Protecting Health or Protecting Imports? Evidence from EU Non-Tariff Measures

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Abstract

Non-tariff measures such as food safety standards are aimed at protecting consumers' health but may also be used as protectionism tool to limit imports. This study investigates the protectionist intent of EU food safety standards using a sample of EU food imports from African countries. We formalized protectionism by comparing EU standards to the internationally scientific benchmarks. Our results support the hypothesis that heavily import dependent sectors are less protected. Further analysis shows no substantial rise in the usage of these measures as protectionism tool during the period of financial crisis.

Keywords: Trade protectionism, Non-tariff measures, food safety standards, food exports, European Union

JEL Classifications: F13 F14 L15 P16 Q17 Q18

1. Introduction

Trade protectionism involving the deliberate use of government regulations to limit the importation of goods and services from third countries has been a popular facet of international trade. Prior to the General Agreement on Tariffs and Trade (GATT) and its subsequent revisions, extensions, and rounds, protectionism has been attained with the use of overly high tariffs on exported goods. However, as a result of the GATT[1] agreement, this kind of protectionism lost its ground following a decrease in the use of tariffs and the consequent rise of non-tariff measures (NTMs) by many countries which shifted towards using them as trade barriers (Baldwin, 1970). NTMs take many different forms ranging from traditional barriers, such as quotas and subsidies, to more sophisticated and complex ones, including technical barriers to trade (TBT), sanitary and phytosanitary[2] (SPS) measures, entry price controls, among many others. However, protectionist intent is not usually glaring in NTMs as it often is with tariffs since NTMs are often less transparent than tariffs and are, at times, linked to non-trade policy objectives[3] such as consumer protection. Consequently, protectionist intent is more difficult to detect. Such non-trade objectives include the legitimate concern for the welfare of the citizenry, in which case the government is mandated to protect consumers' health and the environment by ascertaining that NTMs guarantying a certain health and safety level are imposed.

However, such NTMs could also be employed as a tool in protecting domestic producers and driving out foreign producers; this is done by using stringent trade protectionism measures to drive a wedge between foreign and domestic producers (Baldwin, 1970, 2000). This may occur with many food products in which the government seeks to achieve a non-trade objective of maximizing consumers' health and safety, but at the same time sets much more stringent food safety standards than required by international benchmarks. Indeed, the proliferation and continuous use of some SPS measures on food – food safety standards – as protectionist tools has been found to inhibit the expansion of exports in global markets for many developing countries, particularly Africa (Otsuki, Wilson and Sewedah, 2001; Shepherd and Wilson, 2013; Kareem, Brümmer, Martinez-Zarzaso 2016). Consequently, this may jeopardize the developmental progress of the continent since deep trade integration is widely viewed as the most promising avenue to achieving economic growth (Nicita and Rollo, 2015).

There have been a few, but insightful number of studies investigating whether NTMs are increasingly used as protectionist tools (Beverelli, Boffa, and Keck, 2014; Calo-Blano and Naya, 2005; Grundke and Moser, 2014; Kee, Neagu, and Nicita, 2008; Nordas and Ragoussi, 2015). Nonetheless, little is known on whether EU's usage of pesticide standards have protectionist intent. The literature on SPS standards have primarily focused on examining the effect of minimum quality and compatibility standards on trade flows (Grandal and Shy,

[1] GATT agreements and the subsequent post-war GATT rounds (such as the Uruguay and Tokyo rounds) and the need to substantially reduce the pervasive protectionism of the 1930's and expand world trade resulted into increased success in the reduction of visible tariff (Rivera-Batiz and Danyang, 1992).

[2] SPS are measures aimed safeguarding human, plants and animals' health and safety by protecting them from food hazards, pest and diseases and other related risks (WTO, 2015).

[3] Such non-trade objective includes achieving certain minimum health and safety level.

2001; Otsuki et al., 2001; Disdier, Fontagné, and Mimouni, 2008; Ferro, Otsuki, and Wilson, 2015; Fontagné, Orefice, Piermartini, and Rocha., 2015; etcetera). The protectionist usage of pesticide standards and their implication for exporting countries is not yet completely understood. This can be largely attributed to the difficulty of differentiating these standards' non-trade policy objectives from their trade policy objectives, and a lack of a globally accepted benchmark for doing this (Li and Beghin, 2014; Xiong and Beghin, 2014). This emanates from the fact that that any of them are contingent protection measures that are used in targeting specific sectors without violating the World Trade Organisation (WTO) principle of non-discrimination in trade (Miyagiwa, Song, and Vandenbussche, 2016).

While the literature on the protectionist use of food safety standards is scarce, there are a few theoretical works available in contrast to the very limited empirical literature. On the theoretical side, early studies in this area have qualified protectionism to occur when the welfare maximising standards of the domestic country are higher than those of the social planner, and vice versa for a lack of protectionism. They demonstrated that domestic policy makers set a number of standards in order to maximize both producers and consumers' welfare along with the welfare of some interest groups. These domestic standards are then compared to the globally acceptable international standards that a social planner seeking only to maximise social welfare inclusive of foreign profits, would have implemented (Fisher and Serra, 2000; Marette and Beghin, 2010).

The major conclusion that emerged from these theoretical literature is that standards are being used as tools of disguised protectionism to protect domestic producers from competition (Fischer and Serra, 2000; Anderson, Damania, and Jackson, 2004; Sturm, 2006; Sheldon, 2012). Nevertheless, extensive theoretical underpinnings of some other authors have pointed to the fact that standards are not necessarily protectionist, and might at times be indicating a lack of protectionism (Tian, 2003; Maertens and Swinnen, 2007; Marette and Beghin, 2010; Swinnen and Vandemoortele, 2011). The divergent nature of these theoretical assertions indicates the need for standards to be empirically analyzed product by product before ultimately categorizing them as protectionist tools – a gap which this study attempts to fill.

This research contributes to the literature by ascertaining the protectionist intent of EU SPS standards on tomatoes and citrus fruits. More specifically, we focus on pesticide standards and posit that pesticides standards are a good case study given the fact that they are primarily enacted due to a legitimate concern for consumers' health and safety (the non-trade objective). However, they can also be used as protectionist tool by importing countries that set overly restrictive standards to attain certain level of protectionism (the trade objective). This provides a basis for determining whether or not the chosen level of standards is indeed protectionist. Moreover, out of all NTMs, our interest in standards stems from the fact that a significant share of traded food products is subject to standards regulated by many importing countries, thus making standard an important case study.

While the WTO agreements on TBT and SPS measures specify that the measures should not be used to create unnecessarily trade barriers and recommend that international standards should be used, the agreements also recognize that countries could resort to the usage of more stringent domestic standards provided they have a scientific justification. This clause has been extensively exploited to the advantage of many developed standard-setting countries to the extent that some standards have generated a number of disputes, due to the accusation that they are being used as disguised protectionist tools. For instance, there have been a significant number of disputes among several Organisation of Economic Cooperation and Development (OECD) countries and a number of these have been brought to the WTO after its dispute settling procedure was established in 1995 (Dee and Ferrantino, 2005).

Given that countries have a free hand to make standards that deviate from the international norms, one may pronounce domestic standards that exceed the international socially optimal benchmarks as being overly stringent, suboptimal, perhaps protectionist in nature, and therefore trade distorting (Fisher and Serra, 2000; Grandal and Shy, 2001; Marette and Beghin, 2010). Likewise, domestic standards that are lower than the international socially optimal benchmark can be said to be less trade distorting or perhaps trade enhancing, but also suboptimal and non-protectionist. However, empirical investigation of the trade effect of such *suboptimal standards* is rare due to the difficulty of distinguishing standards with legitimate intent from those with protectionist intent (Li and Beghin, 2014). Thus, this study fills this research gap by estimating the protectionism extent of EU pesticide standards relative to their globally acceptable benchmark and how this affects the potential of African food exporters to establish trade relations with the EU. The most related study in this sense is that of Li and Beghin (2014), albeit still with significant differences. Firstly, the focus of their study was on the United States (US) rather than the EU. Secondly, their study utilized a cross-section of maximum residual limits (MRLs) of pesticides and veterinary drug standards to panels of trade flows. As a result, the study misses an important part of heterogeneity in standards. We use the newly available panel of pesticide standards from the EU database of pesticides to estimate the impact on Africa's exports. Our study is thus an improvement as the use of panel data allows unobserved heterogeneity to be controlled for. Furthermore, to our knowledge, this represents the first study of its kind on Africa's exports.

In this study, we investigate the protectionist intent of EU food safety standards using a sample of EU food imports from African countries with a specific focus on tomatoes and citrus fruits. These products provide a good case study to analyse protectionism of standards with an explicit focus on African countries due to a number of reasons. First, the EU is the largest importer of these products. Consequently, this may spur interest groups to lobby the EU food standard setting process so as to protect domestic producers, being a marginal producer of tropical fruits. Second, the EU remains the top destination for many African countries; top exporters of these products tend to originate from African countries due to the favourable climatic conditions which give them a comparative advantage in the production of these agricultural products. Third, these products are an easy target for protectionist standards due to their perishable nature and their susceptibility to many food hazards.

