

Impact of Technical Barriers to Trade and Sanitary and Phytosanitary Measures on Pakistan Exports

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Abstract

Technical barriers to trade (TBT) and sanitary and phytosanitary (SPS) measures are two major tools of non-tariff barriers set by world trade organization (WTO) and should strictly followed by WTO member countries. These NTBs are set by WTO for safety of food, human, animal, plants and environment. In global competitive market producers/countries can maintain their trade position and trade volume only if they follow WTO rule set for quality and standards of products. These non tariff barriers have promoted as well as restrict trade. As exports in any country promotes not only because of demand and supply of products but it depends on correct functioning of all micro and macroeconomic policies. This paper discusses the role of Pakistan macroeconomic policies that facilitate trade and redefine the prosperity paths in changing global and local economies. Currently CPEC a big opportunity for Pakistan but its challenge for Pakistan to promote its exports in the presence of non tariff barriers. We analyzed impact of these NTBs on trade between Pakistan and its top export partners that are U.S.A, China, and U.A.E, using HS-2 digit code data. To quantify TBT and SPS measures we employ coverage ratio and frequency index, Coverage ratio captures the extent of exports covered by SPS and TBT, whereas frequency index considers the presence/absence of the SPS and TBT in a product without indicating the value of exports covered. As these all countries are member of WTO and follow its standards regarding quality of products, so they constantly uses technical barriers to trade (TBT) and sanitary and phytosanitary (SPS) measures against imports from Pakistan. Literature shows TBT imposed by importer on Pakistan's exports has positively affected the export performance while SPS discourage exports. In this research paper, we constructed SPS and TBT database from 2003-2016 to examine the influence of NTBs initiated as well as enforced on exports of Pakistan, and compare impact of tariff and non tariff barriers (TBT and SPS) on exports of Pakistan. A separate effect of these NTBs on manufacturing and agriculture sectors is also analyzed. The frequency index and export coverage ratio shows that TBT measure promoted exports of manufacturing sector while SPS also promote exports of agriculture sector. The data set is sourced by WTO, UN Comtrade, and WDI.

Introduction

The non-tariff measures (NTMs) barricade foreign trade, hence considered as non-tariff barriers (NTBs) to trade and commerce policies. These NTBs may be protectionist at the expense of exporters from foreign

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countries or non-protectionist, but limit the trade volumes. Technical barriers to trade and sanitary and phytosanitary agreements of World Trade Organization are widely used by the WTO members as NTBs for environmental protection, safety, security, and consumer interests etc. These barriers have impacted increasingly on regional as well global trade. The members maintain trade quality and standard to ensure that merchandised food is safe for buyers, and to prevent the spread of pests or diseases among living organs. Strict health and safety regulations are being used unnecessarily as an excuse for protecting interests of domestic producers or to maintain comparative advantage. However, bilateral and preferential trade liberalization policies have been initiated and implemented particularly after accession to WTO. This research paper forwards an analyses of bilateral trade and enforcement of TBT and SPS measures. Staiger (2012) bifurcated NTMs into three categories, firstly those imposed on import includes import quotas, prohibitions, import licensing, and customs procedures and administration fees. Second those imposed on export include export taxes, subsidies, export quotas, export prohibitions, and voluntary export restraints, whereas third category includes barriers imposed internally in the domestic economy.

According to WTO, tariff is customs duty on merchandise imports; it gives a price advantage to locally produce same goods. NTBs are such measures that imposed on imports include domestic legislation covering technical, health, product, labor, environmental standards, internal taxes or charges, and domestic subsidies. Overwhelmingly, tariff and NTMs are levied to protect home country's import competing industrial sector. Tariff brings revenues (similar to taxes) for home governments; whereas non-tariff measures are non-monetary barriers. Such NTBs are reduced under regional, plurilateral, or free trade agreements, and sometimes eliminated. NTBs increase the cost of trading, and are more challenging to abolish than the conventional tariff.

In this study, we find impact of technical barriers to trade and sanitary and phytosanitary measures as NTBs that selected importing countries use against Pakistan exports. According to Economic Survey of Pakistan 2015-16, Pakistan's top export partners are USA, China, United Arab Emirates. These selected countries are import partners of Pakistani products. Literature suggests that these NTBs restrict exports as well as promote trade, if NTBs have affected country apply standards of WTO agreements NTBs cases will be withdraw from their products and hence exports will increase.

The Agreement on the Application of Sanitary and Phytosanitary measures of the WTO sets out the basic principles for quality and standards. The measures should be initiated and enforced only to the extent necessary to protect lives. Sanitary (human and animal health) and phytosanitary (plant health) measures apply to trading commodities. For the purpose of the SPS Agreement as any measures applied to some specific areas i.e. to protect against risks arising from additives, contaminants, toxins or disease-causing organisms in food; that protect human life from plant- or animal-carried diseases; and protect from pests, diseases, or disease-causing organisms, as well to protect the health of fish and fauna, as well as forests and flora (UNCTAD, 2012). While technical regulations include product characteristics, their related processes and production methods. TBT may deal with terminology, symbols, packaging, marking and labeling requirements. Standards are approved by an official recognized body which is responsible for issues related to these measures. The process related to TBT that government officials uses are step by step starting from procedures for sampling, testing and inspection; then evaluation, verification and assurance of conformity; and registration, then finally TBT approval and issue certificates that whether the TBT and SPS should impose on products or not (UNCTAD, 2012).

Health and hygiene standards are beneficial to household consumers, as these help to avoid risks associated with food trade and economic losses. If the objective of any SPS measure is to protect local industry, opposite to health and life of humans, animals and plants, the measure can be challenged in Dispute Settlement Body (DSB), governed by the WTO since 1995. The whole process is not only cost ineffective but also a time consuming proposition.

