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Fatima Olanike Kareem
Bernhard Brümmer
Inmaculada Martinez-Zarzoso

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The Implication of European Union's Food Regulations on Developing Countries: Food Safety Standards, Entry Price System and Africa's Exports

Fatima Olanike Kareem[a]
Bernhard Brümmer[b]
Inmaculada Martinez-Zarzoso[c]

[a]Corresponding author, Research Associate, GlobalFood Research Training Group 1666, Heinrich DukerWeg 12, 37073 Goettingen, University of Goettingen, Germany. Email: fkareem@uni-goettingen.de. Phone: +49 551 39 20215

[b]Professor, Department of Agricultural Economics, University of Goettingen, Platz der Göttinger Sieben 5, D-37073 Goettingen, Germany.Email: bbruemm@gwdg.de

[c]Professor, Department of Economics and Center for Statistics, University of Goettingen, Platz der Goettinger Sieben 3, 37073 Goettingen, Germany Email: martinei@uji.es

Abstract

We examine the impact of two important non-tariff measures presumed to simultaneously affect firms' decisions to export to the European Union (EU). As a novelty to the literature, we analyse the impacts of EU pesticide standards on African exports alongside a complementary non-tariff measure in the form of a minimum entry price control measure which aims to protect EU growers of certain fruits and vegetables against international competition. We represent these trade costs in the context of a Melitz firm heterogeneity framework using Helpman, Melitz and Rubenstein (2008) method. Analysis was based on Africa's exports of tomatoes to the EU from 2008 to 2013, using the gravity model of trade.

Our results show that at both the extensive and intensive margins of trade, the high stringency of EU pesticide standard prevents new entry into the EU market, drives less productive firms away, and discourages existing exporters from expanding their market base. Furthermore, we find the EU entry price system acts like an export tax, inhibiting tomatoes export to the EU, but only at the intensive margin.

Keywords: EU food regulations, Pesticide standards, Entry price control, African exports, Gravity model

JEL Classification: C13 C33 F10 F13

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1.0 Introduction

The last decade has witness an increase in stringency and proliferation of non-tariff measures, as tariff has been negotiated down. One of such measures is food safety standards (Jaffee and Henson, 2004; Shepherd and Wilson, 2013) whose proliferation is largely attributed to increase in food scare as well as changing consumers' preference for safe food, rising income levels, changing dietary habits of consumers, and their awareness of the environment and ethical aspects of food process and production (Unnevehr, 2003). In particular, fresh fruits and vegetables products have witnessed more stringent standards as they are usually prone to food borne risks and hazards (Jaffee and Henson, 2004; Maerten and Swinnen, 2009), thus, necessitating a more careful and stringent regulation so as to safeguard consumers' health (Unnevehr, 2003).

Standard has therefore emerged as an increasingly powerful tool that provides guidelines for food safety regulations. By definition, sanitary and phyto-sanitary tandards are safeguard measures aimed at ensuring plant, animal, wildlife and human safety and health, based on prior scientific evidence (WTO, 1994). Their implications for international trade have been theoretically documented in the literature in the framework of demand enhancing effect and trade cost effect (Blind, 2001, 2004; Moenius, 2004; and Baller, 2007, Xiong and Beghin, 2014). On the one hand, the theoretical view of standards as a catalyst to trade argument is in line with the demand enhancing effects of standards. According to this stance, standards help in building value into certified goods and services as it provide consumers with information and assurance about their health and safety, therefore stimulating import demand (Blind, 2001 and Moenius, 2004). Standards also remedies asymmetric information, providing information to producers about the specifications and technicalities of the products, which can lead to technology diffusion and innovation (Baller, 2007).

On the other hand, there is the theoretical stance of 'standards as barrier' perspective via the trade costs effects. The proposition is that standards constitute additional barrier to trade because meeting stringent standards imposes excessive costs of compliance on producers which might erode export competitiveness and affect profitability of the export product, thereby acting as an impediment to trade (Markus and Wilson, 2001). This can be aggravated for developing countries, particularly Africa due to their lack of necessary infrastructure and technology which inhibit their ability to meet these standards (Stephenson, 1997). Higher compliance costs for developing countries discourage potential exporters from penetrating foreign markets, drive less productive firms away from international market, and decreases both the trade volume and sustainability of the remaining exporters (Bao and Chen, 2013).

Nevertheless, food safety standards represent a legitimate concern for health and safety as well as the environment, and products which do not meet the stipulated standards are denied entry at the border. To ensure high level of safety, food imports are therefore constantly monitored for breach of sanitary and phyto-sanitary non-compliance, the violation of which lead to trade restrictions such as outright rejection, or import detention and destruction, import bans, recalls from supermarkets, levying of fines and other numerous penalties, which could lead to significant loss for the exporter. For instance in the European Union (EU), there has been a significant number of border refusals of food imports by the EU due to non-compliance of exporting countries with its food safety standards, which amount to about 9233 rejections between 2008 and 2013 (RASFF, 2014). In particular, fruits and vegetables is the second most important category of products that usually refused entry into EU markets as a result of the exporters failing to meet EU standards. Refusal of this product represents about 20% of all EU food export refusals between 2008 and 2013.

In addition, of all EU food safety requirements, the violation of the acceptable maximum residual limits (MRL) of pesticides in food or feed products remains the second largest reason for border rejections of third countries export to the EU. More so, violation is usually committed by developing countries who have limited capacity to comply with EU standards. For instance, violation of pesticide residue limits constitutes about 70% of EU rejection of all Africa's fruits and vegetable exports between 2008 and 2013. The huge number of import rejections implies non-compliance to EU pesticide standards represents an important market access problem to Africa and the world at large. The consequences of these import bans and border restrictions can be enormous and extremely costly. While they results in immediate reduction in exports earnings, in the long run, they affect a country's reputation and damage its export competitiveness (Baylis, Nogueira and Pace, 2010, Jouanjean, Maur and Shepherd, 2012).

We investigated the potential impacts of food safety standards on Africa's export, using EU food safety regulations on allowable pesticides residues in food. EU food safety standards regulations encompasses many requirements, all of which need to be satisfied. However, the focus of this study is on pesticide standards due to 2 important reasons. First it represents the second largest reason for rejecting and detention of food imports, which consequently constitute loss of export revenue and products to the exporters. Second, pesticides mis/use exert an important impact on climate change and have other environmental and health impacts, and thus, its impact on trade flows is therefore important in its own right to be studied in order to proffer evidenced based policies to agitate for sustainability practices**.**

Our study makes several important contributions and novelties to the literature particularly prior research on Africa. To our knowledge, this represents the first study of this kind that investigated the impacts of all regulated pesticides on African exports. Previous empirical researches that investigated all regulated pesticides standards were directed on countries other than Africa (Winchester et al., 2012; Drogué and DeMaria, 2012; Ferro, Wilson and Otsuki, 2015; Xiong and Beghin, 2014). However, similar study on Africa is rare relative to the emergence of food safety standards and its implications for export from the continent. Therefore, the lack of comprehensive trade impacts of all regulated pesticide standards on African exports is one of the gaps this study bridge.

Second, as a novelty in the literature, we introduced another aspect of food market regulation that exporters faces when exporting fresh fruits and vegetable to the EU – the EU entry price control. This measure aims to protect Community growers of selected 15 fruits and vegetable products from intense international competition by means of a minimum entry price control. The is a non-tariff measure which aims to restrict import prices below the stipulated entry price and act to erode the competitiveness of exporters and increase the competitiveness of EU growers relative to exporters'. This is done by imposing a penalty factor in the form of specific duties on exports, when the daily import prices falls below a predetermined seasonally varying stipulated minimum entry price. This system of protection is known as the EU entry price system (thereafter EPS) and it is imposed in addition to the EU safety standards.