This study is motivated by recent literature on firm heterogeneity which reveals that the growth of developing countries' trade was predominantly as a result of the expansion of trade along the extensive margin (exporting of existing products to new trade partners or of new products to already existing markets) rather than due to the growth in the intensive margin, that is, the expansion in the volume of trade to already established partners (Debaere and Mostashari, 2010; Reis and Farole, 2012; Nicita and Rollo, 2015). In spite of this assertion, we argue that the ability of developing countries to initiate or penetrate new markets might be ultimately constrained by the stringent market conditions of importing countries. Thus, analysing the impact of EU pesticide standards in the food sector on Africa's extensive margin is crucial to understanding the process of entries and exits in the export markets. For instance, studies that look at the impact of EU standards in the food sector on Africa's exports have predominantly focused on the intensive margin (Otsuki, et al., 2001; Grebrehewit, Ngqangweni, and Kirsten, 2007). However, the implications of EU food regulations have received less attention when it comes to market access at the extensive margin of trade. Thus, understanding the effects of EU's market access conditions on pesticides and their effect on potential exporters is important from a policy perspective.

The rest of the study is organized as follows: Section 2 presents a theoretical framework to analyse the political economy of government's standards and also presents a simple model of trade protectionism. In section 3, we describe the data and develop an index of protectionism for standards. Section 4 provides the empirical analysis. Section 5 discusses the results and the final section concludes.

2.0 The Political Economy of Government's Standards

Theoretical studies on this issue usually rely on the famous protection for sales model that was first developed by Grossman and Helpman (1994) to analyse the political economy of trade protection. This political economy model allows for interest groups to influence a government's decisions and is essential to understanding the process of standard setting. Thus, to explain standard protectionism, we also rely on a simple model of protection for sales to compare government's public standards to international standards.

2.1. The Protection for Sales Model

We draw from the Grossman and Helpman (1994) protection for sales model[4] of trade to provide a political economy explanation for standard protectionism. In the protection for sales model (summarized here for expository purposes), we assume a two-country world with agricultural trade interactions between a large food importing country (domestic) and a small food exporting country (foreign). We further assume that the latter is a price taker and also standards taker as it has limited resources to initiate the setting of standards. However, the former is a standard setter and imposes its standards on the small country's food exports; the same sets of standards are also applied on domestic producers. Following Grossman and Helpman (1994), we make the assumption that food standards are the only type of trade policy measures available to the government. By setting the standards, it is assumed that

[4] The protection for sale model has also been used in Swinnen and Vandemoortele (2011, 2012) to study the political economy of standards.

government care about protecting consumers' health and safety, and so the government's main objective is to maximize social welfare.

Although by setting standards, government aims to maximize social welfare, this objective is also being influenced by lobbyists (both producers and consumers) who seek to shape government policies. Producer lobbyists aim to achieve a desired level of protection for domestic producers against international competition, and consumer lobbyists aim to influence government policy to achieve higher quality product or higher food safety level. As such, it is assumed that the government cares about social welfare and wants to maximize social welfare but nevertheless also cares about political contributions from these interest groups and consequently seeks to maximize their welfare. Since government values both the weighted sum of the total level of political contributions from the interest group and also the social well-being of the people, the total government objective function is given by the summation of social welfare and contributions from each of these lobbyist groups.

It is assumed that there is truthfulness in the political contribution of the lobbying food sectors such that the government is given higher contributions if the standards stimulate higher producers' surpluses, and vice versa. Thus, maximising government welfare gives rise to the political optimal condition which is posited to depend on the political effectiveness of the lobby groups and the associated relative benefits of the standards for the groups, the producers' compliance costs, and consumers' preferences. According to Swinnen and Vandemoortele (2012), these factors might increase or decrease the optimal standards as exposited below. Firstly, *ceteris paribus*, a higher effectiveness leads to a higher standard if the lobby group stands to gain from the imposition of a higher standard, and *vice versa*. Secondly, higher compliance costs for domestic producers lead to lobbying for lower standards as they have incentives to give less lobby contributions to the government. Higher compliance costs also imply larger prices which result in a lower consumer surplus and increases lobbying for a lower standard. Higher compliance costs for foreign producers relative to domestic producers may motivate producers to give more lobby contributions to the government so as to achieve reduce foreign competition and increase economies of scale. Thirdly, a shift in the consumers' preferences for quality and safety can also lead to an implementation of a higher standard by the government, and *vice versa*, assuming that the consumers are well-organized.

Alongside the government, we assume that a social planner exists whose objective is solely to maximize global social welfare. This, for instance, can be the case with international organisations such as the Food and Agriculture Organization (FAO) and the World Health Organization (WHO) who jointly set standards with the sole aim of maximizing international social welfare and whose agenda is void of any protective motive. Likewise, the socially optimal standards, which are the globally acceptable benchmark, are obtained when government maximizes social welfare. Similar to the analysis of tariff in the traditional trade model, the government's politically chosen trade policy is also compared to the socially optimal trade policy in order to clarify what protectionism is (Swinnen and Vandemoortele, 2011). Here, the chosen government's standard is pronounced as suboptimal if the politically optimal standard is different from the socially optimal standards set by the social planner in the international context. The divergence between these two sets of standards is said to depend on some factors such as the political effectiveness of the lobby groups, producers' implementation costs, and consumers' preference (Swinnen and Vandemoortele, 2011, 2012).

Interest groups may lobby either in favour of or against standards, subsequently increasing or decreasing the politically optimal standard. In the EU, this is the case for organized retailers who seek to influence the standard setting process. In recent times, Non-Governmental Organisations (NGOs) such as the Greenpeace, Friends of the Earth Europe, Compassion in World Farming, Ecoropa, and Green League have taken an interest in standard setting and implementation and, more generally, in the politics of food. Their influence is especially pervasive in the area of anti-genetically modified organism and pro-organic food campaigns. Thus, on the one hand, lobby groups can support the increase in stringency and proliferation of standards, thereby raising the politically optimal standards above the socially optimal standards that would be implemented by a social planner. On the other hand, producers can also lobby for negative protection, that is, a reduction in the number or stringency of standards. Effective lobbying will then make the politically optimal standards to be less stringent or fewer in number than the socially optimal standards. In other words, two suboptimal cases may occur; the first is when the socially optimal standards are lower than the politically optimal standards, which describes over- standardization. The second will occur when the socially optimal standards are higher than the politically optimal standards, which describes under- standardization (Swinnen and Vandemoortele, 2011, 2012).

Furthermore, producers might lobby for over-standardization if their cost of complying with the standards is relatively low, and they want to enjoy economies of scale and increase foreign producers' cost of complying with standards, thereby giving them diseconomies of scale. Effective lobbying by the consumer interest groups might also result in over-standardization if they value the quality of the product. However, domestic producers might lobby for under-standardization or a reduction in standardization if the standards are too costly to comply with for them. In addition, producer groups that depend heavily on exported goods for their production inputs might have a relative weaker preference to lobby the government for a higher standard, and might also lobby for under-standardization.

The protection for sales model thus yields three straightforward implications. (1) The politically optimal standards might coincide with the socially optimal standards when all lobby groups can attain their maximum surplus income at the social optimum. In this case, optimality implies that exporters would not be hurt when politically optimal standards are equal to socially optimal standards, even if the latter are trade enhancing or trade inhibiting. (2) Under-standardization: for cases in which the politically optimal standards are lower than the socially optimal ones, both domestic and foreign producers may benefit from this under-standardization. The negative impacts of standards on trade are reduced such that the level of protection will be directly related to export value. Thus, although under-standardization is suboptimal, it is not protectionist from this point of view. (3) Over-standardization: for cases in which the politically optimal standards are higher than the socially optimal ones. The higher the level of over-standardization, the harder it becomes for exporters particularly those from “small countries” to comply with the importing country’s standards. Thus, in the case of a small country, over-standardization will distort trade and give rise to a higher surplus income for domestic producers while foreign producers lose out. As a result, for protected industries (if the sector or good is protected), then the level of protection will be inversely related to the export value.

3. Data and Descriptive Statistics

In this Section, we first present in sub-Section 3.1 a description of the data and the variables used in the empirical analysis. Next, Section 3.2 presents the protectionism index of EU standards alongside some descriptive statistics of EU pesticide standards *vis à vis* those of the Codex Alimentarious Commission (hereafter Codex). In addition, we provide an insight into the structure of EU production and trade for each of the three products considered in this study with a view to understanding the need to protect or not protect the sector.

