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Food Safety Standards, Compliance and European Union's Rejection of African Exports: The role of Domestic Factors.

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Abstract

This paper investigates the causes of rejections of African exports at the EU border as a barrier in accessing EU markets. Our results indicate that natural geographical hurdle, poor trade-related infrastructure, inefficient border procedure and a lack of technical personnel increase the incidences of rejection at the EU border and add to Africa's challenges in accessing EU markets. In addition, in line with the growing literature, this study finds empirical support for the proposition that institutions, infrastructure and logistic quality matter for increased market penetration and continuous integration into the global trading system. Thus, the barrier created by EU rejection of Africa's exports can be addressed through the strengthening of African's institutions and trade facilitation measures particularly her custom and border management including transit regimes.

Keywords: Non-Tariff Barrier, Export Rejections, Institution, Trade Procedures, Africa, European Union

JEL Classification: F13 F14 L15 017 C33

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1.0 INTRODUCTION

Since the Doha round[1], there has been a continuous drop in tariffs. This is supposed to result in increased trade for African countries many of whom enjoy preferential access to their trading partners such as the Africa Growth and Opportunity Act (AGOA) in the United States and Everything but Arm (EBA) in the European Union. However, with the fall in tariffs comes the shift of many countries from tariff to non-tariff barriers which prove to be more inhibitive than tariff and can also be used as a disguised form of protectionism, thereby constituting an unnecessary barrier to Africa's trade. Indeed these non-tariff barriers (NTBs) might offset any potential benefits of enhanced market access given by the EU to most African countries, especially the preferential tariff and quota, by significantly dampening gains from trade. In particular, among the NTBs, sanitary and phyto-sanitary standards have been found to constitute a more significant barrier to export especially through the associated costs of complying with standards (Gourdon and Nicita, 2013; Shepherd and Wilson, 2013). Sanitary and phyto-sanitary standards are measures aimed at safeguarding the health and safety of the consumers, which is the health objective[2] of such standards. Thus, compliance to such standards is required for both domestic products and third countries' exports, since standards are applied on an MFN basis. However, non-compliance can lead to serious actions being taken against defaulting exporting countries such as outright banning or import rejections. 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 EU food safety standards, amounting to about 9233 rejections between 2008 and 2013 (RASFF, 2014).

Violation of the food safety requirements is the primary reason for border rejections of third countries' exports to the EU. More so, violation is usually committed by developing countries who have limited institutional and technical capacity to comply with EU standards. Africa accounts for about 30% of the total violations of EU food standards, with about 600 cases of African shipments being refused entry into the EU at the border between 2008 and 2013. The huge number of import rejections implies that non-compliance to EU standards represents an important market access problem for Africa. The consequences of these import bans and border restrictions can be enormous and extremely costly. The total cost of rejections at the border includes loss of the export product which is usually destroyed by the importing country, loss of transportation costs, loss of costs due to freight and insurance, and other related costs. In addition to the immediate reduction in earnings from exports, rejections also damage the affected country's reputation and reduce its export competitiveness in the long-run (Baylis, et al., 2009).

Numerous authors have pointed out that the reasons for the inability of African countries to benefit from trade cannot be totally attributed to the trade inhibiting effects of such standards. Major contributory factors for the continent's trade performance have been linked to their domestic supply constraints resulting from their limited productive capacity to produce (Xiong and Beghin, 2012) and the lack of the institution needed to ensure compliance with importing countries' standards (Kim and Reinert, 2009). However, others have attributed it to Africa's poorly developed trade facilitation[3], particularly in the key areas of infrastructure,

[1] This is the most recent rounds of trade negotiations among WTO member states. The round was launched in 2001 with the major objective of improving the trade prospects of developing countries through the lowering of trade barriers and revisions to trade rules.

[2] However, overly stringent standards can also be used to achieve non-health objective when used as a protectionism tool, which is the 'trade objective'.

[3] Trade facilitation is the harmonization and simplification of international trade procedures which span the collection, presentation, communication and processing of data for the movement of goods during international trade the harmonisation of standards as well as conformity to regional or international regulations (OECD, 2005). This includes such formalities as export and import formalities, payment and insurance formalities, customs and regulatory environments.

customs and border procedures, as well as transportation and communication which often results into cumbersome trade procedures. These factors have been said to constitute much more of a barrier to Africa's integration in the global trading system (Djankov, et al., 2010; Freud and Rocha, 2011; Iwanow and Kirkpatrick, 2009; and Portugal-Perez and Wilson, 2012). In fact, Africa's competitive advantage in terms of its abundance of agricultural resources and relatively low labour costs could easily be lost through inefficient logistics and poorly developed trade facilitations. In addition, these barriers might offset any potential benefits of enhanced market access given by the EU to most African countries, especially the preferential tariff and quota, thereby significantly dampening gains from trade. Empirical evidence and detailed specificity about these factors are therefore needed to build a strong case for comprehensive long term reform. It is on the basis of this that this paper is motivated.

Our paper contributes to the literature on non-tariff measures (NTMs), an area that is currently under-researched in Africa. While most of the existing literature have analysed the impact of food safety standards on international trade flows (Disdier, et al., 2015; Ferro, et al., 2015; Fontagne et al., 2015; Otsuki et al., 2001), fewer studies have looked at the impact of enforcement of food safety regulations on trade flows (Artecona and Grundke, 2009; Baylis et al., 2011). The literature has, however, overlooked the factors triggering non-compliance with importing countries' standards which results in their inability to export safe and healthy products. This study uses the number of rejections of unsafe food exports from Africa at the EU border as a measure of EU enforcement of its food safety regulations and as a measure of non-compliance with its food safety standards. We also investigate the extent to which domestic factors are contributing to such non-compliance. A similar approach of measuring compliance to importing countries' food safety standards was employed by Baylis et al., (2009) who used the incidences of EU border rejection to measure compliance. More recently, Jouanjean, et al., (2012) used data on US border rejections[4]. However, these studies did not explicitly focus on Africa which is the focal point of this study. We use a similar approach to these studies by measuring compliance to food safety standards using border rejections, but instead focus on the most often rejected categories of African exports, namely fruits and vegetables, fish and fish products, and nuts and nut products. These products represent about 70% of all products rejected at the EU border.

Our objective is to investigate the extent to which domestic factors in each African country are inhibiting their ability to comply with EU food safety standards. To achieve this objective, firstly, we investigate the impact played by economic and geographical factors in affecting border rejection. Secondly, we proceed by also considering the impact of trade related infrastructure, trade procedures and institutions which might also be responsible for the incidences of border rejections. Most African countries have poorly developed institutions and infrastructures, so this might be a triggering factor responsible for such rejections. While there is a growing body of literature which supports the notion that institution and the strengthening of trade facilitation infrastructure are a catalyst for trade, to what extent such factors help in attenuating the trade inhibiting effects of food safety standards has rarely been investigated in the literature. One exception is that of Kim and Reinert (2009), who focused explicitly on institutions. Our study therefore makes two unprecedented contributions to the literature. First, this represents the first study to link the factors responsible for the EU's rejection of African exports to trade facilitation measures and existing domestic institutions

[4] Baylis et al. (2009) investigated the factors that drive the refusals of third countries' exports by the USA using products and country-pairs that have recently been a target of refusal by the EU. They find that increased EU rejections of third countries' exports are associated with trade protection concerns within the importing country, perceived risk level of the export product, and countries with a long-standing reputation of violating US food safety standards. More recently, Jouanjean et al., (2012) investigate the importance of reputation in driving border rejections using US import refusal data. They find that exporter, sector or product, and nearest neighbours with a previous reputation of non-compliance with US food regulation increases the chances of being refused entry into the US market.

such as country level corruption and domestic regulatory policies. Secondly, to the best of our knowledge, this work remains the first among its kind to empirically investigate the factors responsible for the non-compliance to EU standards and border rejection of African exports by the EU. Thus, its importance in aiding informed policies on enhancement of market access for the continent cannot be overlooked.

We proceed by estimating count data models with panel data to examine the determinants of compliance to EU standards by African countries between 2008 and 2013. Our major findings are that border rejections are affected not only by geographical distance, but more importantly by Africa's dilapidating trade infrastructure, cumbersome trade procedures and weak domestic institutional conditions.

The rest of the study is organised as follows. Section 2 provides the background on compliance with EU food safety standards by African countries. Section 3 provides the methodology of the study and the empirical results are presented in Section 4. The last section concludes with our findings.

2.0 EU FOOD SAFETY STANDARDS AND COMPLIANCE INDICATOR

In this section, we analyse EU enforcement of standards in terms of the border rejection of non-complying countries' exports along with the reasons for such rejections in order to determine the implications of non-compliance on export success.

