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TRADE VALUE AND PRICE EFFECT OF NON-TARIFF MEASURES IN FRUITS TRADE

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ABSTRACT

This paper uses two different approaches of the gravity model (trade value and price approach) in order to investigate the effects of non-tariff measures (NTMs) in international fruits trade. Through the trade value approach, we obtain information on the trade value impact of NTMs. Through the price approach, we derive directly the trade cost effect of these NTMs. There are two broad scenarios where NTMs either positively or negatively affect trade. The first one is seen when compliance with the NTMs provides security guarantees that encourage demand in importing markets to meet or exceed supplying costs, whereas the second scenario reflects the opposite, compliance costs are higher than demand for meeting the externality, thus decreasing supplies. We find positive *ad-valorem* equivalent (AVEs) ranging from 3% for technical measures to 7% for non-technical measures. We also find a negative AVE of -2% for category C (pre inspection measures) although this result is barely significant. The difference between estimated coefficients of both approaches allows developing qualitative information on the market creating effect of NTMs, evidencing that overall technical measures show a slight demand increasing effect in comparison to the stronger decreasing effect of non-technical measures.

Keywords: non-tariff measures, gravity equation, trade values and price approach, fruits

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1. Introduction

Increasing agricultural trade raises concerns about food safety as supply food chains become more interconnected, the risks of diseases or pathogens crossing borders increase, and doubts on the stringency of requirements on residues from pesticides, food additives or drugs, emerge (Boqvist et al., 2014; Perrings, 2016). These risks affect the livelihood of those depending on the agrifood sector, can have a disruptive effect on the domestic and international markets, and require trade policy measures that address food safety without imposing unnecessary trade restrictions (Junker et al., 2009; Knight-Jones and Rushton, 2013; WHO, 2015). Countries wishing to engage in the trade of agricultural products adopt sanitary and phytosanitary (SPS) and technical barriers to trade (TBT) measures to safeguard animal and human health, as well as the environment, which globally are guided by the basic rules or code of practice established in the SPS and TBT agreements of the WTO. Both WTO agreements aim at reconciling food safety with a minimum of trade restrictiveness, providing the mechanisms for dispute settlement and transparency on the implementation of standards (WTO, 2018a, 2018b).

SPS and TBT measures are particular NTMs falling under the technical measures group as classified by the Multi Agency Support Team (MAST) of the United Nations Conference on Trade and Development

(UNCTAD). Contrary to traditional non-technical instruments of commercial policy (i.e. quotas, price control, exports restrictions, or contingent trade protective measures, etc.), technical measures are multifaceted. Their complexity makes it hard to identify if they pursue legitimate domestic goals, such as food safety, or rather aim at protecting domestic producers from external competition (Aisbett and Pearson, 2012; Beghin and Xiong, 2016; Niu et al., 2018). Moreover, governments may impose poorly designed or targeted technical NTMs, without any protectionist intention, which raise production and trade costs above needs and subsequently prices faced by consumers (Orefice, 2016).

Complying with the regulations of the destination countries such as bureaucratic requests, conformity assessments, controls, border checks etc., can have an impact on exporting companies, that can incur fixed costs (e.g. investments needed to adapt to the standards required) and variable costs (e.g. inspections in each issue). In addition, these regulations can also undermine the quality of the products being exported (e.g. perishables), or compromise sales at the right time due to delays, thereby affecting the competitiveness of exports.

Indeed, empirical work on the price effect of NTMs show positive results (Ing and Cadot, 2017; UNCTAD, 2017a; Cadot and Gourdon, 2016). Swinnen (2017) provides a dynamic analysis behind the incentives of such cost and price increasing effect of NTMs. He points out that "producers" and "consumers" are two important political groups that greatly influence the way NTMs regulate internal production and imports.

Consider for instance a case when consumers demand quality and safety assurance, environment and/or animal protection or other objectives of the sort, thus pressure policymakers to implement technical measures to address such needs (i.e. hygienic requirements, animal raising processes etc.). These new requirements increase prices for both local and foreign producers, following increasing costs for meeting the new requirements. Fulfilling such requisites is expected to increase consumer utility, increase demand, although the product is priced more. This in turn could increase the market for those producers (local or foreign) meeting the new requirements at lower costs. Imported volumes and values, will be positively affected in case when compliance with the NTMs provides security guarantees that encourage demand in importing markets to meet or exceed supplying costs, depending also on different factors, such as supply and demand elasticities of the sector.

A contrasting scenario is observed when local producers pressure policymakers to implement regulations on imported products (which are already met from local producers) without addressing any real food safety, environment or animal protection, or any other objective of the sort (i.e. Maximum Residue Limits (MRLs) set below those accepted by international food standards). These cases would cause a market exit for exporters or an increase in costs for meeting the requirement, thus causing increased prices. Consumer utility remains unaltered, prices increase, while demand decreases. In this case, compliance costs are higher than demand for meeting the externality, negatively affecting import volumes and values.

Although very general, the abovementioned examples describe broad economic effects of NTMs, which show that an increasing cost effect does not necessarily mean a hidden protectionist objective, neither the opposite. These contrasting effects make it hard to untangle the true effect of NTMs on trade costs, prices and consumer demand in general.

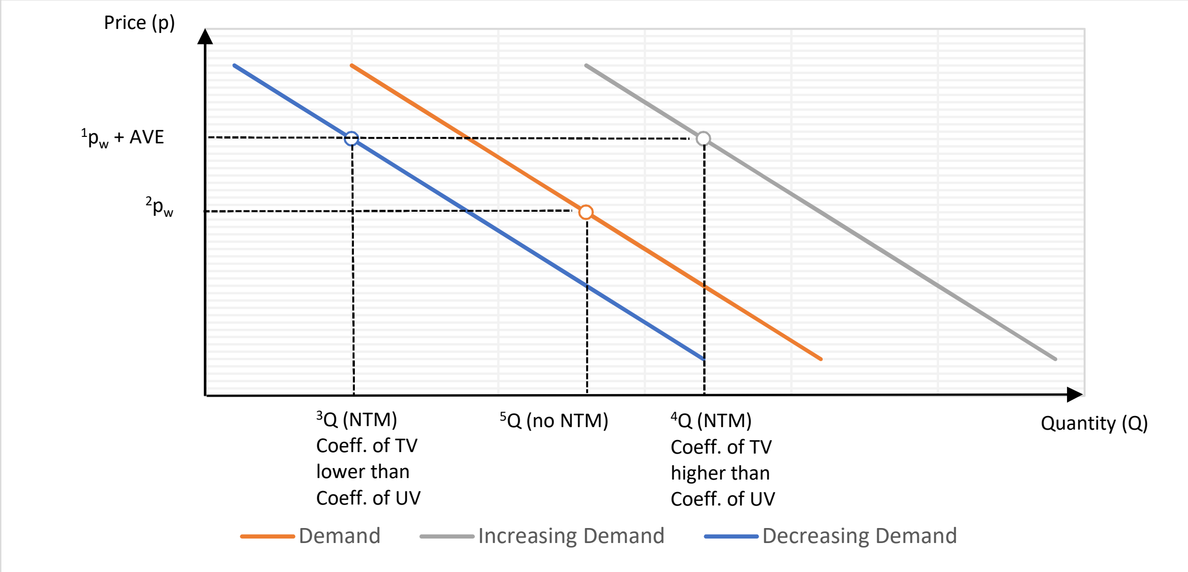
Cadot, Gourdon, & Tongeren (2018) attempt to shed light on such issues by proposing a combined use of the price and quantity (volume) approaches of trade policy analysis, estimating trade costs and demand-enhancing effects of NTMs. In this paper, we follow a similar approach, although for the quantity approach, we make use of trade values (in USD) instead of trade volumes (in tons), and for clarity, we refer to it as the Trade Value Approach. For the price approach, we make use of the new available database on trade unit values (cost insurance and freight (CIF) prices) developed by Berthou and Emlinger (2011). Since prices are defined as unit values, we use these terms interchangeably throughout the paper.