Agreement on Technical Barriers to Trade and Sanitary and Phytosanitary Measures

Article 10 of the Agreement on Technical Barriers to Trade stated that WTO “The TBT agreement aims to ensure that technical regulations, standards, and conformity assessment procedures are non-discriminatory and do not create unnecessary obstacles to trade. At the same time, it recognizes WTO members' right to implement measures to achieve legitimate policy objectives, such as the protection of human health and safety, or protection of the environment”. The Article 20b Agreement on sanitary and phytosanitary stated “The SPS Agreement allows countries to set their own standards. However, that regulations must be based on scientific findings and should be applied only to the extent that they are necessary to protect human, animal or plant life or health; they should not unjustifiably discriminate between countries where similar conditions exist ” (WTO Agreements, 2017).

WTO categories TBT and SPS measures into sub requirements, specific trade concerns, emergency and regular are requirements for SPS measure while specific trade concern and regular are requirements of TBT measure. Specific Trade Concerns (STC) are queries/complaints raised by members related to specific Members or products or measures. The WTO's Information Management System (IMS) contains information about STCs. The emergency procedure allows a notification of an emergency measure after it is in force; therefore, its initiation date (notification date) occurs after its Inforce date. While regular notifications shall be made soon after the SPS and TBT regulation has entered into force, and shall be made at an early stage when amendments can still be introduced and comments taken into account (upto 60 days) before an SPS/TBT regulation is finalized (WTO, 2016).

The Ministry of Commerce Pakistan collaborated with the standardization bodies i.e. Pakistan Standards and Quality Control Authority (PSQCA) and Pakistan National Accreditation Council, Ministry of Science and Technology to implement technical standards and testing assessments for implementation of TBT and SPS agreements for exporters and importers. The bodies advise to the Government bodies, industrialists, trade unions and other stakeholders on technical standardization policies and programs to promote industrial and agricultural productivity and trade. These organizations are also focal points on TBT and SPS for national and foreign institutions such as ISO and Codex Alimentarius. While the quality standards related NTBs enquiring and issuing authorities in importing countries are as General Administration of Quality Supervision, Inspection and Quarantine of China. American Section of the International Association for Testing Materials (ASTM), American National Standards Institute (ANSI), (International standardization organization , 2017). Traders, manufacturers and exporters must be registered with these organizations to ensure adoption and respond according to TBT and SPS notifications.

The objective of this research is to analyze bilateral trade arrangements between Pakistan and its export partners, using gravity model and empirically investigate application of Agreement on TBT and SPS enforced by selected export partners of Pakistan. A few of researches have covered impact of TBT and SPS measures enforcements on Pakistan's export commodities. This research has covered this phenomenon

empirically using geographical indicators of gravity model, tariff and NTBs with 2-digit HS code industry and agricultural level data set on TBT and SPS during 2003-2016.

The study is organized as follow, section 1 describes facts and current implementation status of TBT agreement under WTO regime. Section 2 comprises on theoretical framework, problem statement, previous studies, and objectives of the study. The section 3 contains the literature reviews, and section 4 explains the research methodology i.e. selection of variables and data, econometric model and estimation technique. The last section contains the conclusion and recommendations of the study.

Theoretical Framework

The relationship of non tariff barriers instruments like TBT and SPS imposed by importing countries on exporting country products was also explained by traditional theories. Theoretical literatures explain how much export performance depends upon that country product related measures, standards and technology. Traditional trade models predict that countries will specialize in the goods in which they have comparative advantage either due to technology/productivity according to Ricardo model. Goods are produced and exported in perfectly competitive markets hence there will be many producers of the same good. According to Krugman (1979, 1980) in the trade models with monopolistic competition identical firms produce differentiated products and consumers exhibit love for variety. Country will produce a large amount of differentiated goods.

Monopolistic competition is preserved in the heterogeneous firms models (Melitz, 2003; Eaton and Kortum, 2002; Melitz and Ottaviano, 2007, etc.) however, in these models only the most productive firms exports. Exporting countries with more productive firms will have a larger number of exporters and products shipped to overseas markets. On the other hand if exporting costs increase, these models predict reduction in the number of exporters and hence number of products exported. Empirical evidence of the presence of large trade costs that exporting countries faces other than tariffs, suggests that compliance costs of TBT and SPS are also significant.

Even though the trade theory does not specifically address the question of the non-tariff barriers that include technical regulations and sanitary and phytosanitary measures. Walter (1971) discussed about the implications of nontariff measures, how were the NTBs applied to imports by the industrial countries and the prospects of developing countries export performance. The NTBs were defined as all the government policies and practices to restrict the volume, direction or production composition of the international trade. Some theoretical literature tells adaptation of international standards for Technical barriers to trade and Sanitary and phytosanitary measures impose compliance costs on exporters. These compliance costs are related to potential adjustments of production process, certification procedures, technology upgradation needed to meet the requirements of the countries imposing such regulations and standards (Schlueter et al., 2009).

The most common approach used in the literature is a gravity model which is based on the new trade theory models commenced by Krugman and widely used in the international trade research. Gravity models are stated as the value of trade between any two countries is proportional, other things equal, to the product of the two countries' GDPs, and diminishes with the distance between the two countries (Krugman and Obstfeld 2008). It well suited to capture the trade effects of NTBs. Moenius (2004) and Mahe (1997) stated

that the gravity model is one of the most successful and therefore widely used frameworks for empirical analysis of trade flows between countries. The gravity model has some advantages over other similar methods in estimating the trade flows among countries. The model can estimate the effects of protection on the volume of trade. The gravity model is able to contain the trade-enhancing effect of regulations and the distinct forms of NTBs in estimating the trade flows.

