PRONTO

Productivity, Non-Tariff Measures and Openness

Publishable Project Summary Part 4.1.3
Description of the main S & T results/foregrounds

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1. INTRODUCTION

This document is the "Description of the main S & T results/foregrounds" of the publishable summary report for the medium-scale focused research project "Productivity, Non-Tariff Measures and Openness" (PRONTO). The PRONTO project has aimed for better data, better methodologies, and better understanding of the impact of NTMs on international investment and trade. The project team has been focused on the following over-arching objectives:

1. Collection of quantitative information on the regulatory measures influencing cross border trade and investment;
2. Developing new methodologies for quantifying NTMs and for both quantitative and qualitative analysis of their effects;
3. Mapping data availability, identifying scope for improvement by building on existing sources, and mapping onto other databases such as WIOD and EU-KLEMS.
4. Analysing the impact of NTMs on a range of economic and social indicators (e.g. the SDGs).

This document provides a relatively non-technical description of the objectives and outcomes of the entire project. Referenced papers, data, and related documents are available from the project website: www.prontonetwork.org. The discussion is organized following the four over-arching project objectives outlined above.

2. Objective 1: Collection of quantitative information on the regulatory measures influencing cross border trade and investment

Outcome: consolidation of data and sources

This research stream involved two goals: (i) generation of internal project data for use within the project; and (ii) generation of data and utilities for the end-of-project public dataset. The first goal was met with internal dissemination of data reflecting the following:

- Raw data compilation;
- Documentation/manuals of the various databases (if available);
- Cleaned datasets and corresponding scripts.

Following the initial compilation of raw data beginning in 2014 (i.e. the first year of the project), an update of the data was conducted mid-2017, including rerunning and testing the cleaning scripts developed in the work package. This served as a basis for server script development for the final database as discussed below.

As part of this line of research, a first version of Rau & Vogt (2017) provides a background paper/reference document to NTM data concepts and sources. There, NTM data sources are mapped to a classification/framework for NTM data (see Table 1). The paper provides summaries of the main databases, highlighting the type of data they contain, underlying collection methods, as well as country and temporal data availability. It further elaborates on the nature of NTM data and possible caveats in their application. Thus, PRONTO researchers from other WPs were able to get a quick overview of NTM data before starting their research. Note that a short version of the paper is forthcoming in a Cambridge University Press volume, following presentation at the 2016 *World Trade Forum*.

Table 1: NTM Data Sources

Source	Goods	Services
Inventories of legislation	- NTM TRAINS	- World Bank STRI Database
	- OECD PMR Database	- OECD STRI Database
	- World Bank Investing Across Borders	- OECD PMR Database
	- World Bank TTBD	- World Bank Investing Across Borders
	- OECD Export Restrictions Database	- Global Trade Alert
	- Global Trade Alert	
International agreements	- DESTA	- DESTA
	- UNCTAD BIT Database	- GATS commitment schedule
		- WTO Services RTA Database
		- UNCTAD BIT Database
Review of legislation	- WTO Trade Policy Review	- WTO Trade Policy Review
	- WTO DG Monitoring Reports	- WTO DG Monitoring Reports
	- UNCTAD Investment Policy Review	- UNCTAD Investment Policy Review
Notifications	- WTO Notifications	- GATS Notifications
Surveys and complaints	- ITC NTM Surveys	
	- ITC Trade Obstacle Alert	
	- WTO STC	
	- EU Market Access Database	
	- tradebarriers.org	
Import refusals	- EU RASFF	
	- US FDA OASIS	
Other sources	- USITC CoRe NTM Database	

Source: Rau & Vogt (2017)

Outcome: development of a data platform hosting the PRONTO public access database

Following extensive clean up and processing of external data sources, along with mapping of available regulatory data to product data (in particular, traded goods classification schemes) we have both made the information on raw agency data of NTMs available on a publicly-accessible internet-based portal and have provided access on the same portal to PRONTO datasets generated within this and other work packages. The public release database is based on the internal data backbone of the project and to a large extend has been structured to facilitate future, post FP7 updates to the data. This will ensure a lasting, living legacy and focus point for the research network formed for the project. In particular, the update process has been partially automated to facilitate future periodic updates. The team working on the public data distribution platform also worked closely with agency representatives linked to primary source data, ensuring a cooperative and continued relationship in data updates after the FP7 phase has ended.

Figure 1 depicts a schematic overview of the NTM portal. The three main building blocks are 1) information on NTM data and research, 2) an internal data backbone that organizes datasets and the data they were built on (i.e. the Dropbox repository), and 3) access to the NTM indicators and improved datasets generated in the PRONTO project. With respect to the latter, Table 2 provides an overview and short descriptions of the datasets constructed and available on the platform. These include those datasets that improve (e.g. imputed WTO notifications) and consolidate (e.g. environmental taxes) original data. The indicators were constructed in the various WPs (e.g. PCA-based indicators in WP4). Documentation and reference to the source data is provided.

