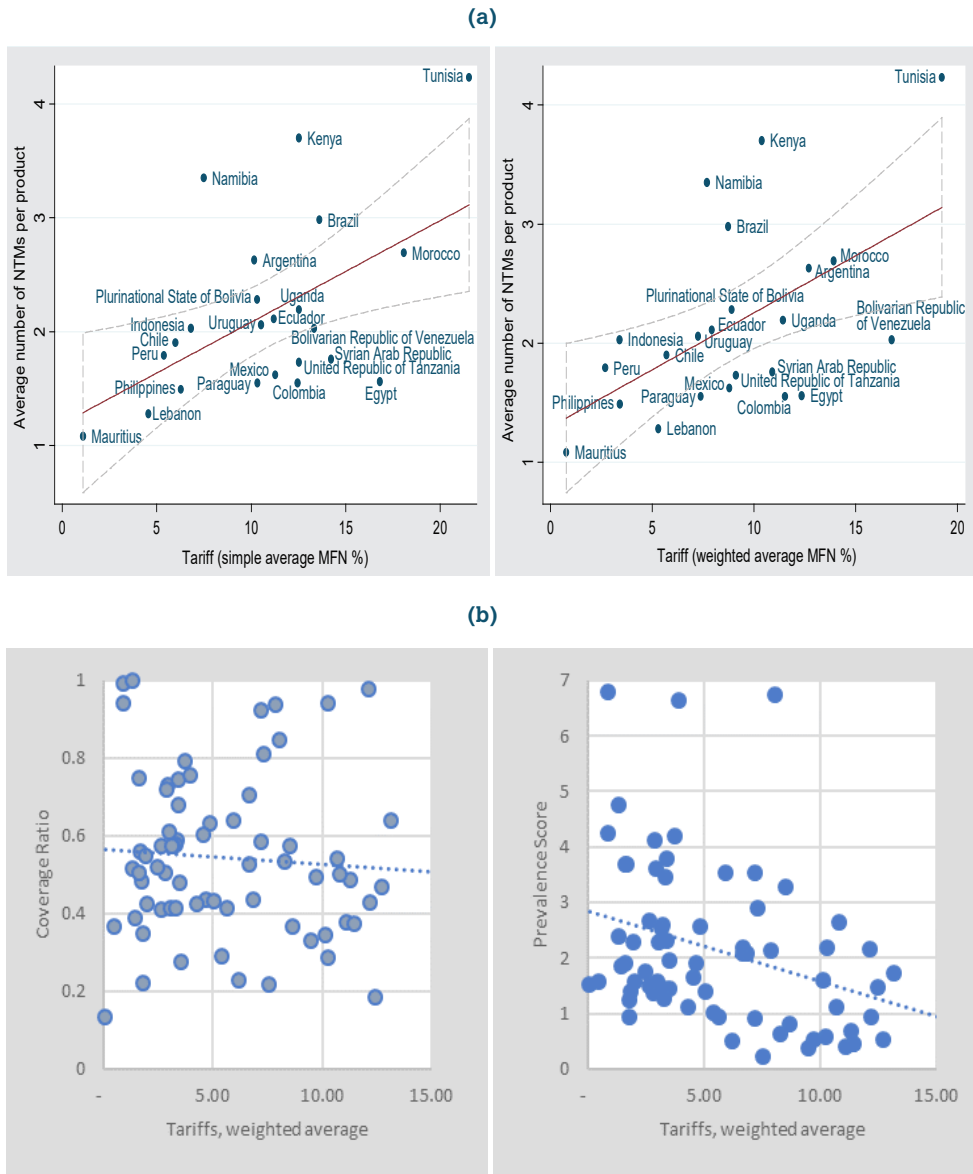
Source: Panel (a) Nicita and Gourdon (2013); Panel (b) UNCTAD-World Bank (2018).
Note: MFN = most-favoured-nation.

Figure 11: Correlation between the prevalence of non-tariff measures and most-favoured-nation tariffs, by product

Source: Nicita and Gourdon (2013).
Note: MFN = most-favoured-nation; NTM = non-tariff measure.