In our study along with Tariff, TBT and SPS, GDP of Pakistan and other importing countries will also be analyzed on export performance. We take real GDP of all countries, the real GDP of an exporting country to proxy its supply capacity and the real GDP of an importing country to proxy its demand capacity. GDP indicates country size and economic development level that can affect export dynamics (Besedina, 2015). In particular rich countries are expected to have high demand of standard food and products. Literatures shows mostly TBT and SPS measures are protectionist tools of developed nations, and developing nation's exports badly affected due to these measures (Hoekman and Mavroidis, 2003), Ederington and Ruta, 2016). The gravity model includes geographical indicators like distance between countries, common languages spoken while dealing in trade, whether countries share common border in bilateral trade, these all factors cause ease in trade. Exchange rates also an important variable to include in analysis. As impact of exchange rate volatility vary across developed and developing countries, the depreciation of currency against dollars results that country export volume positively while depreciation of importing country currency against dollars negatively affect export volume of exporting country (Kurgman, Obstfeld and Melitz, 2008) and (Berman et al., 2012).

2.1 Significance of Study

This study provides latest viewpoint of the prevailing situation in Pakistan in the context of TBT and SPS measures and its impact on exports of Pakistan. Previously no study conducted to examine the both TBT and SPS measures impact on Pakistan overall exports with top exports partner countries. This study will also investigate whether tariff or non tariff barriers to trade affect exports of Pakistan most. We will study the impact of NTBs on exports and along with other selected variables in Pakistan and importing countries i.e. GDP, exchange rate, geographical distance, tariff rate, common language and border. Reformulate a policy for focusing and improving quality and standards of exported products in Pakistan.

2.3 Objectives of Study

The objectives of the study are following:

- To find out the impact of technical barriers to trade and Sanitary and phytosanitary measures on exports of Pakistan.
- To find out which non- tariff barriers affect more on exports of Pakistan.
- To compare impact of tariff and non tariff barriers (TBT and SPS) on exports of Pakistan.

Literature Review

3.1 Introduction

In this chapter we are going to review the empirical studies at nation and international level, to find the impact/cost of technical barriers to trade and Sanitary and phytosanitary measures imposed by importers on Pakistan exports. Most of researchers conclude that TBT and SPS measures imposed by importing

countries on exports of partner country hamper exporting countries trade. Some researchers also conclude that TBT SPS can promote trade as well as restrict trade. These NTBs impact on trade is negative for developing countries but positive for developed countries.

3.2 Review of international literature.

Disdier et al. (2008) investigate impact of TBT and SPS measures on trade in agricultural products using information from WTO members. Improved TBT and SPS requirements results an opportunity to access more profitable markets and to improve business and create better working conditions, raise product durability and also increase productivity and company discipline. Statistical and econometric analyses suggest that the purposes of TBT and SPS notification vary across importing countries and less developed countries are the most affected by such measures. According to Melitz (2003) the effect of the introduction of an NTM measure may not be felt immediately in one year. Monetary costs and more complicated exporting procedures seem to hamper product and market diversification (Besedina, 2015). Disdier et al. (2008) find that TBTs and SPS measures have negative significant effect on agricultural trade. Similar findings are demonstrated by earlier contributions as well (Moenius, 2004, Fontagne et al., 2005)

Literature shows NTBs like TBT SPS hamper trade relatively more as compared to Tariff. Jiang (2008) find relation of tariff verses non tariff barriers for exports of china. As textile products has been expanded and the market shares have been increased due to NTBS as compared to Tariff. TBT has positive influence on international economy as well as the negative influence. The positive effects are due to driving technical advancement. Product outside and inside both quality improves, as inspection organizations increases, so in china competition increases that boost exports. Negative effects are compliance cost of TBT/SPS is high so export cost is increases and it causes international competition weakens. They suggest the main methods adopted by the government are to reduce negative effects of TBT is strengthening the macro-regulation, standardizing and guiding industry to follow standards of WTO. John and Jean (2001) developed methodologies for modeling and quantifying nontariff barriers (NTB) to both imports and exports. The impact of SPS and TBT on trade was analyzed and methods introduces that provide some quantitative estimates of the impact of such barriers on market equilibrium, trade flows, economic efficiency, and welfare. They focused on Quantification of the effects of such measures on a particular product.

Bao and Qiu many time empirically quantify TBT impact on trade in different perceptive. Bao and Qiu (2010) examine the influence of TBT imposed by China on the trade partners. They use both frequency index and coverage ratio approaches to quantify TBT. Frequency index measure shows that TBT are trade restrictive. 1 unit increase in TBT will decrease import value by about 0.8%. Before joining WTO china's data results shows that TBT have trade promotion effects. 0.2% china's import increase due to TBT measures. China's TBT are trade restricting for agriculture goods but trade promoting for manufacturing goods. Previously using gravity model Bao and Qiu (2009) study shows TBT have negative impact on industries. That study also reveals that TBT hamper developing countries more. There result shows 1 unit increase in frequency index of TBT will decrease there import value by 1.1%. Bao and Qiu (2012) study estimate the trade effects of TBT based on WTO members during 1995-2008. For estimation they use Probit model and Maximum Likelihood method and the non-linear least squares (NLS). Result shows that the TBT effects are different depending on the country's economic development level. It was found that a developed

country's TBT notifications significantly decrease other developing countries' probability of exporting, but increase their export volumes.

3.4 Review of national literature.

Some literature reveals the different aspects of SPS measures impact on exports and trade in different regions. Evidence suggests that Pakistan has a potential comparative advantage over developed countries in the production of many products, but it depends on its ability to meet the demands of the world trading system in terms quality of exportable products and their safety standards according to Mustafa (2003). SPS requirements under WTO may likely impede future trade of agricultural products from Pakistan. Khan and Saqib (2004) and Mustafa (2003) studies emphasis that exporters need to be advised by Government so that health related requirements could be analyzed for possible disguised protectionism. The enquiry points for TBT and SPS Agreements need to create institutional support for exporters for allocation of drafts standards notified in the WTO and should also get their feedback for sending comments to Governments abroad.

