The Impact of Technical Measures on Agricultural Trade: A Case of Uganda, Senegal, and Mali. "Improving Food Security through Agricultural Trade"

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Abstract

This thesis estimates the impact of non-tariff measures (NTMs) notified by the importing countries on agricultural trade. The non-tariff measures constitute the technical measures notified under the SPS and TBT agreements and the non-technical measures to trade. Two approaches are used; the inventory approach and the econometric approach which makes use of the gravity model. The inventory results suggest that African countries face more restrictions on their exports than what they impose on their imports. Also, Uganda, Senegal and Mali are among the top twenty most affected importers.

The empirical results suggest that the impact of the overall group on non-tariff measures is ambiguous but when measures are disaggregated into technical and non-technical measures, the results show that the technical measures promote agricultural trade and that the non-technical measures restrict trade. Also, imports of industrialized nations from fellow industrialized nations are promoted by the technical measures but are restricted by non-technical measures, while those from non-industrialized countries are affected negatively by both technical and non-technical measures. Out of the five regions considered, Africa faces the largest negative impact by both technical and non-technical measures.

Dedicated to my family

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Chapter 1: Introduction

There is a considerable threat to food Security globally especially in the developing world. The Food and Agricultural Organization of the United Nations (2009) reports that the number of undernourished people has been increasing since 1995 with an estimate of 1.02 billion people in 2009. Although the situation improved significantly in 2010 with an estimate of 925 million undernourished people, the numbers are still comparatively higher than they were before the food and financial crisis of 2007/2008 (FAO, 2010). As defined in World Food Summit (1996), Food Security is the condition in which all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy lifestyle. According to the Millennium Development Goals Report (MDGR, 2010), there has been an improvement in food availability for the years 2008/2009 compared to the period from 1990 to 2007.

However, high food prices coupled with reduced incomes resulting from the high levels of unemployment, has limited access to food by the poor people. The lack of access to food due to reduced real incomes resulted in a large number of people suffering from hunger and malnourishment in 2009. Because hunger and malnourishment are consequences of food insecurity, it can be said that the absolute number of people exposed to food insecurity is on the rise although the actual proportion has declined since 1990 for most developing countries (MDGR, 2010).

In Sub-Saharan Africa, the proportion of the population categorized as being undernourished has been declining since 1990. The percentage in poverty has declined from 31% (for the period 1990 to 1992) to 26% (for the period 2005 to 2007) (MDGR, 2005; MDGR, 2010). Despite some progress, other food security indicators such as weight of children under

five years show that the proportion of underweight children is still high in Sub-Saharan Africa compared to the rest of the World, with 31% and 27% of the children were undernourished in 1990 and 2008 respectively (MDGR, 2010). However, differences do exist across countries and regions.

In East Africa, each of the countries; Uganda, Kenya, Tanzania, Burundi, DR. Congo, and Rwanda, has a different food security level. For example, Uganda is generally considered to be a food self sufficient country while countries like Burundi and DR. Congo are struggling with food insecurity concerns (Mukhebi et al., 2010; Uganda Nutritional Policy, 2003). These differences are also found within countries. For example, Northern Uganda is reported to be highly food insecure compared to other regions in the country (Bahiigwa, 1999). In Burundi, only 18 % of the population was reported to be food secure in 2010, while 73% of the Congolese were food insecure in 2003 (Mukhebi et. al., 2010; Tollens, 2003). For other countries like Kenya, the Famine Early Warning Network report (2010) indicates slight improvements in food security for some parts of the country. For the past few years, FAO (2010) reports that the absolute numbers of undernourished people has been increasing. For example, the number of undernourished people increased from 8 million people in 1990/1992 to 11.2 million people in 2005/2007 (FAO, 2010).