3.1. Data Description and Sources

Our dataset covers bilateral trade on three export products between five EU countries and 34 selected African countries between 2008 and 2013. The three selected products are coded at the 6th digit of the Harmonize System (HS) classification, and these are tomatoes (HS code 070200), oranges (HS code 080510), and limes and lemons (HS code 080550). Bilateral exports on these products were obtained from the World Bank’s World Integrated Trade Solution (WITS) database. An overview of all importing and exporting countries included in the analyses is available in Table A.1 in the Appendix.

The pesticide standards used in calculating the extent of protectionism of EU standards relative to Codex standards were obtained from both the Europa and Codex websites. More specifically, for each product considered in this study, data on all EU pesticide standards for the period from 2008 to 2013, which are actively in force, were sourced from the EU pesticide database, while the codex pesticide standards were collated from Codex’s database. The period of analysis starts in 2008 mainly because the EU pesticide data is not available before this year. Data on both distance and language were sourced from the Centre d`Etudes Prospectives et d'Informations Internationales (CEPII), while GDP data was obtained from the World Bank’s World Development Indicators (WDI). Finally, regional trade agreements dummies were constructed using data obtained from both the World Trade Organisation (WTO) and the NSF-Kellogg Institute database on economic integration agreements. An overview of the variables considered in our empirical application, including their summary statistics are displayed in Table 1.

Table 1: Summary Statistics

Variables	Mean	Standard Deviation	Minimum	Maximum
Exporters' GDP (Billion US Dollars)	58.388	103.015	0.183	522.638
Importers' GDP (Billion US Dollars)	1130.044	879.092	212.140	2831.800
Export Value (Million US Dollars)	0.137	1.083	2.20e-08	17.371
Extensive Margin of Exports (Tomatoes)	0.165		0	1
Extensive Margin of Exports (Lime & Lemon)	0.193		0	1
Extensive Margin of Exports (Oranges)	0.292		0	1
Index of Protectionism (Tomatoes)	1.397	0.085	1.251	1.502
Index of Protectionism (Lime and Lemon)	0.978	0.203	0.799	1.418
Index of Protectionism (Oranges)	0.974	0.194	0.799	0.1393
Initial Status	0.243		0	1
Distance (‘000 Kilometres)	4.639	1.883	0.562	9.694
Language	0.234		0	1
FTA	0.197		0	1
EPA	0.158		0	1

Source: Authors’ calculations. Note: the variable ‘extensive margin of exports’ takes the value of 1 when the export value of the corresponding product is positive, zero otherwise. The calculation of the index of protection is described in Section 4.2. Initial status is a dummy that takes the value of one when the exported product was successfully exported in the initial period of 2008 zero otherwise. Standard deviations are excluded for all dummy variables because these are not informative for them.

3.2. Measuring Protectionism – an Index of Protectionism for Pesticide Standards

Our measure of SPS standards is based on quantifiable pesticide standards regulated by the importing countries. Pesticide standards are SPS standards imposed on food and feed products to ensure animal, plant and human safety as well as the safety of the environment. The standards are represented in the form of MRLs of pesticides that is scientifically permitted for consumption. To avoid using standards as a protectionist tool, the WTO obliged its members to employ internationally scientific based standards, such as the Codex’s[5] standards, wherever possible. Thus, we define protectionism as the fraction of a country’s standards that are more stringent than the standards internationally recognized by the WTO. Following Li and Beghin (2014), using MRLs of pesticides standards, we formalize what protectionism is by developing an index of protectionism for standards, which we define as the differences in the stringency of a country’s standards to internationally acceptable scientific standards. One may categorize standards that exceed the internationally accepted ones as being overly stringent, ‘excessive standards’, and protectionist in nature and therefore more trade distorting. Given this, our measure of protectionism is constructed by measuring the differences in EU standards against an international benchmark.

Since our focus is on food safety, we employed Codex standards - the international food safety standards - as the ‘socially optimal’ scientifically based benchmark. We developed a simple criterion for protectionism: EU pesticide standards that exceed those set by Codex are taken to be protectionist, while those that are laxer than those set by Codex are defined to

[5]. This is joint FAO and WHO commission. Codex is established to develop internationally standards using scientific knowledge, with the aim of protecting consumers’ health and the environment as well as avoiding unnecessary obstacle to trade.

indicate a lack of protectionism. Our product level protectionism index for pesticide standards is given as:

$$P_{jpt} = \frac{1}{n}\left(\sum_{k=1}^{n}\exp\left(\frac{Codex_{MRL_{pt}} - EU_{MRL_{jpt}}}{Codex_{MRL_{pt}}}\right)\right) \tag{1}$$

Here, P_{jpt} is the index of protectionism of pesticide *k* (which ranges from one to *n*) imposed on product *p* by importer country *j* over time *t*; $EU_{MRL_{jpt}}$ denotes the maximum residual limits of EU pesticide standards at time *t*; $Codex_{MRL_{pt}}$ is the maximum residual limit of the international scientific reference pesticide standard at time *t*. The upper part of the index, $Codex_{MRL_{pt}} - EU_{MRL_{jpt}}$, measures the protectionism of the standard; it was thereafter scaled by Codex standards so as to make the index invariant to differences in pesticide limits between the EU and Codex.

Equation (1) results in an index that is lower and upper bounded by zero and $e \approx 2.718$, respectively. The lower the EU standards are relative to the international Codex standards, the higher the index. The higher the EU standards are relative to the international Codex standards, the lower the index. In other words, the index is normalized at one when both EU and Codex standards are the same, describing the equilibrium condition; an index above one indicates more stringent EU standards relative to those of Codex and describes protectionism; finally, an index below one indicates lower stringency of EU standards relative to those of Codex – lack of protectionism. Thus, the higher the index is, the higher its stringency, and the harder it becomes for exporters to comply with EU standards relative to Codex standards; this consequently implies lower exports and vice versa. The coefficient on the protectionism index is expected to be negative if the EU pesticide standards are protectionist relative to those of Codex, and positive if vice versa.

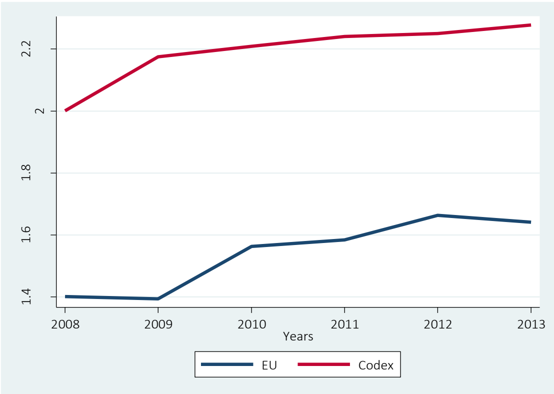
There are some issues that were encountered when working with both the EU and Codex pesticide standards. The foremost issue is that of unestablished pesticide standards. Appendix III of EU Directive 396/2005 stipulates that a default MRL of 0.01 should be applied to products for which no pesticide standards are established. So, we substitute this default MRL value for non-established pesticide standards in the EU. Codex also has some rare cases where certain pesticides that were initially not given an MRL value were assigned one in later years. As a result, we are faced with the problem of missing MRLs; this is exacerbated by the fact that Codex does not use a default MRL value. In order to solve this issue, we posit that African countries exporting to the EU still have to face EU default standards. We therefore replaced these missing values with default EU values. Fortunately, such cases are rare and we concurred that they will not significantly distort our results.

A second issue is that Codex has only established rules on a subset of standards that are regulated by the EU. For example, in 2013, it established about 72 pesticide standards on tomatoes, which is in sharp contrast to the EU which established around 462 standards in the same period. To solve this issue when calculating the protectionism index, we were forced to consider only pesticide standards that are regulated by both the EU and Codex. This is done to produce a consistent list of pesticides regulated by both bodies and allows for ease of comparison of their MRLs. When interpreting our results, this caveat should be kept in mind.

3.3. Overview of EU and FAO/WHO Pesticide Safety Standards

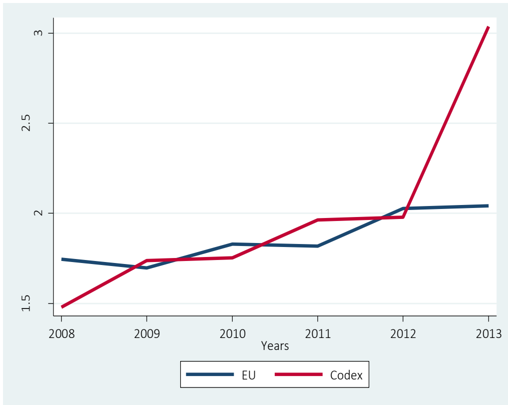
Standards on pesticides are specified in terms of MRLs which provides information about the intensity and stringency of the pesticide standards in the food products. The stringency of pesticide standards is measured in parts per million (indexed as mg/kg). The higher the MRL, the lower the stringency of the pesticide standard, and a decrease in the MRL signals an increase in its stringency level. The EU coverage of regulated pesticides is higher in contrast to Codex that only establishes rules on a subset of standards regulated by the EU. Hence, for ease of comparison, we limited ourselves to only consider the pesticide standards that are regulated by both the EU and Codex. Figures 1, 2 and 3 display the average stringency levels of the subsets of pesticides regulated by the EU and Codex between 2008 and 2013 based on the index formulated in equation (1).