Almost all nations are frequently using NTBS for safety of human and products. Kayani and Shah (2014) study shows that China have more NTBs than Pakistan. Pakistan's NTBs protect well-established rent seekers, such as agriculturalists. Indian and Chinese NTBs protect strategic industries, such as small businesses, defense contractors, and electronics manufacturers. They also mention that Pakistani NTBs operate as bans that shut competitors out of the Pakistani market, Chinese NTBs create costs that make foreign products more expensive to their consumers. But another study Shah et.al. (2014) argued that due to trade liberalization; competition has increased, forcing industries to improve their productivity to compete in this free market. However there are still some trade barriers which are used to block market access i.e. TBT. The impact of TBT on export performance of Pakistan textile industry has been empirically evaluated using primary data. Multiple regression analysis results indicated that TBT has positively affected the performance of Pakistan textile industry.

Ministry of Commerce (2016) highlighted these issues in strategic trade policy framework 2015-18 and also show government work on it to enhance standards and exports. Due to use of inefficient technologies Pakistan's exports of some sectors is not increasing. So in order to up gradation of technology some investment support and markup support programs are initiated for investors. As currently no brand certification development support policy in Pakistan, so the Government decided to provide grant to facilitate the branding and certification for faster growth of the SME and export sector in Pakistan's economy. Ministries of Science & Technology, Commerce and National Food Security & Research will be constituted to work on quality standardization and harmonization of Pakistan standards. There is considerable potential for increase of Pakistan exports in the short-term through strategic interventions in TBT and SPS measures.

Data and Methodology

4.1. Introduction

In this chapter we present the methodology to conduct the study. The study will be based on panel data for the period 2003-2016.

4.2. Data Sources

We will use data of Pakistan exports at HS-2 digit level from 2003-2016 using UN Comtrade database. TBT SPS and Tariff data will be collected from World Trade Organization (WTO), and exchange rate and GDP, tariff data from world development indicators (WDI) of the World Bank, and uses gravity indicators from CEPII database.

4.3. Methodology

This section presents the methodology for the bases for estimation. In this study we want to find how much TBT and SPS measures imposed by importers affect different Pakistan's exports. To quantify TBT SPS we use two approaches Frequency index (FI) and Export coverage ratio (CR).

According to Economic survey of Pakistan 2015-16, Pakistan's major export partners are United States of America, China, United Arab Emirates ². These all countries initiate and enforced Technical barriers to trade (TBT) and Sanitary and phytosanitary (SPS) measures against Pakistan except Bangladesh only. All countries are members of World trade organization (WTO), but there joining dates of WTO are different. Pakistan joined WTO in 1995; we collected data of TBT and SPS from WTO³, for the years of 1995-2016. In our sample, Pakistan is exporting country, whereas above all are importing country of all agriculture and industrial level products at HS-2 digit level of Harmonized System.

4.4. Definition of Variables

Dependent Variable			
Name	Variable	Description	Data Source
EX	Export	Export is a function of international trade whereby goods produced in one country are shipped to another country for future sale or trade. Calculated in current US dollars. Bilateral merchandise trade between Pakistan and partner country j.	UNCOMTRADE
Independent Variables			
GDP	Gross Domestic Products	GDP reflects the value of all goods and services produced by an country i and j in current US dollars in a given year.	WDI, World Bank
Dist	Distance	The geographical distance between Pakistan and partner countries borders (in Kilo meters).	CEPII
Contig	Contiguous/Common Border	Dummy equal to 1 if Pakistan and partner country share common border. And 0 otherwise	CEPII
Comlang	Common Language	Dummy equal to 1 if there is common language between Pakistan and partner country, and 0 otherwise.	CEPII
ER	Exchange Rate	Exchange rate specifies how much one currency the US \$, is currently worth in terms of the other, the PK Rupee (in our case)	WDI, World Bank

² Ministry of Finance, Government of Pakistan (2017)

³ WTO Integrated Trade Intelligence Portal (I-TIP), online dataset accessed on 16, march 2017

Tariff	Tariff	A tax or duty imposed on imported goods and services by importing country. Product of simple average tariffs imposed by partner country on Pakistan Products.	WDI, World Bank
TBT	Technical Barriers to Trade	TBT measure includes product characteristics, their related processes and production methods. It deals with terminology, symbols, packaging, marking and labeling requirements, in order to protect national security, environment, human, animal and plants.	WTO, I-TIP
SPS	Sanitary and Phytosanitary	The WTO SPS Agreement concerns with specific risks related to human health (mostly about food safety) and animal/plant health or life or protection from pests.	WTO, I-TIP

4.5. Econometric Model

On the basis of discussion with respect to link between exports and the independent variables (technical barriers to trade, sanitary and phytosanitary, exchange rate and real GDP), we have specified following model: the NTBs are estimated through gravity equation. The econometric model predicts that bilateral trade flows are proportional to the size of their economies and inversely related to the distance between them (Kurgman, obstsfeld and melitz, 2008; Helpman, 1987; Tinbergen, 1962; Bergstrand, 1989). The simplest specification of the gravity model takes the following form:

$$X_{ijt} = a_0(GDP_{it})^{a1}(GDP_{jt})^{a2}(Dist_{ij})^{a3} \varepsilon_{ij} \dots\dots\dots(1)$$

Where X_{ijt} is the value of bilateral trade from exporter i to the importer j in time t . GDP_{it} and GDP_{jt} is the level of real gross product in country i and j in time period t . $Dist_{ij}$ is the bilateral geographical distance between countries i and j . where the error term ε_{ij} is assumed to be identically and independently distributed.