In West Africa, there has been a declining trend in the number of undernourished people since 1990. Numbers have reduced from 37.6 million people in 1990/1992 to 28.5 million people in 2005/2007(FAO, 2010). The trend is also consistent in terms of proportions. There was a decline from 20% to 10% of the population being food insecure for the period 1990/1992 to 2005/2007. Although there is a general declining trend for the region, variations exist among individual countries. For example, Benin, Burkina Faso, Mauritania, Sierra Leone are relatively

unchanged, while Cote d'lvoire, Gambia, Guinea, Liberia, Senegal, and Togo have experienced increasing numbers of undernourished people. Countries like Ghana, Mali, Niger, and Nigeria, are responsible for pulling down the overall numbers of undernourished people in West Africa (FAO, 2010. Pg52).

This thesis is concerned about these uneven trends in food security across the African countries. The focus is on estimating the impact non-tariff measures (NTMs- to be used in the rest of the thesis) have on agricultural trade and the possible implications of trade on food security. The expectation is that the high food insecurity (resulting from idiosyncratic shocks like that of 2008/2009) would be smoothed through trade. The study primarily concentrates on the extent to which non-tariff measures affect the trade in agricultural products in Uganda, Mali, and Senegal. As broadly defined, non-tariff barriers are *"barriers to trade that are not tariffs and include both trade-restricting measures (quotas, technical barriers, etc) and trade-promoting measures (export subsidies etc)".* This study concentrates on the broadly known trade restricting NTMs. By following the classification of NTMs outlined by the United Nations Conference on Trade and Development (UNCTAD), NTMs are categorized into technical (SPS & TBT measures) and non-technical (which includes the rest of the NTMs).

The NTMs have gained relevance in international trade due to the continual decline of tariffs following the series of multilateral trade negations and the multiple regional trade agreements (Laird and Yeats, 1990; Gervais et al, 2011). However, estimating their impacts on trade has proven quite difficult (Begnin et. al., 2011; Maertens and Swinnen, 2009; Jongwanich, 2009). Laird and Yeats (1990) attribute their complexity in quantitative analysis to the lack of transparency in their usage and economic effects. Their complex definition and diverse impacts

have made it difficult to come up with an established procedure for their quantification without noticeable shortcomings.

1.1 Problem Statement

During the Uruguay Round negotiations (1986-1984) of the General Agreement on Tariffs and Trade (GATT) , a number of changes were agreed to that are currently important in the global trade of agricultural and food products. Three of these changes include the replacement of several NTMs with more transparent tariffs (a process known as tariffication), the signing of the Sanitary and Phytosanitary Agreement to trade (SPS agreement), and the Technical Barriers to Trade (TBT) Agreement (WTO, 2003).

Tariffication resulting from the Uruguay Round Agreement on Agriculture (URAA-1994) involved a switch from a situation where countless NTMs hindered trade flows to a system where tariffs are now the only legitimate form of economic protection. In addition, the URAA implemented a set of tariff reduction commitments which differed depending on a country's development status. Tariffs are preferred to NTMs (such as quantitative import restrictions, variable import levies, minimum import prices and others), because they are transparent, and predictable. Indeed, exporters favor the elimination of tariffs, but importers lower them with great reluctance despite the fact that there are often sizeable welfare gains from tariff liberalization (Grant and Meilke 2006).

Tariffs are often described as being less trade distorting than quotas because they do not establish maximum ceilings on imports, and they allow global price alterations to be passed on to the domestic market. Because the NTMs were an integral part of the domestic policies of most of the WTO member countries, the tarrification package required the member countries to make changes in their trade policies. The adoption of tariffs and their absolute reductions by a number

of WTO countries has made visible the plethora of non-tariff barriers (especially SPS and TBT) as an alternative form of economic protection for most developed importing countries (Otsuki, Wilson and Majumdar, 2003; Scheepers, Jooste and Alemu 2007; and Chen, Yang and Findlay 2008; Gebrehiwet, Ngqangweni and Kirsten, 2007; Disdier, Fontagne and Mimouni, 2008).

