WTO Agreements on SPS and TBT: Implications for Imports of South Asia

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ABSTRACT

Technical Barriers to Trade (TBT) and Sanitary and Phytosanitary Agreement (SPS) initiated by the World Trade Organisation (WTO) have obstructed the world trade patterns; these agreements are conceptualized as non-tariff barriers (NTBs)that impede trade. WTO has bound its member states not to increase current tariffs, so member countries have the only option left is to deploy NTBs to control imports. In this research, the impact of TBT and SPS has been analyzed on imports of South Asian countries (SACs) from the rest of the world. The PPML estimation method is used to address zero-trade flows and overdispersion of data of South Asia based on the gravity model. The results depict that GDP of SACs and partners, exchange rate, tariff, distance, and contiguity are vital determinants; while TBT and SPS initiated are import restrictive; hence TBT, SPS, and tariff can be levied to administer the region's trade deficit. Intra-regional trade is also affected by NTBs and tariffs. Similar to developed countries, SACs need to initiate NTBs frequently to fetch favourable trade flows.

Keywords: Gravity model, South Asia, TBT, SPS, PPML, Import, WTO

INTRODUCTION

World Trade Organisation (WTO) since 1995 passed a number of multilateral agreements. Agreements on non-tariff measures (NTMs) are considered most effective in reforming the quality and technical standards under the WTO regime. The essence of NTMs was that economies should be distortion-free, which is a uniform notion in neoclassical economics. NTMs transformed this notion by targeting for improving market access and competition in trade and lessening domestic support. This in turn is to be attained through lesser tariffication of quantitative restrictions, time-bound reduction in prevailing tariff rates, technical standards, and quality enforcement. An indispensable presumption in the neoclassical notion is that there is comprehensive information about the markets and elimination of tariffs and subsidies that will lead to an increase in non-tariff measures. South Asia is a unique region with the least integration, having a potential of huge growth, increasing industrialization, and transit region between the East and West. This research analyzed the impact of NTMs on import of South Asian countries (SACs) involved in sanitary and phytosanitary (SPS) and technical barriers to trade (TBT). The selected countries Afghanistan, Bangladesh, India, Nepal, Pakistan, and Sri Lanka have either initiated uniformed SPSs and TBTs or faced them. These countries' WTO members and their joining dates are cited in Table 1.

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Table 1: WTO Joining Dates by South Asian Countries

Country	Types	Joining Date
Afghanistan	Accession	29 July 2016
Bangladesh	Succession	1 January 1995
India	Succession	1 January 1995
Nepal	Accession	24 April 2004
Pakistan	Succession	1 January 1995
Sri Lanka	Succession	1 January 1995

Source: (WTO, 2020)

The South Asian markets are characterized by incomplete information leading to preventive and distorting trade. Similar aspects are core in the international trade of multi-products. The products are not homogenous in plurilateral trade; different nations and firms follow different quality standards and safety regulations. Importers cannot ascertain the standards and quality of trade merchandise merely by inspecting the products at ports or pre-shipment inspections. Two certain WTO agreements address such concerns: the Agreement on Application of Sanitary and Phyto-sanitary Measures (SPS) and the agreement on Technical Barriers to Trade (TBT).

This research paper is arranged in the following pattern: section 1 presents an introduction of both NTMs, section 2 provides SPS and TBT related literature review to ascertain the significance of this paper. Section 3 provides methodology and data related issues, section 4 presents results and discussion on the econometrics findings. The last section concludes and suggests policy implications for regional integration in presence of NTMs.

The Motivation for Agreements on TBT and SPS

Producers and consumers have opportunities to sell and buy products of various qualities, with the given prices. Henson and Traill (1993) and Viscusi, Vernon, and Harrington (1995) professed that the government does not intervene in such capitalist settings. Nelson (1970, 1974), Darby and Karni (1973) explained it by differentiating commodities into three groups: search goods, experience goods, and credence goods. For search goods, the consumer can determine a commodity quality before they purchase it by checking it, e.g. pre-shipment physical inspection of tea by home country buyers is enough to determine the quality before the tea is exported. The neoclassical analysis may hold the commodity in similar cases. Second, experience good, the buyer cannot determine the goods' quality until he purchases and utilises it. If a commodity is purchased repeatedly, where selection choice is based on past experience, the market may take care of itself. If consumer purchases products, again and again, a firm that provides high-quality products may charge higher prices. In a case, market imperfection may be addressed by repeat purchase and firm reputation e.g. meat. The third classification is comprised of credence goods in which consumers' information is imperfect pre and post-purchase. Chronic and adulteration effects of low-level exposure to the residues of pesticides and toxins may be unhealthy and risky to human health in long term or with repeated use of good. Some other examples are child labor, gender discrimination, skin diseases, pulmonic allergies, which all are covered by SPS under the WTO

regime. In such cases, certain external regulatory mechanisms are required in the edible or other traded goods, where quality and standards are of great concern. WTO has engaged all member countries to adopt TBT and SPS, which aim to harmonize quality and technical standards and prevent discrimination in trade.

