



Effects of Non-Tariff Measures on Agricultural Export Performance in COMESA

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Abstract

Both classical and neo-classical economists have long held the convention that free trade is a significant generator of welfare of nations. Despite, the exploitation and discriminatory application of Non-Tariff Measures (NTMs) as some form of Non-Tariff Barriers (NTBs), which are an alternative to tariffs, has substantially expanded and is persistently constraining the path towards absolute free trade. This growing incidence has invoked the recognition of the compelling need to enhance the transparency of existing NTMs and promote research on their impact in developing countries as well as within and outside regional groupings such as COMESA. This study employs the gravity model to study the effects of Sanitary and Phytosanitary (SPS) and Technical Barriers to Trade (TBT) measures on intra-COMESA exports. The findings indicate that NTMs have diverse effects on exports within the COMESA region. On one end, SPS measures are export enhancing whilst TBT measures negatively affect intra-COMESA agricultural export volumes. Given the results of this research, COMESA members are encouraged to reduce the application of TBT measures in order to stimulate exports within the bloc, and to expand the application of SPS measures so as to promote the trade in agricultural products.

Keywords: COMESA; free trade; gravity model; non-technical measures; NTMs; TBT; technical measures; SPS.

Introduction

The convention that free trade is a significant generator of the welfare of nations has long been upheld by both classical and neo-classical economists. Although the trade liberalisation developments in the existing

international trading environment have not ushered in absolute free trade, they have been radical and progressive. In fact, the multiple multilateral trade negotiation rounds under the auspices of the 1947 General Agreement on Tariffs and Trade (GATT) and the World Trade Organization (WTO), coupled with the proliferation of trade agreements of regional, bilateral, plurilateral and unilateral nature has led to significant reductions in tariffs globally (Cadot, Gourdon, and Tongeren 2018). The initial multilateral negotiation rounds dealt primarily with the reduction of tariffs on goods, but other concerns such as Non-Tariff Barriers (NTBs) and anti-dumping were incorporated in later rounds following the inception of the WTO in 1995 (Krugman et al. 2012).

Despite these remarkable milestones and while tariff barriers continue to decline at both multilateral and bilateral level, the surge in the exploitation and discriminatory application of Non-Tariff Measures (NTMs) in the form of Non-Tariff Barriers (NTBs), which are an alternative to tariffs, has ostensibly constrained the path towards absolute free trade. NTMs are defined by the United Nations Conference on Trade and Development (UNCTAD 2022) as trade policy measures, other than tariffs, that can potentially affect the international trade in merchandise, altering traded volumes, or traded values or both. NTBs, on the other hand, refer to restrictions that emanate from prohibitions, conditions, or explicit market necessities that make the importation or exportation of products challenging and/or expensive.

The notion of NTMs is impartial and does not infer a direction of impact (Pritchett 1996). Hence, since the focus of this study is on NTMs, it is important to make a distinction between NTMs and NTBs. NTBs, also commonly known as Non-Tariff Costs (NTCs), are a constituent of NTMs, which hold a discriminatory or trade inhibiting effect (Kinzius et al. 2019). An explanatory example can be the Sanitary and Phytosanitary Measures (SPS) and Technical Barriers to Trade (TBT) under the WTO SPS agreement, which covers NTMs that serve to protect human or animal health from foodborne risks and diseases carried by animals or plants; and animals and plants from pests or diseases (UNCTAD 2019). Nonetheless, if the measures adopted under the SPS agreement surpasses the elementary precept of safeguarding animal and plant life and are, therefore, disproportionately onerous in conforming to the detailed standard, it can be construed as an NTB. In fact, all technical NTMs can emerge to be

trade barriers if they are unjustified and discriminatory in their application.

Irrespective of the surge in the application of NTMs in regulating international trade, their incidence and consequences are still yet to be well-comprehended and are frequently challenging to evaluate (De Melo and Nicita 2018). Unlike tariffs, which are transparent and accessible through the customs authority of each country, NTMs are often concealed. Moreover, there are concerns with the definition and/or classification of NTMs (Bora 2005). Hence, it is in this regard that significant efforts are being led by the World Bank (WB), UNCTAD and the International Trade Centre (ITC) to develop a standard categorisation of NTMs, as an instrument of trade policy to facilitate evaluations and country to country comparisons.

Considering the above, the UNCTAD Multi-Agency Support Team (MAST) classifies NTMs into two broad categories, as shown in Table 1, namely import measures and export measures (UNCTAD 2019).

Import measures (Chapter A to O in Table 1) indicate the requirements of the importing country on its imports, while export measures (Chapter P) refer to requirements imposed solely by the exporting country on its own exports. Import measures are further classified under the following two broad measures: (i) technical measures (Chapter A and B), which refer to the application of some scientific process or tests such as labelling and other measures intended to protect humans, animals and the environment; and (ii) non-technical measures (Chapter C to O), which refer to those measures conventionally utilised as instruments of mercantile policy (e.g. quotas, price control, export restrictions, and other behind-the-border measures such as government procurement).