The Agreement on the application of Sanitary and Phytosanitary measures provides guidelines to WTO member countries on the use of policies concerning food safety and plant and animal health with respect to imported pests and diseases. Due to the need by countries to protect their people from unsafe imported foodstuffs, and pests and disease causing organisms, the GATT-WTO (1995) provides guiding principles on how protection measures could be applied (Trade and Development Briefs, 2009). Although countries are allowed to set their own measures to prevent the entry of food and plant risks, the Sanitary and Phytosanitary agreement provides a unified procedure to regulate the disingenuous use of these measures as an instrument of disguised protection.

To reduce such abuses, the agreement recommends that members adopt measures developed by the international standards bodies such as Codex Alimentarius (food safety issues), Office of International des Epizooties (for animal health issues), and the organizations working under the framework of the International Plant Protection Convention (plant health). However, the SPS agreement is flexible because countries are allowed to develop and adopt their own measures as long as they provide sufficient scientific-based proof of their measures. This means that it is possible for a country to develop more stringent measures than those recommended by the international standards setting bodies as long as they are scientifically justified by means of risk assessment.

With this provision, countries may be tempted to develop and adopt measures that can act as disguised non-tariff protection. However, the adoption of such measures seems to have mixed and uneven impacts on the importing and exporting countries. For example, the new aflatoxin B1 and total aflatoxin standards adopted in the European Union (Otsuki Wilson, and Sewadeh , 2001a; Otsuki, Wilson and Sewadeh, 2001b and Gebrehiwet, Ngqangweni and Kirsten, 2007) generally reduced exports from African countries to the European Union[1]. On the other hand, Disdier, Fontagne and Mimoini (2008) note that SPS and TBT measures reduce agricultural exports from developing and least developed countries to countries belonging to the Organization for Economic Corporation and Development (OECD) but not exports of other OECD countries. Further, Bao and Qiu (2010) find that China's non-tariff measures (technical barriers to trade) restrict imports of agricultural products but promote imports of manufactured goods.

The asymmetry in the way non-tariff measures impact trade is attributable to a number of factors. First, developing and least developed country exporters are not ready to adjust their infrastructure according to the market requirements. Second, developing and least developed countries do not have the technical capacity and expertise to challenge SPS measures that deviate from international standards due to lack of scientific justification (Walter, 1971; Mayeda, 2004; and Prevost and Marielle, 2002). This therefore creates a loophole that exposes developing countries to being unfairly restricted with trade distorting NTMs which may have no scientific justification.

[1] However, Beghin and Xiong (2010) overturned the findings of Otsuki Wilson, and Sewadeh, 2001a. The major criticism made by Beghin and Xiong is that Otsuki, Wilson and Sewadeh used data that lacked variation over time for the maximum residue variable. Also, the analysis was conducted before the implementation of the maximum residue limits (MRLs) and thus the analysis was conducted based on unaffected trade data (1989- 1998). With an expost analysis, Beghin and Xiong find that the EU-Aflatoxin standards for groundnuts have no significant impact on the African exports of groundnuts. Thus, African groundnut exporters are more constrained by domestic supply issues than market access.

Indeed, with limited financial, technical and scientific resources in developing and least developed countries (Walter, 1971; Mayeda, 2004) , it is not surprising that these countries have trouble trading with developed countries which have very strict SPS and TBT measures (Otsuki, Wilson and Sewadeh, 2001; Disdier, Fontagne and Mimouni, 2008). The developing and least developed countries (especially those in Africa) are put in a disadvantageous position since Europe and U.S are the largest export markets for most of the African agricultural products (Prevost and Marielle, 2002). According to Oyejide, Ogunkola and Bankole (2000), Europe accounts for about 51% and the U.S accounts for 21% of Sub Saharan Africa Agricultural trade. Due to this concern, several studies have been conducted to analyze and estimate the impacts associated with the non-tariff measures (especially SPS & TBT measures) applied by developed countries on developing and least developed country agricultural exports (I.e., Otsuki, Wilson and Sewadeh, 2001; Disdier, Fontagne and Mimouni, 2008; and Chen, Yang and Findlay 2008) .