2.1 Reasons behind EU Border Rejection of Feed and Food

Standards are set with the aim of achieving high levels of sanitary and health protection for consumers. Compliance with such standards are usually strictly monitored, particularly by developed countries. In the EU, food products that do not meet its stipulated standards are usually refused entry into its borders. Thus, the EU typically enforces its standards on third countries through its rejection of non-complying countries' exports. The EU food standards enforcement was made possible by the Rapid Alert System for Food and Feed (RASFF) in which the EU maintains notifications about violations and potential violations of feed and food products by both EU and third countries. Established in 1979 and subsequently given a legal basis by EC regulation 178/2002, this system enables a swift reaction to food of potential risk to public health that is detected in the food chain. The ultimate aim of the system is to ensure that food products are safe for the consumers. The system enables the maintenance of one of the highest standards in the world, by serving as a tool in enabling food and feed control authorities to efficiently exchange information about potential food risks and measures that were taken in response to the risks. This is done through its 24 hour services which ensure that all urgent notifications about food safety risks are sent out, received, rapidly coordinated and acted on by Members states in a coordinated way, thereby averting many food risks for European consumers.

In the EU, depending on the perceived risks, enforcement of such standards is via three avenues: alerts, information and border rejection. There are *alerts* being circulated about the potential harm of the feed or food products that are already in circulation in one or more member countries, in which case the products not complying with the set standards are withdrawn from the market. *Information* is given about the potential risks from products which are not yet in a members' market at the time of notification, or whose risks are not considered very serious. High risk export products coming into member markets are subject to *border rejection.* Other food and feed safety information that has not been communicated as an alert, information or border rejection is presented as *news*. Border rejection notifications

are the focus of this paper, as they are usually issued when food products are perceived to represent the greatest food safety risks. Border rejection notifications "concern[s] consignment of food, feed or food contact material that was refused entry into the Community for reason of a risk to human health and also to animal health or to the environment if it concerns feed" (RASFF, 2014 p. 37). Thus, non-compliance usually leads to import refusals at the border or import detention and destruction.

Major reasons for EU border rejections of third countries' exports between 2008 and 2013 in order of importance are given in Table 1. These span the violation of a wide range of different standards requirements in the food sector such as the violation of the acceptable maximum residual limits of mycotin and pesticides residues regulations, migration of substances, presence of pathogenic micro-organisms, etcetera. Most surprising, the reasons for refusing all third countries' exports to the EU amounts to as many as 9,660 violations of different EU food safety regulations.

Table 1: Reasons for EU Rejection of Food and Feed 2008-2013

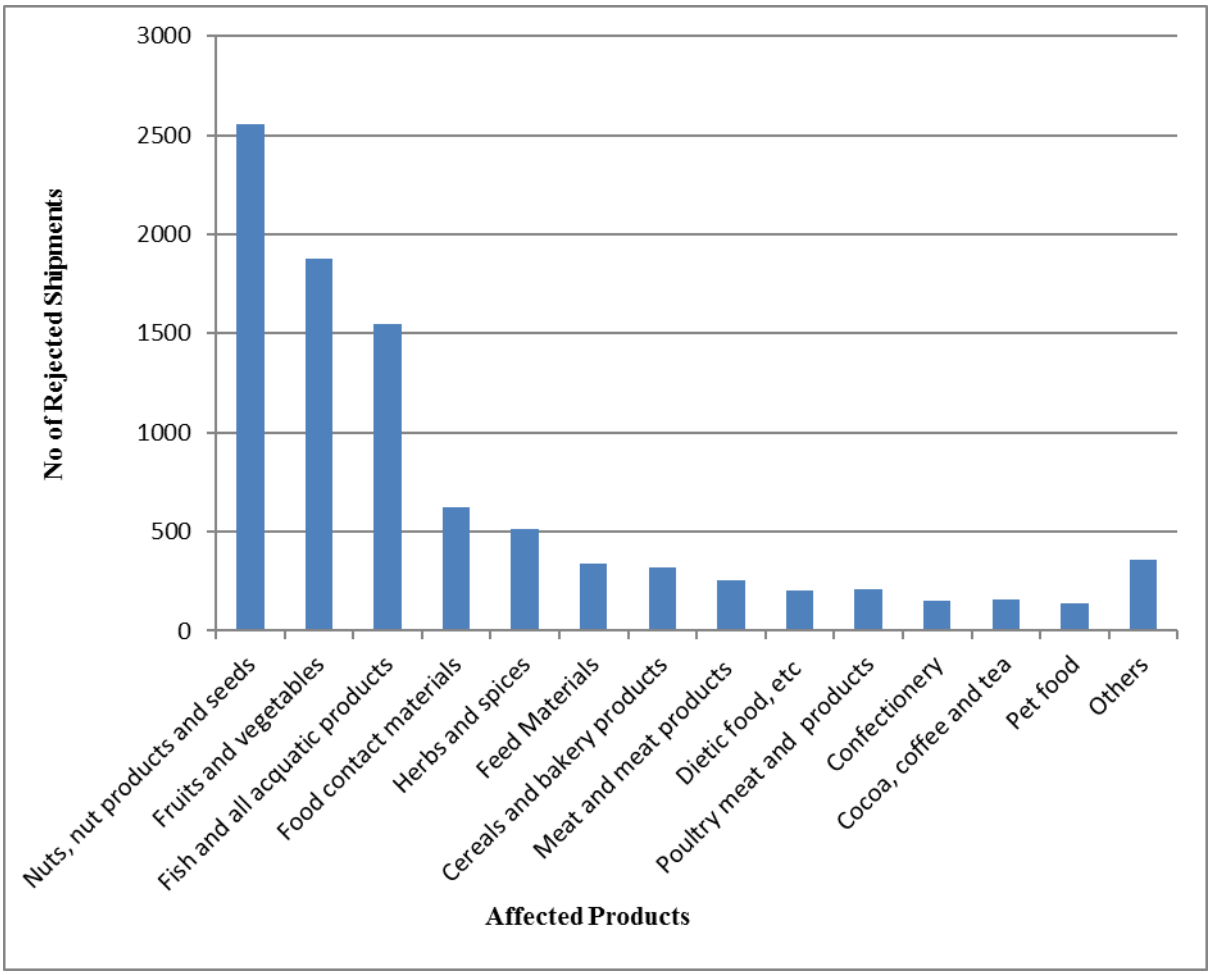
Hazard	2008-2013	Share in Total (%)
Mycotin	1827	18.91
Pesticide Residues	1102	11.41
Not Determined/Other	987	10.22
Migration	773	8.00
Pathogenic Micro-organisms	693	7.17
Poor or Insufficient Controls	551	5.70
Heavy Metals	458	4.74
Foreign Bodies	362	3.75
Organoleptic Aspects	317	3.28
Adulteration/Fraud	292	3.02
Genetically Modified Organism/Novel Food	260	2.69
Food Additives and Flavourings	257	2.66
Composition	255	2.64
Parasitic Infestation	243	2.52
Non-Pathogenic Micro-Organisms	194	2.01
Others	1089	11.27
Total Hazard	9660	100.0

Source: Compilation from EU RASFF Reports, Various Years

Inspectors at the border must be satisfied that each export product is free from the aforementioned food hazards as a prerequisite for granting market access into the EU market. Each requirement is as important as every other one, otherwise, market access could be denied. However, many countries have demonstrated their inability to satisfy EU standards. Thus, there have been a significant number of border rejections of food exports by the EU, amounting to about 9,233 notifications[5] between 2008 and 2013 (RASFF, online database).

[5] The total number of violations (9,960) reported in Table 1 is more than the total number of notifications, which was 9,233 in Figure 1. This was because some notifications can be reported to have more than one food hazard.

Figure 1: EU Border Rejection of Third Countries Exports by Most Affected Product, 2008 to 2013