C. Applications

1. Computing prevalence indicators

This application aims to perform graphical analyses of NTMs and compute descriptive statistics. It uses some datasets presented in Section B.1 and the incidence indicators described in Section B.2. The last part of the technical application investigates the substitutability versus complementarity of NTMs and tariffs discussed in Section C.1.

(a) Download the data

The data needed for the technical application can be downloaded from the UNCTAD website. Explanations on the construction of the datasets used here are provided in Gourdon (2014).

Download the two files "NTM-MAP_Country.dta" and "NTM-MAP HS-Section.dta". The first file reports the data at the country level, while the second reports data at the country and HS section levels. The sample includes 63 countries, of which 24 are European countries, and deals with the five categories of NTMs defined in the TNT classification (SPS measures, TBTs, pre-shipment inspections, price controls, and quantity control measures; see Figure 5).

(b) Open the data into Stata and finalize the dataset

To open the dataset at the country level in Stata, apply the command "use". Before running the graphs and reporting the descriptive statistics, we finalize the dataset. First we average all European countries. Second we define a "continent" variable, which groups countries included in the dataset by continent (Latin America, Africa, Asia, Middle East and North Africa, developed countries). The latter group includes both the European Union and Japan.

```
* Dataset defined at the country level

use NTM-MAP_Country, clear

* Average all European countries
gen EU = 1 if isor == "AUT" | isor == "BEL" | isor == "CYP" | isor == "CZE" | isor == "DEU" | isor
== "DNK" | isor == "ESP" | isor == "EST" | isor == "FIN" | isor == "FRA" | isor == "GBR" | isor ==
"GRC" | isor == "HUN" | isor == "IRL" | isor == "ITA" | isor == "LTU" | isor == "LUX" | isor =="LVA" |
isor=="NLD" | isor == "POL" | isor=="PRT" | isor=="SVK" | isor == "SVN" | isor == "SWE"

replace isor = "EUR" if EU == 1
collapse HSline Num* Pres* Cov* Freq* , by(isor)
* Define continent
gen continent = "Lat_America" if isor == "ARG" | isor == "BOL" | isor == "BRA" | isor == "CHL" | isor
== "COL" | isor == "CRI" | isor == "ECU" | isor == "GTM" | isor == "MEX" | isor == "PER" | isor ==
"PRY" | isor =="VEN" | isor == "URY"
replace continent = "Africa" if isor == "BDI" | isor == "BFA" | isor == "CIV" | isor == "GIN" | isor ==
"KEN" | isor == "MDG" | isor == "MUS" | isor == "SEN" | isor == "TZA" | isor == "UGA" | isor == "ZAF"

replace continent = "Asia" if isor == "BGD" | isor == "IND" | isor == "LKA" | isor == "NPL" | isor ==
"PAK" | isor == "CHN" | isor == "IDN" | isor == "KHM" | isor == "LAO" | isor ==" PHL"

replace continent = "MENA" if isor == "EGY" | isor == "LBN" | isor == "MAR" | isor == "SYR" | isor
== "TUN"
replace continent = "Dvlped" if isor == "EUR" | isor == "JPN"
save temp_NTM_country, replace

* Dataset defined at the country-HS section level
use "NTM-MAP HS-Section", clear
* Sections' label
gen Section_label = "Live animals" if Section == 1
replace Section_label = "Vegetable products" if Section == 2
replace Section_label = "Fats and oils" if Section == 3
replace Section_label = "Processed food" if Section == 4
replace Section_label = "Mineral products" if Section == 5
replace Section_label = "Chemicals" if Section == 6
replace Section_label = "Rubber and plastics" if Section == 7
replace Section_label = "Rawhide and skins" if Section == 8
replace Section_label = "Wood" if Section == 9
replace Section_label = "Paper" if Section == 10
```

```
replace Section_label = "Textile" if Section == 11
replace Section_label = "Footwear" if Section == 12
replace Section_label = "Stone and Cement" if Section == 13
replace Section_label = "Pearls" if Section == 14
replace Section_label = "Base metals" if Section == 15
replace Section_label = "Machinery and electrical equipment" if Section == 16
replace Section_label = "Motor vehicles" if Section == 17
replace Section_label = "Optical and medical instruments" if Section == 18
replace Section_label = "Arms and ammunition" if Section == 19
replace Section_label = "Miscellaneous" if Section == 20
replace Section_label = "Works of Art" if Section == 21


* Average all EU countries
gen EU = 1 if isor == "AUT" | isor == "BEL" | isor == "CYP" | isor == "CZE" | isor == "DEU" | isor ==
"DNK" | isor == "ESP" | isor == "EST" | isor == "FIN" | isor == "FRA" | isor == "GBR" | isor == "GRC"
| isor == "HUN" | isor == "IRL" | isor == "ITA" | isor == "LTU" | isor == "LUX" | isor == "LVA" | isor ==
"NLD" | isor == "POL" | isor == "PRT" | isor == "SVK" | isor == "SVN" | isor == "SWE"


replace isor = "EUR" if EU == 1
collapse Num* Pres* Cov* Freq* , by(isor Section Section_label)


* Define continent
gen continent = "Lat_America" if isor == "ARG" | isor == "BOL" | isor == "BRA" | isor == "CHL" | isor
== "COL" | isor == "CRI" | isor == "ECU" | isor == "GTM" | isor == "MEX" | isor == "PER" | isor ==
"PRY" | isor == "VEN" | isor == "URY"


replace continent = "Africa" if isor == "BDI" | isor == "BFA" | isor == "CIV" | isor == "GIN" | isor ==
"KEN" | isor == "MDG" | isor == "MUS" | isor == "SEN" | isor == "TZA" | isor == "UGA" | isor == "ZAF"
replace continent = "Asia" if isor == "BGD" | isor == "IND" | isor == "LKA" | isor =="NPL" | isor ==
"PAK" | isor == "CHN" | isor == "IDN" | isor == "KHM" | isor == "LAO" | isor =="PHL"


replace continent = "MENA" if isor == "EGY" | isor == "LBN" | isor == "MAR" | isor == "SYR" | isor
== "TUN"
replace continent = "Dvlped" if isor == "EUR" | isor == "JPN"
save temp_NTM_section, replace
```