The specification of the gravity model for use in studying international trade flows started with Tinbergen (1962). His specification included the three variables in equation (1) addition to a fourth variable (A_{ijt}) that accounts for other variables that are either promoting or restricting trade between country i and j at time t , as is shown in the following equation:

$$X_{ijt} = a_0(GDP_{it})^{a1}(GDP_{jt})^{a2}(Dist_{ij})^{a3}(A_{ijt})^{a4} \varepsilon_{ij} \dots\dots\dots(2)$$

If take its natural log then equation (2) will be

$$\ln X_{ijt} = a_0 + a_1 \ln GDP_{it} + a_2 \ln GDP_{jt} + a_3 \ln Dist_{ij} + a_4 \ln A_{ijt} + \varepsilon_{ij} \dots\dots\dots(3)$$

In above equation the coefficients $a_1 > 0, a_2 > 0, a_3 < 0$. The coefficient a_3 represents the trade friction resulting from trade costs especially transportation costs. Gravity equation captures the effect (A_{ij}) includes tariff and non tariff barriers (world trade Report, 2012). Common border and Common language is often conducive to bilateral trade because it results in easy communication and captures culture proximity. Exchange rate volatility largely affects exports in a country like Pakistan. The model captures the following characteristics as in eq (4). We will use eq(4) for each trade partners of Pakistan one by one.

$$\ln EX_{ijt}^k = a_0 + a_1 \ln GDP_{it} + a_2 \ln GDP_{jt} + a_3 \ln Dist_{ij} + a_4 \ln Contig_{ij} + a_5 \ln Comlang_{ij} + a_6 \ln ER_{it} + a_7 \ln Tariff_{ijt}^k + a_8 TBT_{ijt}^k (FI or CR) + a_9 SPS_{ijt}^k (FI or CR) + \varepsilon \dots\dots\dots(4)$$

Where i= exporting country, j= importing country (1.....9), t= 1....16,
k= products at HS-2 level (1....97)

Where the explanatory and explained variables are defined as follows:

EX_{ijt}^k is the value of Pakistan’s export of product k from country j in year t

$\ln ER_{it}$ is Pakistan’s exchange rate in year t

$\ln GDP_{it}$ and $\ln GDP_{jt}$ are Pakistan’s and country j GDP in year t, respectively.

$Contig_{ij}$ shows dummy variable indicating 1 if Pakistan and country j are contiguous; and 0 otherwise.

$Comlang_{ij}$ is the dummy variable indicating 1 if Pakistan and country j share a common language; and 0 otherwise.

$\ln Dist_{ij}$ is the border distance between Pakistan i and partner country j.

$\ln Tariff_{ijt}^k$ is the importing country j tariff applied to product k of exporting country i in year t;

TBT_{ijt}^k is the frequency index or export coverage ratio of country j TBT applied to product k of country i in year t;

SPS_{ijt}^k is the frequency index or export coverage ratio of country j SPS applied to product k of country in year t;

4.6. Quantification Techniques for Technical Barriers to Trade and Sanitary and Phytosanitary Measures:

4.6.1. Inventory Approach

Bora et al. (2002) provided a review of various approaches to quantify TBT and SPS. Conventionally, there are two approaches, which are the frequency index and coverage ratio. In Bao and Qiu (2009, 2010, 2012),

uses this approach to quantify these NTBs. Export coverage ratio (ECR) and frequency index are reviewed by Bora, et al. (2002), so we used to quantify TBT and SPS effects on Pakistan’s export.

4.6.1.1. Export Coverage Ratio:

The export coverage ratio covers the extent of export covered by enforcement of TBT and SPS. The ratio of TBT and SPS in Pakistan for product category j in a year is the percentage of export by Pakistan in product category j which is affected by TBT and SPS in respective year, and denoted by

$$ECR_j = \frac{\sum_i D_i V_i}{\sum_i V_i} \times 100 \dots\dots\dots(5)$$

where i is export good contained in product category j (HS 2). If TBT and SPS is enforced to good i, the dummy variable Di take value one if TBT and SPS is enforced and zero otherwise. Vi is the value of good i’s exported by Pakistan to importing country k. Thus, the coverage ratio of good category j is higher if more of goods are subject to TBT and SPS scrutiny and/or the goods under TBT and SPS have larger exports values. However, there is a difficulty with the coverage ratio: the endogeneity of weights in export values. In extreme, if TBT and SPS is so restrictive in good i, it will preclude all export of good i, and ultimately the weight Vi will be zero. Coverage ratio is downward biased in regression. One solution to this issue is to use the counterfactual free trade weights, but it’s not available. Alternatively, we add frequency index, which does not suffer from this issue.

4.6.1.2. Frequency Index

The frequency index covers the presence/absence of TBT and SPS in a product without considering the exports value covered. FI forwards the percentage of exports transactions affected by TBT and SPS in Pakistan. Specifically, the frequency index of TBT and SPS in Pakistan for product category j in a particular year is the percentage of export goods by Pakistan in product category j affected by importing country k TBT and SPS in that year:

$$FI_j = \frac{\sum_i D_i E_i}{\sum_i E_i} \times 100 \dots\dots\dots(6)$$

Where i is export good contained in product category j (HS 2). If TBT and SPS is enforced to good i, the dummy variable Di takes value of one and zero otherwise. Ei is dummy variable equal to one if value of export of particular product i exists and zero otherwise. Frequency index does not show relative value of affected goods.

Frequency index measures the number of goods subject to TBT and SPS as percentage of total number of goods in a good category, whereas coverage ratio measures value of exports of TBT affected good as percentage of total imports of good category. In case of frequency index, the occurrence of TBT is not weighted by export value, whereas in coverage ratio, it weighted by export value.

4.7. Diagnostic Tests:

Before going to the main estimation technique, some diagnostic tests are conducted before running regression analysis. All tests are described in detail below.