Our objective is to understand the effect of NTMs on trade costs and traded values and understand how this can provide qualitative information on the demand and/or market creating effect of NTMs.

NTM trade costs are obtained through calculation of a*d valorem* equivalent (AVE). Previous studies calculated NTM AVEs (Kee et al., 2009; Kee and Nicita, 2016) through estimations of the quantity approach combined with borrowed import demand elasticities from the literature (Kee et al., 2008), or with tariff estimations of the model. This procedure is complex and pose calculation difficulties and also consistency doubts (Cadot et al., 2018b). On the other hand, coefficient results of the price approach allow retrieving NTM AVEs directly (Cadot and Gourdon, 2016).

Finally, results of the trade value and price approach provide the possibility to ascertain whether NTMs, at different disaggregation levels, enhance or obstruct trade which as in Cadot et al. (2018b), yield qualitative information on "market-creating" effects. Coefficient results of the trade value approach estimated in this study (see details in the methodology section) measure the percent change in trade value following one unit change in the NTM variable (introduced as continuous variable). The price approach, as unit value is in logs (OLS), provides coefficients that also measure the percent change in unit value when the NTM variable (also introduced as continuous variable) changes by one unit. By comparing the percentage change of traded values with the percentage change of unit values, we can identify two different scenarios. First, if the trade value coefficient is higher than the unit value coefficient, this implies a market creation or demand enhancing effect. Second, if the trade value coefficient is lower than the unit value coefficient, than this implies a market reducing, or a demand decreasing effect. Figure 1 illustrates both scenarios. For simplification reasons, we remove the supply line (which under the small country assumption is horizontal).

Figure 1: Visualizing cost and demand effect of NTMs



Notes: TV = Trade Value; UV = Unit Value; 1) Refers to the new price estimated after implementation of the NTM. 2) Refers to the price prior to the implementation of the NTM. 3) Shows the reduction of quantity after the demand decreasing effect of NTMs, which is observed when the trade value (TV) NTM coefficient is lower than the unit value (UV) NTM coefficient. 4) Shows the increase of quantity after the demand increasing effect of NTMs, which is observed when the TV NTM coefficient is higher than the UV NTM coefficient. 5) Refers to the quantity demanded prior to implementation of the NTM.

In this paper, we identify products at the most disaggregated level (6 digits) of the Harmonized System (HS) classification. We have chosen the fruit sector as a case study considering the prevalence of technical NTMs regulating international trade and its weight and importance for the global agrifood industry. On average during 2012-2016, there were 24.08 registered measures affecting fruit imports, which mostly refer to technical NTMs (i.e. 23.43) while the rest are non-technical NTMs (i.e. 0.65) (Own calculations based on the TRAINS NTMs database). Further details are presented in the NTM data section.

The fruit industry is the most imported agrifood sector, increasing yearly, with record imports registered in 2018 (116 thousand million USD), corresponding to 8% share of total world agrifood imports ranking second in the global arena. European Union (EU) countries are the biggest importers, absorbing 56 thousand million USD, representing 42% of all world imports (53% of which is imported from non-EU countries, while 47% is traded within the EU). In order of imports amount, the rest of countries include USA (importing 14% of the total), China (6%), Russia and Canada (4% each), while the rest of the world imports the remaining 30% (ITC, 2018).

The paper is structured as follows. Section 2 presents the methodology and describes both trade value and price approaches from both, a theoretical and empirical perspective, and present the data used (i.e. NTMs, trade value and unit value data). This section also shows the calculation method and interpretation of NTM AVEs. Section 3 present results while section 4 concludes.

2. Methodology

There are two different approaches to estimate NTM effect on international trade, roughly classified as "Price Approach" and "Quantity Approach". We refer to the latest as Trade Value (TV) Approach since our trade data refers to the value of imports in USD, rather than real quantities (i.e. tons).

In both approaches, it is assumed that the existence of an NTM alters trade in comparison to a situation of perfect competition, and this alteration is manifested in a difference between domestic and international prices (factor exploiting the first approach) and the value marketed (factor exploiting the second approach). One significant advantage of the value gap approach in comparison to the price gap approach has been the availability of trade volume data. Recently a new database on trade unit values[1] has been released which aid studies following the price approach.

In this paper, we follow both, the trade value approach based on the works of (Beghin et al., 2015; Grübler et al., 2016; Yotov et al., 2016), and the price approach following closely the recent literature (Cadot et al., 2018a, 2018b; Ing and Cadot, 2017; Cadot and Gourdon, 2016).

2.1. The theoretical trade value approach

The gravity equation has become the standard econometric framework to model bilateral trade, partly due to its high empirical explanatory performance, but also thanks to its strong theoretical underpinnings (Anderson and Wincoop, 2003). In its purest form, the gravity model posits that trade between two countries is a positive function of GDP (i.e., economic `mass') and a negative function of trade costs (proxied by distance) (Pullianen, 1963; Tinbergen, 1962). Over time, further empirical refinements have extended the equation to include geographical (e.g., contiguity, landlocked, distance, North-South hemispheres, remoteness), historical (e.g., colonial ties), and cultural variables (e.g., common language), to better account for trade costs.

Anderson and Wincoop (2003) theoretically consistent[2] gravity equation has become the standard starting point for econometric analysis:

$$M_{rs} = \frac{Y_r \cdot E_s}{Y_W} \left(\frac{t_{rs}}{P_s \Pi_r} \right)^{1-\sigma} \quad (1)$$

where (M_{rs}) are imports from country (r) into country (s); (Y_r) is the value of total production in exporter (r), (E_s) is total expenditure in importer (s) and (Y_w) is value of world output; (t_{rs}) are trade costs (trs = 1 + τ_{rs}) (where (τ_{rs}) is the ad-valorem equivalent of overall trade costs, and no trade costs imply (t_{rs}=1); and (σ) is the elasticity of substitution between varieties or goods from different countries, with (σ>1). The variables (Π_r) and (P_s) are price indices, coined as 'multilateral resistance' terms which are dependent on bilateral trade barriers (t_{rs}), and which reflect how difficult it is for a country to trade with the rest of the world.

The gravity equation has been further enriched to deal with the impact of trade policy, in particular by contemplating preferential trade agreements, tariff liberalization, and NTMs.

From an econometric standpoint, earlier studies favored the use of an Ordinary Least Squares (OLS) log-linear specification. Subsequent literature favours the estimation of the gravity model in its theoretical multiplicative form (see Equation 1) as the log-transformation may lead to inconsistent coefficient estimates in the presence of heteroscedasticity (Santos Silva and Tenreyro, 2011, 2006).

[1] Berthou and Emlinger (2011), have developed the "Trade Unit Values Database" accessible through the CEPII website since April 2017.

[2] Under the assumptions that goods are differentiated by country of origin (Armington, 1969), and that consumer preferences can be approximated by a CES (constant elasticity of substitution) utility function.

This leads Silva and Tenreyro (2006) to recommend the Poisson estimator, which is the most popular model for count data, where the dependent variable has a distribution that takes on non-negative integer values. The Poisson estimator can also be applied to non-negative continuous variables, in which case, it is called the Poisson pseudo-maximum likelihood (PPML) estimator, as it still provides consistent estimates (Wooldridge, 2012). Bilateral trade is an excellent example of non-pure count data (i.e., it is continuous (not integer), and only takes values equal to or greater than zero). The PPML estimator adequately caters for zero trade values eliminating the bias induced by removal of these observations in the more standard OLS estimator, as the log of zero is not defined (Santos Silva and Tenreyro, 2006). This is particularly pertinent in the disaggregated sectoral analysis, where zero-trade values are more likely to prevail. For instance, in our application, 42% of observations are null.