TBT and SPS Agreements and Implications

TBT and SPS have not attained response and attention from the industry, a kind of confusion in understanding the differences between TBT and SPS in the post-WTO regime. The distinction between them is technical and complex, especially at the commodity level. The agreement on SPS defines as food and agriculture sectors, whereas TBT measures include all trading commodities including food items. SPS aims to protect human, animals, and plants life and health against pests and diseases arising out of import of the food and agriculture items; whereas TBT measures deal with trading goods including shape, size, packaging material, and weight requirements including technical safety and labeling issues.

Article 3.1 and Article 3.2 of the SPS agreement of WTO state that "Members shall base their sanitary and phytosanitary measures on international standards, guidelines, and recommendations. The sanitary and phytosanitary measures that confirm to the international standards, guidelines, and recommendations will be deemed necessary to protect human, animal or plant life or health." International technical standards, guidelines, and recommendations are forwarded by the International Standards Organization (ISO), and Codex Alimentarius Commission of WHO and FAO. Codex Alimentarius guidelines has no backing of any international laws, however, WTO endorses its quality standards through agreement on TBT and SPS had declared these quality standards *de-facto* mandatory.

TBT restricts WTO member countries to expedite technical regulations, conformity assessments, and technical standards and procedures. Conversely, TBT did not allow initiating unnecessary obstacles to import merchandise; rather TBT measures would be justifiable, and technically based on scientific information, research and evidence. WTO's TBT agreement Article 1.3 describes that almost all the trading commodities will be subject to provisions of the TBT agreement (GATT, 1994). The agreement on TBT (1994) Article 2 signifies that WTO members will ensure technical quality standards. The standards will not initiate redundant barriers to multilateral trade. As a result, the standard bylaws and technical issues would not be trade restrictive; rather they would abide by the legitimate explicit targets.

United Nations Conference on Trade and Development (UNCTAD) has classified non-tariff measures into two main sectors: technical and non-technical measures for export and imports (2019). In the case of imports, technical measures comprise of sanitary and phytosanitary measures, the technical barrier to trade, pre-shipment inspection, and other formalities. For imports, non-technical measures comprise of contingent trade protective measures, non-automatic import licensing, prohibitions, quotas, quantity control measures and other restriction not including TBT/SPS, price control measures including additional tax and charge, finance measure, measure affecting competition, trade related investment measures, distribution restrictions, restrictions on post-sale services, subsidy and other forms of support, government procurement restrictions, intellectual property, and rules of origin. On the other side, export is comprised of

export related measures (UNCTAD, 2019). Staiger (2012) classified NTMs into three categories: 1) levied on imports includings import quota, custom procedures, and administration fee, imports licensing, and prohibition; 2) imposed on exports including export quota, export prohibition, subsidy, voluntary export restraint, and export tax; and 3) levied in the domestic markets. These NTMs are comprised of local regulation, and legislation covers technical, labour, internal taxes/charges, commodities, health, environmental standards, and home country subsidies.

Non-tariff barriers and tariff lines are imposed as safeguard to the local import-competing industries. The tariff brings revenue similar to taxes for the public sector, while non-tariff measures are non-monetary tools that defend the home country's economy and traders against global competition. In line with the WTO regulations, NTBs are different public sector tools obstructing the multilateral trade. Apart from the custom tariff lines, NTMs are major policy initiatives that potentially affect the exports and imports, hence bring indistinct quantitative impacts. TBT carries multiple impacts via public sector policies due to its implicit effects.

The TBT and SPS measures limit imports are considered as NTBs, it could be protectionist at the cost of exporters or could be non-protectionists too, whereas in many cases cut off imports. The TBT and SPS consist of quality and technical standards, lab tests, levies, sanctions, which are mostly accelerated by the developed member states. But these NTBs could be reduced by initiating regional, plurilateral, bilateral negotiations, free trade agreements. The TBT and SPS increase the cost of imports, hence challenging to lessen the existence of other conventional tariffs. Thorstensen and Vieira (2016) compared TBT and SPS and interpreted them as "single package." They found that local government bodies are in-charge of levying these NTMs, and conforming to the rules, the bodies should work in cohesion in order to limit the unnecessary barriers to international trade, for domestic producers as well as foreigners. Thus, TBT and SPS coordination bodies and decisions making procedure must have common grounds. Multilateral trade system across the world increases as globalization is integrating the whole world. Although the gravity model introduced by Tinbergen (1962) holds in the world trading system, similarly it is determining the trade pattern. Foreign direct investment (FDI) and foreign trade are some of the other sources for the region for foreign reserves and development. SACs have established strong trade linkages with the EU, America, Australia, South East Asia, and the Gulf states.