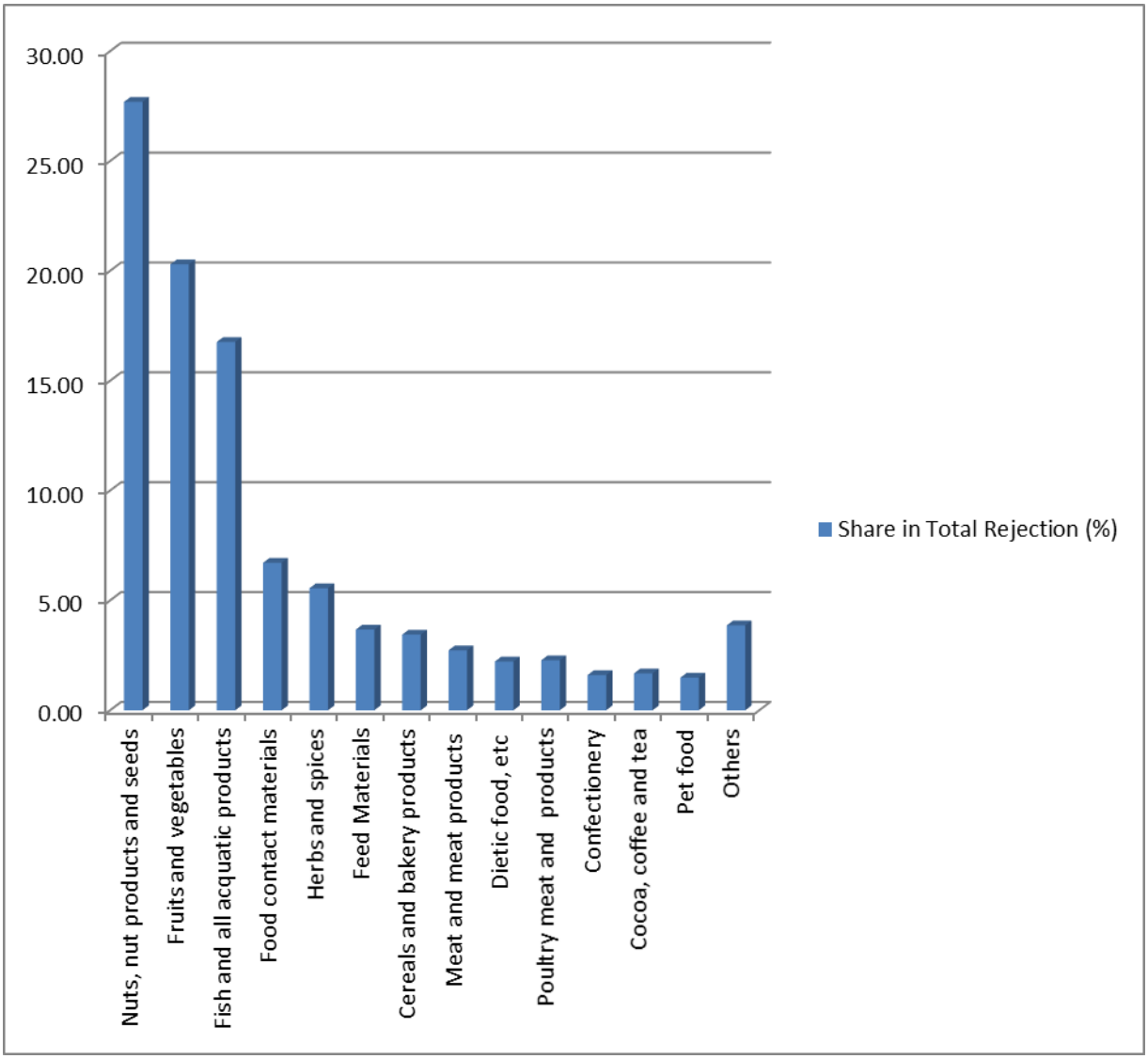


Source: Compilation from EU RASFF Reports, Various Years

This is evident in Figure 1, which shows unit border rejection of the most frequently rejected food exports from countries exporting to the EU. In particular, nuts and nuts products, fruits and vegetables, and fish and other aquatic products[6] are the three most important product categories in order of importance that are usually refused entry into EU markets as a result of exporters failing to meet stipulated EU standards. Refusals of these three products categories represent over 64% of all EU food export refusals between 2008 and 2013 (Figure 2).

[6] Products under these categories in the RASFF database are fish and fish products, crustacean, cephalopods and bivalve molluscs. These were reported separately but summed up by us as they can be classified as aquatic products.

Figure 2: Proportion of EU Export Rejection in Total Rejection (%)



Source: Compilation from EU RASFF Reports, Various Years

Table 2 shows the trend in EU border rejection of Africa's exports for the most affected African countries and most affected products. For Africa, the most frequently rejected export product is fish, crustacean, mollusc and other aquatic products, representing about 40.56% of all Africa's rejected exports between 2008 and 2013. This comprises about 447 of a total of 1548 EU rejections in the products reported in Table 1. This is closely followed by nuts and nuts products which constitute about 19.87% of all Africa's food rejections from the EU between 2008 and 2013. Fruits and vegetable products is the third most important category of rejected products, accounting for about 18.42 % of total rejections of Africa exports. In addition, out of the 1874 cases of fruits and vegetables rejected between 2008 and 2013 from all countries, Africa accounts for about 203 of these cases, which amounts to about 10% of all EU rejections of vegetables in this period. The huge number of rejections implies non-compliance to EU standards represent an important market access problem for Africa. In fact, Africa's fish and fish products, nuts and nuts products, as well as fruits and vegetable - the

three classes of export products often refused entry into the EU market, account for about 70% of all Africa's rejections.

Table 2: EU Rejection of African Exports by Most Affected Countries and Product, 2008-2013

Most Affected Products	Egypt	Ghana	Kenya	Morocco	Tunisia	South Africa	Nigeria	Senegal	Others	Total	% of Total
Fish, Crustacean, Mollusc & other Aquatic Invertebrate	1	17	4	154	38	9	8	57	159	447	40.56
Nuts	89	18	0	1	4	39	52	5	11	219	19.87
Fruits and Vegetables	86	8	23	16	15	4	31	5	15	203	18.42
Feed Material	1	3	0	27	0	3	1	2	28	65	5.90
Herbs and Spices	12	5	1	26	1	2	3	0	9	59	5.35
Cocoa	2	3	1	5	0	0	14	0	3	28	2.54
Fat and Oil	1	5	0	1	0	0	5	3	7	22	2.00
Cereals and Bakery	2	6	0	1	0	2	4	0	2	17	1.54
Meat	2	0	0	0	0	0	0	0	8	10	0.91
Non Alcoholic Beverages	7	0	0	0	0	0	1	0	0	8	0.73
Others	4	4	0	3	1	4	4	2	2	24	2.18
Total by country	207	69	29	234	59	63	123	74	233	1102	100.00

Source: Compiled from RASFF Online Database

The statistics of the reasons for the EU rejecting African food and feed are presented in Table 3. Major reasons adduced for the rejection of these African products are exceeding the stipulated EU mycotin limit, poor and insufficient controls, adulteration and fraudulent practices. By far, the most significant reason given was violation of mycotin limits, accounting for as much as 22.43% of rejections from Africa's food exports between 2008 and 2013. The countries who most frequently violated EU food standards are Morocco with 252 cases of border rejections, closely followed by Egypt which has 211 cases of rejection, Nigeria with 113 rejections, and Ghana and South Africa with 75 and 74 incidences of rejection respectively.

Table 3: Reasons for EU Rejection of Africa's Food and Feed by Hazard Category, 2008-2013

	Egypt	**Ghana**	**Kenya**	**Morocco**	**Nigeria**	**South Africa**	**Tunisia**	**Others**	**Total**	**Share (%)**
Mycotin	84	28	1	0	56	53	4	29	255	22.43
Poor or Insufficient Controls	3	15	1	56	6	5	15	130	231	20.32
Pesticide Residues	80	1	23	36	28	3	3	3	177	15.57
Organoleptic Aspects	3	8	1	15	6	2	10	54	99	8.71
Pathogenic Micro-organisms	2	1	1	23	4	2	1	33	67	5.89
Parasitic Infestation	0	1	0	48	0	2	6	5	62	5.45
Non-Pathogenic Micro-	13	6	0	11	3	0	3	23	59	5.19

Organisms										
Packaging Defective/Incorrect	3	2	0	17	1	0	3	7	33	2.90
Adulteration/Fraud	3	5	0	6	3	1	4	9	31	2.73
Food Additives and Flavourings	9	2	0	1	3	5	1	7	28	2.46
Heavy Metals	0	0	0	9	1	1	0	12	23	2.02
Bio-contaminants	0	0	0	20	0	0	1	1	22	1.93
Foreign Bodies	8	4	0	2	0	0	0	6	20	1.76
Labelling	2	2	0	8	0	0	2	1	15	1.32
Absent/Incomplete/Incorrect										
Industrial Contaminants	1	0	0	0	1	0	0	10	12	1.06
GMO/Novel Food	0	0	0	0	1	0	0	0	1	0.09
Migration	0	0	0	0	0	0	1	0	1	0.09
Not Determined/Other	0	0	0	0	0	0	0	1	1	0.09
Total Hazard	**211**	**75**	**27**	**252**	**113**	**74**	**54**	**331**	**1137**	**100.0**

Source: Compiled from RASFF Online Database

This precedent analysis of EU border rejection might be indicative of the inability of African countries to meet EU standards. This in part might point out their lack of the necessary regulatory institutions to facilitate standards compliance, the lack of minimum country-level standards in African countries, or a case of a regulatory gap[7]. Other factors might also be attributed to the inadequacy of trade facilitating measures caused by cumbersome trade procedures which prevent the efficient movement of commodities in cross-border trade. For instance, while it usually takes a day for the Netherlands to export goods via an airport supply chain, export times could be as high as 18 days in Cameroon and about 25 days for Chad Arvis, et al., 2012). This is attributed to inefficient border procedures and inadequate trade infrastructure which bring about border rejections especially for highly perishable goods such as fish products, fruits and vegetables. Poor storage infrastructure in ship or consignments, especially for perishable goods, can also result in problems such as migration, infestation with a foreign body, bio contaminants, parasitic infestation, and the emergence of pathogenic organisms in the exported products. For instance, according to a 2014 report from the EU, tomato exports originating from three production units in Morocco might have resulted in several cases of food poisoning due to a cooling liquid used in the chiller cabinets where the tomatoes were stored (RASFF, 2014). All these issues signify the role of inefficient trade procedures and of a poor trade infrastructure in increasing the incidences of border rejections.

3.0 METHODOLOGY

The total number of border rejections per exporting country is strictly a non-negative count variable. Furthermore, some of the exporting African countries have had no border rejections in some years, giving rise to the presence of a number of zeros. The occurrence of zero rejections might be due to specific reasons. Firstly, it might be that these groups of countries did not export any of the agricultural export products considered in this study to the EU in these years. Secondly, these countries may have met EU standards, and successfully exported to the EU, and thus recorded zero rejections of their export products. Thus, this type of data generating process gives rise to a class count data model (Cameron and Trivedi, 1998; Winkelmann, 2008).