The multiplicative model estimated with the PPML estimator can be expressed as:

$$M_{rs} = exp(\boldsymbol{x}'\boldsymbol{\beta} + \varepsilon_{rs}) \quad (2)$$

where (x) is the vector of explanatory variables, (β) the vector of coefficients to estimate and (ε_{rs}) the error term. This expression is given in full in the model specification section of the trade value approach.

2.2. The theoretical price approach

The theoretical basis for the price approach is explained in Cadot & Gourdon (2016), which in turn makes use of theoretical developments by Melitz (2003). The empirical price equation is consistent with a standard monopolistic-competition theoretical model with heterogeneous firms, expressed as:

$$P_{rsh}^{CIF} = M_r^{\frac{1}{1-\sigma}} \cdot \tau_{rsh} \cdot \left(\frac{\sigma}{\sigma-1}\right) \cdot \frac{w_r}{\varphi_r} \quad (3)$$

where sub-indexes *r*, *s* and *h*, refer to the exporter, importer and sector, respectively; *P* is price, valued in CIF terms (cost insurance freight), specific to each destination country as it includes trade costs (other than tariffs); M_r is the mass of firms producing product *h* in origin country *r*; *σ* the elasticity of substitution between varieties (i.e. countries); τ_{rsh} is the ad-valorem trade cost (iceberg-type); w_r is a marginal cost reflecting supply conditions in the exporting country *r*, such as the wage rate; and φ_r is a productivity aggregator (i.e. an integral over the unconditional distribution of firm productivities) (Melitz, 2003, eq.7).

Empirically, price is the trade unit value observed in the database, and the ad-valorem trade cost (τ_{rsh}) is decomposed into transport costs, proxied by distance and other geographical and cultural variables (i.e. contiguity, common language, colonial linkage) and subsumed in matrix $\boldsymbol{x}_{rs}$, as well as non-tariff measures (NTM_{rsh}):

$$\tau_{rsh} = exp\left[\beta_{NTM} NTM_{rsh} + \beta\boldsymbol{x}_{rs}\right] \quad (4)$$

We do not include tariffs in our models, considering that from all previous tests, tariff coefficients have always shown insignificant results. Strictly speaking the definition of CIF prices exclude tariffs, which is highlighted by Beghin and Xiong (2016, p. 23) as an inconsistency in the empirical formulation and application by Cadot & Gourdon (2016).

2.3. Data

Focusing on the fruit sector (HS2 Code "08"), we combine NTMs at the HS6 – Importer – Exporter level from the TRAINS NTM database with trade data from the UNCOMTRADE database, and trade unit values data completed by Berthou & Emlinger (2011), over the years 2012-2016. Table 1 describes the general setup of the panel data structure that helps to build up the final database used in the econometric analysis.

Table 1: General setup of the panel data structure of the trade value and price approach

	Trade Value Approach	Price Approach
*Importer countries:	81	80
*Exporter countries:	208	193
*HS6 Product codes:	72	55
Time period:	2012-2016	2012-2016
Number of observations	371,780	135,941

Notes: *The number of importer, exporter countries and HS6 products is based on bilateral trade data taken from UN COMTRADE and on trade unit value database from Berthou & Emlinger (2011) (i.e. all available countries that register foreign trade as well as unit values in the fruit sector) and in the same time for which there is available NTM information.

2.3.1. NTM data

NTMs are defined as: "*policy measures, other than ordinary customs tariffs, that can potentially have an economic effect on international trade in goods, changing quantities traded, or prices or both"* (UNCTAD, 2010).

The concept of NTMs is neutral and does not imply a negative or positive impact on trade. Some NTMs might have a positive impact on trade, though many NTMs are thought to have important restrictive and/or distortionary effects on international trade regardless of whether they are applied with protectionist intent or to address important non-trade objectives (UNCTAD, 2016).

The latest NTMs classification from MAST follows a hierarchical structure divided into two broad categories: i) import measures, that reflect the requirements of the importing country on its imports; and ii) export measures, that reflect the requirements imposed by the exporting country on its own exports (Table 2). Import measures are further divided into two groups, technical and non-technical measures where NTMs are differentiated according to 16 chapters (denoted by alphabetical letters). The first three (A to C) fall under the technical measures, and the rest (D to L) fall under the non-technical measures group. From the 16 NTM categories, the UNCTAD NTMs database records measures from A to J, and P (11 types) in both, agri-food and non agri-food sectors. These 1-digit NTM types are further subdivided into a total of 175 NTM subcategories at 4-digits in agri-food sectors: A (42); B (28); C (6); D (13); E (32); F (19); G (6); H (4); I (2); J (2); and P (19).

Table 2: Non-tariff measures classification

IMPORT	TECHNICAL MEASURES	A	SANITARY AND PHYTOSANITARY (SPS) MEASURES
		B	TECHNICAL BARRIERS TO TRADE (TBT)
		C	PRE-SHIPMENT INSPECTION AND OTHER FORMALITIES (P.I.)
	NON TECHNICAL MEASURES	D	CONTINGENT TRADE PROTECTIVE MEASURES
		E	NON-AUTOMATIC LICENSING, QUOTAS, PROHIBITIONS AND QUANTITY CONTROL MEASURES OTHER THAN FOR SPS OR TBT REASONS
		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	RESTRICTION ON POST-SALES SERVICES
		L	SUBSIDIES (excluding export subsidies)
		M	GOVERNMENT PROCUREMENT RESTRICTIONS
		N	INTELLECTUAL PROPERTY
		O	RULES OF ORIGIN
EXPORTS		P	EXPORT RELATED MEASURES

Source: (UNCTAD, 2015): International Classification of Non-Tariff Measures (2012 version)

Since April 2017, UNCTAD made available a database on the inventory of NTMs[3] for research use, which puts together all the information available for 57 reporters (including the EU as a single identity), conducting the calculation of the number of measures applied, by HS 6-digit line, within each 4-digit NTM category (i.e. MAST classification). In addition, the database is also accessible for partial analysis through the I-TIP platform (developed by WTO)[4].

This database represents a substantial advantage with respect to previous available NTM-TRAINS datasets (i.e. individual for each reporter; the number of measures required own calculations, and less information, such as the type of coverage, was recorded). Details on the interpretation of the database are provided by UNCTAD in their guide on using the database (UNCTAD, 2017b). The database has more than 13 million observations (specifically 13,749,615 observations, from which, 3,279,284 refer to agri-food sectors).

The original database is bilateral, indicating the number of measures that importer *j* applies to exporter *i*, in sector *h* (HS 6-digit), of type *k* (NTM category according to the MAST classification, and defined at four digits). Most measures apply to any origin (which is indicated by partner=WLD), but still there are some measures that can apply to specific partners.

The database informs about the year of collection of the NTM data, that normally is specific for each reporter but not for any other dimension (sector or type of NTM). Besides, the starting and ending date of application is also recorded. Using both variables allows us to provide a temporal dimension to the data, which is used in the estimation phase of the project.

Finally, the UNCTAD NTMs database includes two variables to account for the number of measures applied by the reporter, named as “nbr” and “all”. The former refers to the gross number of measures applied, by each reporter/partner and NTM 4-digit category, while “all” refers to ‘generic measures’, or measures applied by a reporter to all HS 6- lines. We follow the recommendation by UNCTAD (2017b, pp. 13, 24) and calculate the difference between ‘nbr’ and ‘all’, to better depict the sectoral coverage of NTMs.

[3] http://i-tip.unctad.org/Forms/Analysis.aspx
[4] http://trains.unctad.org/

Table 3 summarizes descriptive statistics of NTMs in the fruit sector for each of the years of analysis.