NTMs can impose heavy burdens on producers and consumers. For producers, NTMs raise production cost through adjustment of production technology or sourcing for better-quality inputs. Moreover, producers also need to bear the procedural costs to conform with the regulations. For consumers, NTMs can result in more expensive consumption goods or narrower product choice. Conversely, NTMs can serve legitimate purposes. Unlike tariffs which are unambiguously trade distorting and welfare reducing, NTMs are designed to correct several market failures, particularly to protect consumers' health and safety and to preserve the environment. From that perspective, NTMs are not necessarily NTBs, and their elimination thereof cannot be an alternative for the elimination of NTBs.

Table 1: UNCTAD NTMs classification
Source: Adapted from UNCTAD (2019)

IMPORT MEASURES			
Technical Measures		Non-Technical Measures	
Measure	Chapter	Measure	Chapter
Sanitary and Phytosanitary Measures	A	Contingent Trade-Protective Measures	D
Technical Barriers to Trade	B	Non-Automatic Licensing, Quotas, Prohibitions and Quantity-Control Measures other than for SPS or TBT Reasons	E
Pre-shipment inspection and other formalities	C	Price-Control Measures, Including Additional Taxes and Charges	F
		Finance Measures	G
		Measures Affecting Competition	H
		Trade-Related Investment Measures	I
		Distribution Restrictions	J
		Restrictions on Post-Sales Services	K
		Subsidies	L
		Government Procurement Restrictions	M
		Intellectual Property	N
		Rules of Origin	O
		Finance Measures	G
EXPORT MEASURES			
Measure			Chapter
Export-Related Measures			P

The complexity of NTMs as a regulatory tool poses considerable challenge to policymakers. Moreover, the expansion of global value chains further magnifies the impact of NTMs on trade and competitiveness.

The key issue, however, is comprehending the mechanism through which these NTMs affect international trade and absolute freer trade in general. In this regard, trade costs are singled out as the key mechanism by which NTMs affect foreign trade. In fact, trade costs provide an important signal on resource allocation. Generally, the ability of firms to gain market access opportunities and to benefit from them, increasingly depends on compliance with NTMs which have rampantly become drivers of contemporary trade policy. It is apparent in Table 1 that NTMs, though prima facie construed as trade barriers, have non-trade objectives such as the protection of public health or the environment. Even though, these non-trade objectives represent a major challenge for exporters, importers and policymakers.

The Common Market for Eastern and Southern Africa, in particular, is not immune to the challenges posed by

the application of NTMs. In fact, the large incidence of Technical Barriers to Trade (TBTs) and Sanitary and Phytosanitary (SPS) measures are of concern to many developing countries (Fugazza 2013) and more especially to the COMESA region, which have witnessed a substantial expansion in their application. The sustenance of this trend will eventually undermine intra-COMESA agricultural exports as well as the bloc's trade in general, and this has compelled COMESA member states to collectively direct their efforts towards the elimination of potentially trade impeding NTMs.

Despite this growing incidence of NTMs in international trade and the ensuing protracted political discussions surrounding their (possible) misuse as protectionist implements that functions to erode the economic gains of previous reductions in tariff rates, research on NTMs, mostly for developing countries including COMESA countries, is limited due to data paucity. This has invoked the recognition of the compelling need to enhance the transparency of existing NTMs and promote research on their impact in developing countries as well as within

and outside regional groupings such as COMESA. In addition, the use of NTMs is escalating within the COMESA community.

Given the steadily rising number of various types of NTMs and their application in international trading activities at both bilateral and regional level, the current research primarily aims at enhancing the understanding of NTMs and examine their resulting impact on agricultural exports within the COMESA regional bloc. In achieving the primary objective, the following secondary objectives relating to technical measures policy inferences are also met: (i) examining the effect of SPS on intra-COMESA agricultural export volumes; and (ii) examining the effect of TBT on agricultural exports in the COMESA region.

The rest of the research is outlined as follows: Section 2 presents information on non-tariff measures and agricultural exports in the COMESA region; a review of theoretical and empirical literature relating to the relationship between NTMs and exports is provided in Section 3; the research methodology applied in this study to enhance the understanding of NTMs and examine their resulting impact on agricultural exports within the COMESA regional bloc is provided in Section 4; the empirical results obtained in this research are presented and analysed in Section 5; and lastly the conclusions reached and the proposals for both the policymakers of the respective COMESA member states and future research, along with the limitations encountered in this research, are provided in Section 6.