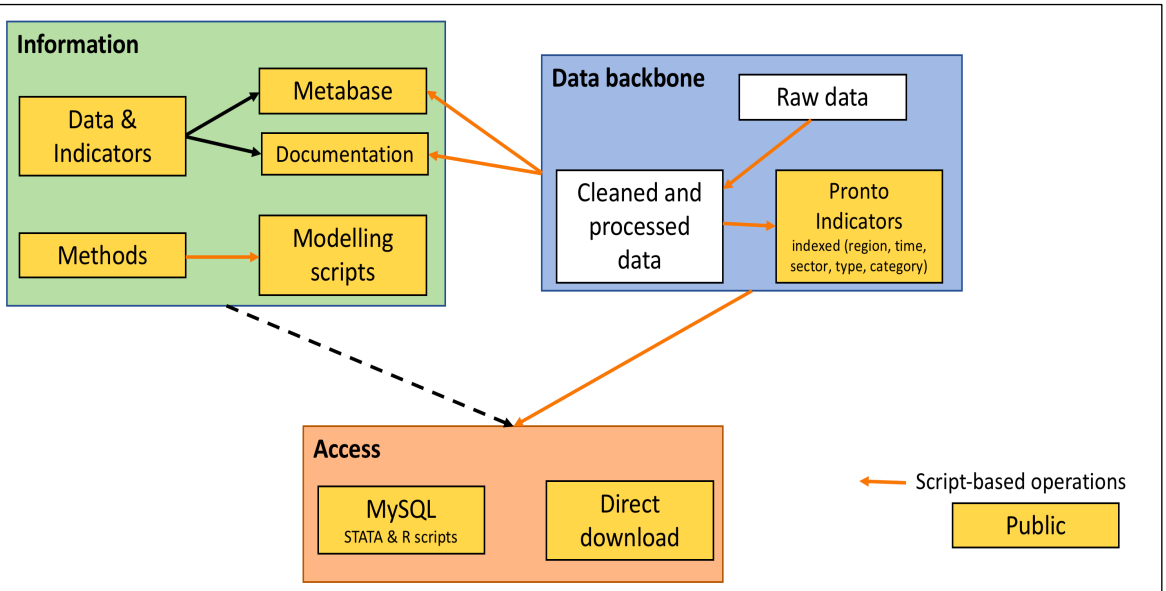

Figure 2: NTM Database Portal

A key feature of the public database, as completed in the last phase of the project, is that not only the datasets themselves but also other elements on the website are script-based. Consequently, period updates will be easier to administered than otherwise, once new raw data are released or NTM and sectoral classification schemes are revised. The set-up thus is a data warehouse with specific features for easy and user-friendly data access. Interactive data availability sheets constructed from the indexed raw data are provided to help searching the available data. Parties interested in conducting NTM related research therefore have a one-stop shop that is easily accessible and guides towards raw data that may be applicable to their work.

Note that while the portal provides data and information on data availability (including guides to sources on classification and institutions active in NTM research), we have also extended the portal by an information component that builds on the work conducted in other parts of the overall PRONTO project. Summary information of the research undertaken within the PRONTO project is provided on the website, and as such the Portal also serves as a dissemination platform in its own right.

Table 2: NTM Database Overview

Dataset	Description
Border Rejection	Product categories of the EU Rapid Alert System for Food and Feed (RASFF) border rejection data have been mapped to HS codes using text and string matching techniques.
Environmental Taxes	This dataset provides national environment-related taxes for 34 OECD countries. The data covers a range of environmental taxes in place as of December 2014. To preserve the nuance of the various instruments, it maintains four broad policy categories: (a) pollution taxes; (b) energy taxes; (c) transport taxes; and (d) taxes on natural resources.
Extended STRI	This database provides an index drawing from the World Bank's Services Trade Restrictions Project to include intra- and extra-EU services trade restrictiveness.
Import demand elasticities	The database contains import demand elasticities for 167 countries over 5124 products at the 6-digit level of the Harmonized System. The estimates cover the period of 1996 to 2014.
Importer-specific ad-valorem equivalents	Ad valorem equivalents of NTMs over the period of 2002-2011 at the 6-digit product level of the Harmonized System. The data is based on a gravity approach and covers about 100 WTO member countries. Estimates are differentiated in accordance to the NTMs notified to the WTO.
Imputed WTO Notifications	Using text-based analysis NTM notifications are mapped to NTM categories as well as to affected products.
NTM GVC AVEs	This database provides two measures of ad-valorem equivalences (AVE) from a combined set of nine different NTMs. The coverage matches the WIOD database in terms of sectors (35 sectors), country coverage (41 importers), and time (2002-2011). In addition to the direct AVE, the database reports indirect AVEs which are accumulated via the global value chain (where the weighted averages are constructed via input/output tables).
NTM inclusive TRIs	These data provide NTM inclusive overall trade restrictiveness indexes (TRIs) under alternative assumptions on market structure.
NTM-MAP	Contains indicators measuring the incidence of Non-Tariff Measures by using different methodologies and the UNCTAD TRAINS Database as source data. Three indexes are proposed as proxies for NTMs occurrence: (a) a frequency index, (b) the coverage ratio, and (c) the prevalence score.
PCA based NTM indexes	This dataset combines information from the GTA, NTMTRAINS, and wiiw's WTO notifications to generate different aggregated NTM indexes based on weights generated by principal component analysis. Overall country indexes and broad HS sectors are included.
Public Procurement	These data provide a mapping from GTA-based notifications of public procurement and subsidies, centered on the years before and after the crisis, product groups and trading partners.
Special Economic Zones	This dataset provides an indicator for whether a country has a special economic zone (SEZ) in place. As SEZs comprise many possible forms, the database provides information on three types of SEZs, (a) an export

Dataset	Description
	processing zone (EPZs are where import duties are waived on intermediates used in the production of exports), (b) export and import processing zones (and EPZ that also waives duties on imports that are sold domestically), and (c) a final classification that covers incentives beyond the waivers of duties (e.g. preferential taxation or lower regulation). The data covers 125 WTO member countries for 2011
WIOD & STRIs	This database links the World Bank Services Trade Restrictiveness Index (STRI), OECD STRI, and the OECD FDI Restrictiveness index to the WIOD database. This then covers 40 countries (plus the rest of the world) for the 22 services industries. The STRI measures are cross-sectional only (2007-2008 for the World Bank, 2014-2015 for the OECD); the FDI restrictiveness index covers multiple years (1997, 2003, 2006, and 2014).

Source: www.prontonetwork.org

3. Objective 2: Developing new methodologies for quantifying NTMs and for both quantitative and qualitative analysis of their effects

Outcome: benchmarking the state of the art

The project study generated by Davies, Rau & Vogt (2015) takes stock of the different methodologies applied in NTM research. As part of the stock-taking exercise, they also provide a framework to classify research according how it makes use of NTM information.