Table 3: Descriptive statistics of NTMs by NTM type and year

	NTM[1]	2012	2013	2014	2015	2016	Total
% of observations with at least one NTM	All (Excl.P)	95.11	95.12	95.12	98.46	98.46	96.45
	Technical	94.55	95.09	95.09	98.43	98.44	96.32
	A: SPS	96.45	92.42	93.12	96.36	96.37	93.94
	B: TBT	86.31	89.14	89.14	92.48	92.48	89.91
	C: P.I.	8.10	8.83	10.69	16.53	16.53	12.13
	Non.Tech.	22.73	22.96	22.96	23.46	23.46	23.11
Reg. Scope (RS)[2] (mean)	All (Excl.P)	15.42	17.15	17.29	18.00	18.03	17.18
	Technical	14.91	16.62	16.74	17.45	17.45	16.63
	A: SPS	11.69	13.34	13.44	13.75	13.75	13.19
	B: TBT	3.12	3.17	3.17	3.49	3.49	3.29
	C: P.I.	0.10	0.11	0.13	0.20	0.20	0.15
	Non.Tech.	0.50	0.54	0.55	0.56	0.59	0.55
Reg. Intensity (RI)[3]	All (Excl.P)	21.98	23.91	24.07	25.19	25.22	24.08
	Technical	21.38	23.28	23.42	24.53	24.53	23.43
	A: SPS	16.44	18.25	18.38	18.82	18.82	18.14
	B: TBT	4.82	4.90	4.90	5.44	5.44	5.10
	C: P.I.	0.12	0.13	0.15	0.27	0.27	0.19
	Non.Tech.	0.60	0.64	0.65	0.66	0.69	0.65

Source: Own elaboration based on UNCTAD NTMs database. Notes: [1]Types of NTMs are classified according to the MAST NTM classification (UNCTAD, 2015). [2] Regulatory Scope counts the mean number of 4-digit NTM subcategories falling under each NTM type mentioned in the table (i.e. The mean number of 4-digit NTM categories falling under the 1-Digit category A (SPS) is 11.69). [3] Regulatory Intensity counts the mean number of measures applied under each group of NTMs.

2.3.2. Trade value data in the fruit sector

We exploit the most comprehensive trade database, The United Nations Commodity Trade Statistics Database (UN Comtrade). The database contains detailed imports and exports statistics reported by statistical authorities of close to 200 countries or areas. It concerns annual trade data from 1962 to the most recent year. Table 4 provides summary statistics for the UN Comtrade database on the fruit sector (HS2 08).

One important note to consider is that only routes (i.e. pairs of countries) that have traded at least once in a sector during the period of analysis are kept, and data is expanded to cover the five-year period. On the other hand, the expanded data matrix is populated by zeros for those combinations of importer-exporter-sector-year where at least in one year there is not a null value of trade (note that UN Comtrade data usually exclude these observations).

Number of products (at HS6 Level): Two countries trade a maximum of 66 different HS6 Lines in the 2012-2016 period. The average number of products at the HS6 level traded has been increasing from 25 in 2012 to 29 in 2016. Number of importers: The maximum number of destinations reached from a single exporter country in a single HS6 sector ranges from 62 to 67. The average ranges from 18 in 2015 to 20 in 2012-2014. Number of Exporters: The maximum (and the average) number of exporters (exporting in a single market and HS6 sector) has been increasing from year to year, 71 (20) in 2012 to 153 (33) in 2016. Imports: The average import amount per observation (trade non-zero) has been slightly increasing through the years from 1,977 Million USD in 2012 to the maximum reached in 2014 (2,237 Million USD). Also the maximum import registered between trading partners in a single HS6 line has been increasing. For four consecutive years (2013-2016) the USA imported from Mexico the record amount of avocados (HS6 code 080440) valued at 1,825,250 Million USD in 2016. The 2012 maximum trade value is registered between Japan and Philippines for imports of bananas valued at 830,815 Million USD. Observations: Finally our fruits database includes 74,356 observations per year, which include both observations, those registering trade (trade value >= 1), and zero trade observations. The portion of zero trade observations has been decreasing over the years (i.e. 46% in 2012 to 37% in 2016). We think that this is due to the proliferation of bilateral trade agreements, allowing countries to diversify their trade (imports or exports) with a larger number of countries.

Table 4: Summary statistics of trade value data

	2012	2013	2014	2015	2016
No. HS6 Lines[1]					
Max (Min)	65 (1)	66 (1)	66 (1)	65 (1)	66 (1)
Mean	25	26	26	28	29
No. of importers[2]					
Max (Min)	65 (1)	62 (1)	68 (1)	62 (1)	67 (1)
Mean	20	20	20	18	19
No. of exporters[3]					
Max (Min)	71 (1)	76 (1)	76 (1)	137 (1)	153 (1)
Mean	20	20	21	29	33
Imports (USD Millions)[4]					
Mean	1,073	1,182	1,232	1,229	1,276
Mean (if trade>=1 USD)[5]	1,977	2,164	2,237	2,035	2,016
Max per obs.	830,815	1,027,524	1,335,246	1,581,028	1,825,250
Total	79,800,000	87,900,000	91,600,000	91,400,000	94,900,000
Observations					
No. of Obs.	74,356	74,356	74,356	74,356	74,356
No. of zero trade obs.	33,984	33,760	33,388	29,446	27,287
% of zero trade obs.	46%	45%	45%	40%	37%

Notes. 1) Calculates the number of distinct HS6 lines traded between importers and exporters in a given year. 2) Calculates the number of distinct importers for a given HS6 line and exporter. 3) Calculates the number of distinct exporters for a specific HS6 line and importer. 4) Calculates the trade value for each observation, provides the maximum registered trade value in a single observation, as well as the total trade value for the year. 5) Refers to the mean calculated over the non-zero observations.

2.3.3. Trade unit value (prices) data in the fruit sector

Trade unit values (prices) is the dependent variable in our estimations. One main advantage of unit values in comparison with other prices datasets, like those based on consumer price data, is that they are available at a high sectoral disaggregation (HS 6-digit), and are bilateral or exporter-importer specific. Besides, the original unit values dataset obtained from international trade repositories, such as the United Nations Comtrade, simply by dividing trade values over quantities, has been completed by Berthou & Emlinger (2011), carrying out further statistical refinements that have improved the overall quality of data. The "Trade Unit Values Database" has been available from the CEPII website since April 2017[5]. Two datasets are offered, valued in CIF (cost insurance freight) and FOB (free on

[5] http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=2

board). As in previous works by UNCTAD (2017) and Cadot & Gourdon (2016), we favor the use of CIF trade unit values. The CIF values are based on importers' declarations (usually recognized as more accurate) and reflect all trade costs[6] except tariffs and domestic taxes after the border. As such, they are expected to capture more of the NTM-related costs (UNCTAD, 2017, p.28).

The trade unit values database is bilateral, that is, for each pair of importer-exporter combination, aggregated at HS6 level, for the period 2012-2016, and expressed in USD per ton.

Table 5 shows some descriptive statistics of trade unit values for each of the years observed in this study. An important issue is that despite the statistical refinements to build up the database, still a large dispersion of data persists. For instance, the mean unit value is 4,767 USD, with a median of 2,604 USD, and ranging from 21 to 336,435 USD. Observing the lower and upper 5% percentile still reveals an enormous dispersion. Furthermore, an inspection within each HS 6-digit line (see excel file IATRC_*Tables.xlsx,* sheet: *"UV by HS6"*) still reveals substantial dispersion of unit values.