Information on non-tariff measures and agricultural exports in the COMESA region

Non-tariff measures (as construed to be a component of NTBs) has been increasing in COMESA following the adoption of free trade in the region (Nsubuga and Musengele 2014). In fact, NTBs are now used as a trade protectionist measure to substitute the ever-decreasing tariffs. Thus, to tame the unjustifiable use of NTBs in regulating trade, COMESA member states agreed that countries should establish entry points that will necessitate invoking Article 50 of the COMESA treaty which deals specifically with NTBs. Besides, the entry points shall: inform the COMESA Secretariat of reported NTBs through the application of a common form to be used by exporters and importers; provide clear guidelines to the business community on the areas identified as NTBs; sensitize stakeholders on the monitoring and evaluation and reporting tool;

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facilitate access to information, including the electronic transmission of information to the business; and track and monitor NTBs affecting intra-COMESA trade.

All these efforts are to provide checks and balances on the use of NTBs to influence international trade. The efforts of the COMESA region in dealing with NTBs were buttressed by the formation of a tripartite forum with the Eastern African Community (EAC) and the Southern Africa Development Community (SADC) with a specific purpose of implementing a NTB reporting and monitoring mechanism, which incorporates concrete timelines for the removal of NTBs.

Since the implementation of these initiatives, the number of NTBs that have been reported has been resolved. Specifically, the NTB resolution rate stood at 95% in 2020. Nonetheless, there are some existing NTBs which remains unsolved dating back to the 2000s. In terms of the composition of NTBs, it is reported that 82% of them are operational and are easy to monitor¹. The remaining 18% constitute the behind the border barriers which are deemed to be complex. Interestingly, the advent of the Covid-19 pandemic saw an escalation in the use of NTBs in regulating trade².

An analysis of the aggregate intra-COMESA agricultural exports reveals an increase from US\$2.5 billion in 2015 to US\$2.8 billion in 2018 before declining to US\$2.7 billion in 2019. The sectoral dynamics in Figure 1 shows that the most traded HS2 sectors over the five-year period from 2015 to 2019 are: 17 – sugars and

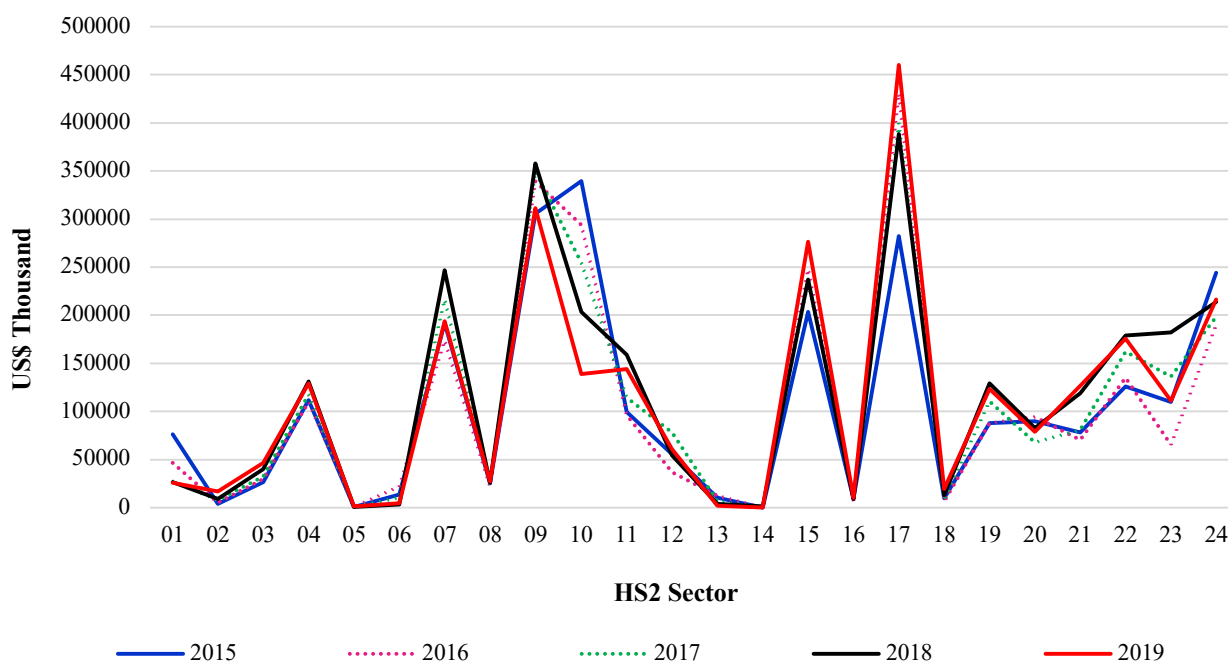


Figure 1: Intra-COMESA agricultural exports from 2015 to 2019
Source: Authors' own illustration

sugar confectionery (averaging US\$392.2 million); 09 – coffee, tea, maté and spices (US\$332.9 million); 10 – cereals (US\$246.0 million); 15 – animal or vegetable fats and oils and their cleavage products (US\$240.1 million); 24 – tobacco and manufactured tobacco substitutes (US\$212.5 million); and 07 – edible vegetables and certain roots and tubers (US\$204.4 million).