Specifically, Davies, Rau & Vogt (2015) consider the following dimensions for making an inventory of the available literature on NTMs:

- Purpose:
    - Construction of alternative measures;
    - Studies of outcome of NTMs;
    - Studies determining NTMs.
    - Literature review
- Perspective & scope.

These categories are not a methodological classification per se but they stipulate the context in which the research under review takes place. Here, for the purpose of the study, i.e. the goal the researcher had in mind when starting her research, is divided into four sub-categories.

First, the construction of an alternative measure relates to the conversion of NTM data, which is oftentimes binary, to a measure more conducive to further analysis, e.g. an ad-valorem equivalent that can be used in simulation experiments. Mostly, these measures indicate a degree of restrictiveness and are based on methods of comparing price and quantity data in the presence versus the absence of an NTM.

Second, Davies, Rau & Vogt (2015) identify methods that are used to assess the impact of NTMs on an outcome variable or set of variables. Figure 1 presents an overview of these and their identified sub-categories. The two methods most often used are econometric regressions and simulation models. Particularly, gravity regressions augmented with NTM variables (dummies 0/1) as a control have been adopted widely in the literature. Furthermore, computable general equilibrium models are often used in trade policy analysis to assess the impacts of trade agreements or tariff concessions. Other methods have not yet been widely used in NTM-related research. However, given the non-trade dimension of NTMs, cost-benefit approaches may prove to be suitable to compare possible trade costs/restrictiveness with regulatory benefits.

Third, the purpose of some studies is to examine determinants of NTMs. Such studies are found specially in the field of political science/economy. Here the measure is the dependent variable and regressed against a set of explanatory variables that explain the presence of the measure (e.g. lobbying, import competition, political cooperation, etc.). Furthermore, this would cover qualitative approaches like case study designs that explain the incidence of an NTM. Fourth and finally, literature reviews survey research on certain aspects that are not further broken down.

Davies, Rau & Vogt (2015) further differentiate between the perspective and the scope of NTM studies. These two categories further narrow down the research focus as well as the methodological options. With regard to the research focus it can be distinguished between retrospective and predictive studies (or a combination thereof). Here, regression analyses can clearly be considered as being retrospective by their nature: data of events and variable realizations that have already taken place are usually applied in regression analyses. Others, such as CGE simulations are instead used for ex-ante assessments of NTMs. Finally, the scope further defines the economic agents, sectors, and

country-level focus of the study. Two general categories emerge from this: partial and general equilibrium studies. The crucial distinction is that in a partial equilibrium setting spill-over effects are not accounted for.

Outcome: new methodologies for extending the TRI to include NTMs

Trade Restrictiveness Indexes (TRIs) and related extensions have been frequently used in the literature on NTMs to derive the tariff equivalent of tariff structures, tariffs and quotas, tariffs and domestic production subsidies, or tariffs and AVEs of other NTMs. However, until recently available measures have not allowed for market structure imperfections (including market power related to country size). Too address this problem and advance the state of the art a parsimonious framework has been developed to account for external effects and corrective policies addressing these effects, in the context of a TRI. The framework has been used in an empirical investigation demonstrating its operability. There are three principal results. First, the TRI calculated with the quantitative model in a small country setting is close to the TRI calculated with an approximate formula for smaller levels of trade costs, whereas the two deviate for larger levels of trade costs. Second, the impact of differences in market structure is limited. Third, the TRI in a small country setting deviates significantly from the large country TRI, which takes changes in the terms of trade into account.

Outcome: new methodologies for modelling NTM policy in the presence of GVCs

Pronto-based research also addressed the important question of the economic impact of NTMs in the presence of international process fragmentation, i.e. global supply chains. This line of research yielded a new database providing cumulative bilateral-trade restrictiveness indices using the ad-valorem equivalents of NTMs and tariffs taking into account backward linkages. In a three-stage approach, the cumulative impacts of trade policy measures along global value chains using the world input-output database (WIOD) were quantified. The next question addressed was then how to model changes in trade policy in the presence of global value chains and non-tariff measures. To do so, Bekkers and Francois (2015) proposed a way to incorporate NTBs for the four workhorse models of the modern trade literature in computable general equilibrium models (CGEs). CGE models feature intermediate linkages and thus allow us to study global value chains. Importantly, and this has been a major computational breakthrough, they have shown that the Ethier-Krugman monopolistic competition model, the Melitz firm heterogeneity model and the Eaton-Kortum model can be defined as an Armington model with generalized marginal costs, generalized trade costs and a demand externality. The authors implement the different models in a CGE setting with multiple sectors, intermediate linkages, non-homothetic preferences and, importantly, detailed data on trade costs. They rely on the Melitz model to mimic changes in non-tariff measures with a fixed cost-character and by analysing the effect of changes in fixed trade costs.

Outcome: new methods for application of border rejection data to study uncertainty

Disdier, et al. (2017) address the microeconomic impact of the risk of rejection at the EU border for Chinese exporters of food products. They combine information from the Rapid Alert System for Food and Feed with firm level export data from China by product-destination over the period 2000-2011. The results show that border rejections reduce the number of competitors, the number of varieties available to consumer and unevenly affect different-sized exporters. Thus, although border rejections may serve to improve product safety, it is likely to have additional, unintended consequences because of competition-inhibiting effects.