4.7.1. Test for Stationarity:

To check the data either stationary or not, a test which is widely used is unit root test. If a series is non-stationary, then all the results of regression analysis are not valid. The standard approach to determine the stationarity of the time series data is checking the existence of unit roots in given time series. In Unit root there are two tests which are used to check out the stationarity,

4.7.1.1. Dickey-Fuller test (DF):

It is named after the statistician, David Dickey and Wayne Fuller, who developed in 1979. A simple AR(1) model is

$$y_t = \rho y_{t-1} + \mu_t$$

Where y_t is the variable of interest, t is the time index, ρ is the coefficient, μ_t is the error term. A unit root is present if $\rho = 1$. The model would be non-stationary in this case. The regression model can be written as

$$\Delta y_t = (\rho - 1)y_{t-1} + \mu_t = \delta y_{t-1} + \mu_t$$

Where Δ is the first difference operator. This model can be estimated and testing for unit root is equivalent to testing $\delta = 0$ (where $\delta \equiv \rho - 1$). since the test is done over the residual term rather than raw data, it is not possible to understand t-distribution to provide critical values. Therefore this statistic has specific distribution simply known as the Dickey-Fuller test. There are three main versions of test, i.e test for unit root, unit root with drift and unit root with drift and deterministic time trend.

In each case the null hypothesis is that $\delta = 0$ there is a unit root (time series is non-stationary). The alternative hypothesis is that $\delta < 0$ (time series is stationary). If the null hypothesis is rejected it means that Y_t is stationary with zero mean in first case, and Y_t is stationary with non-zero mean in second case, while Y_t is stationary around a deterministic trend in third case.

Hausman Specification Test

After checking stationarity, next step is to check the problem of endogeneity suspected between the explanatory variables and error term. This problem may generate biased OLS regression equation. Hausman specification test is applied to endogeneity problem of the variables involve in the estimation analysis. Hausman test can be carried out by artificial regression through running two OLS regressions. The suspected variable to have endogeneity problem is taken as dependent variable in the first step and is regressed on all the exogenous variables and instruments. Then residuals are retrieved from this equation and are given a name. In the second stage, original equation is re-estimated including the residual from the first regression as additional regressors. If the OLS estimates are consistent, then the coefficient on the residual from first stage should not be significantly different from zero, but if the suspected variable is endogenous, it indicate significant probabilities values and confirming the problem of endogeneity.

Estimation Technique:

Pooled Estimated Generalized Least Squares (EGLS):

Empirical Results of Pooled Estimated Generalized Least Squares (EGLS): Total Merchandise Exports

Results of pooled estimated generalized least squares model show that Pakistan exports for selected trading partner are significantly dependant on the explanatory variables included in the model. Table 1 shows the estimated results of all merchandise exports at HS section level products with Pakistan's major trading partners. Dependant variable is the log of all HS section merchandise bilateral export products.

Table 1: Empirical results of pooled EGLS: Pakistan Bilateral Exports HS section products

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	98.42763	4.086275	24.08737	0.0000*
CS	0.008675	0.001326	6.542395	0.0000*
CT	0.014881	0.000928	16.03816	0.0000*
FS	-0.001586	0.001482	-1.070189	0.2845
FT	0.015948	0.001019	15.65619	0.0000*
T	-0.025350	0.003699	-6.853958	0.0000*
ER	0.007458	0.002557	2.916897	0.0035*
G	1.662587	0.076175	21.82576	0.0000*
GP	-0.885426	0.143065	-6.188998	0.0000*
DT	-13.63136	0.373952	-36.45217	0.0000*
CL	13.50239	0.322925	41.81274	0.0000*
R-squared	0.130363	Mean dependent var		14.87961
Adjusted R-squared	0.130207	S.D. dependent var		4.248135
S.E. of regression	3.961926	Sum squared resid		872038.9
F-statistic	832.7983	Durbin-Watson stat		0.433223
Prob(F-statistic)	0.000000			

* Significant at 5%

Pooled EGLS (Cross-section random effects) shows export coverage ratio for sanitary and phytosanitary measures (CS) that USA, China, and UAE impose on Pakistan exported products encourage exports of Pakistan during the year 2003 to 2016. Result shows if 1% SPS measure imposed by importers then exports of Pakistan increases by 0.008%. t- statistics and p-values shows Coverage ratio for SPS is highly significant at 5% level of significance. Frequency index for sanitary and phytosanitary measures (FS) that USA, China, and UAE impose on Pakistan exported products discourage exports of Pakistan during the year 2003 to 2016. Result shows if 1% SPS measure imposed by importers then exports of Pakistan increases by 0.001%. However this variable is not statistically significant. Export coverage ratio for technical barriers to trade measures (CT) that USA, China, and UAE impose on Pakistan exported products encourage exports of Pakistan during the year 2003 to 2016. Result shows if 1% TBT measure imposed by importers then exports

of Pakistan increases by 0.014%. t- statistics is 16.03816 and p-values is 0.000 shows that is highly statistically significant at 5% level of significance. Frequency index for technical barriers to trade measures (FT) that Pakistan exports faces encourage exports of Pakistan during the year 2003 to 2016. Result shows if 1% increase in TBT measure imposed by importers then exports of Pakistan increases by 0.015%. result shows that it is statistically highly significant.

Tariff (T) always act as an obstacle to international trade thus negatively affect exports. Because tariffs imposed on goods causing a switch towards intra-national trade leading to decrease exports. Here estimated coefficient sign for average tariff that importing countries imposes on Pakistan is negative and is statistically significant. Results show that 1 % increase in tariffs will decrease the exports by 0.025%. These results are in line with the findings of Novy (2013) and Wincoop et al. (2004). While the results depict that nominal exchange rate (ER) is statistically significant at 5% level and has a positive sign. Thus, showing that there is an direct relationship between depreciation of nominal exchange rate and exports of Pakistan. In other words, with depreciation of the exchange rate, total volume of exports. The coefficient for exchange rate suggests that 1% depreciation of exchange rate increases exports by 0.0074%. It shows that with depreciation of nominal exchange rate increases total exports with selected countries over the period of 2003-2016.

