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The Impact of Technical Regulations on Trade: Evidence from South Africa

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Abstract. The purpose of this study is to investigate empirically the impact of technical barriers to trade (TBTs) by using the gravity model. The study used data from South Africa's exports of all products and other product groupings destined to 57 selected countries which comprise both developing and developed countries. To control for misspecification error the study incorporated other explanatory variables. STATA system version 13 was used to analyse the regression of data ranging from 1995 to 2015. The results revealed that TBT notifications in general are trade restrictive. The regression results unravel that TBTs negatively affect mechanic and electrical products more than other product groupings. Accordingly for all exports in general the study's findings are an increase in the number of TBTs has an effect of reducing exports by 4.88% on average. Given the results from the study it is imperative for South Africa to harmonise its standards with its trading partners.
Keywords. Gravity model, South Africa, Technical regulation, WTO.
JEL. F10, F40.

1. Introduction

The World Trade Organization (WTO) in the recent years has managed to increase trade through reducing tariffs in phases for most products. This is opposed to the continuous increase in technical barriers to trade (TBTs) over the past 2 (two) decades. The proliferation in regulations and standards has been mainly driven by rise in consumer preferences and improved living standards. In addition to the above governments can interfere in setting up technical regulations and standards for protection of consumers and the environment as well as correction of market imperfects. Wilson & Otsuki (2004) also concurred with the above notion and they stated that technical regulations are mainly used for the purpose of minimizing risk that may be facing by consumers, plants and animals. Nonetheless, if technical regulations are inappropriately applied instead of trade promoting they can obstruct it since time and money can be wasted as a result of conducting tests. Otsuki *et al.* (1999: 19) emphasized the need for putting technical regulations in the form of standards for developing the market as well as facilitating transactions since they can increase the demand for those products. Despite this it is the developing countries that are worse affected due to compliance complications.

The use of TBTs for the purposes mentioned above is considered legitimate by the WTO since there is a provision that allows Member States to do so. Knowing that some Member States can abuse the legitimate use of technical regulations the WTO requires that they must be based on international standards so that market access is not hindered. If countries use TBTs in a disguised manner so as to protect their domestic industries this can however affect international trade flow. In this regard it means TBTs have a dual impact on trade as they can either promote trade

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in the event that there is compliance or can discourage trade if there is non-compliance. On a different note TBTs are sometimes good in the sense that they build consumer's confidence by providing them with minimum guarantee on the goods they are purchasing and inform them if the goods are not harmful for consumption purposes. Bao&Qiu (2012) hinted that providing consumers with information regarding TBTs raises consumer's demand which in turn improves the exporting country's extensive and intensive margins. However, compliance and conformity requirements to technical regulations are associated with costs since in most cases developing countries lack the capacity. This therefore implies that TBTs are of particular worry to most developing countries as they have to bear the burden of compliance costs and at the same time they have limited capital and human resources to meet the standard requirements.

The General Agreement on Tariffs and Trade (GATT) 1947 in its Articles III, XI and XX has provisions for technical regulations and standards. The agreement in itself provides clarity as well as allowing for a predictable trading environment to prevail. WTO members are also encouraged to base their standards to international ones as long as they do not abuse this right by setting stringent measures. There are various objectives and reasons that governments can use as justifications for the use of TBTs. These reasons include protection of human, animal, plant and environment as well as for national security. Member States are also allowed to adopt standards they deem appropriate as long as they are applied in a non-discriminatory, in a way that is unnecessary to hinder trade, in a harmonized, mutual recognition and equivalent, transparent manner and provide technical assistance and take into account differences in levels of development by each country. However, there has been a growing tendency by some governments who use TBTs as a ploy to discourage exports from other countries.