Outcome: new econometric frameworks for NTM assessment

Bekkers, Francois, and Rojas-Romagosa (2018a) provides an overview of the ways in which changes in non-tariff measures (NTMs) are mapped into welfare effects through changes in trade costs. This is done in two steps. First, methods to calculate the trade cost changes associated with changes in NTMs

are discussed, concentrating on changes in NTMs as a result of the conclusion of FTAs. Second, the different ways to calculate the welfare effects of changes in trade costs are presented, compared, and assessed. In the first part the two main approaches to estimate NTM reductions associated with the implementation of FTAs are introduced and examined, the bottom-up and top-down approach. The report compares and analyses the main differences in estimates and how these differences affect the overall estimates of economic impact. One finding is that differences in expected NTM reductions can explain a large share of discrepancies in impact assessments regarding the overall potential economic effects. A second finding relates to differences in solution methods and baseline calibrations in current quantitative trade models (QTMs) used to evaluate the effects of counterfactual experiments on reductions in NTMs: computable general equilibrium (CGE) models, structural gravity (SG) models and models employing exact hat algebra (EHA). The report finds that the different solution methods generate identical results on counterfactual experiments with changes in NTMs if baseline trade shares or baseline trade costs are identical. SG models, calibrating the baseline to gravity-predicted shares, potentially suffer from bias in the predicted welfare effects due to misspecification of the gravity equation, whereas the other methods, calibrating to actual shares, potentially suffer from bias as a result of random variation and measurement error of trade flows. Simulations show that fitted shares calibration can generate large biases in predicted welfare effects if the gravity equation does not contain pairwise fixed effects or is estimated without domestic trade flows. Calibration to actual shares and to pairwise fixed effects based fitted shares display similar performance in terms of robustness to the different sources of bias.

Outcome: numerical frameworks for NTM assessment

The paper by Bekkers, Francois, and Rojas-Romagosa (2018b) provides an overview of numerical methods used for ex-ante policy assessment of NTMs, offering a comprehensive overview based on recent ex-ante policy assessments (particularly of the Transatlantic Trade and Investment Partnership or TTIP). These studies provide a broad range of applied numerical methods focused on non-tariff measures (NTMs), generally involving either computable general equilibrium (CGE) models or structural gravity (SG) models. In most of these studies, the bulk of the expected trade and welfare effects occur through changes in NTMs. The report compares different methodological approaches to predicting the welfare effects of trade policy experiments, with emphasis on those studies employing either CGE models or SG models. In the report the authors compare and critically discuss differences in the estimated trade cost reductions and in the economic models employed and how these can explain the relatively wide range of economic effects found in the different studies. The report also discusses the integration of firm theory with gravity estimation frameworks and the extension of the theoretical structure of CGE models with firms and NTMs.

4. Objective 3: Mapping data availability, identifying scope for improvement by building on existing sources, and mapping onto other databases such as WIOD and EU-KLEMS.

Outcome: GAP-Analysis (mapping our way beyond the state of the art)

As detailed in Rau & Vogt (2016), on the basis of the methodological inventory and data compiled, gaps with respect to actual raw data, as well as methods used in NTM research were identified, which also includes statements on necessary data improvements to facilitate deeper, more comprehensive NTM analysis.

Gaps in the raw data show that the geographic coverage of databases is also a function of the resource intensity of the underlying collection methodology, as well as to what degree NTM data collection is institutionalized. Thus, we see relatively low geographic coverage for large scale business surveys conducted by ITC, and fewer countries available for the full regulatory reviews of NTM TRAINS compared to WTO notifications, where countries are required to report policies to the WTO under various agreements. Other data sources' country focus is by mandate as for example the OECD's primary focus on OECD countries' policies. Given the geographic scope, time coverage was also assessed.

Figure 2: Structure of the MIND

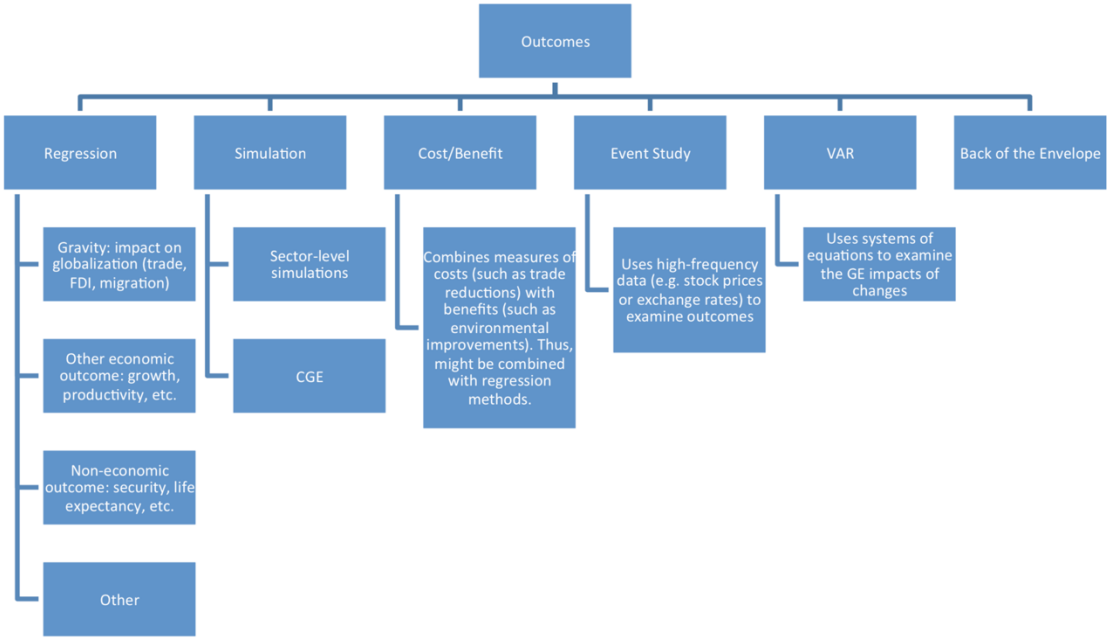

Table 2 summarizes the findings. Note however that the characteristic of the time variable can differ substantially even within databases (e.g. date of measure entering into force relative to the date of announcement and/or year of data collection, etc.). Furthermore, the coverage of measures defined by MAST chapter is highest for SPS, TBT and trade contingent protective policies. Rau & Vogt (2016) conclude with a discussion of data limitations and list a number of points where gaps in NTM data need to be filled ranging from adding more information to current measure (e.g. actual value of residue limit) to connecting NTMs to outcome variables enabling e.g. cost-benefit analysis.