However, previous studies that estimate the impact of EU standards on the exports of fresh fruits and vegetables to the EU failed to take this into account (Winchester et al., 2012; Drogué and DeMaria, 2012). Yet, in the EU, alongside food safety standards, the exports of certain fruits and vegetables are subjected to the imposition of a penalty factor on cheap and competitive exports which makes them more expensive than expensive exports. By working like tariff protection, it not only generates the usual trade distortions effects expected from tariff protection, it also generates another effect which a pure tariff regime would not generate. This is by inducing exporters to supply more expensive exports to the EU to avoid the additional duties (Geotz and Grethe, 2010). Indeed, such behaviour might make the exporter to supply the product at a price which is greater than what is obtainable in EU domestic markets, consequently eroding their competitive cost advantage, thereby jeopardizing trade liberalization efforts and eroding gains from trade. This variable is therefore of paramount importance to market access. However, this has never before been represented in previous studies that investigated the impact of standards on fruits and vegetables. One reason is because comprehensive data on EPS is not easily available. This is coupled with the fact that the process of tarifficating the impact of EPS is long and tedious. This study therefore represents an important landmark to the literature.

In this study, we examine the dual effects of the EU harmonised pesticide standards and entry price control on Africa's export at the HS6 disaggregated level, focusing on tomato exports. We investigated the impact within a gravity model using panel dataset between 2008 and 2013. The choice of this export product is due to its ability to retain high levels of different number of pesticide residues (EWG, 2013). In addition, they are also subjected to EU entry price control and the associated duties might imply enormous costs for the exporters. It is therefore important to greater understand the implications of these two non-tariff measures on exports coming from Africa, in order to ensure evidenced based policy responses by these countries.

The rest of the study is organised as follows. The next section provides some background information on the selected food exports and an overview of the regulatory standards imposed on them. Section 3 reviews the previous literature. Section 4 discusses the methodological, empirical strategy, and the data. Section 5 discusses the empirical results. The final section concludes and proffers some policy recommendations.

2.0. Non-Tariff Food Regulations on Tomatoes in the EU

We provide some background information on the two EU food regulations and the market conditions to be met before being allowed access the EU markets for the export of tomato from African countries.

(a) EU Pesticides Regulations

Pesticides are active substance used in protecting crops from plant and pest diseases before and after harvest, with the aim of increasing the quantity and quality of the produce. However, their usage or misuse remains a concern for human health and the environment.

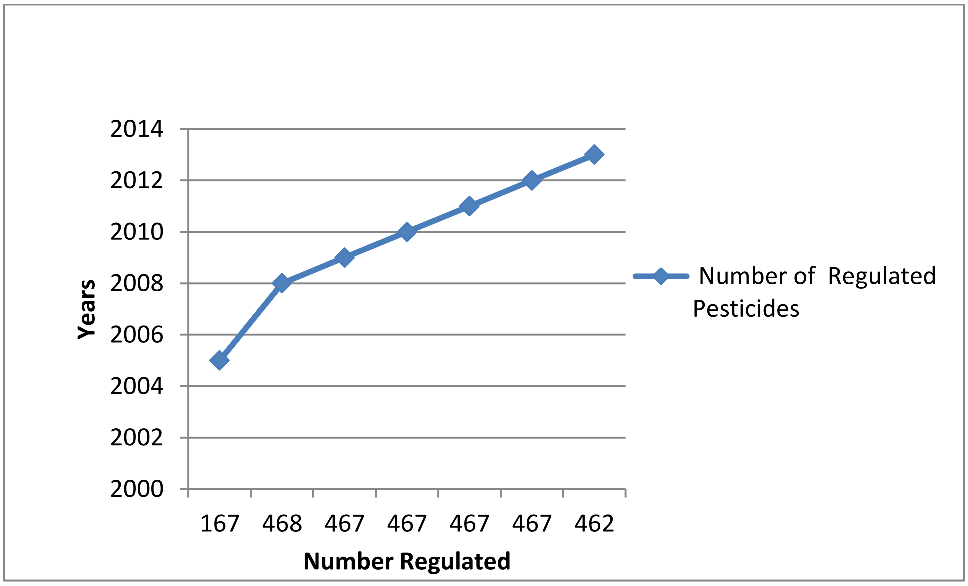
Thus, stringent risks assessment is usually undertaken to determine the maximum acceptable daily intake of pesticides that would be well below the acute reference dose over an individual's lifetime. Pesticide standards are set based on the acceptable maximum residue levels (MRLs) of a pesticides concentrates in or on food, based on good agricultural practices (GAP). In the EU, pesticides regulation is governed by Directive[a] No 396/2005, which establishes the standards on MRLs of pesticides allowed in products of plants and animal origin intended for consumption.

EU exercise a 'precautionary principle' by setting the most stringent default standard of 0.01 mg/kg on pesticides whose risk assessment has not be made or completed. The precaution principle is applied to protect health when there are reasonable concerns for health but sufficient scientific information or evidence concerning food risks is lacking, incomplete or inconclusive. The frequent exercise of this precautionary principle perhaps makes EU pesticide standards to be one of the most stringent in the world.

Figure 1 displays the number of pesticides regulated for each of the 3 products considered in this study. The EU set standards on a large number of pesticides for tomato amounting to 468 standards in 2008 which declined to about 462 in 2013. This reduction is due to a number of previously regulated pesticides standards, which are now exempted from regulation with no MRL required for them, as subsequent risk assessment show them to be safe for consumption.

[a] This directive came into force in September, 2008, repealed the four previously existing fragmented regulations on pesticides – Council Directives 76/895/EEC, 86/362/EEC, 86/363/EEC and 90/642/EEC, harmonized all pesticides standards among EU member states and replaced all national pesticide standards with this new harmonized MRLs.

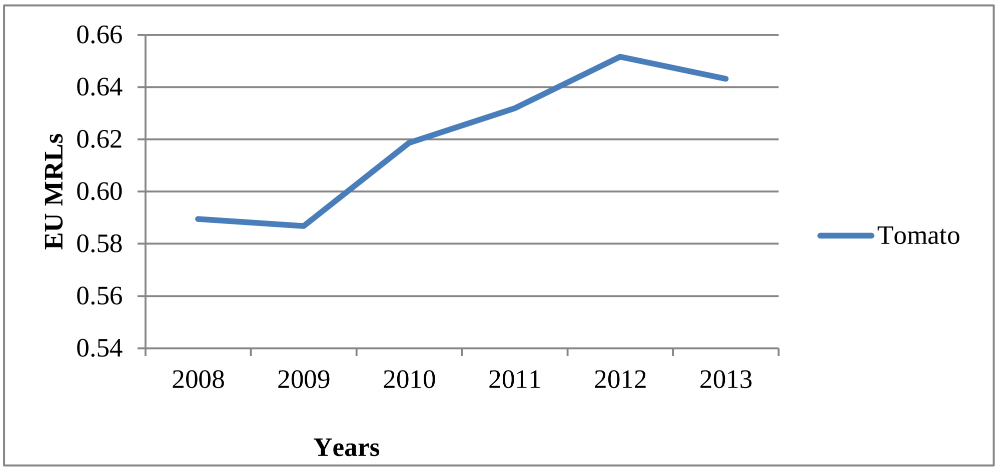
Figure 1: Number of Regulated Pesticides in the EU



Source: Authors' computation

The stringency of pesticide standards is measured in part per million (indexed as mg/kg). The higher the MRL, the lower the stringency of the pesticide standard, and a decrease in the MRL signals an increase in its stringency level. Figure 2 display the average stringency level of the subsets of pesticides regulated by the EU.