Gebrehiwet, Ngqangweni & Kirsten (2007) also find a negative impact on South African exports due to the total aflatoxin level set by five OECD countries (Ireland, Italy, Sweden, Germany and USA). It is estimated that, a one percent increase in the level of total aflatoxin would decrease the trade flow of food products by 0.41 percent. This elasticity is compared to the additional gain of US$ 69 million per year that South Africa would have earned from 1995 to 1999 if the SPS measure had been based on CODEX standards. Other studies (Henson, Saqib and Rajasenan, 2004; Henson and Loader, 2001; Scheepers, Jooste, and Alemu 2007: Oyejide, Ogunkola and Bankole, 2000) also reveal that SPS measures limit access to developed countries where large markets for agricultural products exist.

In contrast to the negative impacts of SPS and TBT measures found in almost all analyses related to SPS regulations, there are welfare benefits associated with these regulations. In a study

conducted by Disdier and Marette (2010), the authors use a combination of gravity and welfare-based approaches to evaluate non-tariff measures. The study focuses on the maximum residue limits (MRLs) of Chloramphenicol in crustaceans imported by Canada, Japan, United States and the European Union. The results show that MRLs have a negative impact on the volume of crustacean exported by developing countries. At the same time, there are welfare benefits associated with these SPS regulations. This is not surprising because as much as the SPS regulations may be trade distorting, they actually facilitate trade because without them long distance trade would almost be impossible.

Standards help minimize risks related to product quality and improve market access once the right technologies are set up, (Swinnen and Maertens 2009). The trade distortions of SPS and TBT regulations stem mainly from compliance costs and certification requirements. However, mixed results have been obtained in empirical studies conducted to estimate compliance costs of SPS and TBT measures. For example, the FAO's (2005) Fact Sheet for the Sixth Conference of the WTO reports that compliance costs for non-tariff measures, especially SPS related ones, exceed total governmental development budgets for all expenditures in some least developed countries. Also, Aloui and Kenny (2005) estimated a compliance cost of 3% of the value of total exports of tomato production in Morocco while Cato, Otwell and Coze (2005) found a cost of less than 3 % to set up quality compliance measures and a compliance maintenance cost of less than 1% of the total value of shrimp exports from Nicaragua[2].

A common feature in the current literature is that most of the studies have focused on quantifying the impact of a single barrier (i.e., Aflatoxins , maximum residue limits) set by developed countries on developing countries' trade (Otsuki, Wilson and Sewadeh, 2001; Wilson and Otsuki, 2004; Gebrehiwet, Ngqangweni & Kirsten, 2007; Scheepers, Jooste and Alemu,

[2] Also see van Tongeren, F. *et al.* (2010) for more insights on costs and benefits of non-tariff measures.

2007;). For Africa in particular, studies have looked at how SPS regulations applied by developed countries such as those in Europe affect Africa's trade. Other studies have considered a group of non-tariff measures imposed by developed countries on developing and least developed country exports (i.e., Disdier, Fontagne and Mimouni, 2008; Disdier, Fekadu, Murillo and Wong, 2008). The literature does not provide empirical analyses of how the non-tariff measures (i.e., technical measures (SPS &TBT) and non-technical measures) impact trade among the least developed and developing countries of Africa whose exports to developed countries are reported to be jeopardized by non-tariff measures. This void in literature needs urgent attention if food security is to be achieved in the African region. This study therefore analyses the impact of non tariff measures in the trade for agricultural commodities intra-regionally with a focus on the technical measures (SPS and TBTs). The study also provides highlights of the implications of these measures on the state of food security in the region.