As opposed to tariffs which can be one sided, the impact of TBTs can either be positive or negative depending on whether they are used in a manner that does not act as an obstacle to trade. Given the above contrasting views on the impact of TBTs on trade it is therefore imperative to look at South Africa's situation and do more research using a quantitative analysis so that one can be able to find out the extent they either promote or discourage trade. this quantitative analysis of the effects of TBTs is very helpful in the sense that countries can be able to know the cost implications associated with stringent measures hence they can review their regulations. Beghin & Bureau (2001) also argue that quantification of the economic impact of TBTs is critical in the sense that it gives an important guideline on the regulatory framework and calculation of compensation in the event of disputes arising. This paper attempts to contribute to ongoing debate on whether TBTs promote or restrict trade with particular focus on exports from South Africa.

In this paper, TBT notifications to the WTO by the 57 (fifty seven) importing countries of South Africa goods were used for the period 1995 – 2015 together with other export determinants on how they impact on export values of aggregate products, specific sectors and sub-sectors. The objective of this paper is to assess the impact of technical regulation, TBTs in particular; set by the 57 importing countries affects the flow of exports from South Africa. The paper's analysis focuses on all products and two major sectors mainly agricultural and industrial products and subsectors such as food products, mechanical and electrical, textile and clothing and chemicals as classified by the WTO. The research questions are;

- Are TBTs export restrictive or not?
- Which of the sectors and sub-sectors above is more affected by TBTs?

Applying the modified standard gravity model the paper finds that TBTs negatively affect South African exports to the various destinations under the scope of the study. It also finds that exports of agricultural products are more affected by TBTs than exports of industrial products.

This study is unique in the sense that it uses both the TBTs by the importing and exporting countries using a wide time frame and country characteristics unlike previous studies which either used importer or exporter's variables only. It also

used exports of sectors and subsectors as dependent variables. The reason for doing a sector and subsector analysis is that TBTs can affect different sectors in a different magnitude.

The rest of the paper is organized as follows: Section 2 provides a short description and explanation of the historical performance of South Africa's exports and how TBTs have multiplied over time. Section 3 outlines the literatures that have looked at the impact of TBTs in other countries and sectors while Section 4 explains the study's methodology. A detailed analysis of the regression results is provided in Section 5 while an overview of the summary and limitations of the study. Section 6 presents the policy implications of the study.

2. Background

Trading of goods is highly affected by many factors which include government policy, price of other goods and own price as well as the quantity produced. For the past decade global trade has been characterized by an upward trend. This has not been the case for some developing countries in general and African country in particular as they have been facing a declining trajectory. South Africa's share of world exports has also been following the same path given its development status in Sub-Saharan Africa (SSA). As revealed in Figure 1 its share of world exports in percentage since 1948 have been deteriorating from levels of 2% to around 0.5%. The worst was in early 1980 and this period coincides with the time when the TBT Agreement's provisions were laid down as a result of the 1979 Tokyo Round of negotiations. Exporting more is a challenge given that different countries especially the developed ones apply stringent technical regulations which may deter exports although the reasons behind them might be genuine.

The WTO put in place the Technical Barriers to Trade Agreement as an attempt to regulate trade reforms as well as to provide clear evidence on the application of these TBTs. If TBTs are appropriately set they can stimulate trade instead of discourage trade. It is in this context that the WTO highlights that "The TBT Agreement aims to ensure that technical regulations, standards and conformity assessment procedures are non-discriminatory and do not create unnecessarily obstacles to trade. At the same time, it recognizes WTO members' rights to implement measures to achieve legitimate policy objectives, such as the protection of human health and safety, or protection of the environment". These have necessitated the need to step up measures that ensure the safety, protection and security of humans, animals, plants and environment. In case of developing countries that may face difficulties in application and formulation of technical regulations and standards they can get assistance from willing developed Member States but the problem is it is not mandatory for developed countries to offer assistance.

All products both agricultural and industrial are expected to meet WTO Members' technical regulations and standards requirements as stated in the TBT Agreement. Article 2.3 of the Agreement allows Member States to adopt and apply technical regulations and standards that are less trade restrictive if they are available. In addition to the Article 2.7 also requires that all WTO Members to recognize other Members' technical regulations as long they can save the same objective.