Figure 2: Trends in EU Pesticide Standards, 2008 to 2013



Source: Authors' computation

In the EU, the stringency and restrictiveness of the pesticides standards differ from period to period. From a high stringency level in 2008, EU pesticide standards on tomatoes became more restrictive in 2009 (a lower trend signifies higher stringency and thus, more restrictiveness and vice versa). In addition, the stringency level of tomato is more restrictive in 2013 compare to what was obtained in 2012. Although these standards are legitimate concerns by countries to safeguard health and safety, compliance with them might however be costly and trade distorting. This might be aggravated for developing countries which lack the necessary technical and scientific infrastructure, as well as the financial resources necessary to comply with these standards. The inability to comply with such standards can lead to trade restrictions such as border rejections or import detentions, import bans on particular products, and loss of country reputation , consequently inhibiting exports to the EU (Baylis, Nogueira and Pace 2010).

(b) EU Entry Price System for Fruits and Vegetables

Although exporting to the EU requires the satisfaction of EU minimum quality standards requirements, in reality, the satisfaction of such stipulated standards does not guarantee unrestricted market access to the EU, particularly for some specified exporters of fruits and vegetables. In addition to satisfying the EU standards requirements, exporters must also satisfy a ‘behind the border’ minimum price requirement – the EU entry price control.

The EU protects Community growers of selected 15 fruits and vegetable products from intense international competition by means of its minimum entry price control. This is done by imposing a penalty factor in the form of specific duties on exports, when the daily import prices falls below a predetermined seasonally varying stipulated minimum price. This system of protection is known as the EU entry price system (thereafter EPS). The EPS is a non-tariff measure which aims to restrict import prices below a stipulated entry price and acts to erode the competitiveness of exporters and increase the competitiveness of EU growers relative to exporters'. For instance, if the exporter supplies the product at a price below the ceiling entry price due to the competitive edge of the exporter who incurs lower cost of production, then a predetermined specific duty is levied as a penalty factor. This consequently makes the final price of the product to be relatively more expensive than the domestic price of the product. The specific duty imposed depends on how far below the exporters' price is to the prevailing entry price. The EU EPS come into force in July 1, 1995, replacing the old reference price system.

To calculate the applicable duties, information is needed on the import price of the product as well as the predetermined entry price. However, a large proportion of EU fruits and vegetable imports are paid on commission, implying that the import price is not determined until the commodity is sold in the EU markets. Due to this, the European Commission therefore calculates a 'synthetic' import price which the Commission refers to as the Standard import values (SIVs). The applicable SIVs, published on a daily basis by the EC are calculated from a survey of fruits and vegetable prices for each product and export origin, collated from designated representative fruits and vegetables wholesales markets in all the EU member countries (Goetz and Grethe, 2009). A SIV is then calculated on a daily basis as a weighted average of all the wholesale market prices collected from these representative markets, less the marketing and transportation costs, and custom duties (EC Regulation 3223/94).

The EPS varies by season with lower entry prices imposed during EU off season period of the applicable fruits and vegetables, and high entry prices are imposed when the fruits and vegetables are in seasons in the EU. Table 1 reports the schedule of entry prices for tomatoes which runs throughout the whole year from 01.01 to 31.12. The all year schedule is applicable in 8 different periods (Column 1) with the situation changing from period to period. The year round entry price (EP) varies between a minimum of 52.60 €/100 kg and a maximum of 112.60 €/100kg. Depending on the import price of the products and entry price (thereafter EP), the product then attracts a composite duty which is made up of an ad valorem tariff and a specific duty. In the case of tariff, the tariff imposed varies between 8.8% and 14.4% while the EPS duties imposed on the product varies between 0 €/100kg and 29.80 €/100kg (Table 1, column 3).

Table 1: Schedule of EU Entry Price Control for Tomato Exports and the Applicable Duties

	Applicable Dates	MFN Tariff (%)	Preferential Tariff (%)	MFN Minimum Entry Price (€/100kg)	MFN Maximum Entry Price (€/100kg)	Specific Duties (EPS satisfied) (€/100kg)	Specific Duties (EPS violation) (€/100kg)
All Year	01.01-31.12	8.80 -14.40	0	52.60	112.60	0	1.10 - 29.80
Period 1	01.01-31.04	8.80	0	77.80	84.60	0	1.70 - 29.80
Period 2	01.04-30.04	8.80	0	103.60	112.60	0	2.30 - 29.80
Period 3	01.05-14.05	8.80	0	66.80	72.60	0	1.50 - 29.80
Period 4	15.05-31.05	14.40	0	66.80	72.60	0	1.50 - 29.80
Period 5	01.06-30.09	14.40	0	48.40	52.60	0	1.10 - 29.80
Period 6	01.10-31.10	14.40	0	57.60	62.60	0	1.30 - 29.80
Period 7	01.11-20.12	8.80	0	57.60	62.60	0	1.30 - 29.80
Period 8	21.12-31.12	8.80	0	62.20	67.60	0	1.40 - 29.80

Source: European Commission, TARIC Database, 2014

The applicable EP duties are calculated as follows: if the synthetic import price (in this case SIV) is equal or greater than the ceiling EP in any given season, only the ad valorem tariff applies, and no EP duty is levied. In other words, the satisfying the ceiling entry price requirement always attracts zero duties (Column 7). If the synthetic import price is equal or below the minimum EP in any given season, an ad valorem tariff plus the highest EP duty applies which is usually 29.80 €/100kg. However, there are series of other applicable duties in between these minimum and maximum entry price duties. In this case, exporters with final selling price falling below the ceiling entry price are also penalised for bringing in products relatively cheaper than the domestic ones. Depending on the period the export product arrived at the EU, this duty varies between 1.10 €/100kg and 29.80 €/100kg (column 8). More specifically, the amount of the duty then depends on how far the import price is to the stipulated entry price. A clear example of the exact amount of entry price duty imposed is given in Table 2 which provides a detailed schedule of the entry price duties between January and April, levied on a typical country that a preferential agreement with the EU.