Table 5: Summary statistics of unit values

year	mean	sd	min	p5	p50	p95	max	N
2012	4,474	6,296	29	549	2,449	13,930	192,380	27,491
2013	4,793	7,178	29	608	2,622	14,510	307,546	28,097
2014	5,029	6,963	24	574	2,793	14,995	216,233	28,655
2015	4,789	6,806	21	521	2,607	14,455	370,393	29,345
2016	4,728	7,376	26	511	2,520	14,337	336,435	22,353
Total	4,767	6,918	21	550	2,604	14,504	370,393	135,941

Notes: N is number of observations; p5: percentile 5; p50: percentile 50 or median; and p95: percentile 95. Available unit value data for all reporters, partners, HS6 sectors in years 2012 to 2016.

2.4. Empirical specification of the model

Following the theoretical specifications (1 and 2) for the trade value approach and specification (3 – 4) for the price approach, in this section we develop their empirical equivalents.

To account for omitted-variable bias, we perform the Mundlak test (Mundlak, 1978), and test weather our regressors are related to the unobserved time-invariant components. Results for both approaches, trade value and price, strongly reject the null hypothesis, meaning that there is evidence to suggest that the unobserved random component is related to the regressors.

Thus, in both approaches, we use a Fixed Effects (FE) Model considering that the unobserved time-invariant component is related to the regressors (Agnosteva et al., 2014; Egger and Nigai, 2015).

The FE model uses two estimators that overcome the difficulty of dealing with unobserved time invariant components. This first is called the Within Estimator, whereas the second is called the First-Differenced Estimator. In this study we make use of the Within Estimator which regresses the demeaned dependent variable on the demeaned covariates. A caveat here is that any of the coefficients associated with the time-invariant components of our model are not going to be recovered (variables such as contiguity or distance between countries, religion, language, etc. are omitted). In case one is interested in obtaining such estimates, we can make use of the Random Effects

[6] Seller must pay the costs and freight, includes insurance to bring the goods to the port of destination.

model that provides estimates of the coefficients associated with the time-invariant variables; nevertheless, this is not the focus of this study.

For the trade value approach, we specify a non-linear equation model (5), using the Poisson Pseudo Maximum Likelihood (PPML) estimator (Silva & Tenreyro, 2006). The dependent variable (M_{it}) is yearly import values in millions USD:

$$M_{it} = \exp\left(\beta_0 + \beta_{GDP} GDP_{srt} + \beta_{RTA} RTA_{srt} + \beta_{NTM} NTM_{it} + \beta_{i\_FE} i\_FE_{it} + \varepsilon_i + \varepsilon_{it}\right) \quad (5)$$

For the price approach, we have to note that prices in absence of trade values are not defined, thus we can only use observations when actual prices apply (UV > 0) (Cadot et al., 2018b). This allows us to specify a log-linear OLS equation (e6) using the within estimator. The dependent variable (UV_{it}) is the logarithm of the trade unit value (the empirical equivalent of "P_{rsh}^{CIF}"):

$$UV_{it} = \beta_0 + \beta_{GDP} GDP_{srt} + \beta_{RTA} RTA_{srt} + \beta_{NTM} NTM_{it} + \beta_{i\_FE} i\_FE_{it} + \boldsymbol{\varepsilon}_i + \boldsymbol{\varepsilon}_{it} \quad (6)$$

In both specifications the individual (i) is identified as importer (s), exporter (r) and product (h); (t) denotes time in years; (β) refers to the parameter to estimate; (εi) refers to the unobserved time-invariant component of the error term; (εit) refers to the unobserved time-varying component of the error term.

The following are the time varying explanatory variables:

- GDP_{srt} Log product of Gross Domestic Product of importer and exporter;
- RTA_{srt} Identifies if the importer and exporter form part of a Regional Trade Agreement;
- NTM_{it} is specified in two different ways: i) as Regulatory Intensity (NTM_RI); and ii) as a dummy indicator (NTM_d). The NTM_RI counts the number of measures applied within each individual. The NTM_d, on the other hand, simply captures the presence or absence of any NTMs. For both we consider 3 levels (L) of the MAST NTM classification system (ref. to Table 2):
    - L1 - Overall NTMs
        - L2 - Technical NTMs
            - L3 - Category A – Sanitary and Phytosanitary (SPS)
            - L3 - Category B – Technical Barriers to Trade (TBT)
            - L3 - Category C – Pre-inspection measures
        - L2 - Non-Technical NTMs
- FE_{it} absorbs the combination of importer, exporter and product specific fixed effects.

Most of the applications use the NTM dummy indicator, while more recent literature like Murina Marina & Nicita Alessandro (2017) and UNCTAD (2017a) use the continuous variable RI. Note, that, the more complete the NTMs database becomes, the more difficult is to find sectors and/or routes where no NTMs are applied, and accordingly, the frequency ratios become close to 100%, turning the dummy approach infeasible or at least challenging (see Table 3).

We need our explanatory variables to change over time, since if all our variables are constant over time, using panel-data analysis, and in particular dynamic panel-data methods, is not worthwhile. As a result, we do not include the variables that are constant in time such as the standard explanatory variables in the gravity literature (i.e. religion, language, distance between countries, contiguity, etc). We include these variables when we perform a robustness check using the random effect model that we explain in the results section. Descriptive statistics of the possible explanatory variables in the file attached (*IATRC_Tables.xlsx*) under the "*XTSUM-TV*" and "*XTSUM-UV*" sheets. The positive within standard deviation evidences that the explanatory variables vary over time.

2.5. Computing AVE calculations through the price approach

AVE calculations through the two alternative definitions of the NTM variable (i.e. as RI or as dummy indicator) have consequences on the interpretation of the accompanying coefficients:

i) AVE using NTM_RI: the coefficient measures the percent change in the trade unit value when RI increases in one additional measure (this interpretation as a semi-elasticity applies because RI is a non-logged continuous variable and the dependent variable is in logs)[7]. This can be interpreted then, directly, as the AVE of one additional NTM. Note that as the coefficient NTM_{it} is the marginal effect, it makes more sense to interpret the impact on prices around the average number of NTMs (UNCTAD, 2017a, p.30).

Note also that one additional measure may be very little compared to the average number of measures, and accordingly, the coefficient itself may not be very informative about the actual AVE faced when exporting to a typical destination with mean RI[8]. Accordingly, the final AVE (we call it Gross AVE by comparison to the coefficient estimate to which we will refer to as Marginal AVE) is obtained by multiplying the coefficient by the average number of measures applied in the sample. More formally:

Marginal AVE using RI (%) = $NTM_{it} \cdot 100$

Gross AVE using RI (%) = $NTM_{it} \cdot \overline{RI} \cdot 100$

where $\overline{RI}$ is the average number of measures in the sample.

ii) AVE using NTM_d (dummy for NTM). Changing from total absence of NTMs (NTM_d=0) to the presence of at least 1 NTM (NTM_d= 1) changes prices by *[exp(NTM_{it})-1] ·100.*

3. Results

We perform 12 estimations, 6 for each approach. For both approaches, we estimate the effect that NTMs (for the first three levels of the MAST classification system, as listed in the empirical specifications of the models) have on trade value (Table 6) and prices (table 7), accordingly, by utilising the RI of NTMs in the first three estimations, and then the dummy equivalent in the last three.

3.1. Estimation results of the trade value approach

Table 6 presents results of the trade value approach. Control variables are strongly significant and show expected signs, providing proof of consistent results of the model. Both, GDP and RTA estimates, show positive effects on traded values. These results are consistent among all six estimations

7 The Regulatory Intensity could also be measured as ln(1+RI) (as in Murina Marina & Nicita Alessandro, 2017) and in which case, the coefficient would measure the elasticity or percent change in the trade unit value following a 1% change in RI. Nevertheless, we think that the definition of Ad-Valorem Equivalent matches better the concept of marginal effect than the elasticity.