(c) Generate graphs and descriptive statistics

We now generate graphs using the different incidence indicators (frequency index, coverage ratio, and prevalence ratio). These graphs can be done for all countries, by continent, for some specific countries and/or continents, for all NTMs, by type of NTMs, etc. We provide different examples below.

- Frequency index and coverage ratio, by broad type of NTMs

```
use temp_NTM_country, clear
collapse FreqA-FreqE CovA-CovE NumA-NumE

graph bar Freq*, legend(label(1 "SPS") label(2 "TBT") label(3 "Pre-shipment") label(4 "Price control")
label(5 "Quantity control")) title("Frequency Index, by broad type of NTMs") ytitle("Value")

graph bar Cov*, legend(label(1 "SPS") label(2 "TBT") label(3 "Pre-shipment") label(4 "Price control")
label(5 "Quantity control")) title("Coverage Ratio, by broad type of NTMs") ytitle("Value")
```

- Frequency index, coverage ratio, and prevalence ratio of NTMs, by continent

```
use temp_NTM_country, clear

collapse FreqNTM CovNTM NumNTM, by(continent)

graph bar FreqNTM CovNTM, over(continent) legend(label(1 "Freq. Index (all NTMs)") label(2
"Coverage ratio (all NTMs)")) title("Frequency Index and Coverage Ratio, by continent") ytitle("Value")

graph bar NumNTM, over(continent) legend(label(1 "Prevalence Ratio (all NTMs)")) title("Prevalence
Ratio, by continent") ytitle("Value")
```