Table 2: Detailed EPS Schedule for Tomato: 01.04 to 30.04

Cases	Entry Price Conditions	MFN Tariff	Preferential Tariff*	Specific Duties
1	If the Import price is equal or greater than the entry price of 112.60 EUR/100 kg	8.80	0	0
2	If the Import price is equal or greater than the entry price of 110.30 EUR/100 kg	8.80	0	2.30 EUR /100 kg
3	If the Import price is equal or greater than the entry price of 108.10 EUR/100 kg	8.80	0	4.50 EUR /100 kg
4	If the Import price is equal or greater than the entry price of 105.80EUR/100 kg	8.80	0	6.80 EUR /100 kg
5	If the Import price is equal or greater than the entry price of 103.60 EUR/100 kg	8.80	0	9.00 EUR /100 kg
6	If the Import price is equal or greater than the entry price of 0 EUR/100 kg	8.80	0	29.80 EUR /100 kg

Source: EC TARIC, 2014

Suppose that in a day in January, tomatoes exports from an Africa country say Liberia arrives at the EU border at a CIF[a] price of 112.6 €/100kg. In this case, the CIF price (import price) is equivalent to the prevailing ceiling EP of 112.6 €/100kg (case 1). Thus, a preferential tariff of 0% applies due to preferential agreement Liberia has with the EU and no specific duty applies as the EU EPS requirement is perfectly satisfied. However, if Liberia arrives with a CIF price of 111 €/100kg, this implies that the CIF price falls below the EP of 112.60 €/100 kg, and a specific duty of 2.30 €/100kg is levied on the product. At the extreme end, if Liberia arrives at EU with a CIF price of 101 €/100kg, this implies that the CIF price falls

[a] Cost, insurance and freights.

below the minimum EP of 103.60 €/100 kg. In this case, the normal custom tariff of 0% applies, and a specific duty of 29.80 €/100 kg is applied implying that the import price of Liberia's tomatoes in the EU market is now 130.80 €/100kg (101+29.80) €/100kg. The addition of this additional duty can erode the competitiveness of these exporters.

3.0. The Tomato Sector in Africa

Africa has comparative advantage in the production of agricultural products, particularly tropical food products due to its favourable climatic conditions. Part of this huge production could result in export, serving as a source of export earnings and boosting income by increasing economic growth. Thus, a competitive export performance is needed to realise this goal. Table 3 shows some trend in Africa's production in the selected products and the corresponding volume exported to the world.

(a) Production and Exports

Africa is one of the important producers of tomatoes given its tropical region and the availability of sunshine all year round which favours its production. This is evident in Table 3 as production of tomatoes increased from about 10 million tonnes in 1995 to about 17.2 million tonnes in 2011. In addition, there has also been some growth in its production with significant positive growth witnessed in most years, apart from the period of 2010 and 2011 in which negative growth were recorded. In spite of the recent fall in growth rate, Africa is still one of the major producer of tomatoes, producing between 11% to 13% of world tomatoes between 1995 and 2011 (Column 7).

Table 3: Africa Exports and Production in Millions US$, 1995-2011

Year	Production		Export			Share in the world %	
Tomato	Tonne[a]	Growth Rate	Tonne[b]	Growth Rate	Share a/c	Production	Export
1995	9.99	2.48	0.17	-9.24	1.84	11.73	5.57
2005	16.25	1.68	0.20	48.38	1.21	12.56	3.94
2006	16.92	4.11	0.22	10.10	1.28	12.88	3.79
2007	17.12	3.21	0.39	11.20	2.22	12.52	5.55
2008	17.67	3.21	0.39	11.20	2.22	12.52	6.03
2009	19.10	8.11	0.47	20.51	2.48	12.37	6.86
2010	18.18	-4.83	0.45	-5.21	2.47	11.96	6.33
2011	17.22	-5.24	0.54	19.26	3.11	10.90	7.19

Source: FAOSTAT, 2014

On the export side, Table 3 also depicts that Africa's tomatoes export more than triple itself increasing from 174 thousand tonnes in 1995 to 540 thousand tonnes in 2011. In addition, after a negative growth of 9.2% in 1995, its export has recorded a positive growth rate with the exception of 2010 when it again witnessed a negative growth. In spite of the rapid expansion in the production of this produce, it is however surprising that a small proportion of it is exported to the world. For instance, in 1995, when tomato production was about 9.99 million tonnes, the volume exported was about 170 thousand tonnes, corresponding to a mere 1.8% of the produced oranges exported. This scenario is also true for subsequent years. In fact, most of the increased production of tomato in Africa has been domestically consumed as the continent only export to the world about 1.2 % in 2005 to about 3.1% in 2011of its total tomato production. This scenario depicts the continent's weak export capacity in tomato despite her capacity to produce it enormously. In addition, the continent still account for about 3.9% to 7.18% of total world export between 2005 and 2011 depicting the slow expansion of exports in the period (Column 8).

Numerous factors have been attributed to the decline in the export of this produce and the weak export as depicted above, out of which the proliferation of standards – both private and public, have been identified as one of the major obstacles to market access for developing countries tropical export products (Disdier, et al, 2008). Remarkably, as evident in our descriptive analysis, most of the poor or declining export growth can be attributable to the non-expanding production due to some domestic supply constraints, or some hidden market access problem of which food safety standards has been identified to be the major culprit (Otsuki et al, 2001b, Shepherd and Wilson, 2013). Coupled with this is the inhibiting entry price system of the EU which penalizes these exporters with the imposition of additional duties whenever they bring in competitive exports from Africa to the EU which also account for declining exports from Africa to the EU. In fact, Chemnitz and Grethe (2005) found entry price system to be an inhibitor to export penetration for Morocco tomato exports to the EU.

In terms of the direction of trade of Africa's tomato exports, aside intra Africa trade in this product, most of the tomatoes are exported to the EU which is the major trading partners of African countries. Thus major trade policies in the EU would have implications on African countries exporting to the EU and such policies consequently influence the decision on whether to or not to trade with the EU. Table 4 shows the direction of trade of tomatoes between 1995 and 2013. For comparison sake, we group this period into the period of pre-harmonisation of pesticide standards in the EU (1995 to 2007) where member states are not obliged to strictly adhere to standards set by the EU, and can impose their own country specific standards on export. The second period is between 2008 and 2013 which represent the period when EU standards are harmonised among member states such that only standards enacted by the EU parliament prevail in member states (Directive 396/2005).

Table 4: Direction of Trade of Africa's Tomato Exports, 1995 to 2013

	1995-2013	1995-2007	2008-2013
Africa	86.5	74.4	91.6
EU	7.7	9.4	2.9
Jordan	2.9	0.04	4.1
Syria	1.3	3.8	0.2
Others	1.6	12.4	1.2
Total	100.0	100.0	100.0

Source: Calculation based on Data from UNCTAD COMTRADE

As evident in Table 4, most of the export of tomatoes has been traded within Africa, amounting to as high as 86.5% between 1995 and 2013. 74.4% constituted intra Africa trade during the pre-harmonisation period, and this increased significantly to about 91.6% following the harmonisation of standards in the EU. This represents a sign of lack of significant market access to developed countries. A further look at Table 4 signifies that EU remains the major destination of Tomato export, aside Africa, accounting for about 9.4% of the continent tomato export between 1995 and 2007. This share however fell drastically to about 2.9% in the harmonisation period in the EU, not only due to the increased number of pesticides now regulated in this period but also due to the very stringent standards set by the EU to guide against risk from pesticide overdose.

Apart from this, tomato is termed one of the dirty dozen products by the Environmental Working Group (EWG, 2013). Dirty dozen are the top most twelve fruits and vegetables that usually retain a high level of pesticide residue and also have numerous numbers of different pesticides found on them. Thus, the EU is very vigilant about this product by exercising 'precautionary principle' such that a large number of pesticides for which risk assessment has not been undertaken or for which risk assessment is still ongoing are assigned a default and most stringent value of 0.01. Thus, the fall in African export of this product could be attributed to the high cost of upgrading their supply facilities in order to comply with the new set of EU standards which is aggravated by the continent's lack of adequate financial and technological resources to successfully comply with such stringent standards. The precedent fall in African tomato exports to the EU in this period has led to diversion of trade to other countries where standards are less stringent, particularly Jordan and some other African countries which absorb the excess supply of the product.