SACs' imports are rising in the emergence of non-tariff barriers and tariffs, which are mentioned often as the core factor explaining weak market cohesion. Contrariwise, the regional and preferential foreign trade policies have been accelerated to implement after WTO's ascendancy. This paper analyzes SACs' import pattern in the wake of NTBs and tariffs under the WTO regime.

Trade Pattern of South Asian WTO Member Countries

SACs offer diverse commodities to the rest of the world to trade with. Afghan trade is increasing steadily after unrest; its major exports include leather and furs, rugs, fresh fruits, cashmere, dry fruits, wool, agriculture primary produce, cotton, etc., and imports include machinery, petroleum products, food, capital goods, textiles, etc. Afghanistan has trade agreements with China, Pakistan,

and the USA, etc. Afghanistan imports stood $7.407[5] billion and export $0.885 billion in 2018. Bangladesh imports worth $48.06 billion and exports $31.74 billion in 2015. Bangladesh exports textiles, fish, jute products, rice, etc., and imports refined cotton, wheat, petroleum products, etc. An outlier in South Asia, India imports $507.62 billion of goods, and exports worth $322.49 billion in 2018. Major exports include vehicles, machines, gems precious metals, refined petroleum, engines, pharmaceuticals, organic chemicals, cereals, clothing, iron and steel, and electronics. India imports gems precious metals, oil, machines, electronics, organic chemicals, iron and steel, plastics, animal/vegetable fats and oils, slag and ash, ores, and medical and technical equipment, etc.

Nepal imports worth $10.04 billion and exports stood $0.74 billion in 2017. Nepal's major exports are clothing, carpets, leather goods, grain, jute goods, and wool products. Country imports machinery and equipment, gold, electrical goods, petroleum products, and medicine. Pakistan is the 42nd largest economy in the world. Its imports are rising consistently, hence the country had to impose certain tariffs and NTBs (TBT only) to govern its trade for ever-hiking trade deficit since 1947. Pakistan imports were $60.163 billion and exports $23.631 billion in 2018. Pakistan imports oil, edible oil, textile machinery, iron/steel, chemicals, vehicles, it has initiated 108 TBT and zero SPS cases since WTO inception i.e. 1995 to 2018. Sri Lanka's imports were worth $ 21.32 billion and exports $11.74 billion in 2017. Sri Lanka exports tea, spices, textiles and apparel, electronics, fish, rubber manufactures, and precious stones. Sri Lanka imports textile fabric, petroleum, machinery, and transportation equipment, mineral products, building material, and foodstuffs, etc.

Wide volatility is observed in TBT and SPS cases in SACs. India and Sri Lanka seem keen to initiate NTBs. Afghanistan, Bangladesh, Nepal, and Pakistan initiated the least cases comparatively. TBTs are enforced mostly on machinery, manufactured, and non-agriculture goods, while SPS are for agriculture and food merchandise. TBTs are initiated to protect the manufactured goods' production e.g. machinery, computers, electronic products, etc. Evaluating the effects of the TBT and SPS are challenging, and difficult to quantify on the imports; e.g. calculation of the technical lab examinations, extra licensing requirements, duplicate health certificates, and distribution restriction. SACs may lessen the tariff slabs, but administering the TBT and SPS involve different ministries and a number of stakeholders. Details of TBT and SPS cases are given in Table 2.

Table 2: TBT and SPS initiated during 1995-2018		
South Asia	**TBT**	**SPS**
Afghanistan	2	3
Bangladesh	0	0
India	131	219
Nepal	6	26
Pakistan	108	0
Sri Lanka	52	36

Source: I-TIP (WTO, 2020)

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[5] Data source in the section UNComtrade (2020); until unless specified.