Sectors such as 14 – vegetable plaiting materials and vegetable products not elsewhere specified or included, and 04 – products of animal origin not elsewhere specified or included are minimally traded within COMESA and have an average export value under US\$1 million over the five-year period.

Literature Review

There is vast literature dedicated to the study of the relationship between NTMs and export expansion. However, the extant literature is abstruse in ascertaining the ultimate effects of NTMs in international trading activities. This ambiguity stems from the existence of a weak theoretical framework linking NTMs and export expansion. On the empirical side, the variations in the effects of NTMs on export expansion emanates from differences in methodologies, nature of NTMs, and the level of product aggregation. This section proceeds by discussing the theoretical literature linking NTMs to export expansion, followed by a review of empirical literature on the same.

1. Theoretical Literature

The Melitz (2003) heterogeneous firms' model is used to relate NTMs to export growth. In the Melitz model, only the most productive firms export. Thus, in the case of increase in export costs, this model predicts a reduction in the number of exporters and, hence, the number of products exported. On the contrary, a decrease in NTMs, which is akin to a reduction in trade costs, leads to an increase in the number of exporters and the number of products being exported. At the same time, existing exporters will increase their export volumes. In other words, trade liberalisation forces least productive firms to exit the export market and reallocates market share towards productive exporting firms. The theoretical model is formally presented as follows:

Considering a three regions model consisting of Home (H), Foreign (F) and Rest of the World (W) as in Chaney (2008) and assuming that there is one sector, producing a single homogeneous good and a second sector producing a continuum of goods, the utility is given by the constant elasticity of substitution utility function in Equation 1.

$$U = q_0^\mu \left(\int_{\Omega} q(w) \frac{\sigma-1}{\sigma} dw \right)^{(1-\mu) \frac{\sigma}{\sigma-1}} \quad (1)$$

Where q_0 is the quantity of the homogeneous good consumed, is the consumption of each differentiated product variety $w \in \Omega$, μ and $(1 - \mu)$ are the respective consumption weights of the two sectors, and σ is the elasticity of substitution among varieties within the differentiated goods sector. Production in the homogeneous sector is subject to constant returns to scale, with one unit of labour input in region $i \in \{F; W\}$ producing \bar{Y} units of output, while one unit of labour in region H produces \underline{Y} units of output. Assuming that H is a low productivity region, while F and W are high productivity regions, this implies that $\bar{Y} > \underline{Y}$. The price of the homogeneous good is normalized to unity and trade is costless, which means that the wage in H is \underline{Y} and the wage in F and W it is \bar{Y} .

In the differentiated goods sector, the cost c of producing q units in region i and selling them in region j is:

$$c_{ij}(q) = \frac{Y_i}{\varphi} + f_{ij} \tag{2}$$

Where f_{ij} is the fixed cost of accessing the market in region j for firms in region i . The fixed costs are conceptualised here as the design and retooling costs a firm in region i must pay to satisfy product standards in j thereby gaining access to its market. Given that the focus of this research is on the intensive margin, the assumption is that there are no variable costs. Firms are heterogeneous in productivity and size (φ), which is drawn from a pareto distribution with support $[1, +\infty]$, shape parameter $\gamma > \sigma - 1$, and a cumulative density function $g(\varphi) = 1 - \varphi^{-\gamma}$

Assuming also that labour is the only factor of production, and each region is endowed with L_i units, the model does not assume free entry and it assumes that the mass of potential entrants in each region is fixed and proportional to $Y_i L_i$. Total expenditure in each region E_i is the sum of labour income $Y_i L_i$ and redistributed profits $Y_i L_i \mathbf{p}$, where \mathbf{p} is the dividend per share of a global mutual fund owned by labour (Y_i shares per worker). Under standard assumptions, firms' export from region i to region j are equal to:

$$x_{ij}(\varphi) = (1 - \mu) E_j \left(\frac{P_{ij}(\varphi)}{P_j} \right)^{1-\sigma} \tag{3}$$

Where $P_{ij}(\varphi) = \left(\frac{\sigma}{\sigma - 1} \right) \left(\frac{Y_i \tau_{ij}}{\varphi} \right)$ is the firm's optimal price and P_j is the constant elasticity of substitution price index of region j . Net firm profits from producing in region i and selling in region j are:

$$\pi_{ij}(\varphi) = [P_{ij}(\varphi) - c_{ij}(\varphi)] q_{ij}(\varphi) - f_{ij} \tag{4}$$

Chaney (2008) provides the full solution of this model and its equilibrium properties. The most important result for the purposes of this study is that firms self-select into markets based on productivity. In equilibrium, zero profit conditions of the type $\pi_{ij}(\bar{\varphi}_{ij}) = 0$ implicitly define a productivity cut-off condition. The equilibrium cut-off $\bar{\varphi}_{ij}$ represents the minimum level of firm productivity consistent with profitably exporting from i to j . Firms with $\varphi < \bar{\varphi}_{ij}$ become exporters, while those with $\varphi > \bar{\varphi}_{ij}$ do not. An increase in fixed costs of compliance means that relatively lower productivity exporters are pushed out of the market while high productivity firms can continue exporting thereby affecting the extensive margin.