4.0. Methodology and Empirical Strategy

In line with previous literature, we employ the gravity model to analyse the trade impact of the NTBs. The formal usage of the model dated back to Tinbergen (1962) and Pöyhönen (1963). The simplest form of the model predicts that bilateral export between two countries is explained by exporters and importers economic masses proxy by their income and the geographical distance between the trading country-pairs.

4.1. Methodological Framework

The framework of our analysis is the Helpman, Melitz and Rubinstein (2008) (thereafter HMR), model, which was based on Melitz (2003) which provides theoretical underpinning for the heterogeneous behaviour of firms. Firm heterogeneity occurs as only a small fraction of firms finds it profitable to export and while others choose not to as they are less productive or efficient. This explains the occurrence of zero trade flows which largely characterise our data.

HMR therefore extended Heckman (1979) procedure by controlling for both sample selection bias and firm heterogeneity bias and approached the zero issue in a two-step estimation procedure which exploits the non-random presence of zero trade flows in bilateral trade data. The first step involves estimating an equation (Probit regression) for the probability of exporting at the firm level based on the decisions of the firms, which gives the effects on the extensive margin of trade (the decision to export). The second step is a trade equation estimated in its logarithm form and involves using the predicted probabilities obtained in the first step to estimate the effects on the intensive margin of trade (the number of exporting firms).

Our choice of the HMR model is based on some important premises. First, the standard practice of excluding zero bilateral trade observations can potentially give rise to sample selection bias, especially if the eliminated zeros are not randomly done, and estimating non-randomly selected sample is a specification error and can potentially bias the results. The HMR sample selection model is advantageous as it corrects for this sample selection bias resulting from the eliminating zero trade flows when estimating the logarithmic form of the gravity equation. In addition, the model is theoretically sound and offers an econometrically elegant solution to estimate gravity equation that includes zero trade flow (Linder and Groot, 2006). About 86% of our data consist of zero flows observations, necessitating us to use a method which deals with zero trade issues.

4.2 Model Specification

Define T_{ijt} as a binary variable which is equal to 1 if country *i* exports to country *j* and zero when it does not. HMR two-step estimation procedure consisting of two separate equations - the probability of exporting and export volume, can then be specified in log-linear form as follows:

$$\rho_{ijt} = P(T_{ijt} = 1 \mid x_{ijt}) = \Phi(\beta_0 + \beta_1 \ln Y_{it} + \beta_2 \ln Y_{jt} + \beta_3 PRI_{ijt} + \beta_4 EPS_{ijt} + \beta_5 \ln Dist_{ij} + \beta_6 Lang_{ij} + \beta_7 Col_{ij} + \beta_8 \mathrm{Re}l_{ijt} + \varepsilon_{ijt}) \quad (1)$$

$$\ln Exp_{ijt} = \alpha_0 + \alpha_1 \ln Y_{it} + \alpha_2 \ln Y_{jt} + \alpha_3 PRI_{ijt} + \alpha_4 EPS_{ijt} + \alpha_5 \ln Dist_{ijt} + \alpha_6 Lang_{ij} + \alpha_7 \mathrm{Re}l_{ijt} + \alpha_8 \eta_{ijt} + \hat{\bar{w}}^*_{ijt} + \ddot{\varepsilon}_{ijt} \quad (2)$$

Equation (1) is the selection equation which determines the binary decision of whether to trade or not. Equation (2) is the trade flow equation which gives trade estimates given that the observation on trade flows is positive. The subscripts *i*, *j*, *t* denote exporter, importer and time, respectively and ln implies the variable is measured in logarithm form. In the selection equation, the dependent variable is ρ_{ij} is the probability that country *i* exports to country *j*, conditional on the observed variables; $\Phi(.)$ is the cumulative distributive function of the bivariate normal distribution. Y_{it} and Y_{jt} are respectively the exporting and importing countries nominal GDP measured in US dollars whose effect on exports is expected to be positive. PRI_{ijt} is the pesticide restrictiveness indices on the allowable MRLs of all regulated pesticides and EPS_{ijt} is the control for the EU entry price system. $Dist_{ij}$ is the geographical distance between countries *i* and *j*. Lang (common language) and Col (colonial ties), are dummy variables that take the value of one when the exporting and importing countries share a common language, and have colonial ties respectively, zero otherwise. Rel (religion) is the probability that the two country pairs belong to the same religion and ε_{ijt} is the idiosyncratic error term which is expected to be well-behaved.

In the trade flow equation, Exp_{ijt} is the exports from country *i* to country *j* in logarithmic form, given that observed trade flow T_{ijt} is positive. We included the same set of explanatory variables contained in the selection equation (1) minus an exclusion restriction variable which does not enter the second stage regression; $\hat{\bar{z}}_{ijt}^{*}$ controls for firm heterogeneity; and $\hat{\bar{\eta}}_{ijt}^{*}$ is the inverse mills ratio – the standard Heckman's, correction for sample selection bias.

Following HMR, we implemented a linear control for firm heterogeneity by expanding $\hat{\bar{z}}_{ijt}^{*}$ around a cubic polynomial using a transformed variable $\hat{\bar{z}}_{ijt}^{*}$ which was obtained from the predicted value of rho using $\hat{\bar{z}}_{ijt}^{*}\Phi^{+1}(\hat{\rho}_{ijt})$. Where $z_{ijt}^{*} = z_{ijt} / \sigma_{ijt}$ and $\hat{\rho}_{ijt}$ is the predicted values of the probit equation which is used to obtain the predicted values of the latent variable. Using this transformation, the inverse mill ratio has a unit normal distribution and is given as $\hat{\bar{\eta}}_{ijt}^{*} = \phi(\hat{z}_{ijt}^{*}) / \Phi(\hat{z}_{ijt}^{*})$ while firm heterogeneity is obtained as a polynomial in $\hat{\bar{z}}_{ijt}^{*}$, where $\hat{\bar{z}}_{ijt}^{*} = \hat{z}_{ijt}^{*} + \hat{\bar{\eta}}_{ijt}^{*}$

To obtain consistent estimates, we also control for multilateral trade resistance terms. A common practice of proxying the terms in panel data is using time varying importer and exporter fixed effect (Fenstra, 2004). As an alternative, we employ Baier and Bergstrand (2010) first order Taylor series approximation of bilateral trade costs using simple averages. The approach has been shown to produce estimates to Anderson and van Wincoop (2003) structurally iterated least square method (Baier and Bergstrand, 2010; Egger and Nelson, 2011). For each trade cost variable, the first order Taylor series is expanded and all the newly demeaned trade costs variables are then used in the regression. Following Egger and Nelson

(2011), using the distance variable as an example, each bilateral trade cost variables is transformed using the following approximation:

$$Dist_{MRTij} = Dist_{ij} - \frac{1}{N}\sum_{j=1}^{N} Dist_{ij} - \frac{1}{2}\frac{1}{N^2}\sum_{i=1}^{N_r}\sum_{j=1}^{N} Dist_{ij} \quad (3)$$

The transformed variable $Dist_{ijMRT}$ is defined as exporter and importer fixed effects, and similar definition holds for the other bilateral trade costs.

5.0. Data Sources and Measures of EU Food Regulations

In this session, we provide the data sources for our analyses and how the two non-tariff measures of EU food regulations on entry price and food safety standards were constructed.