In summary, this study quantifies the overall impact of the technical and non-technical measures affecting agricultural trade to and from developing and least developed countries. The study pays particular attention to trade among the developing and least developed countries of Africa. Also, by considering two regions within Africa, the west and east, this thesis analyzes the differences in the technical measures used or faced in Uganda (East Africa), Senegal and Mali (West Africa). Further, the study identifies the technical measures that are applied (faced) by the three countries in the exports (imports) of the four important food staples: maize, rice, tomatoes and plantain.

1.2 Objectives

The overall objective of this study is to investigate the impact of technical measures (SPS & TBT measures) on agricultural trade. Particular attention is given to intra-African agricultural trade. The information to be obtained is expected to highlight key technical constraints that are problematic to exporters and importers in Uganda, Senegal, and Mali when exporting and importing rice, maize, tomatoes and plantain. The study makes it possible to formulate policy recommendations for Countries in East and West Africa on how to promote agricultural trade in order to improve food security in the African region.

1.2.1 Specific Objectives:

The specific objectives of this study are:

1) To identify technical difficulties faced by exporters and importers in Uganda, Mali, and Senegal especially those dealing with rice, maize, tomatoes and plantain in meeting the technical requirements (SPS & TBT) of their partner countries.
2) To identify the most protected food staple among rice, maize, tomatoes and plantain, and the most protected importing and the most affected exporting countries.
3) To quantify the impact of technical measures to agricultural trade through answering the following questions:
    a) What are the overall impacts of technical measures (SPS & TBTs) on agricultural trade?
    b) How do technical measures compare with non-technical measures in impacting agricultural trade?
    c) How do the effects of the different types of NTMs compare with each other?

d) What is the impact of development status on the way the technical measures impact trade?

e) How does geographical location influence the ability of exporting to meet the technical requirements in the importing countries?

f) Do the impacts of technical measures differ for African and non African importers of rice, maize, tomatoes and plantain from Uganda, Senegal, and Mali?

1.3 Thesis Organization

This thesis is organized as follows. Chapter 2 discusses the literature and relevant empirical applications. Chapter 3 discusses the data and data sources and some preliminary results using the inventory approach. Chapter 4 describes the overview of Agricultural trade in Uganda, Senegal and Mali. Chapter 5 discusses the qualitative Analysis of the survey data collected from Uganda, Senegal and Mali. Chapter 6 develops the empirical method used to for the quantitative analysis (estimating the trade flow effects of NTMs). Chapter 7 presents the results, and Chapter 8 concludes with some policy implications, and identifies and discusses areas for future research.

Chapter 2: Literature Review

The current literature related to identifying and quantifying the impacts of non-tariff measures can be broadly grouped into two categories. The first category includes studies that have considered quantifying the effects of a specific measure (e.g., Maskus, Otsuki, and Wilson, 2001; Wilson and Otsuki, 2003; Wilson and Ostuki 2004; Otsuki, Wilson, and Sewada, 2001a; Scheepers, Jooste, and Alemu, 2007). The second category involves studies that group more than one non-tariff barrier and then estimates the group effect of measures in the category considered. Such studies involve using certain procedures to compute a common measure for the group of non tariff measures under consideration (e.g., Laird and Yeats, 1990; Ferrantino, 2006; Deardoff and Stern, 1998: Disdier, Fekadu, Murillo and Wong, 2008; Disdier, Fontagne, and Mimouni, 2008; Bao and Qui, 2010). The first category of studies is reviewed briefly while the second category is reviewed with some level of detail as it constitutes measures that apply to this thesis.

2.1 Measures for a Specific Type of Non-Tariff Measure

Within the first category of studies, two approaches have been found to be commonly adopted: partial equilibrium simulation models and econometric models, which include the popular gravity model. For example, Peterson and Orden (2008) used a partial equilibrium simulation to study trade effects of a November 2004 phytosanitary measure that removed seasonal and geographic restrictions on U.S imports of fresh Hass avocadoes from selected and approved orchards in the Michoacán, province of Mexico. The results obtained reveal that the adopted systems approach not only offers the required protection, since there is no observed substantial increase in pest risks, but also increases U.S welfare by $ 77 million.