[7] In this case, the existing standards are sub-optimal and sub-standard to the level required by the EU to achieve the desired level of health and safety.

3.1 Model Specifications

To investigate the factors influencing border rejections of African exports by the EU, we rely on a standard count data model which is represented in a general form of a conditional probability function:

$$\Pr(Y_{ijpt} = y_{ijt} \mid x_i) = \frac{\exp(-\exp(x'_{ijt}ß))\exp(y_{itj}x'_{ijt}ß)}{y_{ijt}!} \quad (1)$$

where subscripts *i, j, p* and *t* denote exporter, importer, product and time respectively; *y* is the count variable, in this case, the total number of border rejections of African exports by the EU in the selected products over years; *x* is the vector of independent variables of the model and β is the vector of the associated parameters. Two generalized linear models (GLM) which are the Poisson and Negative Binomial estimation techniques are employed in estimating equation (1).

(a) The Poisson Model

The Poisson specification estimates β by solving the following first-order conditions:

$$\sum_{i=1}^{n} \left[y_{ijt} - \exp(x_{ijt}\beta)\right]x_{ijt} = 0 \quad (2)$$

The estimator is consistent under the estimator's equi-dispersion assumption about the dependent variable that the conditional mean, given as $\exp(x_{ijt}\beta)$, is proportional to the conditional variance $V[y_{ijt} \mid x]$. However, the equi-dispersion assumption[8] is unlikely to hold (Santos Silva and Tenreyro, 2006; Martinez-Zarzaso, 2013) as the estimator does not fully account for the presence of unobserved heterogeneity thus making the conditional variance greater than the conditional mean.

(b) Negative Binomial Model

In the case of overdispersion - when the variance of the dependent variable exceeds its mean - a more suitable model is the negative binomial (NB) model. The NB model is a count data model that does not rely on the assumption of an underlying Poisson process and is able to efficiently deal with the presence of both overdispersion and unobserved heterogeneity in the variation of the dependent variable (c.f. Burger et al., 2009).

Following Winkelmann (2008), the NB model is specified as:

$$\Pr\left[y_{ijt} \mid x_{ijt}, \alpha\right] = \frac{\Gamma(\alpha + y_{ijt})}{\Gamma(\alpha)\Gamma(y_{ijt}+1)}\left(\frac{\alpha}{\alpha + \exp(x_{ijt}\beta)}\right)^{\alpha}\left(\frac{\exp(x_{ijt}\beta)}{\alpha + \exp(x_{ijt}\beta)}\right)^{y_{ijt}} \quad (3)$$

Where Γ is the gamma function, α is the dispersion term which shows the degree to which the variance of the dependent variable disperses from the mean, which is assumed to be greater than one. Given the estimator's overdispersion assumption, its variance function is specified as:

[8] Although the Poisson specification hinges on the assumption of equi-dispersion of the dependent variable, however, Santos Silva and Tenreyro, (2009) show that the estimator is still well-behaved and consistent even with departure from this assumption.

$$Var[y_{ijt} \mid x] = (1+\alpha^{-1})\exp(x_{ijt}\beta) \quad (4)$$

Here, the NB model's expected value is given as that of the Poisson model. However, the variance is specified to include the mean $\exp(x_{ijt}\beta)$ and an unobserved heterogeneity given as a dispersion parameter α which allows unobserved heterogeneity to be incorporated into the model. In addition, the dispersion parameter [9] is allowed to take on values greater than 1, thereby explicitly taking care of overdispersion. The larger α is, the larger the degree of overdispersion in the dependent variable.

3.2. Data and Variables Included

Our objective is to investigate the potential factors that are responsible for noncompliance with EU standards, and the consequential rejection of African exports. Specifically, we first investigate the impact of geographical, economic and trade factors on border rejections and thereafter went ahead and investigated the contributory impact of both institutional and trade procedures. To investigate the determining factors of border rejection of African countries, we set up a standard random effects model. Our model specification follows that of Baylis et al., (2009) with some modifications in terms of the variables included. Our main dependent variable is the total number of border rejections of non-conforming food products exported to the EU by African countries. Our explanatory variables are countries and exporters' characteristics that are associated with the risks of being rejected and are divided into three groups. These are country area characteristics, country trade and economic characteristics, as well as country-level trade and institutional infrastructure.

3.2.1 Description of Variables

Country-level Geographical Characteristics

Distance, being a landlocked or island country and language are important geographical characteristics that might make exports more susceptible to contamination and food hazards. Distance between trading partners represents an important trade cost that might increase cases of import rejections, particularly for poor countries with inadequate facilities to preserve export products during long distance journeys. Inadequate facilities during long distance trade could result in common reasons for rejecting imports; examples of such reasons include parasitic infestation, the presence of pathogenic and non-pathogenic micro-organisms in or on export products, contaminations, the presence of foreign bodies, poor organoleptic properties of the export product, etcetera. Thus, import rejections tend to increase with increasing distance to the EU. Firms operating in landlocked countries are less competitive, and tend to export less due to higher transport costs relative to countries that are not landlocked, and might record fewer import rejections from the EU. However, due to their disadvantaged position, they usually have higher export times thereby rendering highly perishable goods susceptible to the violation of sanitary and phyto-sanitary (SPS) requirements. Similarly, countries sharing a similar language with the EU might find it easier to understand EU food safety requirements, thereby increasing their compliance level and reducing import rejections by the EU.

[9] This dispersion parameter serves as a formal test of overdispersion for the dependent variable.

Country-level trade and economic characteristics

Our dependent variable is the total number of rejections faced by each African country between 2008 and 2013 for the three most frequently rejected products identified earlier in the previous section. These are fish, crustaceans, mollusc, and other aquatic vertebrates; nuts and nut products; and fruits and vegetables. In relation to the explanatory variables, following Baylis et al., (2009) and Jouanjean et al., (2012), we have included some measures of the reputation of the exporting countries into the model. We have used two variables in measuring reputation. The first one was a dummy variable indicating if the product was rejected in the previous year which we termed '*product reputation'*. The second is a dummy variable indicating if at least one export product was rejected in the previous year from a given country, termed '*country reputation'*. Product reputation matters because products high risks products especially perishables exported by frequently violating countries usually attract higher vigilance. Furthermore, they will elicit a great number of inspections in subsequent years which might increase the likelihood of finding evidence of non-compliance.

Country reputation is also important due to the premise that, on the one hand, countries with a history of past rejections in any one product may be subjected to increased vigilance and inspections in all its products. This clearly increases the chances of having products rejected in subsequent years. On the other hand, past rejections of all products coming from a heavy violating country can allow the affected country to gather experience about its weak food safety enforcement. They are then more likely to invest in supply upgrading to conform to EU standards, and such experience might decrease import rejections. In fact, in relation to country reputation, the EU have in some cases rejected (or banned) all products coming from export countries which persistently violate standards due to concerns about the countries' levels of sanitary and phyto-sanitary (SPS) standards.

We also introduce a variable to capture past EU imports from African countries. We control for this due to concerns that increased border rejections might have appeared following an import surge. Under pressure from lobby groups, the EU might have increase border vigilance to deliberately limit import flow in a particular sector. There may have been economic or political pressure for increased import inspections. Finally, we included a measure of the exporting countries' economic growth, captured by their gross domestic product. Due to the huge cost of complying with food safety standards, we consider that low income countries' exports are at a higher risk of being subjected to rejection due to having higher risks of exporting sub-standard products as a result of their limited financial resources to ensure compliance.

Lastly, we included country, product and time-fixed effects to capture the impact of unobserved heterogeneity. Based on the above definitions, the regression model is given as:

$$\begin{aligned} EU\,\mathrm{Re}\,jections_{ijpt} &= \beta_0 + \beta_1 Dis\tan ce_{ij} + \beta_2 Language_{ij} + \beta_3 Landlocked_i + \beta_4 Island_i + \\ &\beta_5 C\_\mathrm{Re}\,putation_{ijpt-1} + \beta_6 P\_\mathrm{Re}\,putation_{ijpt-1} + \beta_7 \Pr evious\_\mathrm{Im}\,ports_{ijpt} + \beta_8 GDP_{it} + \\ &\delta_i + \delta_p + \delta_t + \mu_{ijpt}) \end{aligned} \quad (5)$$

Where *i*, *j*, *p* and *t* are the exporting country, importing countries, product and time respectively, as defined earlier. *Distance* is the geographical distance between each exporting African country and the EU. *Language* is a dummy variable which takes the value of one if the exporting countries share a similar language with at least one country in the EU, and zero otherwise. *Landlocked* and *island* are dummy variables taking the value of one if the African country is a landlocked or island country, and zero otherwise. *P_Reputation* and *C_Reputation* are product and country reputation respectively as discussed previously. *Previous_Imports* denotes a year's lag values of EU import from African countries; and *GDP* is the Gross Domestic Product of the exporting country. δ_i, δ_p and δ_t are the dummy variables controlling for country, product and time-fixed effects respectively, while μ_{ijpt} is the error term. Table 1 provides the summary statistics of all the variables included in this analysis and their sources.

Our second objective is to investigate the impact of trade related infrastructure, procedures, and institutions on border rejection. The important variables of institutional and trade procedures are discussed below.