(a) **Data Sources**

Our dataset covers bilateral trade on exports between 8 EU importing countries and 27 African exporting countries[a] who are major trading partners between 2008 and 2013. Bilateral data on tomato export was extracted from UNCTAD COMTRADE at the HS6 level. A unique feature of our data is that it contains about 86% zeros. Some of these zeros may be due to statistical zeros such as rounding up, but majority of the zeros are more likely to be a result of African exporters' inability to trade due to some prohibitive fixed cost they have to bear in establishing trade partnership with the EU countries. Data on distance, language and colony were collected from the Centre d`Etudes Prospectives et d'Informations Internationales (CEPII) database, GDP data comes from the World Bank's World Development Indicators, while data used in constructing the regional agreement dummy was from the World Trade Organisation. Data on pesticide standards was from the EUROPA online database. We collate

[a] The importing countries are Belgium, France, German, Italy, Luxembourg, Netherlands, Portugal and Spain. Exporting countries are Algeria, Angola, Cameroon, Cape Verde, Chad, Democratic Republic of Congo, Côte d'Ivoire, Egypt Arab Republic, Equatorial Guinea, Gabon, The Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Liberia, Libya, Mauritania, Mauritius, Morocco, Nigeria, Sao Tome Principe, Senegal, Sierra Leone, South Africa, Togo and Zambia.

all pesticide standards in force over the period of 2008 to 2013 by mapping each standard to a standard trade classification (HS6). We used the SIVs as a measure for the EU import price of the commodity which is the milling price of the commodity less the marketing and transportation costs and custom duties. Data on EU entry price measures and duties in Euro was manually collated from European Commission via the TARRIC website and was converted to US dollar using exchange rate data from World Development Indicator, 2014. The ad valorem equivalent of the entry price duties were calculated using the WTO Agricultural method. Data on standard import values were obtained from EU journal

(b) EU Entry Price Measure

We constructed two distinct indicators to capture EU entry price control. The first indicator is based on the antecedent pricing behaviour of the exporter. Intuitively, the rational exporter would want to avoid the EP duties, some exporters may supply export products at the minimum possible price to the EU, such as supplying the product at a price above the prevailing ones in EU markets, consequently eroding exporters' competitive cost advantage. Therefore, we constructed an indicator to capture this pricing behaviour. This indicator[a] captures the difference between the SIV and the corresponding ceiling entry price (EP) imposed by the EU and is given as:

$$Gap_{ijt} = SIV_{itj} - EP_{itj}^{c} \qquad (4)$$

Where *i*, *j*, and *t* are respectively the exporter, importer, and time subscripts. SIV is the synthetic import price of tomato and EP^c is the daily ceiling entry price of tomato imposed by the EU aggregated over each year. Based on equation (4), if $GAP_{ijt} < 0$, then, the import price

[a] This indicator is somewhat similar to that used by Goetz and Grethe (2009) with the exception that theirs was a relative indicator as the right hand side of equation (8) is divided by the EP, while ours is an absolute one.

is below the EP and this leads to the imposition of additional duties which erodes the price competitiveness of the export goods. For observations with $GAP_{ijt} \geq 0$, then, the import price is equal to greater than the ceiling EP, thus no specific duty is levied. On the one hand, cases of SIV being above the EP leads to a decrease in export price competitiveness, as the final price of the exports becomes more expensive relative to similar domestic goods, discouraging export purchases and thus decreasing exports to the EU. On the other hand, cases of which SIV is below the EP also means that additional duties would be incurred as a penalty factor. Thus, the final price of the exports becomes more expensive due to the additional duties incurred. Adding in the additional duties to the synthetic import price (SIV) may increase the export price (CIF) above the prevailing domestic price, thereby also discouraging exports. So, either way, the coefficient will be negative.

The second indicator is the specific duties[a] arising from the enforcement of the EPS by the EU. A large percentage of African countries enjoy preferential access to the EU market under the "Every Thing but Arms Agreement", implying a zero tariff on their tomato exports to the EU. However, only a selected few enjoy preferential EPS (this market condition does not imply zero entry price duties but a reduced EP duties) while the others have to comply with EU's most favoured nation (MFN) market access conditions of the EPS. The effectively applied daily duties measured in EUR per 100kg were manually computed and this sums up to about 365 data point in a year, and a total of 2192 data points, between 2008 and 2013. The ad valorem tariff equivalents of the specific duties were then calculated using WTO agricultural method. A simple yearly average of the daily ad valorem tariffs is then calculated to get yearly ad valorem tariff, and this is then used in our analysis. A prior, we assume this coefficient is expected to have the negative impact on exports.

[a] We omitted tariff as most of these African countries enjoy preferential tariff rate under the non-reciprocal EU's Everything but Arms Agreement, resulting in most case to a 0% tariff for most African countries.

(c) Stringency of Food Safety Standards

We constructed a simple food safety standard restrictiveness index by combining information on the total number of pesticides regulated and level of stringency of the pesticides. Our restrictiveness index is given as:

$$PRI_{ijkt} = \frac{1}{n}\sum_{k=1}^{n} MRL_{ijkt} \quad (5)$$

Where *PRI* is the regulated pesticide restrictive index, which gives the yearly averaged maximum residue limit of all pesticide standards *k* imposed on by importer *j* on country *i*'s exports over time *t*; and *n* denotes the no of regulated pesticides. The regulated maximum residue limit is indicated in parts per million and measured as mg/kg and the lower the value of the index, the higher the stringency of the pesticide standards. The regulated pesticide restrictive index can then either have a direct or an inverse relationship with exports. A positive coefficient on the index implies that standard is trade prohibiting as standard has a direct relationship with exports – such that a decrease in the value of the restrictiveness index (increase in stringency) decreases exports, and vice versa. Therefore, the coefficient on the regulated pesticides restrictive index is expected to be positive if the standard limits trade and vice versa.

6.0. Results and Discussion

The result of the HMR sample selection model is presented in this section. Our exclusion variable is colonial tie and it is assumed to be correlated with the fixed costs of trade but weakly or negligibly correlated with the variable trade costs. The selection equation is estimated using probit methods while the trade equation is estimated using a linear estimator - the feasible generalised least square method due to its advantage. It is does not impose any prior restriction on the model and second, it helps to control for heteroscedasticity. Table 5 presents the main results based the estimation of the selection equation (extensive margin of trade) and those of the selection equation (intensive margin of trade).

(a) **Extensive Margin - Tomatoes**

The extensive margin estimates have several implications for 3 types of exporters. First are new firms or exporters that are seeking to enter the export market, which we term potentially new firms. Second are existing firms that are currently established, but which seek to expand their export base and/or market base, which we termed expanding exporters. Third, existing firms which are not profiting and are gradually abandoning trade, known as disappearing exporters.

Column 2 of Table 5 presents the main results from the estimation of the selection equation (extensive margin of trade) showing the potential trade effects of EU standards and the two indicators capturing EU entry price controls on Africa's exports of tomatoes to the EU. The estimates in the outcome equation show food safety standards on pesticide residues to be deterrent to potential Africa's tomato exporters in penetrating EU markets, while entry price indicators turns out to be of no relevance to establishing trade relations with the EU (column 2). More specifically, EU regulated pesticide restrictive index is positive and significant. As discussed earlier on, our pesticide standard restrictiveness index[a] of regulated standards were constructed such that, a positive coefficient on it implies that that standard is trade prohibiting as standards have a direct relationship with exports – a decrease in the value of the standard restrictiveness index (increase in stringency) decreases exports, and vice versa (see also Otsuki, Wilson, and Sewadeh, 2001a,b; Chen, Yand and Findlay, 2008). This positive coefficient thus indicates that standards imposed by the EU are inimical to Africa's

[a] The regulated pesticide restrictive index can then either have a direct or an inverse relationship with exports. A positive coefficient on it implies that that standard is trade prohibiting as standards have a direct relationship with exports – such that a decrease in the value of the standard restrictiveness index (increase in stringency) decreases exports. However, a negative value denotes that standard is trade promoting as standard has an inverse relationship with exports – such that a decrease in the stringency (increase in standard) increases exports. Therefore, the coefficient on the restrictive index is expected to be positive if the pesticide standard limits trade and vice versa.

tomatoes exports performance at the extensive margin such that a decrease in the index of the standard decreases tomato exports by 6.9%.