In the second step, the gap analysis used information of more than a hundred studies entered into the Methodological Inventory Database for Non-tariff measures (called the MIND and described by Davies, Rau & Vogt (2015)) in order to assess the research on NTMs conducted in the last decade. The majority of studies reviewed seem to have looked at the outcome of an NTM by using regression analyses, thereby taking a retrospective perspective. Many studies focused on NTMs in goods with a particular emphasis on agri-food products, and in this regard SPS measures that are predominantly imposed on agri-food products, have been widely analysed. As mentioned above, data limitations seem to play a key role in that they restrict the use of certain methodologies; for example cost-benefit analyses that require measurement metrics and indicators such as estimates of the consumers' willingness-to-pay in order to assess consumer benefits of higher SPS standards.

Table 2: Gap Analysis

Collection framework	Database	Time coverage	Comment
Inventories of legislation	- NTM TRAINS	1960 – 2016	Date of measure into force
	- OECD PMR Database	1998 – 2013	Policy inventory for 1998, 2003, 2008, 2013
	- WB Investing Across Borders	2011 - 2012	Policy inventory as of data collection
	- World Bank TTBD	1980 - 2015	Date of measure into force
	- OECD Export Restrictions	1996 - 2014	Year of policy inventory
	- Global Trade Alert	2008 - 2016	Date of measure into force
	- World Bank STRI Database	2008 - 2012	Policy inventory as of data collection
	- OECD STRI Database	2014 - 2016	Year of policy inventory
International agreements	- DESTA	1949 - 2016	Year of agreement
	- UNCTAD BIT Database	1957 - 2016	Year of agreement
	- GATS schedule	1995	Year of agreement
	- WTO Services RTA Database	1994 - 2016	Year of agreement
Review of legislation	- WTO Trade Policy Review	1996 - 2016	Year of policy review
	- WTO DG Monitoring Reports	2008 - 2016	Date of implementation
	- UNCTAD Investment Policy	1999 - 2016	Year of report
Notifications	- WTO Notifications	1960 - 2016	Date of measure into force
	- GATS Notifications	2001 - 2016	Date of notification
Surveys and complaint portals	- ITC NTM Surveys	2010 - 2016	Year of survey data collection
	- ITC Trade Obstacle Alert	2014 - 2016	Date of complaint
	- WTO STC	1995 - 2016	Date of STC raised
	- EU Market Access Database	1996 - 2016	Date of complaint
	- tradebarriers.org	2004 - 2016	Date of complaint
Import refusals	- EU RASFF	1979 - 2016	Date of border refusal
	- US FDA OASIS	2002 - 2016	Date of border refusal
Other sources	- USITC CoRe NTM Database	2009 - 2012	Year of measure into force

Outcome: NTMs, vertical specialisation and trade (linking WIOD data to NTMs)

Research on this theme developed a database for non-tariff measures (NTMs) for use by various teams in the project, and also to use these data directly examine how different types of NTMs affected global trade, how effects of NTMs can be compared across different types of NTMs and tariffs, and how important they are in the context of global value chains (GVC). The various steps in generating the database have been documented in a series of working papers (Ghodsi, Grübler, Reiter and Stehrer, 2017; Ghodsi, Grübler, and Stehrer, 2016a, 2016b; Ghodsi and Stehrer, 2017. The contributions of this work are many. First it amended the WTO Integrated Trade Intelligence Portal (I-TIP) to suit econometric analysis. Second, the effects of different types of NTMs on trade flows were estimated at the HS 6-digit product level for more than 100 countries applying a gravity approach. These results are differentiated by country and product characteristics. Third, import demand elasticities, which allow computing ad-valorem equivalents of NTMs, are estimated rendering NTMs comparable across types and with the level of tariffs. Fourth, a database linking NTMs in goods and global supply chains (based on WIOD) has been prepared, which provides bilateral trade restrictiveness indices that are

used to estimate the impact of trade policy measures on labour productivity in goods and services industries. The data are part of the public database and also formed a data source for other teams.

The findings suggest: (i) Roughly 60% of all estimates point towards trade-impeding effects of NTMs, with stark differences between NTM types, where measures related to health are more likely to show positive effects than technical regulations. This is interesting as it co-validates the independently obtained results in other papers from the project. (ii) Highest average import demand elasticities are found for the economically biggest countries in their respective regions and intermediate goods, which appears particularly noteworthy in the context of global value chains. (iii) Simple average AVEs reach up to 8% for SPS measures, 11% for TBTs, and as high as 19% for Antidumping. When compared to an average tariff rate of 5%, this highlights the importance of the work carried out under the project as a whole. (iv) While the number of notifications and types of NTMs used increases with income, AVEs of richer countries seem to be lower. (v) Lowest AVEs are found for final consumption goods and highest for goods contributing to gross fixed capital formation. (vi) SPS regulations along GVCs seem to increase labour productivity, particularly in the services sector. Conversely, TBTs appear productivity decreasing, primarily in the non-services sector.

Outcome: better understating of subsidy and procurement policies as NTMs

The project has also yielded better information (with new data) and better understanding of NTMs related to beggar-ty-neighbour subsidies and discrimination against foreign companies in public procurement. Concerning the latter, despite the large value of such government contracts, very little empirical research has been undertaken on the trade effects of public procurement policy changes, reflecting a dearth of underlying data. Hence the PRONTO data in this area should underpin future research in this area.