Country-level institutional capacity

We also identify missing institutions as factors which can hinder developing countries' ability to comply with developed countries' standards. These institutional factors are high levels of corrupt practices and poor regulatory quality. In fact, in relation to corruption, about 3% of African export products have been refused entry to the EU due to adulteration and fraudulent practices, making it a potentially important variable considered in our analysis. A limited number of studies suggested that corruption impact on export quality and trade (Faruq, 2011; Goel and Korhonen, 2011). For instance, corruption can impact on export quality and trade by weakening long term investment incentives, thereby decreasing productivity and quality improvement (Faruq, 2011). Hence, it may be that more corrupt countries will see their export rejected at the EU border due to their fraudulent practices.

On a related note, the literature has pointed out that the impact of developed countries' standards on developing countries have been aggravated for developing countries for the latter due to their weak domestic regulatory quality which leads to weak standards and quality regulation in the domestic economy. As a consequence, this hinders their capacity to implement testing and certification processes (Essaji, 2008; Kim and Reinert, 2009). Given this information, the measure of African countries' institutional capacity to satisfy EU food safety standards therefore includes the quality of their domestic level regulatory capacity. We use 'regulatory quality' sourced from the World Bank World Governance Indicators – a measure of governance indicators - as a proxy each country's capacity to formulate and implement food safety regulations, testing and certification procedures. This measure reflects the ability of a government to formulate and implement high quality regulatory policies, the quality of its public service delivery and its commitment to such policies. The intuition is that countries that score high in this indicator would definitely have high regulatory quality, including adequate food regulatory mechanisms and, thus, a low probability of having border rejections when exporting to the EU. This is based on the perceived positive influence of institutional quality and governance on trade performance (Dollar and Kraay, 2002).

Country-level core trade facilitation measures

Trade facilitation involves the trade procedures or activities which are channelled towards ensuring the efficient logistics of moving goods during international trade through ports and all procedures associated with cross-border trade. This includes export and import formalities, customs and regulatory environments, as well as conformity to regional or international standards and regulations (OECD, 2005). Trade facilitation can thus be used to achieve an improvement in compliance with SPS measures depending on how weak or strong they are in a country. Such measures include trade-related infrastructure and customs and border procedures. For instance, both soft infrastructure such as information and communications technology (ICT) and hard infrastructure such as road, rail, sea and air ports are essential in transporting export goods in a timely manner, especially in the case of perishable goods. Thus, weak or missing infrastructure can also aggravate rejections of exported goods. In addition, cumbersome border and customs procedures and the associated lack of adequately trained technical staff, especially those related to SPS control and health and safety issues, can escalate incidences of import rejections by the importing countries.

Thus, we also investigate Africa's state of trade procedures as factors which can hinder their ability to comply with developed countries' standards. Major factors which are of high relevance to explaining specific hurdles in international trade are infrastructural quality (c.f. Portugal-Perez, 2012), and trade procedures – which are essentially border and customs procedures (UNECA, 2013). Trade procedures are measured using improved data from the *World Bank Doing Business* database on domestic logistic performances. These span data on the quality of customs procedures and infrastructural quality.

Therefore, we model the impact of institution and trade infrastructure as well as trade procedures on border rejections as follows:

$$\begin{aligned}\text{Re}\,jections_{ijpt} = \beta_0 + \eta_1 Infrastructure_{it} + \eta_2 Trade\_\text{Pr}\,ocedures_{it} + \eta_3 Corruption_{it} + \\ \eta_4\,\text{Re}\,gulatory\_Quality_{it} + \eta_i + \eta_p + \eta_t + \varepsilon_{ijpt}\end{aligned} \quad (6)$$

where *Trade_Procedures* is a vector of variables which measures the efficiency of customs clearance process, border controls, as well as the quality of logistics services. These include documents required to export, number of border agencies, percentage of shipments meeting quality criteria, rate of physical inspection of exports, customs clearance times without physical inspection, and customs clearance times with physical inspections. Infrastructure is the trade related infrastructure in the domestic country which spans air and seaports, rails, road, and Information and communications technology. *Corruption* is the level of control of corruption in the domestic economy while *regulatory quality* is the quality of each African government regulations and laws as well as the extent of the government's commitment to its enforcement. η_i, η_p and η_t are the dummy variables controlling for country, product and time-fixed effects respectively, while ε_{ijpt} is the error term of the model. Table 4 provides the summary statistics of all the variables included in our analyses and their sources.

Table 4: Summary Statistics

Variables	Mean	Standard	Minimum	Maximum

		Deviation		
Rejections	1.45	4.47	0	41
Distance	5820.31	2087.59	1733.39	9693.59
Island	0.12	0.32	0	1
Landlocked	0.16	0.36	0	1
Language	0.04	0.19	0	1
Product_Reputation	0.26	0.44	0	1
Country_Reputation	0.61	0.49	0	1
Past Imports (Million US Dollar)	76116.95	255665	0	2182462
Log of exporter GDP	23.61	1.57	20.56	26.98
Infrastructure quality	2.24	0.42	1.27	3.79
Control of corruption	-0.47	0.52	-1.24	0.87
Regulatory quality	-0.48	0.47	-1.47	0.52
Documents to export	7.16	1.74	4	11
Number of border agencies	3.77	1.80	1	11
Percentage of shipments meeting quality Criteria	68.76	20.43	7	100
Custom clearance day with physical inspection	4.25	3.36	0.79	20
Custom clearance days without physical Inspection	3.18	3.07	0.4	18
Rate of physical inspection of import (%)	32.23	26.89	1	100

3.2.2 Sources of Data

To estimate the different count models previously specified, we focus on EU import rejection data for 26 African countries[10] reported between 2008 and 2013. Data on EU rejection of these African export products were sourced from the EU RASFF database from 2008 to 2013. Although the RASFF was created in 1979, public access to the summary information on the incidence of border rejections only started in 2008. Hence, our analysis starts from this period. The EU classification of import refusal data is reported at a more aggregated level. Thus, to allow a meaningful analysis, we map each notification to the respective Harmonised System (HS) product classification. Analysis was based on three products rejected by the EU at the border identified in the previous section, namely fish, crustaceans, molluscs and other aquatic invertebrates (HS 03), Fruits and Vegetables (HS 07 plus HS 08) and Nuts and nut products. Nuts and nut products were later split into groundnuts, not roasted or otherwise cooked (HS 1202) and edible groundnuts, otherwise prepared or preserved (HS 200811), bringing the number of products considered in the analysis to four. However, we choose not to disaggregate fruits and vegetable products due to the ambiguity in the way in which they were notified in some cases. For instance, for some notifications, we do not have enough information to enable us to distinguish if the refusal relates to a vegetable or fruit product.

For simplicity, we restrict our data to just the countries that have had at least one EU rejection between 2008 and 2013; this reduced our sample countries from 54 African countries to 26 countries for the four products over the 6 years. Data on EU rejection of these African export products amounts to a total of 484 refusals. In relation to other data, export and import data are from the UN Comtrade database. Data on language, landlocked, distance are from the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII), GDP data are from

[10] The included countries are Algeria, Benin, Cameroon, Cape Verde, Congo Republic, Cote d'Ivoire, Egypt, Arab Republic, Ethiopia, Gabon, The Gambia, Ghana, Kenya, Madagascar, Malawi, Morocco, Mozambique, Namibia, Nigeria, Rwanda, Senegal, Seychelles, South Africa, Tanzania, Togo, Tunisia and Uganda.

the World Bank's World Development Indicator, governance indicators on corruption and regulatory quality are from the World Bank's Worldwide Governance Indicators while data on infrastructure, customs and logistic quality are from the World Bank's Doing Business database.

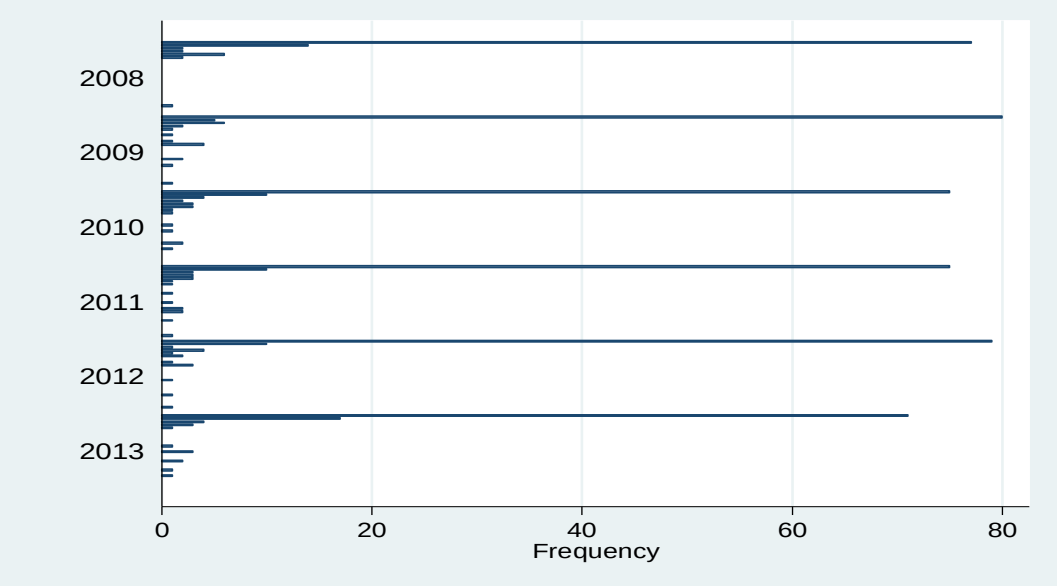
4.0 EMPIRICAL ANALYSIS AND RESULTS

In this section, we first present a descriptive analysis of our independent variable. Thereafter, we move on to the count models where we show the results of the factors affecting import rejections.