Results show that the GDP of Pakistan (GP) has negative effect on Pakistan's export to USA, China, and UAE. 1% increase in Pakistan's GDP decreases Pakistan export by 0.88% . Supporting this result, Irshad (2016) also found similar results. Conversely, Pakistan's GDP does not have much influence on its exports. GDP of USA China UAE (G) positively influence Pakistan exports, its coefficient shows 1% increase in there GDP will increase Pakistan export demand by 1.66%. Therefore, in present conditions, Pakistan benefits more from the bilateral trade because its' exports are positively correlated with trading partner GDP, which is growing faster than Pakistan's GDP.

Distance (DT), common language (CL) are geographic determinants of trade barriers. Distance between the trading partners affects the physical transport cost. Geographic distance between the trading countries is a hindrance to bilateral trade flows. The estimated results show that geographic distance between Pakistan and its trading partners is negatively related to the exports of Pakistan. It indicates that 1% increase in distance decreases the exports by 13.63%. In other worlds Pakistan exports increases as it is demanded by country close to us. It is highly significant at 5% level of significance. If trade partners having common language then exports will increases by 13.50%. R^2 shows 13% exports volume is explained by independent variables. Our result is consistent with the study of Duan and Jason (2012).

Table 2: Empirical results of pooled EGLS: Pakistan Bilateral Exports HS section (1-4) Agricultural products

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	79.69269	21.35894	3.731116	0.0002*
CS	0.001355	0.004762	0.284580	0.7760
CT	0.016346	0.005533	2.954019	0.0032*
FS	0.026176	0.005341	4.901337	0.0000*
FT	0.020580	0.006473	3.179119	0.0015*
T	-0.024511	0.015472	-1.584185	0.1133
ER	0.029293	0.013356	2.193212	0.0284*
G	1.019995	0.397195	2.567994	0.0103*
GP	-0.093610	0.754870	-0.124008	0.9013
DT	-11.75108	1.935304	-6.071959	0.0000*
CL	8.574667	1.645231	5.211831	0.0000*
R-squared	0.211033	Mean dependent var		15.07567
Adjusted R-squared	0.202724	S.D. dependent var		4.361669
S.E. of regression	3.894548	Akaike info criterion		5.567885
Sum squared resid	30244.01	Schwarz criterion		5.629093
Log likelihood	-5590.428	Hannan-Quinn criter.		5.590350
F-statistic	25.39784	Durbin-Watson stat		0.491850
Prob(F-statistic)	0.000000			

*Significant at 5%

Pooled EGLS (Cross-section random effects) shows export coverage ratio for sanitary and phytosanitary measures (CS) that USA, China, and UAE impose on Pakistan exported products encourage exports of Pakistan during the year 2003 to 2016. Result shows if 1% SPS measure imposed by importers then exports of Pakistan increases by 0.001%. coverage ratio shows very less impact of SPS measure on Pakistan exports and is statistically insignificant. Frequency index for sanitary and phytosanitary measures (FS) that USA, China, and UAE impose on Pakistan exported products encourage exports of Pakistan during the year 2003 to 2016. Result shows if 1% increase in SPS measure imposed by importers then exports of Pakistan increases by 0.026%. However this variable is also statistically significant at 5% level of significance. Export coverage ratio for technical barriers to trade measures (CT) that USA, China, and UAE impose on Pakistan exported products encourage exports of Pakistan during the year 2003 to 2016. Result shows if 1% TBT measure imposed by importers then exports of Pakistan increases by 0.016%. t- statistics is 2.954019 and p-values is 0.000 shows that is highly statistically significant at 5% level of significance. Frequency index for technical barriers to trade measures (FT) that Pakistan exports faces encourage exports of Pakistan during the year 2003 to 2016. Result shows if 1% increase in TBT measure imposed by importers then exports of Pakistan increases by 0.02%. Result shows that it is statistically highly significant.

Tariff (T) always act as an obstacle to international trade thus negatively affect exports. Because tariffs imposed on goods causing a switch towards intra-national trade leading to decrease exports. Here estimated coefficient sign for average tariff that importing countries imposes on Pakistan is negative and is statistically significant. Results show that 1 % increase in tariffs will decrease the exports by 0.024%. but it

is statistically insignificant to determine Pakistan exports. While the results depict that nominal exchange rate (ER) is statistically significant at 5% level and has a positive sign. Thus, showing that there is an direct relationship between depreciation of nominal exchange rate and exports of Pakistan. In other words, with depreciation of the exchange rate, total volume of exports. The coefficient for exchange rate suggests that 1% depreciation of exchange rate increases exports by 0.02%. It shows that with depreciation of nominal exchange rate increases total exports with selected countries over the period of 2003-2016.

Results show that the GDP of Pakistan (GP) has negative effect on Pakistan’s export to USA, China, and UAE. 1% increase in Pakistan’s GDP decreases Pakistan export by 0.093% . GDP of pakistan is statistically insignificant for export volume as pakistan economy is in position to complete with partner developed countries. GDP of USA China UAE (G) positively influence Pakistan exports, its coefficient shows 1% increase in there GDP will increase Pakistan export demand by 1.01% and statistically significant. Therefore, in present conditions, Pakistan benefits more from the bilateral trade because its’ exports are positively correlated with trading partner GDP, which is growing faster than Pakistan’s GDP.