Members should also inform other Members through the WTO desk of new TBTs before they are set. This is done in order to invite comments and contributions from Members in case they need to get more clarity. As can be seen from Figure 2 since 1995 until 2015 the total number of TBT notifications to the WTO has been on the rise on average. Starting in 2006 total number of TBT notifications reached above 1000 and the highest that has been recorded was in 2014 with 2239. As of 2015 a total of 25 391 TBT notifications were notified to the WTO. In general the trend of TBT notifications has been following an upward trend. The 2016 [Retrieved from] annual report by the TBT committee cited that most notifications were made by developed WTO Members States. Between 1995

and 2001 and from 2002 onwards developing countries began to take an active role as they had more notifications. More information is shown in Figure 2 in the appendix. The joining of China to the WTO in 2002 contributed to the rise in the number of notifications by developing countries. This change in TBT notifications raise a lot of concerns as to whether TBTs are for trade promotion or restriction since it may be difficult to measure their authenticity. Beginning 2003 the TBTs from developing countries doubled those from developed ones.

According to data from the WTO website it is revealed that China, Brazil and the United States of America are the 3 (three) top list countries with the highest number of TBT notifications. For the period 1995 to 2015 the total numbers of their TBT notifications are 1319, 1341 and 2452 respectively. The rise in TBT notifications by South Africa's trading partners are against the TBTs made by South Africa within the same period. It can also be noted that South Africa as a developing country has realized an increase in its number of TBT notifications to the WTO members. Although the TBT notifications were not directly targeted to South Africa only they may have an effect on exports from South Africa if it does not comply with the requirements. This may hinder South Africa's volume of exports. It is against this background that this research tries to find if the notifications by South Africa's exports destinations have an impact on its exports. The choice of the importing countries is based on the fact that they either have high TBT notifications or being major importers of South African products.

Figure 3 below shows that the justification with the highest number of TBT notifications was for the purpose of protecting animal and plant life followed by protection of consumers against deceptive practices. During the period under review 6960 notifications were for the purpose of protecting animal and plant life. The least objective of maintaining TBTs was national security reason and the unspecified reasons. Under the objectives highlighted in Figure 3 TBT notifications are considered acceptable by the WTO. Based on the objectives for imposing the TBTs this implies that of late WTO Members are now using TBTs for reasonable trade regulations.

3. Literature Review

A lot of literatures have varying views as far as the effects of TBTs on trade are concerned. Some argue that TBTs promote trade whilst others are of the view that they restrict trade. The fact that NTBs in the form of TBTs sometimes add unnecessary costs especially to developing countries calls for their proper management hence the need to analyze their effect on trade. These costs make the exports less competitive in the international market. In addition to this (Otsuki *et al.* 1999: 23) is of the view that technical regulations are also time consuming and they therefore reduce product life. Majority of scholars used the gravity model in analyzing the economic impact of TBTs. For instance Yoon *et al.* (2014) applied the generalized two stage least square (G2SLS) for a sample of 30 WTO members importing from South Korea, that have the most TBT notifications from 2002 – 2010 and they find that TBTs discourage exports of agricultural goods and at the same time promote exports of manufacturing goods.

In the same vein, Bao & Qiu (2012) using a sample of 105 WTO members from 1995 – 2008 they ascertain that TBTs have a negative and significant impact on exports from developing countries while it is insignificant for those from developed countries. Essaji (2008) also revealed the same sentiments about the technical regulations set by developed countries affecting exports flow from developing countries. In addition to the above Bao & Qiu (2010) find that a 1% increase in TBT imposed by China decreases imports value by 0.8% for 43 exporting countries for the period 1998 - 2008. Nevertheless when they shifted their focus to the period 1998 – 2001 their findings are that TBTs have an effect of promoting import values by 0.1%.