In South Asia, NTBs are abrupt policy tools, and it is grim to outspread focused protection to the strategic industries through NTBs. The region's quality and technical standards requirements are concentrated on the manufactured commodities and machinery. Ministries of trade and commerce collaborate with other standardization institutions for the testing assessments, development, and monitoring of TBT and SPS, the institutions include Pakistan Standards and Quality Control Authority, Ministry of Health, Social Welfare, and Population Planning. The institutions advise the respective governments, chambers of commerce, industries, and stakeholders on quality and technical standards, and policies to implement the TBT and SPS. These institutions are focal points for the national as well as respective foreign institutions such as Codex Alimentarius, Office of International Epizootics (OIE), International Electro Technical Commission, ISO (International Standards Organisations), International Plant Protection Convention (IPPC), etc. which is National Enquiry Points to deal TBT and SPS officially by the countries under the TBT and SPS agreements. Domestic industrialists and manufacturers also assist accreditation and quality institutions with the consultation of the ministries to develop and register the quality and technical standards to ensure the adoption and response to the TBT and SPS regulations. Table 3 shows national enquiry points of SACs that deal with the TBT and SPS regulations and rules, and are focal points to address the TBT and SPS among the member states. The focal points are responsible to maintain the WTO updated concerning any progressions in the respective member states. SACS are required to establish a strong co-operation with other member states and regions to attain benefits from them on quality and technical standards, requisite machinery, and relevant skills.

The ministries of trade, commerce, science, agriculture, health, technology, and economic affairs are core nodal responsible public sector to initiate and implement the TBT and SPS cases, hence officiate cases to report to the WTO.

Table 3: National Enquiry Points for TBT		
Afghanistan	SPS	Ministry of Agriculture, Irrigation, and Livestock
	TBT	Afghan National Standards Authority
Bangladesh	SPS	WTO Cell, Ministry of Commerce
	TBT	Bangladesh WTO-TBT National Enquiry Point
India	SPS	• Food Safety Standards Authority of India • Department of Animal Husbandry and Dairying
	TBT	• International Relations & Technical Information Services Department Bureau of Indian Standards • Enquiry point for Telecom Sector: Telecommunication Engineering Center
Nepal	SPS	Department of Food Technology and Quality Control
	TBT	Nepal Bureau of Standards and Metrology
Pakistan	SPS	• Department of Plant protection • Animal Quarantine Department
	TBT	• Pakistan Standards & Quality Control Authority • Ministry of Health, Social Welfare, and Population Planning

Sri Lanka	SPS	Environmental Health, Occupational Health & Food Safety, Ministry of Health
	TBT	• Sri Lanka Standards Institute • Department of Commerce

Source: TBT & SPS Information Management System (WTO, 2020)

SPS measures are biosecurity and quarantine measures, which are implemented to protect the animal, human, or plants life or health from the risks increasing from introduction, establishment, and the spread of pests, and diseases, and from the risk arising from the toxins, additives, and contaminants in the food and the feed. TBT regulations lay down the mandatory products characteristic, or their related processes, and the production method. For example, requirements on the product's size, compositions, weight, packaging, labeling, and marking. The conformity assessment procedure is any procedures which are used to determine, that relevant requirement of the TBT technical regulation, or standard are fulfilled. For example the procedures for the sampling, inspections, testing, evaluations, verifications, and assurance of the conformity, accreditation, registrations, and approval.

Technical standards such as TBT regulations have emerged indispensable to WTO members. A unique set of standards and regulations based on the possible risk assessments, non-discriminatory among the WTO members with the homogenous circumstances are allowed by the WTO on TBT measures. Hence, it was growing consumer, client, and public concern related to the quality, technical, and scientific challenges that motivate the officials to improve the safety and quality of imported products by the technical barrier to trade (Peterson, Grant, Roberts, & Karovo, 2013). The effects of TBT on import patterns was the core and has been signified, and probed by several research scholarships i.e. Maertens and Swinnen (2009), Minten, Randrianarison, and Swinnen (2009), and Disdier and Tongeren (2010); whereas, there is a dearth of empirical studies on impacts of TBT and SPS on the imports in case of South Asia.

Does the implementation of the technical and quality regulations by SACs affect their imports? In order to address this research question and the above-mentioned objectives, the research paper is designed to analyze the correlation between the import volume and TBT/SPS regulations of SACs against all importing partners and intra-regional trade.