NTMs simultaneously affect trade flows and market structure. According to Ing et al. (2016), the costs imposed by NTMs on businesses can be decomposed into three broad classes, namely enforcement costs, sourcing costs, and process-adaptation costs. Enforcement costs relate to the effort that private companies must expend to show compliance with NTMs. This may involve staff devoted to paperwork, inspection by officials from enforcement agents or efforts to encourage certification of foreign suppliers under national standards. Because these costs are largely fixed, they weigh heavily on small firms than larger ones. They might also weigh more heavily on foreign firms less familiar with local administrative process, although foreign firms tend to purchase legal/consulting assistance locally. Accordingly, through enforcement costs, NTMs may discriminately affect local and foreign firms (Ing et al. 2016).

Sourcing costs are costs generated by switching from low grade intermediate sources to high grade ones in order to meet NTM standards. A given standard can have different effects depending on products and users. Sourcing costs are essentially variable costs as they affect every unit produced. If the standard is not discriminatory, they affect domestic firms and importers in the same manner. However, intermediate producers from different countries may have unequal abilities to comply with NTMs due to variations in the effectiveness of national regulations and the quality of infrastructure.

Consequently, an NTM may affect sourcing patterns with complex effects. For instance, Mauritian regulation on payments used in paints forced domestic producers to switch from their traditional supply sources to more expensive German made pigments. In general, Disdier et al. (2015) show that harmonization clauses in North-South agreement which typically mean stiffening of standards for the southern partners tend to reduce South-South trade. This ‘shutting door’ effect on imports from Southern third-party suppliers may also be so large as to raise profitability of home intermediate producers as was the case in Morocco after harmonization with European Union (EU) standards (Augier et al. 2016).

Process adaptation costs relate to changes in capital equipment needed to meet NTM standards. For instance, dairy standards force farmers to buy expensive equipment to ensure that milk is not contaminated by bacteria before being pumped into tank trucks. Investment in compliant capital equipment also requires the upgrading of operator skills. These costs are similar to the costs typically incurred by firms when they essentially involve the hiring of white-collar workers and engineers and most importantly higher skill levels in every occupation (Verhoogen 2008; Bustor 2011). Process adaptation costs are essentially fixed costs and, therefore, affect small firms more than larger ones and in the process affect market structure.

The market structure effect can interact in subtle ways with traditional rent-shifting effects. In fact, an increase in fixed costs induces the exit of firms. This extensive margin effect alters the market’s structure. However, even if the exit movement is large, the effect on trade flows is small because the exiting firms represent a small fraction of the aggregate flow. By contrast, an increase in variable costs affects all firms. Thus, the market structure does not change as all firms reduce their flows proportionately. However, aggregate flows change markedly. This argument has important implications for the empirical analysis of NTMs and its policy implications.

In terms of the market structure effect and considering a world with symmetric firms and transport costs, firms sell systematically smaller volumes on their export markets than on their home markets because of transport costs. Supposing now that each country sets a particular (different) standard, then firms spread country-specific process-adaptation costs on smaller volumes on their export markets than on their home markets. It is as if home firms were always larger than foreign ones,

in spite of the initial symmetry. In that case, NTMs mechanically generate a home bias even if they are not *de jure* discriminatory. The picture becomes more complex with heterogeneous firms as process-adaptation costs induce the exit of the smallest foreign and domestic firms, allowing larger foreign and domestic firms to expand market shares.

Accordingly, foreign firms may find themselves better-off, a conjecture that is documented empirically by Asprilla et al. (2016). If quality upgrading takes place on a sufficiently large scale in the economy (say, because a wave of new NTMs is adopted following a trade agreement) the complementarity between recent-vintage capital and skills can raise the skill premium in the whole economy, resulting in a widening of wage inequalities between educated and non-educated workers. This effect, documented in the case of an expansion of export opportunities by Bustos (2011), can induce a sorting of firms, with the largest upgrading and expanding, while the smallest are forced to exit, squeezed by the NTM’s requirements and the rising cost of skilled manpower. While the scale of these effects varies across contexts and is not widely documented yet, a good rule of thumb is that variable costs matter for aggregate trade flows, while fixed costs matter for market structure.

2. Empirical Literature

There is an existence of a number of studies in extant literature that have interrogated the effects of NTMs on export market participation, export values and export growth at both firm-level (Chen, Otsuki and Wilson 2006; Otsuki 2011; Fontagne et al. 2015; El-Enbavy, Hendy and Zaki 2016; Timini and Conesa 2019) and country-level (Disdier, Fontagné and Mimouni 2008; Devadason and Chenayah 2014; Shepotylo 2016; Orefice 2017; Bratt 2017). However, these studies have not precisely examined the impact of NTMs on export diversification and the survival of export initiatives.