Using industrial level data from 684 firms in 17 developing countries Wilson & Otsuki (2004) find that standards and TBTs are among the biggest factors that

affect businesses' operations as well as their ability to export. This is because the costs of compliance and testing requirements have a tendency of increasing the cost of production and investment. Within the context of South Africa, Peet & Koch (2005) find that compliance to standards still remains a major challenge to small, micro and medium enterprise exporters and importers. Kapuya (2015) also revealed that removal of TBTs has an effect of improving South Africa's exports of oranges to the European Union (EU) market by 0.1% on average. Otsuki *et al.* (2000) applied the gravity equation model on data for 9 African countries and 15 countries from EU for the period 1989 – 1998 and they found that stringent aflatoxin levels applied by the EU on cereals, nuts and dried fruits exported by the 9 African countries were trade deterrent as compared to when international standards are used.

When it comes to developed countries the effects of TBTs on trade as examined by Henson & Loader (2000) is positive. The authors revealed that technical standards are not perceived to be trade restricting but they are rather trade promoting. Their impact varies from one industry to another. This is contrary to the negative implications of TBTs when it comes to developing countries. Contributing to this endless debate Swann (2010) finds that standards have varying effects depending on whether the importer (exporter) is cooperating/ responding or not to the set standards. Based on exports data from China to Japan between the period 1995 and 2004, Camei also find that standards set by Japan had a positive impact on imports from China.

Findings from Swann, *et al.* (1996) in Otsuki *et al.* (1999: 24), on data spanning from 1985 – 1991 concluded that a 100-unit increase in British national standards promoted exports and imports by 48% and 34% respectively. In addition to the above Moenius (1999) regressed data from a sample that include both transition and developing countries and he find that share the same standards have the potential to increase their bilateral trade among them.

Although there is no single answer to the impact of TBTs on trade, in a nutshell most of the literature point to the fact that TBTs set by Member States have a negative impact on trade in general and exports in particular.

4. Data and Methodology

This paper has extended and applied the standard gravity model which is chiefly used in assessing trade flow. According to Anderson & Wincoop (2003), the general consensus regarding the gravity model is that bilateral trade flow is positively affected by economic size, market size, common language and contiguity and also affected in a negative way by distance and other multi resistance factors. This is informed from previous work done by Beghin & Bureau (2001) and Gebrehiwet *et al.* (2007) who applied the gravity model to analyze the impact of TBTs and SPSs on trade flow. Kapuya (2015) further emphasized that the gravity model is less tedious since it requires the use of limited data and also it can be used to analyze if a measure is trade restrictive or trade enhancing. In this study TBTs were quantified by the total number of TBT notifications by the importing country in a given year to the WTO. This is based on a similar approach applied by Yoon *et al.* (2014), Bao & Qiu (2012) and, Beghin & Bureau (2001). In this case the research wants to find if TBTs have a trade promotion or discouraging effect.

Since the research is using one exporting country and many importing countries the model used is motivated from recent studies by Nag & Nandi (2006), Brodzicki *et al.* (2015) and Siyakiya (2016).

Below is the gravity model specification

$$\ln EX_{ijt} = \alpha_i + \gamma_j + \lambda_t + \beta_1 \ln(GDP_{it} * GDP_{jt}) + \beta_2 \ln(GDP_{pcit} * GDP_{pcjt}) + \beta_3 \ln DIS_{ij} + \beta_4 \ln(NEER_{it} / NEER_{jt}) + \beta_5 \ln TBT_{jt} + \beta_6 COMLAN_{ij} + \mu_{ijt} \quad (1)$$

Ignoring the time and importer intercepts the reduced form of the equation is as below;

$$\ln EX_{ijt} = \alpha + \beta_1 \ln GDP_{ijt} + \beta_2 \ln GDP_{pcijt} + \beta_3 \ln DIS_{ij} + \beta_4 \ln NEER_{ijt} + \beta_5 \ln TBT_{jt} + \beta_6 COMLAN_{ij} + \mu_{ijt} \quad (2)$$

Taking into account that there are zero trade observations in the data the research applied the Poisson Pseudo Maximum Likelihood (PPML) previously used by Silva & Tenreyro (2006) and Westerlund & Wilhelmsson, (2011). In their studies Silva & Tenreyro (2006) and Brodzicki *et al.* (2015) highlighted that the PPML estimator yields consistent results as compared to fixed effects, random effects and ordinary least squares estimators when heteroskedasticity behavior is observed in the data which is the case for this data. The PPML approach is also a good technique for count variable and in this case TBT is a count variable.