Figure 1: Tomatoes MRLs



Sources: Authors' Computation from EU and Codex's Pesticides Databases

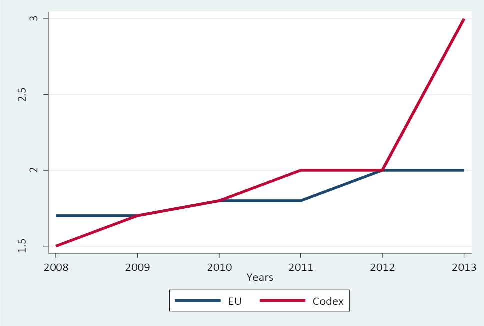
Figure 2: Oranges MRLs



Sources: Authors' Computation from EU and Codex's Pesticides Databases

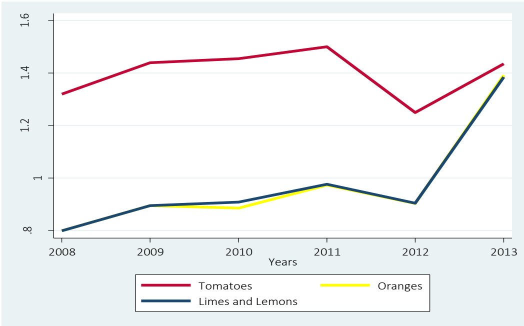
In the case of tomatoes, Figure 1 shows that the regulated MRLs of EU standards are consistently below those of Codex for all years, indicating that the EU set lower (stricter) pesticide standards on tomatoes relative to the international benchmark of Codex. This is an indication of over-standardization and protective standards relative to the international standards. However, in the case of oranges, and limes and lemons, as shown in Figures 2 and 3, the EU standards are only more stringent than those of Codex in 2011 and 2013. There is a significant presence of under-standardization as the stringency is below that of Codex in the other years. In other words, there are indications of protectionism in 2011 and 2013 and lack of protectionism in other years. Thus, the overall impact is an empirical one.

Figure 3: Lime and Lemon MRLs



Sources: Authors' Computation from EU and Codex's Pesticides Databases

Figure 4: Index of Pesticides Protectionism



Sources: Authors' Computation from EU and Codex's Pesticides Databases

Finally, in Figure 4, we depict the index of protectionism of pesticide standards as formulated in equation (1). As noted earlier, the index is bounded between 0 and 0.278 with an index above one indicating more stringent EU standards relative to those of Codex; an index below one indicates lower stringency of EU standards relative to those of Codex. As shown in Figure 4, the indices of protection for both oranges and limes and lemons overlay each other except in 2010 when the two indices noticeably differ. Clearly, for both oranges, and limes and lemons, their indices always lie below one with the exception of 2013, indicating evidence of lack of protectionism for all years apart from 2013. However, in the case of tomatoes, the index lies above the value of one for all years which might be an indication of protectionism. Whether or not these assertions are true will be empirically ascertained in the empirical section.

3.4. Structure of EU Production and Trade in the Selected Products

The EU is an important importer of fresh fruits and vegetables. It is a net importer, recording a constant trade deficit in fresh and processed fruits and vegetables since 1999 with the deficit increasing from a value of 8.7 billion Euros in 1999 to 11.9 billion in 2011 (EC, 2014). However, trade balance is revealed to be worsening in the fresh fruit sector, while it is more or less constant and, at times, slightly improving in the vegetable and processed fruit sectors. This deficit is due to the growth of imports which are uncompensated by EU exports due to the fact that the EU is a marginal producer of tropical fruits and vegetables.

With regard to citrus, there is a high reliance on imports due to the fact that citrus fruit production in the EU is restricted by unfavourable climatic conditions. Within the EU, a high percentage of citrus fruit production originates in Spain, amounting to around 59.8% (EC, 2014). In terms of composition, citrus, particularly oranges constitute a top imported product for the EU, with the main exporters being South Africa, Egypt, and Morocco. South Africa is one of the major suppliers of oranges to the EU, supplying the EU market from June until October when the harvest starts in the Northern Hemisphere (Gain, 2015). However, in 2014 there was an 11.5% decrease in imports from South Africa since May 27, 2014. This followed the European Commission's (EC) increased control measures on South Africa's citrus imports due to the perceived health risks relating to black spot diseases by the EC. This resulted in decreased orange imports from South Africa.

Tables 2 and 3 show the trends in the production and trade of the products focused on in this study. On the production side, Table 2 shows that between 2008 and 2013, a yearly average of around 6629.8 thousand tonnes of oranges were produced, with Spain, Italy, and Greece accounting for about 96% of the total production with a share of 46.7, 36.4% and 13.2%, respectively. During this period, 4% of production was exported to third countries amounting to around 933 million Euros; meanwhile, the total import cumulated to a value of about 3007.1 million Euro (Table 3).

Similar trends also occur for limes and lemons. Between 2008 and 2013, yearly production of limes and lemons totalled an average of 1248.4 thousand tonnes (Table 2) with 96% of total production concentrated in Spain (57%), Italy (36.7%) and Greece (3.9%). 5.7% of the total production of limes and lemons were exported to extra EU countries, representing a yearly value of 59.7 million Euros.

Table 2: Structure of Production of the Selected EU Products, averaged 2008 to 2013

	Oranges		**Limes and Lemons**		**Tomatoes**	
	Tonnes (‘000)	**Share in EU (%)**	**Tonnes (‘000)**	**Share in EU (%)**	**Tonnes (‘000)**	**Share in EU (%)**
Belgium	0.0	0.0	0.0	0.0	231.0	1.5
Bulgaria	0.0	0.0	0.0	0.0	111.3	0.7
Czech Republic	0.0	0.0	0.0	0.0	11.5	0.1
Denmark	0.0	0.0	0.0	0.0	9.0	0.1
Germany	0.0	0.0	0.0	0.0	68.7	0.5
Estonia	0.0	0.0	0.0	0.0	1.2	0.0
Ireland	0.0	0.0	0.0	0.0	3.1	0.0
Greece	878.4	13.2	48.3	3.9	1275.0	8.5
Spain	3098.2	46.7	712.2	57.0	4099.5	27.3
France	3.3	0.1	2.8	0.2	651.2	4.3
Croatia	0.3	0.0	0.0	0.0	20.7	0.1
Italy	2410.6	36.4	458.7	36.7	5800.7	38.6
Cyprus	35.9	0.5	12.9	1.0	18.1	0.1
Latvia	0.0	0.0	0.0	0.0	3.6	0.0
Lithuania	0.0	0.0	0.0	0.0	9.0	0.1
Luxembourg	0.0	0.0	0.0	0.0	0.1	0.0
Hungary	0.0	0.0	0.0	0.0	156.8	1.0
Malta	1.2	0.0	0.5	0.0	13.2	0.1
Netherlands	0.0	0.0	0.0	0.0	795.0	5.3
Austria	0.0	0.0	0.0	0.0	47.3	0.3
Poland	0.0	0.0	0.0	0.0	500.9	3.3
Portugal	201.8	3.0	12.9	1.0	638.1	4.2
Romania	0.0	0.0	0.0	0.0	495.7	3.3
Slovenia	0.0	0.0	0.0	0.0	4.3	0.0
Slovakia	0.0	0.0	0.0	0.0	18.3	0.1

Finland	0.0	0.0	0.0	0.0	39.2	0.3
Sweden	0.0	0.0	0.0	0.0	7.5	0.0
United Kingdom	0.0	0.0	0.0	0.0	0.0	0.0
EU 28	6629.8	100.0	1248.4	100.0	15030.0	100.0

Source: Eurostat.

However, as depicted in Table 3, EU's average yearly imports of limes and lemons imports (380.3 million Euros) were relatively higher than its average yearly exports (59.7 million Euros), amounting to an average yearly trade deficit of 320.6 million Euros. The figures for both limes and lemons, and oranges also indicate that the EU is a net importer, with a significant trade deficit in each product, as the EU relies extensively on imports to satisfy domestic demand. Thus, our hypothesis is that the sector might be less protected. In other words, the EU's heavy dependence on third countries for its domestic consumption might undermine the relative influence of lobbyists on the government, and or prompt the government to lower its standards to allow more imports from third countries.