Table 5: Impact of EU Food Regulations on African Exporters

	Extensive Margin		Intensive Margin	
Exporters GDP	0.127	(0.092)	0.626***	(0.130)
Exporters GDP	0.091	(0.128)	0.028	(0.142)
EU Pesticide Standards	6.947***	(2.034)	14.448***	(4.734)
Entry Price GAP	-0.017	(0.018)	-0.062**	(0.025)
Entry Price Tariff	-0.202	(0.370)	-1.075**	(0.516)
Distance	-3.147*	(1.607)	-0.597	(1.929)
Language	0.393	(0.656)	-0.231	(1.208)
Religion	3.529	(3.437)	20.213***	(3.275)
Colonial Ties	3.096***	(0.894)		
Inverse Mill Ratio			17.285***	(2.295)
Zeta			307.440***	(38.716)
$Zeta^2$			-275.278***	(38.252)
$Zeta^3$			82.560***	(12.973)
Constant	-8.267**	(3.282)	-130.7***	(16.806)
Observations	1248		134	

*** p<0.01, ** p<0.05, * p<0.1 clustered robust standard errors in parentheses, clustered by importer, exporter and year

This result is as expected: in fact tomatoes our result is in confirm those of Otsuki, Wilson, and Sewadeh, 2001a,b; Chen, Yand and Findlay, 2008; and Shepherd and Wilson, 2013 all of whom found EU standards to hurt export penetration. The coefficient on the variable which measures the competitiveness of Africa’s tomatoes price relative to domestic growers’ due to the imposition of the entry price barrier is indistinguishable from zero.

Likewise, the coefficient on the ad valorem duties incurred from exceeding EU ceiling entry price is insignificant, implying that entry price is of no relevance to establish new trade.

In relation to the other explanatory variables in the models, the economic masses of African countries proxied by their GDP do not significantly encourage tomato export. In essence, economic growth recently enjoyed by the continent has not been used in encouraging tomato exports which is indicative of a major domestic market constraint in these African countries. Similar result was obtained by Mayer & Fajarnes, 2008; and Beghin and Xiong (2012) who confirmed that Africa's domestic market constraint such as its lack of supply capacity is one of the major constraints to Africa's export penetration to the EU markets. In addition, on the demand side, importers' consumption expenditure on African's tomatoes, measured by EU GDP[a] is not statistically significant for these set of exporters. This can be attributed to the changing tastes and preferences of EU consumers for organic tomatoes which negatively affect their marginal propensity to import these tomatoes from Africa. Furthermore, we find African tomatoes exports to decrease with increasing distance, and the effect as large as a 3.1% decrease in exports with a one percentage increase in kilometre. This has been attributed to the high cost of conducting international transactions (Djankov, Freund, & Pham, 2010) existing poor trade facilitation infrastructures in the continent which results into higher trade costs for the region (Iwanow and Kirkpatrick, 2009; Portugal-Perez and Wilson, 2012) and weak trade related infrastructure (Francois & Manchin, 2013) all of which affect Africa's export competitiveness. Sharing similar religion and language between African exporters and EU importers does not significantly influence the probability of exporting tomato from Africa to the EU, while colonial ties between them is a significant determinant of establishing new trade or expanding existing ones. The significance of this latter variable

[a] In addition, when analysing sectorial trade flows such as agricultural export products, the notion that bilateral trade flows between country pairs would be increasing in the economy masses of the country pairs is not necessary warranted (Ferro et. al, 2015).

justifies its use as a plausible excluded variable in the trade equation (intensive margin model).

(b) **Intensive Margin Tomatoes**

The result of the intensive margin indicate that EU food safety pesticide standards significantly decrease Africa's export of tomato to the EU and complying with EU entry price requirements limit tomato export to the EU (column 4, Table 5). More specifically, the result of this model shows that, regulated standards has a direct impact on existing Africa's tomatoes exporters signifying that a decrease in the pesticide standards (increase in its stringency) decreases tomatoes exports to the EU by 14.4% which is on a very high prohibitive side. This is not unexpected as tomatoes constitute one of the 'dirty dozen' exports. The dirty dozen products is a list of the most pesticide-contaminated fruits and vegetables that usually retain the highest levels of pesticides residues and are more likely to test positive for multiple pesticides (EWG, 2013). Thus, this product attracts the most stringent standards to protect consumers, implying additional fixed trade costs which might be enormous for the small scale producers, most of which constitute exporters of this product in Africa. This has led to significant trade diversion to other countries. For example, prior to the harmonisation of EU pesticide standards in 2008, Africa's export about 9% of its tomatoes to the EU, however with the new EU regulation and the associated increase in the stringency of standards forced exports to the EU to fall to 2.9 % with Africa redirecting its exports to the countries in the Middle East, particularly Jordan (c.f. Table 4).

Meanwhile, the entry price system of the EU which penalizes exporters whose import price is below the specified maximum entry price is significantly inimical to tomato exports from Africa. the 'entry price GAP' variable which measures the competitiveness of Africa's tomatoes exports import price relative to domestic growers' due to the imposition of the entry price barrier is also significantly negative, signifying that the imposition of the entry price control inhibits Africa's price competitiveness although its magnitude is very moderate. In fact, for every 100 kilogramme of tomatoes exported to the EU, a one dollar increase in Africa's CIF price of tomatoes over the EU ceiling entry price reduces exports by 6 dollars . Thus the entry price regulation is associated with a decrease in export volume, as the final price of the exports becomes more expensive relative to EU domestic prices, discouraging export purchases and thus decreasing exports to the EU. Similar results were found by Chemnitz and Grethe (2005) on Morocco tomato exports to the EU and by Goetz and Grethe (2010) on China's exports of apples and pears to the EU.

On a related note, the second indicator of EU entry price system capturing the tariff equivalent of the duties incurred by the exporters as a result of their violation of the entry price requirement also significantly decrease tomato, such that a 10% increase in the additional duties leads to 10.1% decline in tomato exports to the EU by these countries. This is expected as the final price of the export good becomes more expensive due to the additional duties incurred. Adding in the additional duties to the CIF increases the final import price above the prevailing domestic price in the EU, thereby discouraging exports and might have implication for cases of disappearing exporters in the tomato export market.

Despite the negative implications of these EU food regulations on Africa's export, on average, Africa's productive capacity for this product has been able to propel the export of this product to the EU by the existing firms who choose to remain in the export market such that a one percent rise in GDP increases the export of this product by 0.6%. However, the consumption expenditure of EU consumers is not significant, implying that their current income does not encourage their propensity to import or consume tomatoes from Africa. This is probably because as income increases, so does their unwillingness to consume conventional tomatoes and instead their preference for organic products increases. In relation to other trade costs, again, distance and sharing similar languages are insignificantly for existing tomato exporters to the EU. However, having sharing the same religion significantly increases tomatoes exports to the EU market. The inverse mill ratio and the polynomial variables proxying for firm heterogeneity are all statistically significant confirming the presence of both sample selection and firm heterogeneity biases which the HMR helps in controlling for, thus justifying the use of the HMR model which helps in eliminating these two biases.