The gravity model that uses the PPML estimator is as follows;

$$EX_{ijt} = \exp(\alpha + \beta_1 \ln GDP_{ijt} + \beta_2 \ln GDP_{pcijt} + \beta_3 \ln DIS_{ij} + \beta_4 \ln NEER_{ijt} + \beta_5 \ln TBT_{jt} + \beta_6 COMLAN_{ij}) \mu_{ijt} \quad (3)$$

Where;

EX_{ijt} - Value of all exports in US dollars from country i to j at time t. i is the exporter (South Africa) and j is the importing country. The goods are HS 1992 coded;

GDP_{ijt} - Multiplicative interaction of the gross domestic products of the exporter and importer, in billion US$ at current price. This represents the supply capacity of the exporter and importer.

GDP_{pcijt} - Multiplicative interaction of the gross domestic product per capita of the exporting country and the importing country at period t. The variable is used as mass factor which proxy the purchasing power and demand size of the importer. As the exporting countries experience more income it means more exports to that country due to high buying power.

$NEER_{ijt}$ - Relative nominal effective exchange rate between exporter and importer at time t.

DIS_{ij} - Weighted distance in kilometres between the exporter and importer. This is a better approximation since the majority of the countries involved are big and it is not only their capital cities that have high economic activities. The closer the two countries to each other the more they trade with each other.

$COMLAN_{ij}$ - Take the value 1 if countries have a common official language and 0 otherwise. Countries that share the same official language tend to trade more to each other as opposed to those without.

TBT_{jt} - Number of TBT notifications by importing countries at time t. More TBT notifications imply that less is exported to the country imposing TBTs.

The coefficients β_1, β_2, β_4 and β_6 are expected to be positive while β_3 is expected to be negative while β_5 can take either sign depending on the nature of the product exported. Costs components of the equation are captured by distance, TBTs, relative nominal effective exchange rate and language.

In this study the sample of 57 importing countries[1]which include Argentina, Brazil, Canada, China, Columbia, Switzerland, Thailand and the United States of America to mention a few. The choice for using these countries in the sample is that for the period of analysis they are the ones that have highest number of TBTs, and some of the countries are among the major trading partners with South Africa. Data for GDP and per capita GDP was collected from the World Bank's World Development Indicators (WDI), NEER was collected from Bruegel [Retrieved from] website, TBT data was extracted from the WTO website while that of distance and language were retrieved from the CEPII website.

Summary statistics of the data is shown in Table 1 and it indicates that all the variables have 1197 observations except TBT which has 722. On average the importer has 11 TBT notifications per year while the maximum number of notifications is 298.

5. Discussion of Regression Results

5.1. All Products

In this research STATA version 13 was applied to find the impact of TBTs on exports in the modified gravity model. In particular the PPML estimation was used since there are zero exports for the period of my analysis and also the variable of interest (TBT) is a count variable. Results for the impact of TBTs on all products are shown in Table 2 column 1. The signs of the coefficients of GDP, distance and language are as expected except for that of per capita GDP. It can be noted that a 1% increase in multiplicative GDP has an effect of increasing export values by 0.758%[2] and it is significant at 95% confidence interval. This is contrary to the effect of an increase in per capita GDP which decreases export value by 0.0099%.

The distance and the relative nominal exchange rate between South Africa and trading partners are both have a negative effect on the value of exports. If the distance and the nominal exchange rate are to increase individually by 1% the net result is a decrease in exports by 0.752% and 0.141% respectively. The coefficient of distance variable is significant while that of relative nominal effective exchange rate is insignificant. Increase in distance and exchange rate have implications of increasing the cost of importing which in turn discourage the amount to be exported. Looking at the variable common language, the results reveal that countries that share a common official language usually trade more among themselves (30.87% more) as compared to those that do not.