At the firm-level, Fontagne et al. (2015) examined the effects of SPS on trade using the data of French exporting firms. Using the gravity model, the study findings strengthen the hypothesis of the heterogeneous trade models that large and productive firms can accommodate escalations in fixed costs and maintain their exports, while small exporting firms suffer the brunt of SPS measures. The results further revealed that, in terms of export market participation, invoking an SPS measure negatively affect the behaviour of French exporting firms. Like Fontagne et al. (2015), an estimation by El-Enbavy et al. (2016) of the impact of

SPS measures notified to the WTO on Egyptian firms' exports of agricultural products established a statistically significant effect on the export value of Egyptian firms. However, El-Enbaby et al. (2016) find that SPS measures reduce the probability of a firm exporting to a market that has instituted the SPS measure.

Another firm-level study by Chen et al. (2006) examined the effects of standards and technical regulation on trade using a database of 619 firms from 17 developing countries. As with Fontagne et al. (2015) and El-Enbaby et al. (2016), the study of Chen et al. (2006) asserts that developed countries' standards and technical regulations deter developing firms' participation in export markets. Further, the standards and technical regulations affect the export market diversification of developing firms. Explicitly, the study establishes that standards and technical regulations affect the propensity of exporting to at least three markets by 7%.

Through the utilisation of a gravity model at country-level, Disdier et al. (2008) found that SPS and TBT measures have significant trade impeding impact on the exports of developing countries, but no effect on the exports of the Organization for Economic Cooperation and Development (OECD) countries. Similarly, by utilising a gravity model, Devadason and Chenayah, (2014) argues that China's TBTs are trade reducing for the Association of Southeast Asian Nations (ASEAN) countries. In fact, China's TBT measures have negative

effects from the ASEAN perspective. However, at the sectoral level, the effects are dichotomic even in TBT intensive products.

Another country-level study by Bratt (2017) found that NTMs have varying trade effects across import-export pairs. The results indicate that many NTMs can facilitate trade for some import-export pairs and can be trade impeding for others. Hence, when conditioned on trading partners and products, Bratt (2017) establishes that NTMs can have different and even opposite effects across countries.

Research Methodology

1. Data

In this study, cross-sectional trade data for 10 COMESA member states in 2019 is explored. The period was selected based on the availability of the COMESA countries data for TBT and SPS measures. The importer country coverage (see Table A.1 in appendix) was also based on the availability of the data for technical NTMs.

The variables employed in this research are itemised and described in Table 2. Annual data on intra-COMESA agricultural trade at the Standard Industrial Classification (SIC) level were retrieved from the World Integrated Trade Solution database of the World Bank (WB, 2022a) and the research utilised the import data in 11 COMESA importing countries and their 20 COMESA partners.

Table 2: Description of variables

Variables	Symbol	Measurement	Sources
Imports	Imports	Annual intra-COMESA import value in US\$000.	WB (2020a)
Exporter's GDP	GDP_o	Annual exporter GDP at constant 2010 US\$.	WB (2020b)
Importer's GDP	GDP_d	Annual importer GDP at constant 2010 US\$.	WB (2020b)
Exporters population	POP_o	Number of people in the exporting country	CEPII (2020)
Importers population	POP_d	Number of people in the importing country	CEPII (2020)
Distance	Dist	Distance between the importer and the exporter.	CEPII (2020)
Contiguity	Contig	Dummy: = 1, if the importer is landlocked; = 0, if otherwise.	CEPII (2020)
Language	Lang	Dummy: = 1, if the exporter shares a common language with the importer; = 0, if otherwise.	CEPII (2020)
SPS	SPS	Number of active SPS measures, notified to the WTO, applied in the agricultural sector.	WTO (2022)
TBT	TBT	Number of active TBT measures, notified to the WTO, applied in the agricultural sector.	WTO (2022)

CEPII, *Centre d'Études Prospectives et d'Informations Internationales*; COMESA, Common Market for Eastern and Southern Africa; GDP, Gross Domestic Product; SPS, Sanitary and Phytosanitary; TBT, Technical Barriers to Trade; WB, World Bank; WDI, World Development Indicators. Source: Authors' compilation.

The data for TBT and SPS measures was drawn from the Integrated Trade Intelligence Portal (I-TIP) database of the WTO (2022). The data for the Gross Domestic Product (GDP) of COMESA countries was retrieved from the World Development Indicators (WDI) database of the WB (2022b), while the data for the other traditional gravity model variables was accessed from the *Centre d'Études Prospectives et d'Informations Internationales* (CEPII 2020).