(c) Robustness Checks

We did some robust checks in order to assure the reliability of our results. We first check the sensitivity of our results to an alternative constructed measure of the stringency of EU standards. The new standard restrictive variable we constructed is based using the Laspeyres[a] index which is popularly used in calculating the consumer price index. Since the LI is an acceptable index used in capturing the upward and downward movement of prices, we deem this index fit as an alternative that could capture the stringency and laxity of standards, thus justifying our use of it. Formally, the formula is given as

$$L_{MRL_{ijkt}} = \frac{1}{n} \frac{\sum_{k=1}^{n} P_c Q_b}{\sum_{k=1}^{n} P_b Q_b}$$

Where *L* is the Laspeyres index of MRL of regulated pesticides in the EU, which gives the yearly averaged maximum residue limit of all pesticide standards *k* imposed on by importer *j* on country *i*'s exports over time *t*. the subscripts *c* is the current year, while *b* is the base year, which in our case is always the previous year; and *n* denotes the no of regulated pesticides. Since higher MRLs allow the presence of greater pesticide residues, therefore, higher Laspreye index implies a less restrictive standard. Again, as before, an decrease in the Laspeyres index (signifies an increase in the stringency of the standard relative to the based year) decreases export, thus, a positive coefficient on it implies that standard is trade

[a] We thank an anonymous reader for suggesting to test the robustness of our results using an index with similitude to the Laspeyres index.

prohibiting as standards have a direct relationship with exports and vice versa. The results of this robustness check are reported in the part A of Table 6. As expected, the results are in line with those reported in Table 5, albeit the effects of the food safety standards on pesticide residues are relatively smaller.

Table 6: Robustness Checks

	(A)		(B)		(C)	
	Extensive	**Intensive**	**Extensive**	**Intensive**	**Extensive**	**Intensive**
Exporters GDP	0.127	0.626***	0.028	0.317**	0.119	0.812***
	(0.092)	(0.130)	(0.093)	(0.098)	(0.091)	(0.103)
Importers GDP	0.091	0.028	0.124	0.358*	0.101	0.006
	(0.128)	(0.142)	(0.132)	(0.174)	(0.142)	(0.139)
EU Pesticide standards	4.095***	8.517**	6.924**	8.729	6.528**	18.105***
	(1.199)	(2.791)	(2.191)	(4.611)	(2.203)	(4.327)
Entry Price GAP	-0.017	-0.062*	-0.011	-0.069*	-0.016	-0.083***
	(0.018)	(0.025)	(0.022)	(0.029)	(0.017)	(0.022)
Entry Price Tariff	-0.202	-1.075*	-0.040	-1.166	-0.213	-1.511**
	(0.370)	(0.516)	(0.450)	(0.620)	(0.372)	(0.485)
Distance	-3.147	-0.597	-3.326	-1.363	-4.029*	-2.508
	(1.607)	(1.929)	(1.711)	(2.352)	(1.630)	(1.827)
Language	0.393	-0.231	0.425	-2.495*	0.339	1.912*
	(0.656)	(1.208)	(0.690)	(1.139)	(0.702)	(0.951)
Religion	3.529	20.214***	3.637	22.550***	1.865	16.338***
	(3.437)	(3.275)	(3.580)	(2.916)	(3.150)	(3.309)
Colonial Ties	3.096***		3.241***		3.688***	
	(0.894)		(0.932)		(0.951)	
Inverse Mill Ratio		17.285***		11.534***		14.213***
		(2.295)		(2.237)		(2.074)
Zeta		307.442***		205.680***		167.712***
		(38.716)		(34.311)		(24.380)
$Zeta^2$		-275.280***		-178.125***		-120.064***
		(38.252)		(30.771)		(18.683)
$Zeta^3$		82.560***		50.904***		28.213***
		(12.973)		(9.316)		(4.851)
Constant	-8.267*	-130.734***	-6.898*	-92.056***	-8.122*	-94.094***
	(3.282	(16.806)	3.303	(16.551)	3.638	(13.213)
Observations	1248	134	1152	117	1008	124

*** p<0.01, ** p<0.05, * p<0.1 clustered robust standard errors in parentheses, clustered by importer, exporter and year

As a further robust check, we probe if our results are driven by characteristics of the exporting countries. We excluded both Nigeria and South Africa from our exporting countries sample and again estimated the effects of these food regulations on African exports. The results presented in part B of Table 6 are similar to those obtained in columns 2 and 4 of Table 5 and so, our major conclusion remain the same signifying that our results are robust to the exclusion of two largest African countries that has significantly higher income growth. We again repeat the exercise but now excluded countries[a] that have relative lower exports to the EU to check if these outliers are the one driving the negative results obtained. The results of this check are presented in the part C of Table 6. Again, this results further highlight our conclusion as the results are similar to those obtained in Table 5, although a few of the coefficients are lower in magnitude. Nevertheless, the basic message of this study in relation to the impact of the two non-tariff measures remains largely unchanged.

7.0. Conclusion and Policy Recommendations

As tariff has been negotiated down, an array of non-tariff barriers particularly food safety standards are increasingly assuming importance in agricultural food trade. Standards help in building value into certified goods and services as it provide consumers with information and assurance about their health and safety. Compliance can therefore ensure increased market access. Standards can however constitute additional barriers to trade because meeting these standards imposes excessive costs on producers which might be aggravated for those from developing countries, particularly Africa which is largely characterized by imperfect market.

In addition to complying with EU pesticide standards, concurrently, exporters must also comply with the EU minimum entry price requirement for certain fruits and vegetables, which protect EU growers from intense competition, the violation of which attracts some specific duties. The cost implication of these two NTMs is enormous, especially for small scale exporters. This study therefore investigates the impact of these two non-tariff measures on selected Africa's fruits and vegetable exports to the EU. The selected food exports are

[a] The excluded countries are Chad, Guinea, Libya, Mauritius and Zambia.

those that Africa has relative productive strength in and these include: tomatoes, oranges, and lime and oranges.

Our main result shows that the EU entry price control to greatly diminish Africa's exports of tomatoes to the EU. Future trade negotiations and agreement with the EU should include the provision of beneficial preferential entry price duties for these highly competitive exporters to allow them to also benefit from trade. Trade agreements are undertaken so as to strengthen trade relations between participating countries, remove unnecessary bottlenecks and increase trade volume. Thus, trade negotiations between the two trading partners should be one which will ensure that adequate provisions are made to enable African countries not only to strengthen their supply side capacity but also to lower the entry price entry barrier for least developed and lower income countries among them.

More so, standards seem to significantly hurt exports success of African tomatoes exporters at both margins of trade. Thus, adequate measures must be put in place to ensure compliance with EU standards so as to enhance continuous market access for the continent, such that the Africa would be able to make use of trade to alleviate its prevailing poverty as well as achieve a more balanced and equitable economic growth. Engaging in sophisticated scientific and technology transfer as well as providing both financial and human development assistance to producers and exporters are important policy imprint needed to be implemented to ensure positive change. At the home front, the removal of domestic market restraints such as an improvement in trade facilitation, provision of enabling regulatory framework, and institutional development will work not only to increase aggregate agricultural output but also its production for export.

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