4.1. Descriptive Analysis

In terms of the features of our dependent variable, a simple chart of distribution of the dependent variable shows our data is skewed to the right for most of the years under consideration. Clearly employing non-count data estimation techniques for analyzing such count data would be grossly inappropriate.

Figure 3: The Distribution of Border Rejections of the Selected African Exports, 2008-2013



Source: Authors' Computation

4.2 Econometric Analysis

Before we go on to interpret our results, we begin by reporting various specification tests to ascertain the most efficient of the count data models previously discussed. The main statistics tests employed are the Park (1996) test and the Ramsey reset test. The various goodness of fits are discussed below.

Firstly, we used the Ramsey reset test (Ramsey, 1969) to check the adequacy of all the estimated models. It is a test of specification error of the functional form of the model to determine whether the models are correctly specified. The test is performed by checking the significance of an additionally constructed regressor specified as $(x'\beta)^2$, where β is the vector of the estimated parameters. The null hypothesis is that the coefficient of the test variable is zero or insignificant. The test results are displayed in Table 5. As reported in Table 5, for both the populated average and random effects Poisson regressions, the coefficient of the test variable is statistically insignificantly different from zero, suggesting that both Poisson models are appropriate. However, for the NB models, the test rejects the null

hypothesis that the coefficient of the test variable is zero, implying that the NB specifications are inappropriate.

Table 5: Comparisons of the Estimation Techniques

Various Tests	(1) Poisson (*p.a*)	(2) Poisson (*r.e.*)	(3) NB (*p.a.*)	(4) NB (*p.a.*)
Ramsey Reset Test	- 0.03	0.003	-0.11**	0.31***
Park TEST: $v(y \mid x) = (\mu(y \mid x)^{\alpha}$				
α_1	1.13	0.30	–	–
P Value	0.31	0.00	–	–
95% Confidence Interval	0.88 - 1.39	-0.08 - 0.69	–	–

Note: p.a. and r.e. are populated average and random effects, respectively. "–" not available after populated average effects models.

Secondly, we also employ a Park-like test to ascertain if the Poisson assumption is satisfied. We are interested in whether the equi-dispersion property (conditional mean is proportional to the conditional variance) assumed by the Poisson estimator is satisfied. The general form of this property is given as $v(y \mid x) = (\mu(y \mid x)^{\alpha}$. Here, α is the dispersion term, it is non-negative and finite and its value determines the difference between the Poisson and NB models. For instance, when $\alpha = 1$, we obtain the Poisson model; when $\alpha > 1$, we obtain the NB model. The more efficient estimator now depends on the assumption of how its variance relates to its mean.

Following Manning and, Mullaby, (2001), the choice of the appropriate estimator could be based on a Park-type regression. We therefore rely on a Park-type test (Park, 1966) which checks for the adequacy of the models. To check the adequacy of the models, the test consists of estimating the following equation:

$$(y_{it} - \hat{y}_{it})^2 = \alpha_0 + \alpha_1(\hat{y}_{it}) + \varepsilon_{it} \qquad (7)$$

Equation (7) is estimated using the appropriate GLM estimator based on the Eicker-White robust covariance matrix estimator (see Manning and Mullahy, 2001 and Santos Siliver and Trenyro, 2006). The null hypothesis that $H_o : \alpha_1 = 1$ is tested against the alternative that it is not. In addition, the approach of Manning and Mullahy (2001) gives a confidence interval for α_1 and the null hypothesis is accepted if the appropriate confidence interval for α_1 contains 1 or if the (p-value) of the test is not statistically different from zero. Acceptance of this null hypothesis would be in favour of the Poisson model.

The second part of Table 5 reports the results of the modified Park test using a robust covariance matrix. The tests are reported after the populated average and the random effects Poisson models. For the populated average Poisson model, the point estimate for α_1 is 1.13**,** which is close to the value of 1 and is therefore in support of the Poisson equi-dispersion assumption of variance being proportional to the mean. Its reported p-value also shows that the estimated coefficient of α_1 is insignificantly different from 1 at the usual 5% level of significance. In addition, the 95% confidence intervals of α_1 reported in Table 5 also show that

the estimated confidence intervals for α_1 which is (0.88 - 1.39) contains the value of 1 – also confirming the satisfaction of the equi-dispersion assumption. Thus, the Poisson assumption cannot be rejected. Conversely, for the random effects estimator, the point estimate given as 0.30 is statistically significantly different from 1 as shown by the reported p-value described below the point estimates. In addition, the estimated confidence interval for α_1 does not contain 1. Therefore, the random effects Poisson specification is unequivocally rejected while the populated average Poisson specification cannot be rejected.

While most of the test results are in favour of the populated average effects Poisson, the results from the Poisson and NB models show similar conclusions about the impacts of the variables affecting border rejections, although their coefficients are slightly different. Based on this, we present the results of the Poisson and NB estimations techniques but place emphasis on the populated average effects Poisson model.

A. Impact of Geographical and Economic Factors

Table 6 present the results of both the populated average and random effects Poisson and NB models. A clear look at the results indicates that both the Poisson and Negative Binomial models have the same signs but differ relatively in the magnitudes of the coefficients, apart from the coefficient of GDP which turns out to be statistically insignificant in the Negative Binomial random effects model.

As shown in Table 6, factors relating to geographical, cultural and economic characteristics turn out to be important in explaining import rejections. Distance between each African country and the EU is positive and statistically significant, indicating that rejection of the selected African products increases with increasing distance. In fact, a one kilometre increase in distance between the EU and African countries increases border rejection of their products by 18 shipments {that is $e^{0.167}$-1*100}, which is a very large distance effect. Although fresh products are transported in refrigerated containers, contamination might still occur during storage especially when stored in contaminated containers, during loading and unloading of products into the container and when transporting over long distance even when adequate sanitary measures have been taken earlier in the food chain (Ackerley, 2010). During transportation, contamination may result from poor road conditions, high transit temperature, rough handling, chilling or freezing damage, moisture damage, heat damage, insect damage, chemical contamination from preservatives, cross contaminations, bruises and cuts in produce, all resulting in rapid decay etc. These all lead to undesirable microbial growth, spoilage and the rapid decay of the products, resulting in high spoilage levels and increased import rejections.

Table 6: Economic and Geographical Factors influencing Rejections of Africa's Exports at the EU Border

	(1) Poisson	(2) Poisson	(3) Negative Binomial	(4) Negative Binomial
Independent Variables	*p.a.*	*r.e.*	*p.a.*	*r.e.*

Distance	0.167***	0.168***	0.191***	0.077*
	(0.036)	(0.042)	(0.033)	(0.046)
Landlocked	-762.946***	-768.525***	-873.517***	-351.464*
	(161.858)	(192.170)	(152.102)	(208.808)
Same Language	-255.734***	-257.852***	-292.567***	-116.792*
	(55.367)	(65.789)	(51.968)	(70.655)
Product's Reputation	1.872***	1.844***	1.585***	1.603***
	(0.342)	(0.349)	(0.341)	(0.217)
Country's Reputation	-1.115**	-1.115**	-1.482***	-0.877***
	(0.495)	(0.514)	(0.462)	(0.326)
Previous Imports	-0.000	-0.000	-0.000	0.000*
	(0.000)	(0.000)	(0.000)	(0.000)
Log of exporters' GDP	2.373***	2.501***	2.755***	1.060
	(0.782)	(0.948)	(0.733)	(0.828)
Exporters Effects	Yes	Yes	Yes	Yes
Products Effects	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes
No of Observations	520	520	520	520

Note: p.a. and r.e. are populated average and random effects, respectively. Clustered robust standard errors are in brackets and * p<0.10; ** p<0.05; *** p<0.01.

Common language exerts a significantly negative effect on border rejections. This highlights that exporting countries that have a similar language with the EU have lower rates of rejections, compared to those that do not share a similar language with the EU. Intuitively, one would expect that it is relatively easier for them to understand and thus adapt to EU standards requirements. This result contrasts that of Baylis, et al. (2009) who found countries sharing similar languages with the EU have higher rejection rates.

In relation to the other variables capturing geographical characteristics of the exporter, landlocked is negative and statistically significant, signifying that landlocked countries are not so disadvantageously prone to border rejection. In fact, landlocked countries have lower incidences of border rejections than countries that are not landlocked. In the literature, much attention had been drawn to the relative disadvantage of landlocked developing countries in trade and transport facilitation, as their lack of access to the sea hinders their ability to integrate better in the global trading system and also poses considerable challenges to their growth and development. This is because landlocked countries have to transit their exports and imports through neighbouring countries leading to high trade costs and a reduction in their international competitiveness and level of trade. This shows why landlocked countries export less due to their relative disadvantage and thus their exports are less prone to being rejected in comparison to countries that are not landlocked. Island countries are subject to similar problems and have an analogous chance of being rejected at the border as the coefficient is negative and statistically significant.