Table 3: Structure of Trade with Extra EU countries, 2008 to 2013

	Oranges		**Limes and Lemons**		**Tomatoes**	
	Sum	**Average**	**Sum**	**Average**	**Sum**	**Average**
Production ('000 tons)	39778.7	6629.8	7490.2	1248.4	90179.8	15,030
Volume Exported ('000 tons)	1590.1	256.0	426.1	71.0	1364.1	227.3
% of Production Exported	4.0	4.0	5.69	5.69	1.5	1.5
Imports (Value million EUR)	3007.1	501.2	2282.1	380.3	2247.3	374.5
Exports (Value million EUR)	933.0	155.5	358.4	59.7	1668.3	278.0
Trade Balance (Value million EUR)	-2074.1	-345.7	-1923.7	-320.6	-579	-96.5

Source: Eurostat.

The case of tomatoes is somewhat different. It remains EU's top imported vegetable, constituting the highest share of its fresh vegetables imports, amounting to around one fifth of its vegetable imports (EC, 2014). The EU exports of fresh vegetables is also dominated by tomatoes, however, this is not enough to achieve a trade balance. According to the Eurostat data, major exporters to the EU are Morocco and Egypt, with Morocco supplying about 80% of EU imports of the product. Unlike citrus products which are mainly tropical fruits, tomatoes are cultivated *en masse* by some Southern EU countries due to favourable weather conditions. This is complemented by production from all season greenhouses in countries such as Belgium and the Netherlands, reducing an overreliance on imports in contrast to what was seen in the cases of oranges, and limes and lemons. As provided in Table 2, the total production between 2008 and 2013 amounts to 90179 thousand tones with major producers accounting for 91% of production; major producing countries include Italy (38.6%), Spain (27.3), Greece (8.5%), France (4.3%), the Netherlands (5.3%), Portugal (4.2%), and Romania (3.3%). Tomato's production is more than twice as large as both orange production, and lime and lemon production with only 1.5% of it being exported and the rest being consumed domestically. The huge domestic production of tomatoes relative to the other citrus products reduces the need for excessive imports and might explain why the sectors' total trade deficit between 2008 and 2013 of 579 million Euros, which is reported in the last row of Table 3 is far below the deficits for oranges and limes and lemons.

Thus, unlike citrus, the EU is not over-dependent on imports to satisfy tomato consumption; as a result, it may yield more to lobbyists who seeks to influence the EC to set stringent standards so as to increase exporters' implementation costs and therefore erode their market competitiveness. However, it is not clear if stringent MRLs set by the EU since 2008 are influenced by lobbyists due to the difficulty of differentiating standards' trade from non-trade objectives. Thus, a testable hypothesis in this study is that protectionism decreases or vanishes altogether with overdependence on imports and vice versa. For instance, concerning products where the EU heavily (lightly) depends on foreign exported goods for its domestic consumption, under-standardization (over-standardization) can result as the relative influence of lobbyist groups may be weaker (stronger). Thus, we hypothesized that the two selected citrus fruit sectors are under-protected due to the EU's heavy import dependence and the tomato sector is hypothesized to be over-protected due to EU's relatively less reliance on its imports.

4. Empirical Analysis

To investigate the protectionist intent of EU's food safety standards, we employ the gravity model which predicts that bilateral exports between country pairs is explained by exporters' and importers' economic masses and geographical distance between the country pairs, as well as other factors that increase or inhibit trade (Pöyhönen, 1962; Anderson, 1979; Anderson and Wincoop, 2003).

4.1. Model Specification

Our empirical strategy is to determine if standards are used as protectionist tool in restricting trade by focusing on the extensive margin of Africa's exports to the EU. The theoretical model for our analysis is based on the new-new trade's concept of firm heterogeneity which shows that due to the heterogeneous behaviour of firms, a small fraction of firms finds it profitable to export while others choose not to as they are less productive (Melitz, 2003; Helpman, Melitz, and Rubinstein, 2008). This thus gives rise to positive and zero trade flows. This is because EU market conditions on food might affect African countries' probability of exporting to the EU, with productive firms exporting and non-productive firms choosing not to export. Our empirical strategy is therefore to measure the effect of EU food regulations on Africa's probability to export. Our model is similar to that of Nicita and Rollo (2015), which analysed the impacts of tariffs on the extensive margin of trade for sub-Saharan exports. The extensive margin is defined as the establishment of new trade relationships and can arise from exporting a product to new partners or markets, exporting new products or new varieties to existing markets, or exporting new products to new markets (Hummels and Klenow, 2005). Similar to Helpman et al., (2008), we used a dummy variable capturing the probability of exporting (an export participation dummy variable) to establish if there is an increase or decrease in the creation of trade relationships.

We employ a probabilistic model to explore the implications of food safety standards on the probability of exporting (extensive margin). Moreover, our bilateral export data contains many zeros, thus allowing us to exploit the information contained in the zero trade flows along the extensive margin. Following Helpman et al. 2008, to quantify the trade impacts at the extensive margin, a probit model is specified as follows:

$$\begin{aligned}\rho_{ijpt} = P(E_{ijpt} = 1 | x_{ijpt}) = \Phi(\alpha_0 + \alpha_1 \ln Y_{it} + \alpha_2 \ln Y_{jt} + \alpha_3 Initial\_Status_{ijp} + \alpha_4 P_{jpt} * T + \\ \alpha_5 P_{jpt} * L + \alpha_6 P_{jpt} * O + \alpha_7 \ln Dist_{ij} + \alpha_8 Lang_{ij} + \alpha_9 FTA_{ijt} + \alpha_{10} EPA_{ijt} + \delta_p + \varepsilon_{ijpt})\end{aligned} \quad (2)$$

Equation (2) is a probabilistic model which determines the binary decision of whether to trade or not. The subscripts i, j, p, t denote exporter, importer, product and time, respectively, while ln denotes natural logarithm. The dependent variable ρ_{ijpt} is the probability that country *i* exports product *t* to country *j* at time *t*, conditional on the observed variables x_{ijpt}; E_{ijpt} is a binary variable which equals one $(E_{ijpt} = 1)$ when country i exports product *p* to country *j* in year *t*, and zero when it does not $(E_{ijpt} = 0)$, where Y_{it} and Y_{jt} are the importing and exporting countries' GDP respectively, measured in US dollars. Similar to Nicita and Rollo (2015), we included a proxy of the initial export status of the product ($Initial\_Status_{ijp}$) which is a dummy given the value of one when the exported product was successfully exported in the initial period of 2008 (the start of the harmonization of EU food regulations), and zero otherwise. The intuition is that products already exported in the year 2008 have a high probability of being exported in subsequent years.

P_{jpt} is the index of protectionism of pesticides imposed on product *p* by country *j* over time *t*. It captures the extent of protectionism of EU pesticide standards relative to Codex standards calculated from equation (1). *T, L* and *O* are controls for product dummies introduced to capture product effects. Here, T is a dummy variable that takes the value of one if the product is tomato, zero otherwise; L is a dummy variable that takes the value of one if the product is lime and lemon, zero otherwise; while O is a dummy variable that takes one if the product is orange, zero otherwise. $P_{jpt} * T$, $P_{jpt} * L$ and $P_{jpt} * O$ are interaction terms between the index of protectionism and each of the three product dummies. These interaction terms allow us to test whether the effect of the target variable is different across products.

$Dist_{ij}$ denotes the geographical distance between countries *i* and *j*. $Lang_{ij}$ is a dummy variable that assumes the value of one when the exporting and importing countries share similar language, zero otherwise. FTA_{ijt} and EPA_{ijt} are trade agreement variables included in our analysis to capture the depth of EU's trade agreements with the participating African countries. Two major trade agreements that the EU has undertaken with African countries are identified. These are the free trade agreements (FTA) and the more recent interim economic partnership agreement (EPA). FTA is a dummy variable given the value of one if the African country has a FTA in force with the EU, zero otherwise. EPA is a dummy variable that takes the value of one if any African country in our sample has ratified an EPA with the EU, zero otherwise. Lastly, δ_p denotes product fixed-effects, while ε_{ijpt} is the error term of the model.

As a further step in our analysis, we included variables capturing EU's "relative comparative advantage" of each product considered in the analysis. Comparative advantage in a product is determined using the revealed comparative advantage (RCA) index. This allows us to ascertain whether or not protectionism is lower for those products for which the EU does not have comparative advantage in and is therefore more interested in importing. One common measure of the RCA is the popular Balassa (1965) revealed comparative advantage (BRCA) index. This index is calculated as the market share of a country's export product in world export to the market share of the country's total exports in world exports. However, a limitation of the BRCA index is that it has been identified as being problematic and limited in comparative analysis (Deardoff, 1994; Yeats, 1985). In addition, the index also has a symmetric problem due to the fact that it has a lower bound of zero but no upper bound; signifying that the same BRCA value will imply different levels of comparative advantage for different countries and or commodities, thereby limiting the index's comparability across countries and commodities (Deardoff, 1994; Yeats, 1985).