8 This qualification is based on the fact that coefficients are scale dependent (for instance, dividing RI by 10 would multiply the coefficient by 10) (Cameron & Trivedi, 2010, p.88, p.345).

performed. GDP estimate (using the mean coefficient in regressions 1-6) indicate that a 1% change in GDP equal a 0.62% change in traded value [exp(0.484)–1=0.62][9]. RTA estimate (using the mean coefficient in regressions 1-6) shows a 17% increase in trade value [exp(0.153)–1=0.165] for countries sharing a preferential trade agreement, in line with results from Bureau and Jean (2013)[10].

RI of the overall NTMs (column 1) shows a positive and highly significant impact on traded values. Dividing by type of NTMs (column 2), shows a dual effect of NTMs, technical measures have a positive and significant effect on traded values, compared to the negative and significant effect of non-technical measures. When looking at the 2-digit level NTMs (column 3) within the Technical Measures, we note a dual trade value effect (i.e. positive and significant effect for type A (SPS) and type B (TBT) and negative and significant effect for type C (pre-inspection) measures.

The NTM dummy shows different results (column 4 – 6), of questionable consistency considering the opposite effects for the Technical and Non-Technical NTMs which in principle do not make economic sense. Non-Technical NTMs refer to traditionally used instruments of commercial policy (e.g. quotas, price control, exports restrictions, or contingent trade protective measures, etc.), thus a trade impeding effect is expected.

Table 6: Estimation results of the trade value approach

	NTM Regulatory Intensity (RI)			NTM dummy		
	(1)	(2)	(3)	(4)	(5)	(6)
L1. Any NTM	0.0019**			0.0784***		
	(0.0009)			(0.0276)		
L2. Technical NTMs		0.0049***			-0.1140**	
		(0.0010)			(0.0446)	
L3. Cat. A (SPS)			0.0104***			-0.0349
			(0.00259)			(0.0475)
L3. Cat. B (TBT)			0.0114**			0.2370**
			(0.00544)			(0.0986)
L3. Cat. C (PRE.INSP.)			-0.0884**			-0.0609
			(0.0349)			(0.0373)
L2. Non-Tech. NTMs		-0.1440***	-0.0984***		0.1330***	-0.1390
		(0.0362)	(0.0322)		(0.0370)	(0.0853)
GDP	0.5180***	0.4930***	0.4250***	0.5120***	0.5130***	0.4410***
	(0.0585)	(0.0574)	(0.0525)	(0.0600)	(0.0601)	(0.0534)
RTA	0.1540***	0.1500***	0.1430***	0.1570***	0.1560***	0.1580***
	(0.0390)	(0.0391)	(0.0394)	(0.0389)	(0.0389)	(0.0388)
Constant	-18.250***	-16.890***	-13.260***	-17.950***	-18.010***	-14.070***
	(3.246)	(3.185)	(2.919)	(3.337)	(3.339)	(2.954)
Observations	368,853	368,853	368,853	368,853	368,853	368,853
Pseudo R2	0.980	0.980	0.981	0.980	0.980	0.980
LogLikelihood	-3.160e+07	-3.150e+07	-3.150e+07	-3.160e+07	-3.160e+07	-3.160e+07
imp. x exp. x prod. FE	YES	YES	YES	YES	YES	YES

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

These results are robust under alternative model specifications. **Robustness checks** for the trade value approach are presented in the file “IATRC_Tables.xlsx” under the “TV – Robustness Checks” sheet.

9 This value is still lower than the value of 1% predicted by the theory, which however, applies to overall trade, rather than sectorial trade.
10 Bureau and Jean (2013) estimate similar result in their study of the impact of RTAs on trade in agricultural products, practically estimating an increase in trade values of 12% in the case of goods with a preferential margin below 5%, an increase of 18% in the case of goods with a preferential margin ranging between 5% and 10% and finally an increase of 48% for those benefitting from a margin exceeding 10%..

First, we perform a **random effect (RE) model**. In addition to the GDP and RTA variables, we include the usual explanatory variables of the gravity equation (i.e. Contiguity, common language, colony and the distance between importer and exporter), which do not vary over time, but permissible in the RE model. Results support those of the baseline model, showing consistency among all groups of NTMs analysed. Significance, direction and magnitude are not altered.

As a second robustness check we **exclude within European Union (EU) trade** considering that a common external agricultural policy might influence results. Estimations under this condition hold consistent among all groups of NTMs, significance and direction remain unaltered, although we notice a slight reduction in magnitude among level 2 and level 3 NTMs.

3.2. Estimation results of the price approach

Table 7 presents results of the price approach. Control variables of the price approach differ in results compared to the trade value approach. As expected, the GDP coefficient, strongly significant, positively affect trade unit values. The RTA coefficient on the other hand does not show a significant result. These results are consistent among all six estimations performed.

RI of the overall NTMs (column 1) shows a positive and highly significant impact on trade unit values. At the second level of NTMs (column 2), both technical and non-technical measures increase trade unit values, although we notice a stronger effect of non-technical measures. When looking at the 2-digit NTMs within the Technical Measures (column 3), we note a dual effect (i.e. positive and highly significant effect for type A (SPS) and negative, although poorly significant effect for type C (pre-inspection) measures. Type B (TBT measures) show insignificant results.

Once again, similar to the trade value approach, estimates using the NTM dummy show different results in the price approach, of questionable consistency considering the negative (although not significant) coefficient of Non-Technical measures. In addition, all estimates at the 2-digit level are insignificant.

Table 7: Estimation results of the price approach

	NTM Regulatory Intensity (RI)			NTM dummy		
	(1)	(2)	(3)	(4)	(5)	(6)
L1. Any NTM	0.0013***			0.0249*		
	(0.0003)			(0.0127)		
L2. Technical NTMs		0.0011***			0.0367***	
		(0.0003)			(0.0128)	
L3. Cat. A (SPS)			0.0031***			0.0236
			(0.0007)			(0.0178)
L3. Cat. B (TBT)			0.0006			0.0072
			(0.0012)			(0.0117)
L3. Cat. C (PRE.INSP.)			-0.0135*			0.0103
			(0.0076)			(0.0140)
L2. Non-Tech. NTMs		0.0257***	0.0282***		-0.0337	-0.0373
		(0.0082)	(0.0084)		(0.0327)	(0.0324)
GDP	0.2970***	0.2990***	0.2930***	0.2940***	0.2950***	0.2980***
	(0.0104)	(0.0104)	(0.0107)	(0.0105)	(0.0104)	(0.0107)
RTA	0.0111	0.0108	0.0087	0.0137	0.0136	0.0131
	(0.0123)	(0.0123)	(0.0123)	(0.0122)	(0.0122)	(0.0122)
Constant	-8.0350***	-8.1450***	-7.8800***	-7.8590***	-7.9150***	-8.0930***
	(0.557)	(0.558)	(0.572)	(0.562)	(0.559)	(0.572)
Observations	135,666	135,666	135,666	135,666	135,666	135,666
Correlation	0.950	0.950	0.950	0.950	0.950	0.950
LogLikelihood	-29681	-29672	-29665	-29689	-29685	-29682
imp. x exp. x prod. FE	YES	YES	YES	YES	YES	YES

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Contrary to the trade value approach, robustness checks for the price approach are not consistent under different model specifications. **Robustness checks** results for the price approach are presented in the file “IATRC_Tables.xlsx” under the “UV - Robustness Checks” sheet.

We repeat the **random effect (RE) model**. Once again, in addition to the GDP and RTA variable, we include the usual explanatory variables of the gravity equation (i.e. Contiguity, common language, colony and the distance between importer and exporter). Direction and magnitude are altered for the first and second level of NTMs. The third level shows a change of significance and magnitude, although direction is maintained. In addition, the control variables GDP and RTA show altered results in significance, and magnitude. This inconsistent results might be considering that the RE model does not address endogeneity issues.