Examining our priority variable (TBT of the importing country) it can be revealed that TBT notifications by the importer negatively impacts on South Africa's export values. A 1% increase in the number of TBT notifications results in a 4.88% decline in the value of all exports from South Africa to the 57 destinations. Considering the fact that South Africa is a developing country the results concur with previous researchers such as Bratt (2014) and Disdier *et al.* (2015), who find that developing countries are affected by technical regulations. In general TBTs are trade restricting in the case of all exports by South Africa.

5.2. Agricultural and Industrial Products

Since TBTs can have varying impact on different products, the research further examines the effect of TBTs on agricultural and industrial products. Exports of these subsectors were substituted as dependent variables into the main equation. Estimated summary results of the regressions of exports of agricultural and industrial sectors are reported in column 2 and 3 of Table 2 respectively. It is

[1] A detailed list of importing countries can be offered upon request from the author.

[2] $(e^{0.269} - 1)* 100 = 30.87\%$. This explains how dummy variables' coefficients are calculated. Since the equation is in exponential form the actual increase in the dependent variable is the exponent of the coefficient of the independent variable. If the coefficient is positive it means an increase and decrease for a negative coefficient. For a more detailed explanation see Schofer (2010, slide 11-12).

evident that TBTs have a negative effect on both agricultural and industrial exports from South Africa. in addition to the above TBTs more severe impact is on agricultural than industrial products. This implies that TBTs are more trade restricting in the case of agricultural exports as compared to industrial exports.

5.3. Other Sub-Sectors

Lastly, investigating the impact of explanatory variables on the sub-sectors namely mechanical and electrical, textile and clothing, chemicals and food products, it can be noted that TBTs have a trade restricting effect for all products apart from chemical products where they are trade promoting. The worst affected groups of products are mechanical and electrical products followed by food products and finally textile and clothing. Surprisingly chemical exports are positively affected by TBT notifications.

5.4. Robustness Testing

The R-squared (R^2) which measures the goodness of fit of the model (main equation) is 0.642. This represent the variation in the dependent variable (value of exports) explained by the independent variables. This means that multiplicative interaction of GDP and per capita GDP, distance, relative nominal effective exchange rate, common official language and TBTs only explain 64.2% of the variation in South Africa's value of exports to the 57 destinations.

The PPML estimator used for this research is appropriate since the dependent variable has missing values. Given the above scenario OLS, RE and FE are not appropriate for this research. Also the variance of the dependent variable over time exhibit heteroscedasticity (Baum, 2006, 590-592). All forms of tests across countries' imports and TBTs evidently reject the hypothesis of homoscedasticity. A detailed presentation of results can be requested from the author.

5.5. Limitations of the Study

The study failed to separate TBTs that directly affect the exporting country and those that are general. It could not also account for TBTs that are targeted to a specific sector but it just took TBTs as if they affect every sector equally. The weakness of using total number of TBT notifications by the importing country is that they may not affect the exporting country.

6. Conclusion and Policy Implications

This paper contributes to the existing literatures that analyzed the impact of TBTs on exports in general but this one is with special reference to South African exports to 57 various destinations for the period 1995 - 2015. The study use the number of TBT notification by each importing country as a measure of technical regulation. Results from the gravity model which applied the PPML using STATA software version 13 shows that TBTs set by the importing countries generally have a negative impact on South Africa's exports of all products. The findings suggest that TBTs in general negatively affect South Africa's exports. The incidence is low although the magnitude is high in percentage terms. The study unravels that despite being statistically significant TBTs are more trade discouraging on mechanic and electrical products that any other sector in the scope of the study. Contrary to the above TBTs are trade promoting when it comes to chemical exports. The results are in line with theory and partly with findings by other researchers. In order to mitigate the impact of TBTs on South African exports it therefore important for harmonization and cooperation in the setting of standards by South Africa and its trading partners.