Past rejections turn out to be a significant factor in explaining border rejections. We have used two variables in measuring reputation. The first one is the lag values of a dummy variable indicating if the product was rejected in the previous year – product reputation. The second is the lag values of a dummy variable indicating if at least one export product was rejected from the country in the previous year – country reputation. The coefficient on the product

reputation is positive and statistically significant, indicating that the likelihood of experiencing a border rejection in the current year increases if the product has already faced at least one border rejection in the previous year. This scenario implies that the reputation of the product matters in the enforcement of food safety standards. Products from countries which are rejected in previous years face more scrutiny when inspected at the EU border as they keep track of prior rejections. This is in line with Baylis, et al. (2009) and Jouanjean, et al. (2012) who find similar results for products rejected at the US border. However, the country reputation variable has a negative sign and is significant. As expected, an EU border rejection which affects a country's reputation - to the point where other products exported by it are also heavily scrutinised - decreases the chances of being rejected in subsequent years. This is because a heavy violator of EU food safety standards would soon be put on the EU ban list. However, being on the ban list represents a learning process for the exporter who subsequent pays more attention to the SPS requirements of its export products in the future so as to avoid EU rejection.

In addition, the level of economic and financial capability of the exporting countries proxy by GDP, turns out to be a significant determinant of border rejection. GDP is an indicator of a country's financial ability to comply with importing countries' standards. However counterintuitively, our results point out that richer countries have higher border rejections, which might be indicative of their financial unwillingness to comply. This is not surprising as the increase in economic growth witnessed by many of the richer African countries has not been efficiently utilised to upgrade their production and supply chain and ensure compliance with international standards. Thus, given the fact that richer countries in Africa trade more than poorer ones, they are prone to more border rejections, given their financial unwillingness to comply with international standards. Our result is in line with Henson and Jaffee (2008) who find that many developing countries, including those in Africa, have weak financial capability to comply with international standards. However, previous imports by the EU are statistically insignificant when explaining the incidences of border rejection. This indicates that the incidence of rejections does not occur following the surge in imports in the previous years. This points out that these rejections are purely a result of the countries not meeting the stipulated EU standards and not due to some hidden protectionist intent of the EU or some lobby groups aiming to reduce the flow of Africa's exports to the EU.

B. Impact of Trade Procedures, Infrastructure and Institution

In the preceding discussions, the magnitude of the distance coefficient turns out to be very high, illustrating the increasing importance of transportation costs and trade facilitation and infrastructure in explaining the rejection of Africa's exports. Consequently, we further examine their significance in reducing or increasing the incidence of rejections of Africa's exports at the EU border using detailed data from the World Bank's doing business report. These data are only available consecutively for 22 African countries[11], therefore limiting our analysis to this subset of countries for which the data are available. In addition, we also

[11] Cape Verde, Congo Republic, Rwanda and Tunisia have no data regarding customs and trade procedure data sourced from the World Bank's Worldwide Governance Indicators. In addition, some of the variables used for the analyses were started to be collated in 2010 (for example, variable relating to percentage of shipments meeting quality criteria), thus limiting our analysis from 2010 to 2013.

consider how important institutional factors are in driving border rejection using two measures of the exporting countries: regulatory quality and control of corruption.

Robustness Checks

Before we report our estimated results, we first check the adequacy of the estimated models. As a robustness check, we perform a similar set of specification tests to the ones used before when comparing the models. The results of these checks are reported in Table 7.

Table 7: Robustness Checks on the Estimation Techniques

Various Tests	(1) Poisson (*p.a*)	(2) Poisson (*r.e.*)	(3) NB (*p.a*)	(4) NB (*r.e*)
Ramsey Reset Test	- 0.23	0.01	-0.12***	0.06
Park Test: $v(y \mid x) = (\mu(y \mid x)^{\alpha}$				
α_1	1.58	1.07	–	–
P Value	0.00	0.78	–	–
95% Confidence Interval	1.22 - 1.95	-0.60 – 1.54	–	–

Note: p.a. and r.e. are populated average and random effects, respectively. "–" not available after populated average effects models.

The p-values of the Ramsey reset test are in favour of all models except the populated average effects NB model. This model shows evidence of misspecification as the test results reject the null hypothesis that the coefficient of the test variable is statistically insignificantly different from zero. Finally, the modified Park test reported at the end of Table 7 indicates that the estimated coefficient of α_1 is insignificantly different from 1 at the 5% statistically significant level for the random effects Poisson model. This indicates that we cannot reject the Poisson equi-dispersion assumption when the random effects Poisson model is employed. Thus, based on these tests, our preferred model is the random effects Poisson model, contingent on our dataset.

The results of the populated average and random effects Poisson and Negative Binomial are presented in Table 8. As shown, most of the variables turn out to be statistically significant at the 1% level but display considerable variation in their sign.

Table 8: Impact of Trade Procedures, Infrastructure and Institution on Border Rejection

Independent Variables	(1) Poisson (p.a)	(2) Poisson (r.e.)	(3) NB (p.a.)	(4) NB (r.e.)
Documents to Export (Number)	0.382*	0.392*	0.196	0.274
	(0.213)	(0.214)	(0.225)	(0.308)
Number of Border Agency (Exports)	-1.666**	-1.546**	-1.707***	-0.502

	(0.720)	(0.672)	(0.573)	(0.498)
Shipments meeting Quality Criteria (%)	0.051*	0.045*	0.038	0.009
	(0.029)	(0.027)	(0.024)	(0.022)
Rate of Physical Inspection of Imports (%)	0.050***	0.047***	0.059***	0.022
	(0.018)	(0.017)	(0.015)	(0.016)
Clearance Days with Physical Inspection	0.720**	0.664**	0.813***	0.206
	(0.287)	(0.264)	(0.226)	(0.220)
Clearance days without Physical Inspection	-0.332**	-0.311**	-0.291**	-0.156
	(0.147)	(0.143)	(0.136)	(0.197)
Quality of Infrastructure	-1.307**	-1.258*	-1.721**	-0.357
	(0.664)	(0.662)	(0.750)	(0.548)
Regulatory quality	-2.622**	-2.654**	-3.712***	-2.764**
	(1.088)	(1.113)	(1.420)	(1.269)
Control of corruption	0.094	0.073	0.890	0.529
	(1.136)	(1.087)	(1.133)	(1.124)
Exporters Effects	Yes	Yes	Yes	Yes
Products Effects	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes
No of Observations	272	272	272	272

Note: p.a. and r.e. are respectively populated average and random effects. Clustered robust standard errors are in bracket and * p<0.10; ** p<0.05; *** p<0.01.

Documents required to export are the number of documents required for clearance by customs authorities, government ministries, container and port authorities, banks and health and technical control agencies, when exporting. The coefficient is positive and statistically significant, increasing the import rejections. This is because obtaining the documents required by the importing country - particular those relating to health and technical certification - is usually costly, especially for small scale exporters. In addition, such documents are usually cumbersome to obtain as they tend to involve third party certification and accreditation. As such, exporters who don't have all the documents would have their exports refused entry at the EU border. In addition, the excessive number of documents needed to export - such as sanitary and phyto-sanitary documents - might cause unnecessary delays, while a lack of the recognised documents and certificates documenting conformity with importing countries' standards might also lead to rejections. Indeed, a number of Africa's exports have been rejected on the grounds of lacking the required health certificate and fraudulent practices relating to the health certificate (RASFF, online database). Freud and Rocha (2011) have also affirmed that the huge number of documents required to export is one of the factors constraining Africa's export success.

We also examine the number of border agencies encountered when exporting. Our results show the coefficient to be highly significant and negative. Apart from customs agencies, other agencies such as transport, veterinary, and health or sanitary and phyto-sanitary (SPS) are also encountered when exporting. Intuitively, our results imply that a reduction in the number of border agencies in the exporting countries, especially those agencies involved in health and food safety checks, increases the incidence of border rejections of African exports. Indeed, a reduction of border agencies by 1 can lead to about 2 cases of border rejections. Like most developing countries, African countries are usually short of staff and lack the necessary technical staff at the country's border to detect export goods that do not meet EU

requirements (Essaji, 2008). Sub-standard export products therefore usually pass the border agencies of the exporting countries and are consequently rejected at the EU border. This is so because the EU is well equipped with the required number of trained border agencies and staff to undertake technical and physical detection of food safety violation.

In the Poisson model, the percentage of shipments meeting the domestic company criteria also turns out to be significant factor increasing border rejections. This result implies that export shipments meeting domestic companies' quality requirements are usually rejected at the EU border as EU quality criteria are much stricter than those required by the exporting company; this reflects a case of a wide regulatory *quality gap*. Such a geographical quality gap has serious implications for border rejections and can damage the reputation of exporting countries. This situation is worsened due to the lack of stringently enforced regulatory standards by most African countries which are at least in similitude with those of the EU, as well as the lack of sophisticated standard testing and accreditation facility. Thus, the continuous usage of the less stringent domestic standards and testing facilities may make a large percentage of shipments meet the domestic exporter's quality criteria, but such export products would be subjected to border rejection after the EU's more sophisticated and technologically advanced testing facilities were used. This result is aligned with those of Arvis et al. (2014), which finds a wide gap in shipment quality between low performing developing and high performing developed countries, as the acceptable quality requirement is much more stringent in the latter than in the former. However, in the Negative Binomial model, the variable has no apparent effect on border rejection as its coefficient is statistically insignificant at the conventional level.