- Frequency index, coverage ratio, and prevalence ratio of NTMs, by African countries

```
use temp_NTM_country, clear

graph bar FreqNTM CovNTM if continent == "Africa", over(isor) legend(label(1 "Freq. Index (all NTMs)")
label(2 "Coverage ratio (all NTMs)")) title("Frequency Index and Coverage Ratio, by African country")
ytitle("Value")
graph bar NumNTM if continent == "Africa", over(isor) legend(label(1 "Prevalence Ratio (all NTMs)"))
title("Prevalence Ratio, by African country") ytitle("Value")
```

- Frequency index and coverage ratio, by continent and broad type of NTMs

```
use temp_NTM_country, clear

collapse FreqA-FreqE CovA-CovE, by(continent)

graph hbar Freq*, over(continent) legend(label(1 "SPS") label(2 "TBT") label(3 "Pre-shipment") label(4
"Price control") label(5 "Quantity control")) title("Frequency Index, by continent & type of NTMs")
ytitle("Value")
graph hbar Cov*, over(continent) legend(label(1 "SPS") label(2 "TBT") label(3 "Pre-shipment") label(4
"Price control") label(5 "Quantity control")) title("Coverage Ratio, by continent & type of NTMs")
ytitle("Value")
```

- Share of product lines (defined at the HS six-digit level) with at least one NTM, one SPS measure, and one TBT

```
use temp_NTM_country, clear
gen shr_NTM = PresNTM/HSline * 100
gen shr_SPS = PresA/HSline * 100
gen shr_TBT = PresB/HSline * 100
label var shr_NTM "Share of HS6 lines with at least one NTM (%)"
label var shr_SPS "Share of HS6 lines with at least one SPS (%)"
label var shr_TBT "Share of HS6 lines with at least one TBT (%)"
* average share over the whole sample of countries
sum shr_*
```

(d) Generate graphs and descriptive statistics by economic sector

We now account for the sector dimension by adding the HS section dimension in our graphs and descriptive statistics.

- Frequency index of NTMs across economic sectors

```
use temp_NTM_section, clear
collapse FreqNTM, by(Section Section_label)
browse Section Section_label Freq
```

- Frequency index of NTMs across economic sectors, by continent

```
use temp_NTM_section, clear
collapse FreqNTM , by(Section Section_label continent)
reshape wide FreqNTM, i(Section Section_label) j(continent) string
rename FreqNTMAfrica Freq_Africa
rename FreqNTMAsia Freq_Asia
rename FreqNTMDvlped Freq_Dvlped
rename FreqNTMLat_America Freq_LatAmerica
rename FreqNTMMENA Freq_MENA
label var Freq_Africa "Freq. Index, Africa & all NTMs"
label var Freq_Asia "Freq. Index, Asia & all NTMs"
label var Freq_Dvlped "Freq. Index, Dvlped countries & all NTMs"
label var Freq_LatAmerica "Freq. Index, Latin America & all NTMs"
label var Freq_MENA "Freq. Index, MENA & all NTMs"
browse Section Section_label Freq*
```

- Frequency index across economic sectors, by broad type of NTMs

```
use temp_NTM_section, clear
collapse FreqA-FreqE, by(Section Section_label)
rename FreqA Freq_SPS
rename FreqB Freq_TBT
rename FreqC Freq_PreShip
rename FreqD Freq_PriceC
rename FreqE Freq_QtyC
label var Freq_SPS "Freq. Index, SPS"
label var Freq_TBT "Freq. Index, TBT"
label var Freq_PreShip "Freq. Index, Pre-shipment"
label var Freq_PriceC "Freq. Index, Price Control"
label var Freq_QtyC "Freq. Index, Quantity control"
browse Section Section Freq*
```

- Frequency index across economic sectors for African countries, by broad type of NTMs

```
use temp_NTM_section, clear
collapse FreqA-FreqE CovA-CovE, by(Section Section_label continent)
rename FreqA Freq_SPS
rename FreqB Freq_TBT
rename FreqC Freq_PreShip
rename FreqD Freq_PriceC
rename FreqE Freq_QtyC
label var Freq_SPS "Freq. Index, SPS"
label var Freq_TBT "Freq. Index, TBT"
label var Freq_PreShip "Freq. Index, Pre-shipment"
label var Freq_PriceC "Freq. Index, Price Control"
label var Freq_QtyC "Freq. Index, Quantity control"
browse Section Section_label Freq* if continent=="Africa"
```