In view of the above South Africa can also engage in research, human capital and infrastructural development so as to improve its standards. This may have a positive effect on its exports since standards also guarantee customers about the safety of the product. Although complying with the standards has cost implications on the other hand it can increase market share of the exporter. The South African government should therefore set policies which respond to TBT measures through

grooming the industries concerned as well as to further negotiate on less restrictive measures. TBT developed by importing countries negatively affect all exports from South Africa. In this case the conclusion is that TBTs have an effect of reducing intensive margin that is they limit the export flow of the exporting country (South Africa). Since majority of TBT notifications are to do with human and plant protection it therefore imperative for South Africa to adopt other country's standards.

Lastly, through the help of governments of the exporter and importer, South African firms can also enter into mutual recognition agreements (MRA) with firms in the importing countries since the multilateral TBT Agreement allows members to do so (Otsuki *et al.* 1999: 13). As an example the South African National Accreditation System (SANAS) is recognized globally by the Netherlands' RaadvoorAccreditatie (RvA). This is impetus in the sense that one country can be able to recognize the testing and certification requirements of another country hence reducing the testing hustles and exporting costs. With an MRA of standards in place, this may mean South African exporters can be able to meet domestic regulation requirements which may increase their chances of exporting more to countries that it has MRAs with.

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Conflict of Interest

The author declares that there is no conflict of interest.

Appendices

Table 1. *Summary Statistics*

VARIABLES	(1) N	(2) Mean	(3) sd	(4) Min	(5) Max
EXijt	1,197	784,616	1.386e+06	0	1.249e+07
lGDPijt	1,197	51.92	2.150	45.94	57.13
lGDPpcijt	1,197	17.19	1.771	12.68	20.52
lDISTij	1,197	8.723	0.879	6.165	9.601
lTBTjt	722	2.388	1.379	0	5.697
lNEERijt	1,197	-0.0857	0.687	-9.644	0.866

Source: Author Computation from WDI, WITS and WTO

Table 2. *Results for Aggregate and Sub-sector Exports*

VARIABLES	(1) EX	(2) EXA	(3) EXI	(4) EXME	(5) EXTC	(6) EXC	(7) EXFP
lGDPijt	0.758***	0.440***	0.787***	0.673***	0.727***	0.657***	0.408***
	(0.0352)	(0.0342)	(0.0358)	(0.0559)	(0.0586)	(0.0315)	(0.0334)
lGDPpcijt	-0.00991	0.273***	-0.0321	0.158***	-0.160**	-0.109**	0.285***
	(0.0382)	(0.0537)	(0.0379)	(0.0545)	(0.0662)	(0.0445)	(0.0593)
lNEERijt	-0.141	0.0974	-0.142	0.344*	0.652**	0.310**	0.329*
	(0.123)	(0.171)	(0.123)	(0.199)	(0.275)	(0.148)	(0.179)
lTBTjt	-0.0500*	-0.108***	-0.0465*	-0.186***	-0.0766*	0.0754**	-0.0795**
	(0.0265)	(0.0376)	(0.0265)	(0.0483)	(0.0457)	(0.0306)	(0.0350)
lDISij	-0.752***	-0.844***	-0.739***	-1.113***	-0.797***	-0.943***	-0.980***
	(0.154)	(0.145)	(0.155)	(0.146)	(0.207)	(0.123)	(0.141)
COMLANij	0.269***	0.450***	0.246***	0.569***	0.674***	0.997***	0.663***
	(0.0929)	(0.103)	(0.0947)	(0.138)	(0.158)	(0.0873)	(0.0947)
Constant	-19.89***	-9.553***	-21.26***	-17.43***	-19.36***	-14.36***	-7.898***
	(2.146)	(2.064)	(2.173)	(3.188)	(3.164)	(1.548)	(2.017)
Observations	722	722	722	722	722	722	721
R-squared	0.642	0.323	0.657	0.328	0.286	0.679	0.353