The rate of physical inspection of Africa's exports by their importing countries also plays a significant role in determining whether Africa's exports will be rejected at the EU border. Indeed, an increase in the rate at which Africa's exports are physically inspected for health and safety violations increases their chances of being refused entry into the EU. Usually, the EU only inspect a subset of the export product, however, the rate of physical inspection of imports are usually increased in situations when the EU receives an alert about potential violations or with high risk products, or exporters that have previously had a record of having their exports rejected. Thus, in such a situation, a 20 percent increase in the rate of physical inspections would increase border rejections by 1 case.

Other interesting results relate to the variables on customs clearance days both with and without physical inspection. Our results show that export goods which undergo customs clearance days with physical inspection have an increased incidence of border rejections, while those that are cleared without physical inspections have decrease border rejection. During this physical inspection, delays might increase the chances of the export good becoming spoilt, especially highly perishable goods such as fruits and vegetables; such spoilage also increased their susceptibility of being rejected entry into the EU border. For instance, in the case of Benin, it takes about 10 days for the good to be cleared with physical inspection, and about 4 days for the good to be cleared when no physical inspection is required. This implies that increased export times associated with physical inspections in the domestic country increases the incidence of border rejection. Intuitively, one would have

thought that when goods are physically inspected for violation of health and SPS regulations in the exporting country, border rejections at the EU would be reduced. However, as previously discussed, due to the regulatory quality gap, border rejection remains high in spite of subjecting the exported goods to physical inspections at the domestic economy. The results also confirms Djankov et al. (2010) and Freund and Rocha (2011) who show that large customs and ports times in Africa pose a significant hurdle to her export performance. In fact, time delays and export times have been found to pose significant hurdle to export performance for many developing countries (Martinez-Zarzoso and Marquez-Ramos, 2008) the impact of which can be huge for highly perishable and other time-sensitive products.

All these results obtained in relation to the impact of trade and customs procedures discussed above are in line with UNESCAP, (2011) who posit that customs procedures and documents needed to trade are an important source of delays and inefficiencies, posing significant bottlenecks to trade. These include the duplication of procedures, delays at the border caused by excessive physical inspection procedures, lack of coordination among border agencies, and lengthy custom clearance procedures The OECD and WTO (2013) also revealed that customs delays have been identified as a major trade problem confronting agro-food exporters from developing countries.

In relation to the institutional variables, our results show that domestic regulatory quality in Africa is a highly negative and significant institutional determinant of border rejections. Indeed, Africa's deteriorating regulatory quality significantly increases the rejection of Africa's exports. This is not surprising as Africa has a 'missing regulatory institution' which is necessary to implement a minimally acceptable food regulation, as well as the non-commitment to regulatory policies for countries that have them. In fact, the literature has pointed out that the impact of importing countries' standards on developing countries has been aggravated them for them to their lack of institutional capacity to satisfy such standards. This results from missing or weak regulatory capacity from the domestic government to implement a testing and certification process, as well as weak domestic regulatory quality (Essaji, 2008; Kim and Reinert, 2009). The quality of domestic regulatory environment are evidently beneficiary in preventing rejections of goods at the EU border; and in this sense, our results are in line with those of Hanousek and Kocenda (2014) that affirm that business and regulatory environment are crucial for trade performance in primary and consumer goods.

In relation to the other institutional variable, measuring the control of corruption in the exporting country is negative, and this is in line with our expectations. This result indicates that a decrease in the control of corruption in the African exporting countries increases their frequency of being rejected at the EU border. In support of this, the incidences of border rejection occurring due to corrupt practices such as fraud and adulteration accounts for about 3% of the total number of border rejections of Africa's exports between 2008 and 2013. However, counterintuitively, the variable is statistically insignificant at the conventional level. This results confirms that of Goel and Korthonen (2011) who found that the influence of corruption depends on the type of exports considered; but the case of agricultural exports is special as it is found to reduce corruption, especially for perishable agricultural goods which needed to be disposed of quickly, thereby reducing the time to formulate corrupt contracts. In

addition, agricultural exports has been found to be sensitive to prevailing corruption levels, specifically reducing corruption in heavily corrupt countries. This is because in heavily corrupt countries like Africa, overall infrastructure to elongate the short shelf life of agricultural products is generally weak and "in the absence of a quick formation of a corrupt deal, the agricultural produce is likely to rot and thus corruption goes down in this case" (Goel and Korthonen , 2011, p. 119).

Finally, our control of the quality of domestic trade related infrastructure turns out to be negative and statistically significant, indicating that Africa's dilapidating infrastructure would increase border rejections. This point out the importance of trade infrastructure in meeting the importing countries' quality criteria, especially those relating to availability of appropriate air or port containers to transport perishable products. A survey done by the OECD and WTO identified the lack of cold storage and cold chain infrastructure as one of the major constraints facing agricultural-food firms in developing countries (OECD and WTO, 2013). In addition, USAID (2011) reported that the lack of availability of cold chain infrastructure presented significant impediments to agricultural trade in West Africa. In fact, a number of studies have pointed out the significance of trade infrastructure in boasting export performance and efficiency (Iwanow and Kirkpatrick, 2009 and Portugal-Perez and Wilson, 2012; Hanousek and Kocenda; 2014) This may have a spill over effect in reducing border rejection when exports are efficiently transported to importing countries in line with international standards. Efficient trade infrastructure spanning road, rail and maritime transport as well as ICT usually ensures less export time and reduces unnecessary spoilage of the export product which is associated with longer export times. For instance, in 2012 it took 2 days for Singapore to export its products in contrast to about 14 days for Ethiopia. Export times are extremely high for most African countries due to their poorly developed infrastructure. This result therefore suggests the need for an improvement in transport-related infrastructure.

5.0 CONCLUSION

This paper investigates the impact of the incidences of rejections of African exports as an important market access problem at the EU border. It also considers the logistical trade procedures and institutional factors contributing to the occurrence of such rejections. Our result indicates that geographical hurdles, poor trade infrastructure, inefficient border procedures and a lack of technical personnel all add to Africa's challenges in accessing EU markets. In line with the growing literature, this study finds empirical support for the proposition that institutions, infrastructure and logistical quality are all important for increased market penetration and continuous integration into the global trading system. It is therefore glaring that targeted long term development and policy intervention is focused at ensuring the provision of infrastructure, regulatory policies, and trade facilitation services and procedures at the border to ensure market access.

Our results have several implications for policy formulation and implementation. To move products to the international market more efficiently, African countries must adopt policies to support trade. The issue of export rejection at the border as a non-tariff barrier can be addressed through policy measures that improve both logistics and connectivity.

Comprehensive reforms and long term commitments to the implementation of sustained and strategic policy intervention in the area of trade facilitations, involving the private sector, is an important policy imprint. Improving logistics quality is at the core of achieving export competitiveness and economic growth, which will enable African countries to join globally efficient supply chains. Good customs and border management and the improvement of transit regimes are all areas of trade facilitation that would help to improve the quality of logistics and move products to market more efficiently and reliably. This would reduce unnecessary trade time and costs as well as bolstering trade competitiveness. For instance, automating customs procedures can facilitate trade and reduce logistical procedures. Investment in both soft and hard infrastructure through public private partnership and coordination would ensure goods are cleared even before they reached the importing countries and would minimise delays that cause food spoilage and border rejections. Streamlining unnecessary border procedures could ensure faster market access to the importing market, especially for fresh and highly perishable products which need to be exported on time. Also, concerns about environmental sustainability are emerging as a market drive, with strong indication for green logistics by developed importing countries. Moreover, sustainability is becoming more important in food trade. Thus, there is a need to consider the environmental impact of logistics in reducing the trade barrier associated with EU rejections. Coordination therefore remains essential in trade facilitation efforts and should include the introduction of best practices, especially in the areas of the two key components of trade facilitation: border management, and communication and transportation infrastructure.

As indicated by our results, Africa is missing an institution in the area of regulatory quality; such an absence proves to be a major hindrance to export performance. Thus, policy makers also need to make improved long term institutional changes that are consistent with the fast changing standards requirements of the developed countries, particularly the EU which remains their most important trading partner. Provision of sophisticated testing and accreditation technology as well as putting in place stringent domestic food safety regulatory policies that are aligned with those required in the EU is one such policy. Lastly, in line with the consensus reached during the 2013 WTO Trade Facilitation Agreement at the Ministerial Conference Agreement in Bali, African countries should demonstrate a strong commitment to the adoption of modern approaches to customs and border management and other best practices. African countries are in dire need of support from donor communities and developed countries. Thus, addressing some of these challenges through a strong commitment to policy reforms will be key to not only bypassing stringently enforced EU food safety standards, but also to ensuring market access and deep global trade integration in general.

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