Once again, we test the unit value base line model by **excluding within European Union (EU) trade**. Estimation result for NTM level one loses significance. For NTM groups of level two, results of technical NTMs loose significance, whereas for non-technical NTMs, there is a change in direction, becoming negative, which is economically not viable. At level three, results of category A show slight changes in significance and magnitude, although direction is maintained. Category B becomes significant, increases in magnitude, while direction remains the same. Category C increases in magnitude and significance, maintaining the same direction.

For the price approach, we perform an additional robustness check by **excluding extreme values**; specifically we remove values falling under the lower and higher 5 percentiles. In this specification results change in magnitude and direction for all three NTM levels. These might be because these extreme values might hold information on the quality differentiation of the products traded. Nevertheless further analysis is required.

3.3. Additional estimations at 2-digit and 4-digit level of NTMs

In addition, we estimate the effect of NTMs at a further disaggregation level of the MAST classification, practically at the 2 digit level (i.e. A1, A2, B1, C2 etc.) and at the 4 digit level (i.e. A130, A140, B110, C200 etc.). Results are presented in the file attached (*IATRC_Tables.xlsx*) under the "*TV_2&4-digit*" and "*UV_2&4-digit*" sheets. It must be noted that at this level of NTM disaggregation, outcomes of the price approach are not economically viable, since the majority of significant cases present negative coefficients[11], which erroneously implies that the application of specific NTMs decrease prices. We expect that technical NTMs increase trade unit values of imported goods, since they imply additional forms of compliance costs (i.e. implementing new phytosanitary and technical requirements, such as using new packaging materials or transportation systems). In principle, technical NTMs can incur fixed costs (e.g. investments needed to adapt to the standards required) and variable costs (e.g. inspections on each shipment). These inconsistent results remain an unresolved issue at this moment.

3.4. AVE results

Table 8 presents ad-valorem equivalents of NTMs calculated through estimates of the price approach, using both, the NTM RI and the NTM dummy. Results of the NTM dummy are questionable, considering that estimations of the price approach show mostly non-significant results, and in addition, inconsistent for non-technical measures, which contradict our expectation that, non-technical NTMs (i.e. quotas, price controls etc.) increase prices of imported products.

On the other hand using the NTM RI provides results for almost all levels of NTMs (except for category B – TBT measures). The marginal AVE (column 1) is simply the coefficient estimated. This impact is small, although we should keep in mind that the coefficients are dependent on the measurement scale (Cameron and Trivedi, 2010, p. 88). Thus adjusting this unit-increase by the average number of measures applied in the sample, leads to AVEs ranging from -2% for category C (Pre-inspection measures) to 7% for non-technical measures. This approach is also followed by (UNCTAD, 2017a, p. 30).

Table 8: AVE results

	NTM Regulatory Intensity (RI)		
	(1)	(2)	(3)=(1)x(2)
NTM Level	Marginal AVE	Mean RI	Gross AVE
L1. Any NTM	0.0013***	24.96	3%
L2. Technical NTMs	0.0019***	24.32	3%
L3. Cat. A (SPS)	0.0031***	19.31	6%
L3. Cat. B (TBT)	0.0006	5.67	-
L3. Cat. C (PRE.INSP.)	-0.0135*	1.55	-2%
L2. Non-Tech. NTMs	0.0257***	2.80	7%

Notes: Significance: *** p<0.01, ** p<0.05, * p<0.1. (1) is the estimated coefficient for the RI in table 7. (2) is the mean Regulatory Intensity in table 3.

[11] Most of the significant cases show negative results (46% of the cases). Only 11% of the cases show significant and positive results. The rest (43% of the cases) show insignificant results.

3.5. Qualitative information on the market creating effect of NTMs

Table 9 compares coefficient results of both approaches. The overall NTM (level 1) shows a market creation effect in the fruit sector in the whole estimation sample. At the second level of NTMs, we note a market creating effect of technical NTMs, and a market decreasing effect for non-technical NTMs. The third level of NTMs (2-digit technical NTMs) shows positive results for category A (SPS measure) and negative results for category C (pre-inspection). Category B (TBT measure) shows a clear market creating effect considering the null effect on unit values (result is insignificant), while showing a positive and significant result on trade values.

Table 9: Market creating effect of NTMs in the fruit sector

NTM Level	(1) Trade Value (TV) Coeff.	(2) Unit Value (UV) Coeff.	3=(1)-(2)	Market effect[1]
L1. Any NTM	0.0019**	0.00132***	0.0006	Increasing
L2. Technical NTMs	0.0049***	0.0011***	0.0038	Increasing
L3. Cat. A (SPS)	0.0104***	0.0031***	0.0073	Increasing
L3. Cat. B (TBT)	0.0114**	0.0006	0.0114	Increasing
L3. Cat. C (P.I.)	-0.0884**	-0.0135*	-0.0749	Decreasing
L2. Non-Tech. NTMs	-0.1440***	0.0257***	-0.1697	Decreasing

Notes: Significance: *** p<0.01, ** p<0.05, * p<0.1. [1] The market effect can be either positive (increasing) or negative (decreasing), which is retrieved simply from the difference between the trade value and the unit value estimated coefficients.

4. Conclusions

Overall, NTMs have a trade promoting effect in the fruit sector, increasing traded values, as shown from the positive and significant coefficients of the trade value approach, partly explained from the increasing trade costs evidenced through the price approach (AVE of 3%). Additionally, we can observe a market creating effect of NTMs, considering that trade value coefficients are higher than unit value coefficients, which could be due to demand enhancing effects that overcome compliance costs faced by foreign and domestic producers (Cadot et al., 2018b).

These findings are more evident at the second level of NTMs. Both, technical and non-technical measures positively affect unit values, reflecting increasing cost effects of NTMs (3% AVE for technical NTMs vs 7% AVE for non-technical NTMs). On the other hand, results of the value approach show both, trade enhancing and trade inhibiting effects. Technical measures increase the demand for the fruit sector in general considering that trade value coefficient results are higher than unit value coefficients. The contrary is evidenced for non-technical measures, which reflect the highest costs (AVE of 7%) while registering a negative trade value coefficient. These results are further sustained at the third level of NTM disaggregation, although we notice a decreasing market effect for category C measures, nevertheless coefficients are poorly significant (p<0.1).

Further division of NTMs at the most disaggregated level (2 and 4 digit NTMs) show a high number of negative coefficients for both, trade value and price approach. While in the trade value approach there is a clear and theoretically consistent explanation (i.e. NTMs may inhibit trade following increasing costs), the price depressing effect is more difficult to interpret. Quoting Cadot & Gourdon (2016, p.229): "… negative coefficients, i.e. negative AVEs, would imply that the presence of NTMs reduces trade unit values. The only case where such a price-reducing effect could possibly make sense economically is when a large country imposes a quantitative restriction … depressing its demand…

leading to a lower before-quota unit value because of the large-country effect on the world price. However,.. [such] effect would be felt on the products' unit values for all country pairs, not just when imported by the country imposing the quota. It would then be picked up by the product fixed effect rather than the NTM coefficient".

The challenge becomes identifying those specific NTMs that increase costs above needs, requiring action from policy makers streamlining trade-obstructing NTMs. This requires evaluating NTMs at the most detailed disaggregation level from a specific bilateral and sector perspective. Thus, the next step of our study is to identify differences between different bilateral routes by applying the indirect characteristics approach initially employed by Kee et al. (2009) and more recently by Cadot et al. (2018b). In particular, this would require extending equation (5) and (6) by including two variables that capture specific country characteristics (i.e. import or export shares, factor endowments etc.) for each sector (Cadot et al., 2018b; Kee et al., 2009), and their interactions with RI.