Yue, Beghin, and Jensen (2006) use a partial equilibrium model to investigate the recent Japan-U.S. apple trade dispute. The dispute concerns the prohibitions and requirements that Japan imposed on apple imports from the United Stated as a protection against fire blight. The measures included: the prohibition of apples from states other than designated areas for apple production in Oregon and Washington; the prohibition of imported apples from any orchard if fire blight was detected within a 500-meter buffer zone surrounding such orchard; the requirement that orchards that produce apples for export be inspected three time a year; the requirement that at post harvest stage, apples destined for export to Japan be separated from fruits destined for other countries; and chlorination of apples for export to Japan. The results obtained indicate that removing the Japanese TBT measures would yield limited export gains to the United States.

Studies that use econometric models, especially the gravity equation, have concentrated on ex post effects of non-tariff measures, especially those in the category of the SPS and TBT measures (Otsuki, Wilson and Majumdar, 2003; Wilson and Otsuki 2004; Scheepers, Jooste and Alemu 2007; and Chen, Yang and Findlay 2008 among others). For example; Otsuki, Wilson, and Majumdar (2003) examine the impact of drug residue standards on trade in beef and the trade effects of setting harmonized international standards. The study focuses on the impact of the maximum residue limit requirement (MLR) on beef exports from 16 exporting countries to five importing countries and the European Union during the period 1995 -2005 using a gravity model. The results reveal that if all importers had adopted the international standards on antibiotics set by Codex, global trade in beef would have increased by over $3.2 billion. Among other developing countries, South African exports would have risen by $160 million, Brazil by $200 million, and Argentina's by over $300 million.

In the same way, Scheepers, Jooste, and Alemu (2007) investigated the impact of country specific MRLs that are more stringent than the MRLs set by CODEX on avocado exports from South Africa to the European Union with specific reference to Prochloraz[3] (. The results reveal that the more stringent Prochloraz Maximum Residue Limits (MRL) indeed have a negative impact on avocado exports from South Africa to the European Union[4]. The simulation results show that the revenue foregone due to the more stringent Prochloraz MRL levels is 15.27 million United States dollars.

2.2 Studies that Investigate Multiple Non-Tariff Measures.

Under the second category of literature, various approaches have been used to aggregate and measure the impacts of a group of non-tariff measures. These approaches are classified differently by different authors although there is some overlap. For example, according to Ferrantino (2006), there are basically four broad ways of estimating the effect of non-tariff measures: the handcraft price gap method; price-based econometric methods; quantity-based econometric methods; and simulation methods. According to Laird and Yeats (1990), these approaches can be categorized as the inventory approach, price impact measures, quantity impact measures, and a control group approach. Deardorff and Stern (1998) categorize them as frequency type measures, price comparison measures, quantity impact measures, and measures of equivalent nominal rates of assistance. Other authors such as Beghin and Bureau (2001) also have their own categorization.

3

Prochloraz is a broad-spectrum fungicide which is used as a seed treatment and foliar spray on a range of crops such as cereals, oilseed, grapes, rice, mushrooms, and ornamentals and as a post harvest treatment of certain fruits. For these uses, Prochloraz is very important in avocado exports to reduce post harvest diseases and losses.

4 MRLs are defined as the maximum concentration of pesticide residue (expressed as milligrams of residue per kilogram of food) likely to occur in or on food stuffs after the use/application of pesticides according to Good Agricultural Practice (PRC, 2002; Scheepers, Jooste, and Alemu, 2007).