Two inter-linked research streams involved first constructing detailed product-level (6-digit level of the harmonized classification of traded products – HS6) bilateral trade database for which there are available reports on subsidies in the Global Trade Alert database. This was done using the BACI database, a harmonized and reconciled matrix of bilateral trade flows covering all countries in the world and derived from COMTRADE. The database provides with stylized facts across sectors, country type, and time (up to 2016). Of particular interest is the incorporation of the time dimension, permitting the analysis of whether there are domino effects in which countries match subsidies in certain sectors with subsidies of their own. Ultimately, the economic impact of these two sets of data on subsidies and public procurement policies has been evaluated using a gravity-type estimation of the responses of the different margins of exports. The result is a database and analytical report.

In the second research stream, data providing a mapping from GTA-based notifications of public procurement, centred on the years before and after the crisis, product groups and trading partners, was also collected and assembled into a larger dataset including trade flows at the HS6 level by PSE. The data are available on the PRONTO portal.

The data are first exploited in Evenett and Shingal (2016). This paper summarises public procurement policy changes undertaken since November 2008, based on data from the GTA project. A particular focus is on policy changes that alter the relative treatment of domestic firms vis-à-vis foreign rivals. The ultimate goal of this paper is to inform other, ongoing data collection efforts, public policy deliberations on crisis-era policy response in particular as they relate to state purchasing policy, and discussions on the relative merits of strengthening disciplines on public procurement matters in trade agreements.

The data on public procurement NTMs are further exploited in the second paper (Fontagné et al., 2017). In their paper, the expanded database, including individual products and trade flows, as well

as procurement based NTM measures, is included in the NTM data platform. Although representing a significant share of GDP in many countries, little was known on how public procurement policies affect international trade in goods and services until PRONTO addressed this issue and provided a novel database. Part of the difficulty was indeed data availability. The contribution of PRONTO is to rely on a recently developed database mapping a treatment of the Global Trade Alert database focusing on obstacles to public procurement policies with the matrix of world trade flows at the bilateral and product level (BACI). Considering the 2009-2016 period, the paper shows that the most active restrictive policies are enforced in large markets, that the most successful exporters are targeted by these policies, and finally that these policies significantly deflect sales of targeted exporters for the targeted goods in imposing countries.

Outcome: new priority rankings of NTMs

The PRONTO team also focused on integrating the outcome of the various PRONTO work streams to generate a ranking and prioritization of NTMs based along different vectors – incidence of use, direct economic impacts, indirect impacts along value chains, and impacts in social and sustainability dimension. This work ran alongside database development, wherein data were made available to other teams working on development of NTM indicators, analysis of detailed firm data, econometric (gravity) analysis of NTMs, mapping of NTMs to value chain data based on input-output tables, and analysis of economic performance, social, and sustainability impact of NTMs. The resulting data extends the NTM data developed in the project through principal component analysis of NTMs. The resulting report, Francois et al (2018), reflects contributions from all project consortium teams. It serves as a synthesizing report from the PRONTO project teams, bringing together findings from work packages focused on NTM measurement and on the impact of NTMs on economic performance, social outcomes, and sustainability. As such, it provides an integrated assessment from the broad PRONTO project team, who have been engaged in a mix of regulatory data analysis, econometrics, and numerical assessment of NTMs. Chapter 2 of the report provides a conceptual overview of NTMs. This includes methods of classification, data collection on NTMs, and the mapping from raw regulatory data to quantitative measures. The Chapter draws heavily on work by the PRONTO project team under the work packages on database development. Chapter 3 of the report examines broad patterns of NTM incidence, in terms of countries, regions, and sectors, working with a large-scale dataset that follows from the data elements of the PRONTO project. The merged dataset also reflects extensive processing and clean-up of individual datasets, as well as mapping to detailed HS6 product categories and to the standard MAST classification scheme. Chapter 4 presents composite NTM measures based on principal component analysis (PCA) of the full, HS6 based set of NTM indicators. The PCA measures combine information unique to individual source data, which otherwise vary in coverage and focus, providing a basis for identifying key measures in particular sector across countries, and key NTM users in particular sectors. In other words, the PCA exercise provides a basis for integrating information from multiple data sources for use in ranking and prioritizing NTMs. Chapter 5 is focused on the impact of NTMs. Here, the report draws on lesson from work by the PRONTO team on the economics, social, and sustainability impacts of NTMs.

5. Objective 4: Analysing the impact of NTMs on a range of economic and social indicators (e.g. the SDGs).

Outcome: evidence on the impact of regulatory linkages in services

Leitner et al (2018) provide evidence of the role of business services and trade barriers on services on manufacturing productivity growth. Here, the resulting estimates point to a negative impact of services trade restrictiveness on manufacturing labour productivity growth might exist. In a second paper, (Pellizzari and Pica, 2018) have studied the impact of occupational licensing which can be viewed as a barrier to entry. In a theoretical framework it is shown that lower barriers to entry lead to higher-quality service providers depending on the ability of the provider. In an empirical analysis on a regulatory reform in 2006 in Italy it is shown that reducing the level of barriers to entry had very strong short run (and most likely long-run) impacts on exits, thus supporting the hypothesis and the interpretation of such licenses as NTMs. This work also yielded data contributions to the final PRONTO dataset.

Outcome: evidence on the impact of NTMs on firms

Two papers focus on the impacts of NTMs on productivity at the firm level and the population of exporters based on the hypothesis derived from a heterogeneous firm model: Behrens, et al. (2017) and Barba-Navaretti et al. (2017b). The link between NTMs and domestic market conditions depends on whether they involve new standards and technical specifications imposed on both domestic and foreign firms or the extension to foreign firms of standards and technical specifications already adopted by domestic firms. Data confirms this. In a second paper reflecting the same theme, it is shown that a liberalization of trade in services will have stronger impacts than a liberalization of trade in goods on EEA countries' productivity. However, gains (and losses) remain modest an in all cases below 1 % and are distributed unevenly across countries. In an additional counterfactual exercise to isolate the role of NTMs concerning the exit of the UK form the EEA (Brexit) the paper finds sizeable losses for many EEA countries and in particular for the UK and Ireland for services trade. Overall, the results point towards heterogeneous effects of NTMs on trade depending on the exact measure (e.g. TBT or SBS), the industry (or product) and the countries considered. Concerning the effects on productivity and competitiveness results are similarly dependent on the exact nature of the measure.