Given the limitations of the Balassa's index, this study thus employs the normalised revealed comparative advantage (NRCA) developed by Yu, Cai, and Leung (2009), which has an advantage over the Balassa's index because it allows a more accurate comparison across countries, time and products (Yu et al., 2009). The NRCA normalises changes in country *j*'s export of product *p* by the world exports of all commodity, and is denoted as:

$$NRCA_{jpt} = \frac{X_{jpt}}{X_{wt}} - \frac{(X_{jt} X_{wpt})}{(X_{wt})^2} \tag{3}$$

In equation (3), the subscripts j, p, t, w denote importer, product and time and world respectively, while ln is the logarithm. X_{jpt} is country *j*'s (EU) export of product *p* at time *t*; X_{jt} is country *j*'s export of all commodities at time *t*; X_{wpt} is denotes world exports of product *p* at time *t*; and X_{wt} is world's exports of all commodities over time. Positive (negative) values of the NRCA index implies that countries *j* reveals a comparative advantage (disadvantage) in product *p*; and the more positive (negative) the index is, the higher (lower) the comparative advantage (disadvantage) the country has in the given product, and vice versa.

To obtain consistent estimates, we have controlled for multilateral trade resistance terms, theoretically modelled by Anderson and van Wincoop (2003). To do this we have used the Baier and Bergstrand (2010) first order Taylor series log-linear approximation of the bilateral trade cost. Their approach has been shown to produce estimates that are close to those obtained in the Anderson and van Wincoop (2003) structurally iterated least squares method (Baier and Bergstrand, 2006; Nelson and Egger, 2010). Controlling for multilateral resistance terms (MRT) using Baier and Bergstrand (2010) simple average approach, we applied a first order Taylor series expansion to all bilateral trade costs and thereafter used the newly transformed variables in the regression. In line with Baier and Bergstrand (2010), each trade cost variable is transformed using the following approximations:

$$P_{jptMRT} = P_{jpt} - \frac{1}{n}\sum_{j=1}^{n} P_{jpt} - \frac{1}{n}\sum_{i=1}^{n} P_{jpt} + \frac{1}{n^2}\sum_{i=1}^{n}\sum_{j=1}^{n} P_{jpt} \quad (4)$$

$$Dist_{ijMRT} = Dist_{ij} - \frac{1}{n}\sum_{j=1}^{n} Dist_{ij} - \frac{1}{n}\sum_{i=1}^{n} Dist_{ij} + \frac{1}{n^2}\sum_{i=1}^{n}\sum_{j=1}^{n} Dist_{ij} \quad (5)$$

$$Lang_{ijMRT} = Lang_{ij} - \frac{1}{n}\sum_{j=1}^{n} Lang_{ij} - \frac{1}{n}\sum_{i=1}^{n} Lang_{ij} + \frac{1}{n^2}\sum_{i=1}^{n}\sum_{j=1}^{n} Lang_{ij} \quad (6)$$

$$EPA_{ijtMRT} = EPA_{ijt} - \frac{1}{n}\sum_{j=1}^{n} EPA_{ijt} - \frac{1}{n}\sum_{i=1}^{n} EPA_{ijt} + \frac{1}{n^2}\sum_{i=1}^{n}\sum_{j=1}^{n} EPA_{ijt} \quad (7)$$

$$FTA_{ijtMRT} = FTA_{ijt} - \frac{1}{n}\sum_{j=1}^{n} FTA_{ijt} - \frac{1}{n}\sum_{i=1}^{n} FTA_{ijt} + \frac{1}{n^2}\sum_{i=1}^{n}\sum_{j=1}^{n} FTA_{ijt} \quad (8)$$

The right hand side variables in equations (4) to (8) are analogous to the fixed exporte96*;ir-year and importer-year effects (Nelson and Egger, 2010). Using the *FTA* variable as an example, the second term on the right hand side of equation (8) is the average distance of exporter *i* from all its trading partners. The third term on the right hand side is the average distance of a given importer *j* from all trading partners. The last term denotes world trade resistance, capturing the trade costs between all country pairs. A similar definition holds for the other transformed equations. Substituting equations (4) through (8) into (2) gives a theoretically consistent gravity model that accounts for the influence of MRT as:

$$\begin{aligned}\rho_{ijpt} &= P(E_{ijpt} = 1 \mid x_{ijpt}) = \Phi(\alpha_0 + \alpha_1 \ln Y_{it} + \alpha_2 \ln Y_{jt} + \alpha_3 Initial\_Status_{ijp} + \alpha_4 P_{jptMRT} * T \\ &+ \alpha_5 P_{jptMRT} * L + \alpha_6 P_{jptMRT} * O + \alpha_7 \ln Dist_{ijMRT} + \alpha_8 Lang_{ijMRT} + \alpha_9 FTA_{ijtMRT} + \alpha_{10} EPA_{ijtMRT} + \delta_p + \varepsilon_{ijpt})\end{aligned} \quad (9)$$

5. Results and Discussion

(A) Protectionist Extent of EU Standards

Table 4 presents the estimates of the extensive margin of EU-African trade. Using the probit model, in colunm (1), we provide the estimated results of our model with controls for both the importers' NRCA and the interaction term between the NRCA and the index of protectionism excluded. In column (2), we ascertain the robustness of the results in column (1) using the linear probability model. In column (3), we controlled for both importers' NRCA and the interaction term between the NRCA and the index of protectionism and estimated the regression using the probit model; and in column (4), we again controlled for the both variables and estimated our model using the linear probability model.

To begin with, estimates obtained from estimating equation (8) using the probit model are reported in column (1) of the table. For comparison and robustness, we had also employed the linear probability model to provide a check on the results from the probit model. Using the 'margin' command in Stata, we calculated and reported the average predicted probabilities of the coefficients of the linear probability model. As shown by the estimates from both columns (1) and (2), for all the products, the gravity covariate has the expected sign for the products considered in this study. Physical distance between country pairs inhibits export potential, while sharing the same language and membership in FTA with the EU increase Africa's exports at the extensive margin. However, membership in EPA is positively related to trade flows but does not significantly increase the exports of these particular products. In addition, for all products, our results point out that the decision on whether to export to the EU largely depends on whether the product was already exported in the initial period of 2008 when harmonization of pesticides standards in the EU started (*Initial_Status*). In other words, products already exported in 2008 have a high probability of being exported in subsequent years, whether or not the standard is overprotective.

The coefficient of the variable of interest, which measures the protectionism of pesticide standards, is differently signed across products indicating that the decision to protect a product is product specific. As a starting point, we conducted statistical test of equality of slopes to check if each of the coefficient on the index of protectionism on all the three products is significantly different from one another. In essence, the test is testing the equality of slope between the coefficient of the protectionism index of tomatoes versus those of lime and oranges. The null hypothesis here is that the index of protectionism of tomatoes = index of protectionism of oranges = index of protectionism of limes and lemons. The probability values of the test statistics are statistically significant at 1%, and based on this, we reject the null hypothesis that the coefficients on the index of protectionism on all the three products considered are not significantly different from one another. For each regression model, the probability values of the test statistics are reported at the bottom of Table 4.

Table 4: Protectionist Extent of EU Standards Relative to International Benchmarks

Dependent Variable: ρ_{ijpt}	**(1)**	**(2)**	**(3)**	**(4)**
Exporters' GDP	0.070	0.007	0.059	0.005
	(0.060)	(0.010)	(0.060)	(0.010)
Importers' GDP	0.422**	0.053**	0.390**	0.046**
	(0.141)	(0.019)	(0.139)	(0.020)
Protectionism Measure (Tomato)	-0.909**	-0.130**	-1.189**	-0.182**
	(0.454)	(0.061)	(0.506)	(0.069)
Protectionism Measure (Lime and Lemon)	0.679***	0.097***	0.609***	0.085**
	(0.164)	(0.028)	(0.165)	(0.028)
Protectionism Measure (Orange)	0.435**	0.071**	0.306	0.048
	(0.170)	(0.030)	(0.194)	(0.031)
Initial_Status	0.649***	0.115***	0.666***	0.118***
	(0.117)	(0.022)	(0.116)	(0.022)
Distance	-3.503***	-0.610***	-3.224***	-0.591***
	(0.725)	(0.125)	(0.702)	(0.118)
Language	2.857***	0.456***	2.844***	0.452***
	(0.421)	(0.057)	(0.420)	(0.057)
FTA	1.449**	0.156**	1.430**	0.156**
	(0.719)	(0.059)	(0.702)	(0.059)

EPA	0.998	0.117	1.187	0.150
	(8.576)	(0.818)	(8.569)	(0.835)
NRCA			4649.118	847.699
			(3093.975)	(574.423)
NRCA* Protectionism Measure			7122.765	1587.024
			(4705.412)	(886.440)
Constant	-15.238***	-1.454**	-14.253***	-1.258**
	(4.147)	(0.550)	(4.074)	(0.564)
Equality Test	10.69**	11.430**	11.83**	13.530**
	(0.005)	(0.003)	(0.003)	(0.001)
R-square/Pseudo R-square	0.193	0.174	0.198	0.185
Product Effect	Yes	Yes	Yes	Yes
Observations	2310	2310	2310	2310

*** p<0.01, ** p<0.05, * p<0.1; clustered robust standard errors in parentheses, clustered by importer, exporter and year. Product dummies not reported but were included in all regression models. R-square coefficients directly obtained from Stata are reported for the linear probability regressions, while McFadden R-square (Pseudo R-square) are calculated for the probit regressions.