The most recently developed measure of non-tariff measures is the heterogeneity index (HTI) of trade regulations. The index is used to aggregate data on different measures and estimate the impact of regulatory heterogeneity. In other words, the index facilitates the comparison of different agricultural food requirements, ranging from product and process standards to firm-level conformity assessment measures and country requirements, across countries. The HTI values range between zero and one. The zero indicates no difference in requirements between importing and exporting countries while a value of one indicates maximum dissimilarity in regulations. However, the HTI does not measure the costs that exporters could incur when selling their products on foreign markets (Gervais. et. al., 2011).

In this study, measures in the category of frequency type measures, price comparison measures (handcraft and price impact), quantity impact measures, and price effect measures using import demand elasticities are discussed in detail.

2.2.1 Frequency Type Measures

These measures include the frequency and coverage indexes. The frequency index shows the percentage of tariff lines covered by some pre-selected group of non-tariff measures. According to Laird and Yeats (1990) the frequency index is computed as:

1) $F_j = (\sum D_i N_i / N_t) * 100$

Where N_i is tariff line i, D_i is a dummy variable that takes a value of unity if one or more non-tariff measures is applied to the tariff line item or zero otherwise, and N_t is the total number of lines in the product group. This summation is made over all countries exporting to the importing country j. The coverage ratio (import coverage ratio) on the other hand, is an index that shows the share of total imports subject to non-tariff measures.

Laird and Yeats (1990) mention that the frequency based measures have their limitations. First, they appear to have a limited potential for analysis of socialist countries' trade regimes. This is because the socialist economies are not affected the same way as market economies by non-tariff measures since imports in socialist economies depend on the state planning authority compared to market economies where decisions are made by the firms themselves (Laird and Yeats, 1990, Pg. 24). Second, the results obtained with the frequency-based measures (frequency index and coverage ratios) may have limited policy or analytical uses since they tell nothing about the restrictiveness or ad valorem incidence of the different trade measures.

Also, Kee, Nicita, and Olarreaga (2006) note that the frequency and coverage ratios among other common aggregation methods used for identifying NTMs have no sound theoretical basis. Further, Bao and Qui (2010) note that the coverage ratio is affected by the problem of endogeneity resulting from the weighting of import values. This is because if the TBT is trade restrictive, the affected products will systematically have lower weights and consequently the coverage ratio is downward biased. A way to avoid this problem is to use the counterfactual free trade weights, which is not always available. On the other hand the frequency index does not suffer from the endogeneity problem.

There are a number of studies that have used these indexes to study the trade restrictive nature of NTMs. It is important to mention that studies that use the frequency based measures have to group the NTMs into categories. Laird and Yeats (1990) refer to this grouping as a "selection approach". This approach recognizes that certain types of measures, like quotas or variable import levies, normally are imposed with the specific intention of modifying or limiting international trade. Such measures are termed "hardcore" nontariff measures and are defined to include variable import levies and other product specific charges, non-automatic import

authorization requirements such as restrictive licensing regulations, voluntary export restraints for both prices and quantities, trade restrictions negotiated under the Multifibre Arrangement (MFA), prohibitions, and various quantitative restrictions such as global and bilateral quotas. SPS and TBT requirements such as packaging requirements, labeling requirements, marketing requirements and others have always been excluded from such analysis until recently. The explanation (Laird and Yeats, 1990) is that such measures as sanitary requirements and automatic import authorizations may often have no or relatively unimportant trade effects and thus frequency or coverage indexes that include such regulations are likely to overestimate the importance of NTMs.

However, Liard and Yeats' (1990) argument is countered by the recent literature that has included the technical measures in their coverage and frequency estimations and have obtained relevant and informative trade effects of technical measures (SPS and TBTs). For example, Disdier, Fontagne, and Mimouni (2008), used three variables to estimate the impact of SPS and TBT measures imposed by 29 OECD countries on the least developed and developing country's agricultural trade. The variables included: a frequency index, a simple dummy set to equal unity if an SPS or TBT measure exists and zero otherwise, and the ad valorem equivalent of SPS & TBT measures. Also, Bao (2010) use the frequency and the coverage ratio to estimate the impact of technical barriers on China's imports.