Outcome: evidence on the impact of NTMs on labour demand

Leonardi and Meschi (2017) develop a quasi-experimental approach to identify the effect NTMs have on labor demand. Rising import competition from low-income countries has been an important cause of the decline in manufacturing employment in many countries. Since tariffs on international trade have been progressively liberalized over the last decades, developed countries have increasingly relied on Non-Tariff Measures (NTMs) to protect their industries from foreign competition. This analysis uses a quasi- experimental approach and exploits a novel database on NTMs to study the effects of NTMs on labor demand, composition of the workforce and wages. The results indicate that NTMs protection managed to mitigate the negative employment effect of import exposure, but has no effect on local wages, which is consistent with mobility of workers across local areas until wages are equalized. These results are potentially important for policy makers in many countries.

Outcome: evidence on the impact of NTMs on gender and skill inequality

Research in the PRONTO project also focused on the impact of NTMs on wage inequalities between genders and workers characterized by different skills and/or educational attainments, as well as the specific contribution of NTMs on inequalities under the the "anything but guns" provisions of EU trade barriers.

In the first of three resulting papers, Davies and Mazhikeyev (2016) use firm level data across 99 developing and transition economies to explores the productivity differences between firms depending on their export status and the gender of their owners. Findings are that female-owned exporters have roughly half the exporter productivity premium of comparable male firms. This is particularly true for larger firms, suggesting that this difference may reflect greater difficulty in implementing learning by exporting for female-owned firms. Nevertheless, there is also evidence consistent with selection into exporting where female-owned firms face relatively higher export costs. Together, these point to significant discrimination barriers female firms face when exporting.

The second paper (Barba-Navaretti, et al. 2017a) provides an empirical assessment of the effect of NTMs on the size of firm-level wage skill premia and on the skill composition of labour demand, making use of detailed firm level matched employer-employee data with information on exports by destination country and Specific Trade Concern (STC) data released by the WTO to measure trade restrictive non-tariff measures. Findings are that NTMs have little impact on skill premia, while still affecting the skill composition of employment. In particular, Technical Barriers to Trade (TBTs) raise the share of managers at the expense of white collars and professionals, while Sanitary and PhytoSanitary (SPS) measures raise the share of qualified blue collars and reduce the share of white collars.

The third paper provides analysis of labour market effects specific to the "anything but guns" provisions of EU trade policies. The Everything But Arms agreement, introduced by the EU in 2001, eliminated duties on most imports from the least developed countries. To avail of these benefits, however, the exported product must contain a sufficiently large share of local content. Thus, the agreement may have affected both the quantity and the factor content of exports from the least developed countries to the EU. Using a panel of sector-level data across countries, Davies and Desbordes (2016), report estimates suggesting that, contrary to expectations, the agreement may have increased the skill-content of these exports, benefitting the lowest-skilled EU workers at the expense of their highest- skilled counterparts. This result, however, is entirely driven by textile trade; when omitting this industry, the authors find no significant effects. This suggests that the EBA may have led to the local provision of higher-skill inputs in the textile industry.

Outcome: evidence linking NTMs to aspects of Europe 2020 objectives

Research also focused on the nexus between trade policy and the locations of economic activities with the European space. Behrens et al. (2017) develop a computable general equilibrium model featuring love of variety, heterogeneous firms, labour mobility, as well as endogenous markups and productivity, that can be applied to analyse the impacts of trade costs changes, and in particular NTMs changes, on the location of economics activities across space. The model is calibrated to goods and services trade data, as well as GDP and population data, for European Economic Area (EEA) regions plus other OECD countries. Finally, the study assesses the importance of NTMs and other trade costs by performing a series of counterfactual experiments. Specifically, it evaluates the impact of implementing the Transatlantic Trade and Investment Partnership (TTIP) between the EEA and the US and the impact of Brexit. The paper separately considers a liberalization/restriction of trade in goods and a liberalization/restriction of trade in services (as well as a join liberalization/restriction) with the latter being a much cleaner instance in which NTMs represent the main existing obstacle to trade. Concerning TTIP results indicate that a liberalization of trade in services (essentially NTMs) will have stronger impacts than a liberalization of trade in goods on EEA countries' productivity. However, gains (and losses) remain modest an in most cases below 1%. Interestingly, countries in the core of the EEA (Germany, Belgium, the Netherlands, etc.) will mainly loose from TTIP while peripheral countries will gain. At the same time, large city-regions (Paris, London) tend to gain less from deeper service trade integration. The reason is that their large size confers them an advantage that is larger the harder it is to trade. As for population changes, they roughly mirror the pattern of productivity changes and are

overall modest. When considering Brexit, while focusing on trade in services, results suggest sizeable losses for many EEA countries, with the UK and Ireland particularly impacted (about -1.5% productivity each and with a decrease in population of respectively 1.12% and 1.35%). Furthermore, results suggest changes induced by Brexit are likely to favour the larger city regions at the expense of smaller regions.