2. Calculating complementarity/substitutability between tariffs and non-tariff measures

We now explore the complementarity versus substitutability between tariffs and NTMs (see Section C.1). Tariff data come from the TRAINS database (see Section B.1). For each country, we use the trade-weighted average MFN tariff applied on all products and all partners. Data are for 2009 for almost all countries; if the 2009 tariff is not available, we use 2008 data. The data extracted from TRAINS are reported in "Tariffs_country.txt" available on the UNCTAD website. We first merge the tariff and NTM data.

(a) Study complementarity/substitutability at the country level

```
clear
insheet using Tariffs_country.txt, name
sort isor
save Tariffs_country, replace

use NTM-MAP_Country, clear
* Finalize the dataset: Average all EU countries
gen EU = 1 if isor == "AUT" | isor == "BEL" | isor == "CYP" | isor == "CZE" | isor == "DEU" | isor ==
"DNK" | isor == "ESP" | isor == "EST" | isor == "FIN" | isor == "FRA" | isor == "GBR" | isor == "GRC"
| isor == "HUN" | isor == "IRL" | isor == "ITA" | isor == "LTU" | isor =="LUX" | isor == "LVA" | isor ==
"NLD" | isor == "POL" | isor == "PRT" | isor == "SVK" | isor == "SVN" | isor == "SWE"
replace isor = "EUR" if EU == 1
count
collapse HSline Num* Cov* Freq* , by(isor)
sort isor
merge isor using Tariffs_country
drop _merge
keep isor mfn_tariffs name CovNTM FreqNTM NumNTM
gen FreqNTM_pc = FreqNTM*100
gen CovNTM_pc = CovNTM*100
```

Using the different incidence indicators (frequency index, coverage ratio, and prevalence ratio), we now investigate the complementarity versus substitutability between tariffs and NTMs at the country level. A linear prediction plot and its confidence interval are added to the graphs.

```
* Using a frequency index of NTMs
twoway lfitci FreqNTM_pc mfn_tariffs || scatter FreqNTM_pc mfn_tariffs, mlabel (isor) legend(off)
xtitle(Tariffs (MFN, weighted average %)) ytitle(Frequency index of NTMs (%)) title("Frequency index
vs. tariffs, by country")

* Using a coverage ratio of NTMs
twoway lfitci CovNTM_pc mfn_tariffs || scatter CovNTM_pc mfn_tariffs, mlabel (isor) legend(off)
xtitle(Tariffs (MFN, weighted average %)) ytitle(Coverage ratio of NTMs (%)) title("Coverage ratio vs.
tariffs, by country")

* Using a prevalence ratio of NTMs
twoway lfitci NumNTM mfn_tariffs || scatter NumNTM mfn_tariffs, mlabel (isor) legend(off) xtitle(Tariffs
(MFN, weighted average %)) ytitle(Prevalence ratio of NTMs (%)) title("Prevalence ratio vs. tariffs, by
country")
```