Bibliography

Agnosteva, D.E., Anderson, J.E., Yotov, Y.V., 2014. Intra-national Trade Costs: Measurement and Aggregation (No. 19872), NBER Working Papers. National Bureau of Economic Research, Inc.

Aisbett, E., Pearson, L., 2012. Environmental and Health Protections, or New Protectionism? Determinants of SPS Notifications by WTO Members (SSRN Scholarly Paper No. ID 2196193). Social Science Research Network, Rochester, NY.

Anderson, J.E., Wincoop, E. van, 2003. Gravity with Gravitas: A Solution to the Border Puzzle. Am. Econ. Rev. 93, 170–192.

Armington, P.S., 1969. A Theory of Demand for Products Distinguished by Place of Production. IMF Staff Pap. 16, 159–178.

Beghin, J.C., Disdier, A.-C., Marette, S., 2015. Trade restrictiveness indices in the presence of externalities: An application to non-tariff measures. Can. J. Econ. Can. Déconomique 48, 1513–1536. https://doi.org/10.1111/caje.12157

Beghin, J.C., Xiong, B., 2016. Economic Effects of Standard-Like Nontariff Measures: Analytical and Methodological Dimensions (CARD Working Paper No. 595).

Berthou, A., Emlinger, C., 2011. The Trade Unit Values database. Int. Econ. 128, 97–117. https://doi.org/10.1016/S2110-7017(13)60005-0

Boqvist, S., Dekker, A., Depner, K., Grace, D., Hueston, W., Stärk, K.D.C., Sternberg Lewerin, S., 2014. Contagious animal diseases: The science behind trade policies and standards. Vet. J. 202, 7–10. https://doi.org/10.1016/j.tvjl.2014.06.020

Bureau, J.-C., Jean, S., 2013. The Impact of Regional Trade Agreements on Trade in Agricultural Products (OECD Food, Agriculture and Fisheries Papers No. 65). OECD Publishing, Paris. https://doi.org/10.1787/5k3xznkz60vk-en

Cadot, O., Ferrantino, M.J., Gourdon, J., Reyes, J.-D., 2018a. Reforming Non-Tariff Measures: From Evidence to Policy Advice, Directions in development - Trade. International Bank for Reconstruction and Development - The World Bank, Washington DC.

Cadot, O., Gourdon, J., 2016. Non-tariff measures, preferential trade agreements, and prices: new evidence. Rev. World Econ. 152, 227–249.

Cadot, O., Gourdon, J., Tongeren, F. van, 2018b. Estimating Ad Valorem Equivalents of Non-Tariff Measures: Combining Price-Based and Quantity-Based Approaches (No. 215), OECD Trade Policy Papers. OECD Publishing.

Cameron, A., Trivedi, P., 2010. Microeconometrics Using Stata, Revised Edition. StataCorp LP.

Egger, P.H., Nigai, S., 2015. Structural gravity with dummies only: Constrained ANOVA-type estimation of gravity models. J. Int. Econ. 97, 86–99.

Grübler, J., Ghodsi, M., Stehrer, R., 2016. Assessing the Impact of Non-Tariff Measures on Imports (Paper). The Vienna Institute for International Economic Studies (wiiw).

Ing, L.Y., Cadot, O., 2017. Ad valorem equivalents of non-tariff measures in ASEAN (ERIA Discussion Paper Series No. ERIA-DP-2017-09).

ITC, 2018. Trade Map - Trade statistics for international business development [WWW Document]. URL https://trademap.org (accessed 3.22.18).

Junker, F., Komorowska, J., Tongeren, F. van, 2009. Impact of Animal Disease Outbreaks and Alternative Control Practices on Agricultural Markets and Trade: The case of FMD. OECD Publishing, Paris. https://doi.org/10.1787/222658358641

Kee, H.L., Nicita, A., 2016. Trade Frauds, Trade Elasticities and Non-Tari¤ Measures. The World Bank.

Kee, H.L., Nicita, A., Olarreaga, M., 2009. Estimating Trade Restrictiveness Indices. Econ. J. 119, 172–199.

Kee, H.L., Nicita, A., Olarreaga, M., 2008. Import Demand Elasticities and Trade Distortions. Rev. Econ. Stat. 90, 666–682.

Knight-Jones, T.J.D., Rushton, J., 2013. The economic impacts of foot and mouth disease - what are they, how big are they and where do they occur? Prev. Vet. Med. 112, 161–173. https://doi.org/10.1016/j.prevetmed.2013.07.013

Marc J. Melitz, 2003. The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity. Econometrica 71, 1695–1725.

Mundlak, Y., 1978. On the Pooling of Time Series and Cross Section Data. Econometrica 46, 69–85.

Murina, M., Nicita, A., 2017. Trading with Conditions: The Effect of Sanitary and Phytosanitary Measures on the Agricultural Exports from Low-income Countries. World Econ. 40, 168–181. https://doi.org/10.1111/twec.12368

Niu, Z., Liu, C., Gunessee, S., Milner, C., 2018. Non-tariff and overall protection: evidence across countries and over time. Rev. World Econ. 154, 675–703. https://doi.org/10.1007/s10290-018-0317-5

Orefice, G., 2016. Non-Tariff Measures, Specific Trade Concerns and Tariff Reduction. World Econ. 40, 1807–1835. https://doi.org/10.1111/twec.12447

Perrings, C., 2016. Options for managing the infectious animal and plant disease risks of international trade. Food Secur. 8, 27–35. https://doi.org/10.1007/s12571-015-0523-0

Pullianen, K.A., 1963. World Trade Study: An Econometric Model of the Patterns of the Commodity Flows in International Trade 1948-1960. Econ. Samf. Tidskr. 2, 78–91.

Santos Silva, J., Tenreyro, S., 2011. Further simulation evidence on the performance of the Poisson pseudo-maximum likelihood estimator. Econ. Lett. 112, 220–222.

Santos Silva, J., Tenreyro, S., 2006. The Log of Gravity. Rev. Econ. Stat. 88, 641–658. https://doi.org/10.1162/rest.88.4.641

Swinnen, J., 2017. Some Dynamic Aspects of Food Standards. Am. J. Agric. Econ. 99, 321–338. https://doi.org/10.1093/ajae/aax022

Tinbergen, J., 1962. Shaping the World Economy; Suggestions for an International Economic Policy. Twent. Century Fund N. Y.

UNCTAD, 2017a. Non-Tariff Measures in Mercosur: Deepening Regional Integration and Looking Beyond (No. UNCTAD/DITC/TAB/2016/1). United Nations, Geneva, Switzerland.

UNCTAD, 2017b. UNCTAD TRAINS: The Global Database on Non-Tariff Measures - User Guide (Version 2).

UNCTAD, 2016. Guidlines to Collect Data On Official Non-Tariff Measures.

UNCTAD, 2015. International Classification of Non-Tariff Measures. 2012 Version.

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

WHO, 2015. WHO estimates of the global burden of foodborne diseases: foodborne disease burden epidemiology reference group 2007-2015. World Health Organization, Geneva, Switzerland.

Wooldridge, J.M., 2012. Econometric Analysis of Cross Section and Panel Data. The MIT Press, Cambridge, Massachusetts, London, England.

WTO, 2018a. Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement) [WWW Document]. URL https://www.wto.org (accessed 3.11.18).

WTO, 2018b. Agreement on Technical Barriers to Trade (TBT Agreement) [WWW Document]. URL https://www.wto.org (accessed 3.12.18).

Yotov, Y.V., Piermartini, R., Monteiro, J.-A., Larch, M., 2016. An Advanced Guide to Trade Policy Analysis: The Structural Gravity Model. UNCTAD - WTO. https://doi.org/10.30875/abc0167e-en