Distance (DT), common language (CL) are geographic determinants of trade barriers. Distance between the trading partners affects the physical transport cost. Geographic distance between the trading countries is a hindrance to bilateral trade flows. The estimated results show that geographic distance between Pakistan and its trading partners is negatively related to the exports of Pakistan. It indicates that 1% increase in distance decreases the exports by 11.75%. In other worlds Pakistan exports increases as it is demanded by country close to us. It is highly significant at 5% level of significance. If trade partners having common language then exports will increases by 8.57%. R² shows 21% exports volume is explained by independent variables. Our result is consistent with the study of Duan and Jason (2012).

Table 3: Empirical results of pooled EGLS: Pakistan Bilateral Exports HS section (5-21) Non-Agricultural products

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.809914	103809.7	4.63E-05	1.0000
CS	0.009478	0.001902	4.983978	0.0000*
CT	0.013639	0.001120	12.17642	0.0000*
FS	-0.002385	0.002605	-0.915376	0.3600
FT	0.019231	0.001223	15.72555	0.0000*
T	-0.033696	0.005165	-6.524405	0.0000*
ER	0.002374	0.003117	0.761624	0.4463
G	1.813191	0.093017	19.49320	0.0000*
GP	-1.077774	0.174507	-6.176112	0.0000*
DT	-1.223134	13584.04	-9.00E-05	0.9999
CL	-7.378813	22711.20	-0.000325	0.9997
CONT	-8.245712	8453.309	-0.000975	0.9992
R-squared	0.145958	Mean dependent var		14.83348
Adjusted R-squared	0.145700	S.D. dependent var		4.219927
S.E. of regression	3.900409	Sum squared resid		553790.6
F-statistic	565.5637	Durbin-Watson stat		0.452989
Prob(F-statistic)	0.000000			

*Significant at 5%

Pooled EGLS (Cross-section random effects) shows export coverage ratio for sanitary and phytosanitary measures (CS) that USA, China, and UAE impose on Pakistan exported products encourage exports of Pakistan during the year 2003 to 2016. Result shows if 1% SPS measure imposed by importers then exports of Pakistan increases by 0.009%. t- statistics and p-values shows Coverage ratio for SPS is highly significant at 5% level of significance. Frequency index for sanitary and phytosanitary measures (FS) that USA, China, and UAE impose on Pakistan exported products discourage exports of Pakistan during the year 2003 to 2016. Result shows if 1% SPS measure imposed by importers then exports of Pakistan increases by 0.002%. However this variable is not statistically significant. Export coverage ratio for technical barriers to trade measures (CT) that USA, China, and UAE impose on Pakistan exported products encourage exports of Pakistan during the year 2003 to 2016. Result shows if 1% TBT measure imposed by importers then exports of Pakistan increases by 0.013%. t- statistics and p-values shows that is highly statistically significant at 5% level of significance. Frequency index for technical barriers to trade measures (FT) that Pakistan exports faces encourage exports of Pakistan during the year 2003 to 2016. Result shows if 1% increase in TBT measure imposed by importers then exports of Pakistan increases by 0.019%. Result shows that it is statistically highly significant.

Tariff (T) always act as an obstacle to international trade thus negatively affect exports. Because tariffs imposed on goods causing a switch towards intra-national trade leading to decrease exports. Here estimated coefficient sign for average tariff that importing countries imposes on Pakistan is negative and is statistically significant. Results show that 1 % increase in tariffs will decrease the exports by 0.033%. These results are in line with the findings of Novy (2013) and Wincoop et al. (2004). While the results depict that nominal exchange rate (ER) is statistically significant at 5% level and has a positive sign. Thus, showing that there is an direct relationship between depreciation of nominal exchange rate and exports of Pakistan. In other words, with depreciation of the exchange rate, total volume of exports. The coefficient for exchange rate suggests that 1% depreciation of exchange rate increases exports by 0.002%. It shows that with depreciation of nominal exchange rate increases total exports with selected countries over the period of 2003-2016.but insignificant for non agriculture products.

Results show that the GDP of Pakistan (GP) has negative effect on Pakistan's export to USA, China, and UAE. 1% increase in Pakistan's GDP decreases Pakistan export by 1.07% . Conversely, Pakistan's GDP does not have much influence on its exports. GDP of USA China UAE (G) positively influence Pakistan exports, its coefficient shows 1% increase in there GDP will increase Pakistan export demand by 1.81%. Therefore, in present conditions, Pakistan benefits more from the bilateral trade because its' exports are positively correlated with trading partner GDP, which is growing faster than Pakistan's GDP.

Distance (DT), common language (CL) and common boarder (CONT) are geographic determinants of trade barriers. Distance between the trading partners affects the physical transport cost. Geographic distance between the trading countries is a hindrance to bilateral trade flows. The estimated results show that geographic distance between Pakistan and its trading partners is negatively related to the exports of Pakistan. It indicates that 1% increase in distance decreases the exports by 1.22%. In other worlds Pakistan exports increases as it is demanded by country close to us. If trade partners having common language then exports will increases by 7.37%. If trade partners having common border then exports will decreases by 8.24%. this result is in line with Pakistan current senerio, as Pakistan export more with USA, UAE as

compare to India. It is statistically insignificant at 5% level of significance. R^2 shows 14% exports volume is explained by independent variable.

Conclusion and policy recommendations

TBT and SPS helps exports and tariff hampers exports from Pakistan to its major trading partners i.e. USA, UAE and China. Stringent and alarming for Government to take immediate necessary actions to tackle the issue to maintain its comparative advantageous position in concentrated commodity exports. Capacity building of nodal points appointed by the Government to update them is need of the time to boost export. Protectionist macroeconomic policies in wake of CPEC and emergence of Chinese economy at global level reinforce Pakistan to increase its competitiveness to boost exports. Reshaping size and dimensions of GDPs of China and USA, as well as UAE may help Pakistan to avail market share with assistance of China.

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