LITERATURE REVIEW

The gravity model was first introduced by Ravenstein (1889), it was deployed to analyze the migration patterns of the UK, and later model was discussed by Tinbergen (1962) to examine bilateral trade. Trade between exporter and importer nominated by the respective country's income, and narrated by GDPs mostly, whereas distance among partner countries was also considered. Anderson and van Wincoop (2003; 2004) added into the literature by incorporating multilateral resistance trade cost and firm heterogeneous behaviour in the gravity model. Melitz (2003) and Bernard, Eaton, Jensen, & Kortm (2003) examined firm heterogeneity and reported that not all the firms in the country import goods, whereas a few countries join the foreign trade across a certain period. The motivation is fixed cost that is market specific, and quite greater in import, against the domestic trade. Subsequently, the import data will have zero entries. Standard gravity literature disregards the prevalence of zero imports, whereas Helpman, Melitz, and Rubinstein

(2008); Melitz and Ottaviano (2008); and Chen and Novy (2011) introduced the gravity model with the theoretical interpretation. Melitz (2003) first presented the trade model with the firms' heterogeneity.

Theoretical Review of Literature

The gravity model remained famous in the emerging trade pattern, first due to its theoretical foundation, and second is due to its analysis of international trade relations. In the presence of these benefits of the gravity equation, still, questions are raised on proper econometric estimation technique, which provides consistent estimation when zero[6] values are frequent in the dependent variables (import variable).

The gravity model has been deployed panel data for years (Rose and Van-Wincoop, 2001; Baltagi, 2008; and Melitz, 2007). Silva and Tenreyro (2006; 2011) have used the Poisson Pseudo Maximum Likelihood (PPML) method to handle zero import values and the logarithmic data conversion. The researchers found that in the presence of a large number of zeros, and logarithmic data transformation of the gravity equation in a model, ordinary least square OLS gives inconsistent and larger bias, which do not eliminate as sample size increased that confirmed that they are not consistent (Silva and Tenreyro, 2011).

Poisson pseudo maximum likelihood (PPML) model is vulnerable because of over-dispersion in the explained variable (Burger, Oort, & Linders, 2009), and larger the number of zero in it, which leads to the consistent but inefficient estimates. Silva and Tenreyro (2011) reported that PPML brings consistent coefficients despite over-dispersion in the explained variable (with a prerequisite of conditional variance not equal to conditional mean); a larger number of zeros does not affect its existence. Head and Mayer (2014) claimed Multinomial Pseudo Maximum Likelihood (MPML) work in the simulation than the PPML. Sören and Bruemmer (2012) studied PPML efficiently in presence of overdispersion and found that PPML well behaved in a bimodal distributed dataset.

Empirical Literature on TBT and SPS

TBT and SPS are used as NTBs widely by all the WTO member states. Trade liberalization has been promoted significantly by lessening the trade barriers which include tariff, TBT, and SPS measures in goods. NTBs are trade restrictive mostly than the applied tariff rates. TBT and SPS have amplified the trade effects on the technologically advanced sectors, while negative effects on the agricultural sectors (WTO, 2012). It is measured empirically by Alaeibakhsh and Ardakani (2012) who quantified the trade impacts of quality and technical regulations on export and reported the negative impacts in the case of European Union members. But Bao and Qiu (2012) reported that TBT's effect depends on countries' economic growth. A developed country's TBT notification decreases the probability to export by the developing countries; however, increases their export volume. They also ascertained that TBT affects the export of developing countries, but impacts the export of developed countries insignificantly; while Essaji (2008) reported similar opinion about the quality and technical regulations initiated by the developing and developed countries. Earlier, Bao and Qiu (2010) found that China has compromised its imports by initiating TBT.

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[6] 37% zero values found in the import values of South Asia for this study

Karki (2002) studied TBT and SPS in the SAARC perspective and found that lack of harmonization in quality standards; inadequate regional capacity, compliance cost, SMEs, inadequate testing, certification and accreditation, and legal consistency are major issues to address compliance issues. The region needs to review and harmonize regulation to enhance regional trade, with compliance of NTBs. Information sharing and legal competency may also bring voluminous trade. Khan and Haider (2003) report that WTO agreements on TBT and SPS are formulated to harmonize quality and standards to facilitate technical assistance for the developing countries. They highlighted the need for regional capacity building approaches for compliance of agreements on TBT and SPS, and bilateral requirements pertaining to quality and technical regulations, and voluntary standards, in order to enhance exports of SACs.

Research, infrastructural development, and human capital can be involved to develop its standards. It can bring positive effects on the export and import since standards ensure customers' products safety (Siyakiya, 2017). Complying with foreign standards is costly, while it can increase the market share of the exporters. TBT developed by the importing countries negatively affects exports. Most TBT initiations are related to human and plant protection, whereas it is mandatory for the country to follow rest of the countries' standards. Otsuki, Maskus, and Wilson (1999), and Wilson and Otsuki (2004) underlined the need for implementing the TBT in the form of standards to develop the markets, and assisting transactions, as they can enhance the requirements for the goods. In spite of this, the developing states are affected the worse because of compliance hitches. Devadason and Govindaraju (2016), Silva-Glasgow and Hosein (2018), Keiichiro, Otsuki, and Wilson, (2015), and Sanjuan, Rau, Oudendag, and Himics (2017) found negative relations between the import and TBT under the WTO regime including. The TBT has trade distorting impact, documented by (Kapuya, 2015; Maskus, Wilson, and Ostsuki, 2000; Moenius, 2004).