Outcome: evidence linking NTMs to the role of technology in Development

Research also focused on the linkage between NTMs, technology, and development. Bagayev and Davies (2017b) examine whether trade protection in the form of SPS or TBT regulations affect innovation in a dataset of 4750 firms across 13 developing countries. Specifically, the study examined two types of innovation: that related to the development of new products and that affecting the production method (process innovation). This was embedded in the infant Industry argument for trade protection which posits that by using short term trade protection, it encourages local firms to develop their productivity so that they can successfully compete even after protection is removed. This argument is often used to justify trade protection – including NTMs – as a means of sparking development. Critics of the Infant Industry Argument, however, counter that the lack of competition may actually reduce the need to innovate in order to survive, hurting growth. The findings validate this argument by using the WTO notification database developed within the project to examine the relationship between self-reported product and process innovation in firm level data obtained from the World Bank. In short, no evidence is found supporting a pro-innovation effect of protection. Whereas SPS regulations are completely uncorrelated with either type of innovation, TBT protection lowers product innovation and tariffs reduce both types of innovation. Thus, the evidence indicates that NTMs may inhibit growth by slowing innovation.

In a second paper, Bagayev and Davies (2017a) examines the relationship between NTMs and the distribution of firm productivities. As posited by Melitz (2003) among many others, an increase in trade barriers limits import competition, thereby permitting low-productivity firms to survive. In contrast, trade liberalization would drive those firms under, reallocating their resources to more productive firms, enhancing aggregate productivity and thereby economic development. Using data on 28 industries across 99 countries, this study examines two features of the productivity distribution: its mean and its skewness. The reason for considering both of these is that although economic development may depend on the average productivity across firms, in a political economy setting, the median voter likely holds a great degree of influence. Therefore, to understand the political economy of trade liberalization, it is necessary to consider not just the average firm but the difference between the average and the median firm. As predicted by Melitz (2003), the estimates indicate that NTM protection (as measured by the datasets produced in the PRONTO project) lowers average productivity. Further, they suggest that NTM protection increases the skewness of the distribution, widening the gap between the median and average firm. This suggests that although liberalization might spur development via reallocation, it is likely to encounter significant political resistance.

Outcome: evidence linking NTMs to government revenues and development

Although the link between trade policy and government revenues, particularly for developing countries, may not seem obvious, it must be recognized that developing countries rely on trade taxes (which include both tariffs and revenue-generating NTMs such as anti-dumping duties or export fees) for up to a third of their government revenues. As such, a push to liberalize trade policy may have unexpected detrimental effects if it lowers revenues and thus the ability to provide infrastructure or other services associated with development. In particular, one important government service associated with development is the enforcement of regulations, including the enforcement of trade policy. This sets up a nexus of trade taxes, government revenues, enforcement capability, and development in which each may well support the other.

To explore this issue, Bagayev, et. al (2017) estimated the impact of revenue-generating antidumping duties on imports and how this varies with proxies of government enforcement capability, including the size of government expenditures relative to GDP and the size of the shadow economy. They do so using PRONTO NTM data together with trade data for 108 countries at the 6-digit product level. The results indicate that, as predicted, the effect of NTMs are larger when government enforcement is higher. This is especially true for emerging economies. A key implication of this finding is that if, for example, international pressure forces governments to relax revenue-generating NTMs, this has both a direct negative effect on government revenues (as less is collected given enforcement capability) as well as an indirect one (since less revenue can weaken enforcement efforts). Together, these suggest the need for caution in recommending trade liberalization in emerging economies where trade taxes form a significant part of the government expenditure needed to promote development. This then mirrors the tariff/VAT debate elsewhere in the literature.

Outcome: evidence on the impact of NTMs on the environment

Davies, Edwards, and Mazhikeyev (forthcoming) consider the energy intensity of 11,000 firms in 32 developing countries in Africa and Asia as it depends on whether or not they are in a special economic zone, among other factors. As special economic zones are an increasingly important NTM, this then fits into the broader NTM and development objectives of this WP. In particular, the analysis finds that even after controlling for other factors, firms operating within a zone are significantly more electricity intensive, with the gap about 4% on average. As this is a common proxy for polluting, this suggests that this NTM may have negative environmental impacts even as it aids other types of development by lowering tariffs and export barriers (something considered in WP2). Going further, the study finds that this effect is especially large when firms are financially constrained, suggesting that part of the mechanism may be that firms in zones are more able to access credit and invest in more energy intensive technologies than others.

In another paper providing evidence on SEZs and emissions, the paper on Processing and Special Economic Zones by Francois and Davies (2015) The study first describes a database of WTO Members that employ special economic zones as part of their industrial policy mix. This is based on WTO notification and monitoring through the WTO's trade policy review mechanism, supplemented with information from the ILO, World Bank, and primary sources. The paper athen provides a first analysis of the relationship between use of export processing zones and the carbon intensity of exports based on GVC and carbon accounts data. Thus, this provides a further tie between economic development and the environmental impact of NTMs, and corroborates the findings of Davies Edwards, and Mazhikeyev (forthcoming).

Pantelaiou, et. al (2016) develop a model in which two competing nations have multiple policy instruments, including public abatement and ERSs which affect both trade and resource use (i.e. pollution). Each of these policies has its advantages and disadvantages as they result in different trade-offs between trade levels and pollution. The authors find that while public abatement, funded by an emissions tax, is the best at encouraging economically beneficial trade between countries, ERSs and other policies do a better job at reducing pollution for a given level of trade. Such intuition is buttressed by simulation evidence indicating the impact on emissions, resource usage, and trade levels. Therefore, the optimal policy depends on a government's relative valuation of trade and environmental quality. In particular, building on the Bagayev, et. al (2017) results, this might suggest that when trade is an important revenue source, environmentally effective ERSs may be an unlikely policy choice.

Hatzipanayotou, et. al (2017) directly link the use of ERSs and development via the so-called "resource curse." In the resource curse, a resource abundant country is actually damaged as trade barriers decline because the increase in exports results in an income-reducing terms of trade effect. As such,

an ESR which limits resource usage and exporting can be used to offset this effect. They begin by using a growth model to illustrate this benefit of environmental NTMs. This is then supported by empirical evidence on income and poverty data from the least developed countries where ISO14001 certification is used as the measure of ESRs (something obtained from the environmental database work in support of the public PRONTO database).

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