2. Model Specification

To examine the effects of technical NTMs on intra-COMESA agricultural export volumes, this research employs the gravity model in a cross-sectional framework. Therefore, to test the hypotheses that SPS and TBTs affect intra-COMESA agricultural export volumes depending on the import-exporter bias, the estimated standard gravity model is specified as in Bratt (2014) and Fugazza (2013) as follows:

$$M_{ij} = \delta_0 + \delta_1 LGDP_i + \delta_2 LGDP_j + \delta_3 LPOP_i + \delta_4 POP_j + \delta_5 LDist + \delta_6 Contig + \delta_7 Lang + \delta_8 SPS_i + \delta_9 TBT_i + fe + \varepsilon_{ij} \quad (5)$$

Where M_{ij} the import volume, i is the importing country, j is the exporting country, t is the time period, and fe are different sets of fixed effects controlled for, which include exporter fixed effects, sector fixed effects, and time fixed effects.

The standard gravity model specified in Equation 5 was estimated using the Poisson Pseudo-Maximum Likelihood (PPML) method suggested by Silva and Tenreyro (2006). The PPML approach permits the utilisation of information from zero trade flows and to correct for potential bias in the estimation. Moreover, to avoid biased estimation results, diagnostic tests were conducted initially to determine and correct the presence of multicollinearity, heteroscedasticity, and serial correlation amongst the variables before any statistical inferences were drawn from the estimated results.

Presentation and Discussions of Results

The presentation of the results of this study begins with the descriptive statistics of the variables included in this research. It is clear in Table 3 that there are 208 observations, and the standard deviations of non-dichotomous variables are relatively high pointing to widely spread data suggesting that the utilisation of an estimation technique that minimises standard errors would be appropriate.

Table 3: Descriptive statistics

Variable	Observations	Mean	Standard Deviation	Min	Max
Imports	208	2510.22	9369.23	0.00	92469.60
GDP_o	208	27806.32	53372.52	709.11	249751.08
GDP_d	208	16938.57	31651.77	421.94	249751.08
POP_o	208	25757105.00	27014819.00	1186873.00	98423595.00
POP_d	208	18967747.00	23474864.00	81131.00	109200000.00
Dist	208	3000.86	1729.57	162.18	7990.13
Contig	208	0.09	0.28	0.00	1.00
Lang	208	0.57	0.50	0.00	1.00
SPS	208	14.98	17.91	1.00	52.00
TBT	208	36.63	53.44	0.00	148.00

The correlation matrix in Table A.2 shows that there is a relatively high correlation among the GDP_o and POP_o (0.67), GDP_d and POP_d (0.67), SPS and TBT (0.85). This infers the presence of multicollinearity. Hence, the affected variables were isolated and their impacts on intra-COMESA agricultural export volumes were estimated in solitude.

The PPML results of the baseline gravity model estimation are shown in Table 4. The canonical Ramsey Reset Test was used to examine the qualitative nature of the regression model. The results confirmed that the model was a parsimonious model in the estimation of the effects of NTMs on agricultural exports in the COMESA region. To examine the impact of technical NTMs (i.e. TBT and SPS) on intra-COMESA agricultural export volumes, this research took natural logarithms of SPS and TBT measures, which are the variables of interest. The coefficients of both SPS and TBT are found to be significant at 1% and 5% level, correspondingly. However, only the coefficient of TBT had the expected negative sign, while that of SPS is positive contrary to the theoretically anticipated trade impeding effects of NTMs. As such, a percentage increase in active applied SPS measures results in a 0.10% increase in intra-COMESA agricultural export volumes, whereas a percentage increase in active applied TBT measures reduces intra-COMESA agricultural export volumes by 0.02%.

Table 4: PPML regression results of the Impact of technical NTMs on intra-COMESA agricultural exports

Imports	LGDP_o	LGDP_d	LPOP_o	LPOP_d	Ldist	Contig	Lang	SPS	TBT
Coefficient	0.694**	0.009	-1.182***	0.047	-0.839**	0.979	-0.289	0.102***	-0.023**
Standard error	0.310	0.274	0.290	0.332	0.369	0.633	0.390	0.038	0.010
T-value	2.240	0.030	-4.080	0.140	-2.270	1.550	-0.740	2.700	-2.380
Pseudo R-squared	0.332								
Ramsey Reset (p-value)	0.124								
Observations	208								

Significant at the: 10% level (*), 5% level (**), 1% level (***)

In terms of the traditional gravity model variables, the coefficient of GDP for the exporting country has the expected positive sign which is statistically significant. A one percent increase in the GDP of the exporting country leads to a 0.69 percent increase in intra-COMESA agricultural exports. The population of the exporting country has a corresponding negative coefficient that is highly significant. An increase in the population of the exporting country leads to an increase in the demand of the domestically produced goods which is matched by a decrease in exports. A one percent increase in population in the exporting country results in a 1.18% decrease in the volume of intra-COMESA agricultural exports.

As theoretically expected, the coefficient of the distance is negative. An increase in the distance (a proxy for trade cost) causes a decrease in the volume of bilateral imports. In this research, it has been found that a one percent increase in distance leads to a 0.84% reduction in the volume of imports. Other variables (i.e. GDP of the importer, population of the importer, contiguity and language) were all found to be statistically insignificant and, therefore, do not have an impact on intra-COMESA agricultural exports.