(b) Study complementarity/substitutability at the sector level

Finally, we study the complementarity and substitutability at the sector level. Our tariff data still come from the TRAINS database, but are now defined at the sector level. They are included in "Tariffs_section.txt" available on the UNCTAD website. We still use the trade-weighted applied MFN tariff for 2009. We first finalize the dataset and merge tariff and NTM data.

```
clear
insheet using Tariffs_section.txt, name
sort section
save Tariffs_section, replace

use NTM-MAP HS-Section, clear
* Finalize the dataset
* 1/ Sections' label
gen Section_label = "Live animals" if Section == 1
replace Section_label = "Vegetable products" if Section == 2
replace Section_label = "Fats and oils" if Section == 3
replace Section_label = "Processed food" if Section == 4
replace Section_label = "Mineral products" if Section == 5
replace Section_label = "Chemicals" if Section == 6
replace Section_label = "Rubber and plastics" if Section == 7
replace Section_label = "Rawhide and skins" if Section == 8
replace Section_label = "Wood" if Section == 9
replace Section_label = "Paper" if Section == 10
replace Section_label = "Textile" if Section == 11
replace Section_label = "Footwear" if Section == 12
replace Section_label = "Stone and Cement" if Section == 13
replace Section_label = "Pearls" if Section == 14
replace Section_label = "Base metals" if Section == 15
replace Section_label = "Machinery and electrical equipment" if Section == 16
replace Section_label = "Motor vehicles" if Section == 17
replace Section_label = "Optical and medical instruments" if Section == 18
replace Section_label = "Arms and ammunition" if Section == 19
replace Section_label = "Miscellaneous" if Section == 20
replace Section_label = "Works of Art" if Section == 21


* 2/ Average all EU countries
gen EU = 1 if isor == "AUT" | isor == "BEL" | isor == "CYP" | isor == "CZE" | isor == "DEU" | isor ==
"DNK" | isor == "ESP" | isor == "EST" | isor == "FIN" | isor == "FRA" | isor == "GBR" | isor == "GRC"
| isor == "HUN" | isor == "IRL" | isor == "ITA" | isor == "LTU" | isor == "LUX" | isor == "LVA" | isor ==
"NLD" | isor == "POL" | isor == "PRT" | isor == "SVK" | isor == "SVN" | isor == "SWE"
replace isor = "EUR" if EU == 1
collapse NumNTM CovNTM FreqNTM, by(isor Section Section_label)


* 3/ Average all countries within each section
collapse NumNTM CovNTM FreqNTM, by(Section Section_label)
rename Section section
sort section
merge section using Tariffs_section
* _merge =1: for some sections, tariff is missing in Trains
drop _merge
gen FreqNTM_pc = FreqNTM * 100
gen CovNTM_pc = CovNTM * 100
```

We report below the command that should be run to obtain a graph on the complementarity versus substitutability between tariffs and NTMs at the sector level. A linear prediction plot and its confidence interval are added to the graphs.

> * Using a frequency index of NTMs
> twoway lfitci FreqNTM_pc mfn_tariffs || scatter FreqNTM_pc mfn_tariffs, mlabel (Section_label) legend(off) xtitle(Tariffs (MFN, weighted average %)) ytitle(Frequency index of NTMs (%)) title("Frequency index vs. tariffs, by product")
>
> * Using a coverage ratio of NTMs
> twoway lfitci NumNTM mfn_tariffs || scatter NumNTM mfn_tariffs, mlabel (Section_label) legend(off) xtitle(Tariffs (MFN, weighted average %)) ytitle(Prevalence ratio of NTMs (%)) title("Prevalence ratio vs. tariffs, by product")

D. Exercises

1. Comparing incidence ratios
   - (i) Preliminaries
     - a. Open the data file "NTM-MAP_Country.dta"
     - b. Generate a continent variable following the definition used in application 1 but keeping EU countries disaggregated
   - (ii) Incidence per country and continent
     - a. For each continent generate a graph including the three measures of incidence reported in the dataset at the country level
     - b. Identify in each continent the country with the highest frequency index, the highest coverage ratio and the highest prevalence ratio

2. Investigating the relationship between tariffs and non-tariff measures
   - (i) Preliminaries
     - a. Open the data file "NTM-MAP_Country.dta"
     - b. Generate a variable EU like the variable generated in application 2
     - c. Generate a continent variable based on the definition used in application 1
   - (ii) Merging with tariff data keeping EU countries separated
     - a. Merge with tariff data but keeping each EU country represented in the dataset

       Hints: Rename the isor and EU variables
     - b. Express incidence indicators in percentage points when necessary
   - (iii) Generate graphs by continent
     - a. Generate graphs of the relationship between tariffs and coverage ratios by continent
     - b. Generate graphs of the relationship between tariffs and prevalence ratios by continent