The WTO defended its TBT regulations in the General Agreement on Tariffs and Trade (1995) articles 3, 11, and 20 provisions for technical regulations and standards. GATT clarified and permitted for expected trading scope. The WTO members are motivated to link their standards with global standards and do not exploit such rights by launching rigorous measures. The effects of TBT and SPS and technical regulations on import patterns are vital, and the importance of TBT and SPS using PPML is emphasized by various researchers as discussed in the literature review section. However, there is a huge empirical research gap related to the impact of TBT and SPS on the import of selected SACs under the WTO regime. There also remained a scope to introduce a refined PPML approach to estimate TBT and SPS effects on the imports of SACs. Similarly, the impacts of TBT and SPS on imports from selected groups of different income countries are almost absent.

DATA AND METHODOLOGY

Data Description

In this research, secondary data from certain sources are used. Import data is retrieved from the United Nations Commodity Trade Statistic Database, Department of Economic and Social Affairs. GDP data is from World Development Indicators, a database of the World Bank. Data on the distance between the capitals (or importers) and trading partners (exporters) are collected from

the Institute for Research on the International Economy (CEPII). Import tariff[7] rates are taken from World Integrated Trade Solutions (WITS), World Bank. TBT and SPS data is collected from the Integrated Trade Intelligence Portal (I-TIP), WTO. Table 4 presents the data of variables selected for estimation models.

Variable	Description	Proxied for	Data source
Table 4: Description of Variables of Model			
Import (IM)	Import value (dependent variable)		UNComtrade
TBT (tb)	Natural logarithm of Technical Barrier to Trade	Measure of restrictiveness	I-TIP WTO
SPS (sp)	Natural logarithm of sanitary and phytosanitary	Measure of restrictiveness	I-TIP WTO
GDPi (gdp_{st})	Natural log of Pakistan GDP current US dollars as a reporter country	Size of economy & demand side effect	WDI
GDPj (gdp_{sat})	Natural log of Partner countries' GDP current US dollars	Trading capacity	WDI
Exchange rate (exrat)	Official exchange rate (Local Currency Unit LCU per US$ period average)	Competitiveness	WDI World Bank
Tariff rate (tarr)	Effectively Applied Weighted Average %	Measure of restrictiveness	WITS World Bank
Distance (dista)	Natural log of distance in km between capitals of Pakistan and partner country's capital cities	Transportation and logistics cost	CEPII
Contiguity (con)	Dummy equal to unity if two countries share a common border	Information cost	CEPII

(Source: Author compilation, 2020)

Gravity Model Approach

The gravity model approach applies for quantification of the effects of TBT and SPS on SACs' imports during the WTO regime from 1995 to 2018. This is one of the standard approaches of the gravity estimation, with the coefficient estimated used subsequently for TBT and SPS for the importing countries. This analysis will contribute to the gravity literature with the applications of the TBT and SPS dataset by the WTO. Moreover, bilateral impacts of TBT and SPS are considered by taking into account the imports of selected SACs. Moreover, the difference between TBT and SPS measures is made; both quality and technical standards related measures. This allows attaining insight into distinct impacts of the TBT and SPS measures, which tends to have straight forward purposes of accomplishing the government policies targets e.g. maximum residue level, technical labeling, etc.

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[7] Effectively Applied Weighted Average (%) tariff; the average of tariffs weighted by their corresponding trade value (WITS – UNCTAD TRAINS, World Bank, 2020).

The gravity model is deployed to study imports and exports, and further impact of the safety regulations, and technical standards. The model was initially introduced by Tinbergen (1962) and Linneman (1966) to examine trade set up in the absence of biased trade impediments. It is based on the world history famous "Newton gravity law." It dominates with three core explanatory variables consisting of GDP of the importing country, GDP of the exporting country (Partner countries), and transportation cost (distance between capitals of partners). They used countries' GDP as the market size for measuring the potential demand and supply of trading partners (Hossain, 2009).