The gravity model results provide evidence on the effects of SPS and TBT measures on intra-COMESA agricultural exports. They show that SPS measures promotes intra-COMESA agricultural exports whereas TBT measures reduce the volume of intra-COMESA agricultural exports. With respect to TBT measures, TBT measures are construed as barriers to trade in this study, a finding which is supported by empirical evidence.

Conclusion and Policy Implications

Both classical and neo-classical economists have long held the convention that free trade is a significant generator of welfare of nations. Despite this widely sustained belief and the progress attributed to multilateral negotiations, under the auspices of the 1947 GATT and the WTO, that has seen substantial universal reductions in tariffs, the exploitation and discriminatory application of NTMs as some form of NTBs, which are an alternative to tariffs, has substantially expanded and is persistently constraining the path towards absolute free trade. This growing incidence of NTMs in international trade along with the ensuing protracted political discussions surrounding their (potential) misuse as protectionist implements that functions to erode the economic gains

of previous reductions in tariff rates has invoked the recognition of the compelling need to enhance the transparency of existing NTMs and promote research on their impact in developing countries as well as within and outside regional groupings such as the COMESA.

In the framework of the above, this research examined the impact of technical NTMs (i.e. SPS and TBT) on intra-COMESA agricultural exports. The gravity model results from the PPML estimation method shows that TBT measures affect intra-COMESA agricultural exports, while SPS measures promotes intra-COMESA agricultural exports. The results support both views of the effect of NTMs on trade. The negative effect of TBTs on intra-COMESA agricultural exports supports the view of NTMs as a barrier to trade, while the positive effect of SPS on intra-COMESA agricultural exports support the trade enhancing effect of NTMs.

In terms of other traditional gravity model variables, the GDP and the population of the exporting country were found to be significant in explaining intra-COMESA agricultural exports. An increase in the exporting country GDP by a percentage point leads to a 0.69% expansion in intra-COMESA agricultural exports, while a 1% increase in the population of the exporting country results in a 1.18% decrease in the volume of intra-COMESA agricultural exports. Distance is also as theoretically expected and its increase by a percentage point significantly leads to a 0.84% reduction in the volume of intra-COMESA agricultural exports. Other variables such as the GDP of the importer, population of the importer, contiguity and language were all found to be statistically insignificant and, therefore, do not have an impact on intra-COMESA agricultural exports.

Informed by the results of this research, the following policy implications can be made: first, COMESA countries need to reduce the application of TBT measures to stimulate trade within the regional trading bloc; and second, COMESA countries should also promote the application of SPS measures to promote the trade of agricultural products. Given the data constraints encountered in this research, future research activities can be directed towards an analysis which covers all the COMESA member states conditional upon the imminent availability of technical NTMs data. Within this framework, COMESA need to develop and maintain its own NTMs database as regional grouping. Future analysis of the impact of NTMs within COMESA can also be spread to other non-technical NTMs not covered in the current research.

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Notes

- 1 <https://www.comesa.int/82-of-ntbs-in-comesa-are-operational-and-easy-to-monitor-but-behind-the-border-type-of-ntbs-are-more-complex/>
- 2 <https://www.comesa.int/new-regional-forum-established-to-deal-with-escalation-of-ntbs/>

Appendix: COMESA Countries Covered in The Study and Supplementary Tables

Table A.1: COMESA countries covered in the study

Importers
Burundi; Democratic Republic of Congo; Egypt; Eswatini; Kenya; Madagascar; Malawi; Mauritius; Rwanda; Tunisia; and Uganda.
Exporters
Burundi; Comoros; Democratic Republic of Congo; Djibouti; Egypt; Eritrea; Eswatini; Ethiopia; Kenya; Libya; Madagascar; Malawi; Mauritius; Rwanda; Seychelles; Somalia; Sudan; Tunisia; Uganda; Zambia; and Zimbabwe.

Notes: The importers were selected based on the availability of the technical NTMs (i.e. TBT and SPS) data.

Table A.2: Correlation matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) imports	1.000									
(2) LGDP_o	0.182	1.000								
(3) LGDP_d	0.045	0.089	1.000							
(4) LPOP_o	0.027	0.668	0.055	1.000						
(5) LPOP_d	0.044	0.003	0.677	-0.008	1.000					
(6) Ldist	-0.101	0.139	0.124	-0.102	-0.097	1.000				
(7) Lcontig	0.154	0.055	0.085	0.151	0.178	-0.528	1.000			
(8) Lang	0.041	-0.130	-0.272	-0.222	-0.204	-0.215	0.165	1.000		
(9) SPS	0.123	0.476	-0.025	0.579	-0.021	-0.151	0.078	-0.086	1.000	
(10) TBT	0.044	0.173	-0.023	0.360	-0.017	-0.282	0.142	0.040	0.854	1.000