In the case of tomato exports, the estimated coefficient on the protectionism index is negative and statistically significant; this points to the evidence that EU pesticide standards on tomatoes are actually protectionist as they are more stringent than the international benchmark stipulated by Codex. In essence, the negative coefficient reinforces the fact that they have demand inhibiting effects on potential African exporters, preventing them from establishing trade relationships with the EU and from taking advantage of the preferential access the EU usually grant to Africa's exports. This result is an indication of over-standardization which is an indication that the EU might have set very stringent and low pesticide residue limits on tomatoes due to lobbying from domestic producer groups seeking to protect their interests.

While the tomato sector is relatively less import dependent and is revealed to be over-protected, the case for oranges and limes and lemons is somewhat different. The estimated coefficients on their protectionism index are positive and significant, indicating that EU standards do not have protectionist intent. These EU standards have a demand enhancing effect; they are capable of stimulating new trade relations with the potential to enhance trade for new and potential African exporters targeting EU markets. Given the set of Codex's standards considered in this study, the corresponding EU standards seem to be less stringent relative to those regulated by Codex. Thus, for these two products, EU pesticide regulations represent legitimate concerns for consumers' health and safety and do not necessarily imply protectionism against imports. Similar results were reported by Xiong and Beghin (2014) for US standards.

One important explanation for this result was provided by Marette and Beghin (2010) who posited that such a lack of protectionism might occur if producers and exporters from exporting countries are more cost efficient in complying with standards than domestic producers. However, in the case of African countries, this explanation is less tenable as many of them cannot meet some of the standards set by the EU due to a lack of financial, technical and qualified labour (Jaffee and Henson, 2004; Henson and Wilson, 2005). A much more tenable explanation for this result is that domestic policymakers in the EU may choose relatively lower standards than an international social planner; this could serve to explain in part the observed results. For instance, compared to tomatoes, the EU are heavily dependent on third countries' citrus fruits for domestic consumption and processing. Due to the large numbers of imports and heavy dependence on foreign exported citrus for domestic juice production, the relative influence of lobbyists might be weaker on the government such that the government might be prompted to lower standards so as to allow more imports. In other words, unlike tomatoes, the EU has relatively low comparative advantage in the producing citrus due to unfavourable weather conditions; instead they depend heavily on imports to satisfy the domestic consumption of these fruits and thus, might be less yielding to lobbyists who seek to influence the EC to set stringent standards. This might even give rise to under-standardization in order to allow more imports. Thus, our results support the hypothesis that protectionism decreases or altogether vanishes with overdependence on imports and vice versa.

As a further step in our analysis, we investigated if protectionism is lower for products in which the EU has a lower RCA. As a starting point, we provided graphical analyses (Figures 5, 6 and 7) to enable us to get a clear picture of products and or EU countries that have comparative advantage (disadvantage) in each of the products that are considered in this study. The pattern of comparative advantage is depicted based on the NRCA index such that a positive value of the index indicates comparative advantage and negative values denote comparative disadvantage. A clear look at the figures shows that all EU countries have comparative advantage in the production of tomatoes except France in 2008; all the importing countries have comparative disadvantage in limes and lemons except for Spain and the Netherlands; and in the case of oranges, only Spain has a very high comparative advantage in oranges while the Netherlands and Portugal relatively weaker comparative advantage and the remaining countries have comparative disadvantage.

Figure 5: Pattern of Comparative Advantage in Tomatoes

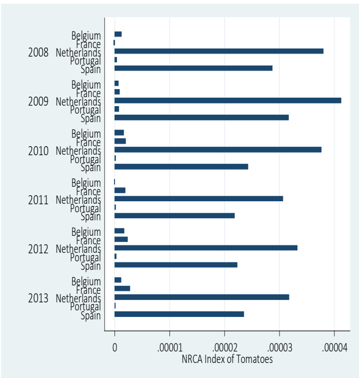


Figure 6: Pattern of Comparative Advantage in Lime & Lemon

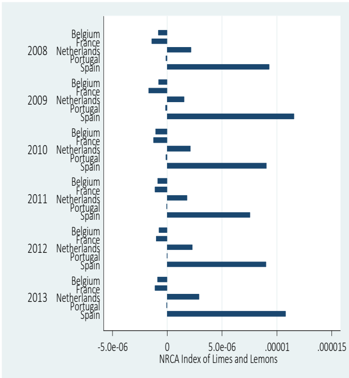
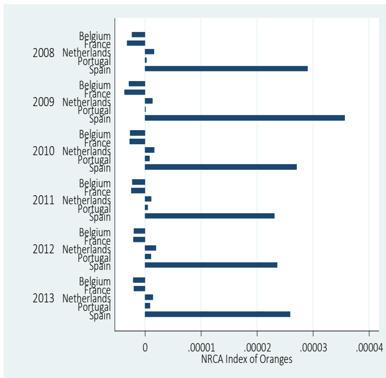


Figure 7: Pattern of Comparative Advantage in Oranges



Source: Authors' Computation based on trade data sourced from WITS (2008 to 2013)

Now, to ascertain if protectionism is lower for products in which the EU has lower revealed comparative advantage in, we simply include the NRCA index and the interaction of the NRCA index with the index of protectionism. The results of this exercise estimated using the probit model are reported in column (3) of Table 4. For robustness, in column (4) we have also report the marginal effects of the estimated coefficient from the linear probability model. First, in relation to the new results, the sign and magnitude of all variables are almost comparable to those obtained in columns (1) and (2) of Table 4. An exception is the index of protectionism for oranges which now turns out to be statistically insignificant. However, the basic conclusion in regards to the index not reducing the probability of exporting oranges to the EU by African countries still holds.

Second, regarding the new variables, a prior, we expected the coefficient on the NRCA to be negative and statistically insignificant on the probability to export, while its interaction with the protectionism index should also be negative and statistically significant signifying that having a higher revealed comparative advantage in a product would make one to protect it more, thus resulting in a lower probability to export to the EU for the African countries. However, on the contrary, the coefficients of the variable of interests of the NRCA and its interaction with the index of protectionism both turn out to be positive and statistically insignificant on the probability of the African countries to export to the EU. This results signifies that EU's revealed comparative advantage does not significantly determine its pattern of protection for the products considered in this study.

For robustness, we have also estimated our model using the linear probability model and have reported the average predicted probabilities of the coefficients from the model. Remarkably, similar conclusion was derived from the model as reported in column (4) of Table 4.

(B) Extent of Protectionism during the Financial Crisis

In a further analysis, we investigate the assertions that many developed countries resorted to using protectionist NTMs both during and after the financial crisis (Bown, 2011; Datt, Hoekman, and Malouche, 2011; OECD, 2010). Thus, to ascertain if this occurred in the case of standards, we had added an interaction term between the index of protectionism and the year of the crisis (2008). This we did by generating a dummy variable which equals one for the financial crisis period and zero otherwise. The dummy variable is then interacted with the index of protectionism variable. Thereafter, we ran our regression and included the interaction term and the single year dummy capturing the year of the financial crisis. Table 5 presents the estimates differentiating the extent of protectionism during the financial period using both the probit and linear probability models. Column (1) provides the estimated results using the probit model while column (2) provides the estimated average probabilities of exporting obtained from the linear probability model.

Table 5: Extent of Protectionism during and after the 2008/2009 Financial Crisis.

Dependent Variable: ρ_{ijpt}	**(1)**	**(2)**
Exporters' GDP	0.060	0.005
	(0.061)	(0.010)
Importers' GDP	0.411^{**}	0.047^{**}
	(0.142)	(0.020)
Protectionism Measure (Tomato)	-1.535^{**}	-0.226^{**}
	(0.544)	(0.078)
Protectionism Measure (Lime and Lemon)	0.524^{**}	0.072^{**}

	(0.166)	(0.027)
Protectionism Measure (Orange)	0.202	0.033
	(0.200)	(0.031)
Financial Crisis's Year dummy	0.754*	-0.068
	(0.394)	(0.048)
Protectionism Measure* Financial Crisis's Year Dummy	-0.754	-0.059
	(1.281)	(0.156)
Initial_Status	0.750***	0.122***
	(0.117)	(0.022)
Distance	-3.182***	-0.585***
	(0.713)	(0.118)
Language	2.872***	0.451***
	(0.430)	(0.057)
FTA	0.631	0.089
	(0.655)	(0.066)
EPA	-4.196	-0.263
	(8.197)	(0.782)
NRCA	4843.421	854.420
	(3144.650)	(574.827)
NRCA*Protectionism Measure	6955.124	1578.673
	(4785.474)	(887.514)
Constant	-14.798***	-1.275**
	(4.178)	(0.566)
Equality Test	13.530***	13.030***
	(0.001)	(0.002)
R-square/Psuedo R-square	0.205	0.186
Observations	2310	2310

Clustered robust standard errors are in brackets and * p<0.10; ** p<0.05; *** p<0.01; Product dummies not reported but were included in all regression models. R-square coefficients directly obtained from Stata are reported for the linear probability regression model, while McFadden's R-square (pseudo R-square) are calculated for the probit model.