The model is developed in log format (equation 1.1), the standard gravity model for import is as follows:

$$\ln\left(IM_{ijt}\right)= \tau_0 + \tau_1\left(tarr_{ijt}\right) + \tau_2 \ln\left(tb_{ijt}\right) + \tau_3 \ln\left(sp_{ijt}\right) + \tau_4 \ln gdp_{st} + \tau_5 \ln gdp_{sat} + \tau_6 \ln dista_{ij} + \tau_7 con_{ij} + \tau_8 exrat_{ijt} + \mu_{ijt} \ldots \quad (1.1)$$

Here TBT_{ijt} and SPS_{ijt} represent number of TBT and SPS cases initiated, TBT and SPS measures initiated against each other, and all 148 countries, country i initiated cases against 1 or more j countries. Contiguity and distance are gravity variables and measures the change in trade due to the distance between countries.

PPML is deployed to estimate certain gravity models; the method deals with a large number of zero values in the import dataset. PPML also allows identifying the effects of issues of time invariant factors; it was an imperative feature for analysis. The research article aims to test a dummy variable effect and a time-invariant variable (distance). By using the Poisson estimator for fixed effects (unlike PPML), time-invariant regressors would not be skipped but different pairs of never trading partners from the sample (Silva & Tenreyro, 2006; 2011; and Kareem, Martinez-Zarzoso, & Brümmer, 2016). Skewness, Kurtosis, Shapiro-Wilk W test, Shapiro-Francia W' tests of normality proved strongly non-normality of data, that is necessary pre-requisite for PPML.

EMPIRICAL RESULTS AND DISCUSSION

Descriptive statistics of model variables are presented with mean, standard deviation, minimum and maximum values. The table below presents explanatory and explained variables. The total number of import values is 21,312 whereas 7895 (37%) import values are missing, which states that SACs did not import from all WTO members from 1995 to 2018. Along with GDP and distance, IM is assumed trade flow between SACs and the rest of 142 partner countries (all WTO members); τ_0 is a constant term and μ_{ijt} is an error term.

Pseudo Poisson Maximum Likelihood estimators are deployed in the research in order to add all the import information: bilateral zero import values and ignore inconsistent estimates derived from the logarithmic linear approach (by Silva and Tenreyro, 2006). PPML estimation transforms the gravity model given in equation 1.1 into the following exponent form:

Poisson: E(y|x) = E(IM_{ijt}|x) = exp (x′τ) =

$$\exp\left(\tau_0 + \tau_{tar}tar_{ijt} + \tau_{TB}tb_{ijt} + \tau_{sp}sp_{ijt} + \tau_{gdpi}gdp_{it} + \tau_{gdpj}gdp_{jt} + \tau_{dist}dist_{ijt} + \tau_{con}con_{ijt} + \tau_{exrat}exrat_{ijt}\right) + \mu_{ijt} \quad (1.2)$$

Where E(y|x) is expected values and mean of dependent variable y (import between South Asia and WTO partners IM_{ijt}) conditional on the independent variable x and τ are coefficients to estimate. Sub-index i and j denote to the importer countries, and partner countries (j=1...148) respectively, whereas t shows time line i.e. years (t = 1995, 1996, 1997,...,2018).

The TBT and SPS cases of a country come into force during a certain year when it was initiated. Dataset of WTO I-TIP includes TBT and SPS measures initiated. TBT and SPS measure dataset is applied, initiated by the country.

Estimation Results and Discussion

The estimation results of PPML with the gravity model and robust standard error respectively are discussed in Table 5. The results are presented in two groups; the first column presents results of SACs' trade with the 142 partner countries including high, upper middle, lower middle, and low income countries. The second column presents the results of intra-regional imports by SACs. The PPML and random effect import's gravity model of SACs with the rest of the world, coefficients on importer's GDP are presumed generally positive. The results are supportive; the elasticity of GDP is highly statistically significant and equal to just around 0.99 percent. The results support the large size of the economies and demand side effect import positively; estimated results show that an increase of one percent in SACs' GDP leads to an increase in the region's import by 0.99 percent. The results are in line with the findings of many researchers including Thuong (2018), Kareem, et al. (2016), Hermawan (2019), and Silva and Tenreyro (2006). Likewise coefficient prevails for the intra-regional import, as shown in Table 5.