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

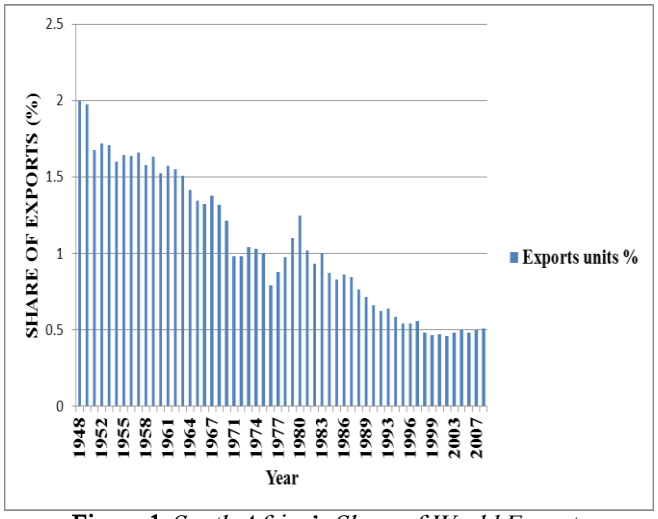

Figure 1. *South Africa's Share of World Exports*
Source: UNCTAD website and Author Computation

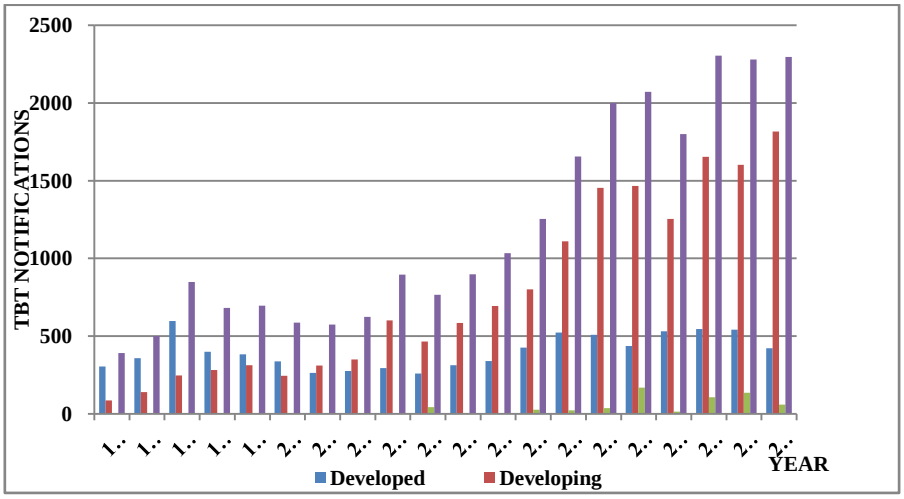

Figure 2. *Total number of TBT Notifications to WTO (1995 – 2014)*
Source: Author's Computation of Data from WTO

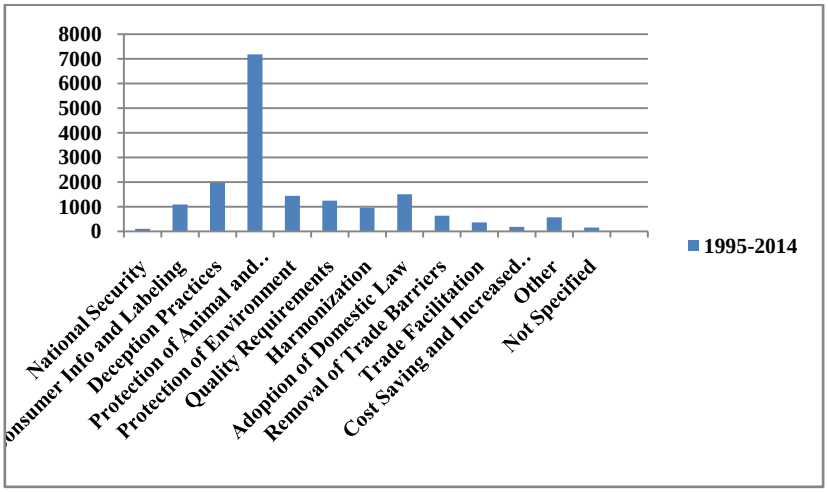

Figure 3. *TBT Notification by Objective*
Source: Author's Computation of Data from WTO

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