In relation to the new results, the sign and magnitude of all variables are almost comparable to those obtained in Table 4. However, the inclusion of the new variables yields some interesting results. For the probit regression model, the coefficient on the single financial crisis year dummy reveals a statistically significant decline in the probability of exporting from Africa to the EU during the financial crisis. However, the coefficient is not statistically significant in the linear probability model. However, more importantly, our main variable of interest, which is the interaction of the financial year dummy variable and the index of protectionism turns out to be negative but statistically insignificant in both the probit and linear probability models as reported respectively in columns (1) and (2) of Table 5. These estimated coefficients in both the two regression models thus show that the EU's usage of food standards during the financial crisis does not significantly affect the probability of Africa's exports to the EU for the products selected in this study. These results thus refute the claim that the EU food standards were used as protectionist tools during the financial crisis.

These results support that of the WTO report of 2009 which finds that none of its Member states have resorted into a widespread usage of trade protectionism or trade restrictions during the global financial crisis (WTO, 2009). Similar result was obtained by Hoekman (2012) who also affirm that there was no substantial rise in the level of trade protection during the financial crisis but that a strong wave of trade protectionism in many developed countries after the crisis.

5.1. Robustness Check

We checked the robustness of our results to an alternative estimation technique. We have previously employed a probabilistic model to investigate the extent of protection on Africa's binary export decision of whether to trade with the EU or not. However, while it is true that the decision not to export (and the consequential occurrence of zeros in export flows to the EU) by many of these exporting countries may be in part attributed to over-protective standards, it may also be due to the statistical recording format. For instance, we have used the United Nations Commodity Trade (UN COMTRADE) statistical database of the United Nations Conference on Trade and Development (UNCTAD) that was housed in WITS; some literature has reported that export values that are below a certain threshold are rounded down and are thus recorded as zeros (Frankel, 1997). If some of the zeros in our data are due to this statistical recording format, this implies that some of the export data has been censored[6] below zero. Thus, as a robustness check, we employed the Tobit model which is well-suited to deal with such situations.

The regression models reported in Table 4 were again replicated using the Tobit model. More specifically, similar to what was done in columns (1) and (2) of Table 4, first, we have estimated a model in which we excluded both the NRCA index and the interaction of the NRCA index with the index of protectionism. Second, similar to the regression models in columns (3) and (4) of Table 4, we had also estimated a model in which we now included the importers' NRCA index and the interaction of the NRCA index with the index of protectionism to ascertain if protectionism is lower for products in which the EU has lower RCA in. The results using the Tobit model are presented in Table 6. Column (1) of Table 6 gives the estimated results omitting the importers' NRCA index and the interaction of the NRCA index with the index of protectionism. In column (2), we had included the NRCA index and its interaction with the index of protectionism.

Table 6: Robustness to a Different Estimation Technique – using Tobit Model

Dependent Variable: ρ_{ijpt}	**(1)**	**(2)**
Exporters' GDP	0.055	0.047
	(0.043)	(0.043)
Importers' GDP	0.274^{**}	0.252^{**}
	(0.107)	(0.105)
Protectionism Measure (Tomato)	-0.582^{*}	-0.763^{**}
	(0.313)	(0.343)
Protectionism Measure (Lime and Lemon)	0.446^{***}	0.404^{***}
	(0.118)	(0.118)

[6]This implies that some of the actual trade flow observations were not included in the trade matrix or have been recorded as zeros as they fell below a minimum predetermined threshold. Any trade flow value that is less than a certain predetermined threshold is recorded as zero, while other observations that are equal to or greater than the threshold are recorded as their actual values.

	(1)	(2)
Protectionism Measure (Orange)	0.284**	0.192
	(0.105)	(0.125)
Initial_Status	0.389***	0.396***
	(0.073)	(0.073)
Distance	-2.314***	-2.168***
	(0.547)	(0.510)
Language	1.647***	1.643***
	(0.283)	(0.291)
FTA	0.973	0.978
	(0.690)	(0.679)
EPA	2.005	2.146
	(7.595)	(7.543)
NRCA		2658.543
		(2002.537)
NRCA*Protectionism Measure		4286.242
		(2747.879)
Constant	-10.161**	-9.705**
	(3.226)	(3.135)
Equality Test	9.130**	10.380**
	(0.010)	(0.006)
Pseudo R-square	0.250	0.246
Observations	2310	2310

Bootstrap clustered robust standard errors are in brackets and * p<0.10; ** p<0.05; *** p<0; Product dummies not reported but were included in all regression models. McFadden's pseudo R-square are calculated and reported for the tobit regressions.

Column (1) of Table 6 gives the estimated results omitting the importers' NRCA index and the interaction of the NRCA index with the index of protectionism. Remarkably, the estimates on the coefficients of the index of protectionism remain similar to those previously obtained in Table 4 in columns (1) and (2) in Table 4, using both the probit and linear probability model, respectively. Furthermore, in column (2), we had included the NRCA index and its interaction with the index of protectionism to check if protectionism would be higher for products that the EU has lower revealed comparative advantage in, and is less interested in importing. The results from the tobit model as reported in column (2) of Table 5 is also in similitude to the estimates previously reported in columns (3) and (4) in Table 4, using the probit and linear probability model, respectively. In sum, these results imply that even if some of the zeros in the data are as a result of statistical zeros and not because of the inability to meet the standards (true zeros), the basic conclusions of the results that were obtained in Table 4 remain the same, indicating that the previous results are robust even with the presence of statistical zeros.

6. Conclusion

This study provides some first empirics on the extent of protectionism of EU pesticide standards relative to those of Codex, which serve as the international benchmark recommended by the WHO and FAO. Using a sample of African countries, EU tomato standards are found to exhibit protectionist tendencies as they are more stringent than their Codex counterpart. However, in the case of oranges, and limes and lemons, these export products indicate a lack of protectionism in relation to firms' decisions to export; this fact points to the indication that EU pesticide regulations may be aimed solely at addressing legitimate concerns for human health and safety and do not necessarily address protectionist concerns.

Our results show that tomatoes represent a relatively less import dependent product which is over-protected; meanwhile oranges and limes and lemons represent heavily import dependent product which is under-protected. Thus, our results support the hypothesis that protectionism vanishes with overdependence on imports and vice versa. The implication of our findings highlights the fact that importing countries' standards are not always protectionist and can indicate a lack of protectionism relative to internationally acceptable standards. In other words, standards are not necessarily always problematic or protectionist as widely portrayed in the literature. The protectionist intent of a standard is product specific, indicating that the decision to either protect health or protect imports is product specific.

Despite the fact that the EU sets one of the strictest collection of standards in the world, and international standards like Codex have been posited as those that maximize global social welfare, EU standards are not always the more stringent of the two and neither is it always the case that they are trade inhibiting. Thus, a caveat is worth mentioning: although we found international standards to have, at times, a weaker trade enhancing effect than domestic standards, this is not to say that countries should refrain from the usage of globally acceptable standards as recommended by the WTO. Clearly more research is needed in this direction with extensions to other product lines and importing countries.

Conclusively, from a policy point of view, an important policy implication of our findings is that overly protective standards can have huge trade inhibiting effects on developing countries. Although many African countries are in regional trade agreements with the EU, standards make market access penetration conditional, as most of the existing regional trade agreements were negotiated on the basis of reduced tariffs and not on the transfer of technical or financial resources to increase conformity to standards. Thus, increased capacity building and transfer of technology would be a welcome policy if the numerous regional trade agreements that the EU has with Africa are to help in achieving the continent's developmental goals. Consequently, even if standards are used as a protectionist tool, the effect might be dampened for these countries.

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Appendix

Table A.1: List of Countries in the Dataset

Country Groups	Members
Importers (EU)	Belgium, France, Netherlands, Portugal, Spain
Exporters (Africa)	Angola, Benin, Cameroon, Cape Verde, Chad, Congo Democratic Republic, Congo Republic, Côte d'Ivoire, Djibouti, Egypt Arab Republic, Equatorial Guinea, Gabon, The Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Liberia, Libya, Madagascar, Mali, Mauritania, Morocco, Mozambique, Nigeria, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, South Africa, Togo, Zambia.

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