Table 5: Coefficient Estimation Results of Gravity Model		
Import	**World**	**Regional**
Tariff	-0.028 (0.012)	0.003 (0.003)
TBT	-0.018 (0.010)	-0.028 (0.016)
SPS	-0.031 (0.016)	0.066 (0.037)
GDPi	0.999 (0.080)	0.337 (0.228)
GDPj	0.922 (0.072)	0.905 (0.188)
Distance	4.235 (0.525)	3.250 (0.717)
Contiguity	12.710 (0.817)	10.598 (1.031)
Exchange Rate	-1.087 (0.132)	-0.178 (0.124)
No. of observation	13,207	526
No. of groups	814	30

Robust standard errors are shown in parentheses (Source: Author calculation, 2020)

In the same way, an increase in GDP of other 142 partners by one percent will enhance import by 0.922 percent assuming the ceteris paribus. Partner country's GDP is presumed as a proxy of the trading capacity (142 WTO partners). The results are similar to previous researches i.e. Kaur and Nanda (2011), Ronen (2017), Chen, Hartarska, and Wilson (2018), and Devadason and Govindaraju (2016) Intra-regional trade shows the same positive coefficient.

Presenting logistics and transportation variables, PPML estimates reveal that distance affects the probability of SACs' imports. It is worth noting that bilateral distance enhances the likelihood of zeros. If this distance between SACs with their trading partners increases by one percent, the import will increase by 4.24 percent. The exchange rate is a proxy of the competitiveness of SACs' trade with the rest of the world; it witnesses a negative sign with significance; an increase of one percent in the exchange rate will decrease the import of South Asia by 1.087 percent. The exchange rate is essential for the region in determining its import. A similar pattern of the coefficient sign exists in intra-regional trade.

PPML estimates expose that the tariff rate coefficient is negative and significant statistically with the estimated elasticity -0.028; it shows that the region's import would decrease by -0.028 percent when a region has increased the tariff lines by one percent. The tariff rate is a core restrictive policy tool to manage the import pattern from selected countries; and is used to protect home markets, often. Chen and Wilson (2017), Olper and Raimondi (2002), Fassarella, Souza, and Burnquist (2011), and Dong and Zhu (2015) used different techniques (including PPML) and brought a similar result. As anticipated, when the tariff rate is enhanced, the regional import will decrease because the importing region's governments use tariff rates as an import policy measure. Mostly, tariff rates are imposed to control import inflow. The neighborhood variable, contiguity is used as a measure for the information cost, a dummy variable depicts an increase in the contiguity by one percent will increase the import of SACs by 12.71 percent.

The SPS is NTB to restrict imports, this is expedited to lessen the imports, or to improve the quality and standards of imports for consumer protection. The results witness that a one percent increase in SPS would decrease the imports by -0.031 percent. It complies with the previous researches that SPS is trade restrictive to lessen the imports. It also implies that partner countries were unable to comply with SPS standards posed by WTO. The results support the previous studies of Peterson et al. (2013), Kareem, et al. (2016), Thuong (2018), and Schlueter, Wieck, and Heckelei (2009).

The TBT as a NTB measures the import restrictiveness, it is initiated to control the quality factors in regional imports flows; the result shows that a one percent increase in the TBT will decrease the imports by -0.018 percent. Hence, it verified many previous studies that TBT is a trade-restrictive measure to decrease import inflows. This implies that partner trading countries did not address TBT standards and challenges when exporting their products to the region. The partner 142 countries should comply with the quality and technical standards developed by SACs. Partner countries should attain valuable lessons to advance their quality and technical standards by raising the measures and processing them before exporting the goods to the importing economies. The result supports the findings of Keiichiro *et al.,* (2015), Moenius (2004), Devadason and Govindaraju (2016), Otsuki et al. (2000), Kapuya (2015), and Silva-Glasgow and Hosein (2018). Similarly, SACs show a similar pattern of the coefficient. Future research can be carried out on the product level or comparison between various high income, and middle/low-income regions.

CONCLUSION

The research aimed examine the impacts of the TBT and SPS on the import flows of selected SACs from other SACs and from 142 NTBs user countries under the WTO regime. SACs expedited many TBT and SPS measures for controlling plurilateral and multilateral trade from 1995 to 2018. The

empirical results of regression estimation found that SACs initiated TBT and SPS measures, which has restrictive impacts on import volume during the period of analysis. Hence there is scope for decreasing the imports further by promoting the NTBs. The results show that increasing the tariff rate by region would decrease imports. This is also deduced that during the study period SPS (0.03 percnet) is   more effective than the tariff rate (0.028 percent), whereas TBT is lesser effective than the tariff rate prevailing in the region. An increase in GDPs of countries, contiguity, and distance would lead to increase imports of SACs; while an increase in the exchange rate and tariff rate lessened the import inflow. SACs need to enhance capacity building to improve quality and technical standards by introducing more NTMs and process them actively before importing the merchandise from the partner economies for consumer protection and quality conformity.

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