2.2.2. The Price Comparison Measures

The price comparison measure can be calculated using two methods; the handicraft price gap method and the price impact measures (price based econometric method). The Handicraft method is used to estimate the degree to which NTMs raise domestic prices of countries imposing the barriers above international prices or a reference price. The method involves

calculating a "price wedge" between domestic prices and a reference price of a comparable good, such as a border price (Yue, Beghin, and Jensen, 2006). The price wedge can be used to calculate ad valorem equivalents that can be compared with tariffs and can also be used in simulation models. However, because this method depends on price data which are not always readily available for all products and countries, it's difficult to come up with representative prices for the domestic market and reference prices. Ferrantino (2006) suggests that some modifications need to be made to account for factors such as transport costs, wholesale and retail margins. The problem with this method is that it is burdensome when applied to datasets with many countries, products or policies.

The price impact measure (Price-based econometric method) provides an extension to the price gap method. It provides a handy way to work with many countries and many products simultaneously. The method is used to identify the extent to which high prices for some countries and products may be attributable to non-tariff measures. The method also offers a possibility of comparing the effects of non-tariff measures more broadly, in order to identify which categories of goods they are most applicable to by using a common method for all countries and products. The results obtained can be expressed in form of ad valorem tariff equivalents and can be used in simulation models. However, since more countries and products can be dealt with simultaneously, data requirements for specific details as product prices and policies are intensified.

According to Laird and Yeats (1990), the derivation of price and quantity impact measures have limitations. Even when reliable estimates of price and quantity changes resulting from NTBs are available, they may not be useful for cross-country or cross-industry studies since they incorporate the influence of additional factors like supply and demand differences. In

addition, third-country protectionist practices may also have a significant influence on the foreign supply curve for exports and thus affect the differences between domestic and import prices. For example, for some agricultural products, export subsidies exist that have lowered the world prices of these products. In this case, a price wedge is a biased estimate of the domestic protection.

In addition to their inability to account for quality differences between the domestic and the imported goods (Laird and Yeats, 1990; Deardoff and Stern 1998; Disdier, Fontagne and Mimouni, 2008), price comparisons are also often not able to account for transport costs inside the country. For example, prices recorded in different locations within the same country could significantly bias the price impact estimates. Further, the domestic-foreign price ratio for any one year (for the case of time series studies) could potentially be distorted by transitory factors such as a bad harvest. In addition, the comparisons utilize world prices that prevail under protection and these may be significantly lower than prices under free trade (Laird and Yeats, 1990).

Further, Beghin and Bureau (2001) note that the price comparison estimates are only valid under the assumption that the imported goods are perfect substitutes. If firms are able to price discriminate, the price comparison methods will reflect economic rents rather than the effect of NTMs.

Some of the studies on SPS regulations and other technical measures that use a price-wedge approach (price comparison measures) to quantify the impact of a barrier on market equilibrium and trade include: Ronigen and Yeats, 1976: Calvin and Krissoff 1998; and Campbell and Gossette, 1994. For example, Roningen and Yeats (1976) computed price impact measures for 90 products known to face non-tariff barriers in fifteen developed countries. In their

results they report that Japan and Sweden have the highest price impact measures of about 70% followed by France (at 40%) and United States (at 35%).

Disdier, Fontagne and Mimouni (2008) identify three influential papers (Bradford 2003; Dean et. al., 2006; Yue, Beghin, and Jensen 2006) that have contributed to use of the price comparison measures. Bradford uses prices of imports adjusted for transport, taxes and other distribution costs to compute ad valorem equivalents of NTMs. Dean et al (2006) use a differentiated products model of retail prices to estimate an equation that calculates ad valorem equivalents. Yue, Beghin, and Jensen (2006) apply the price comparison approach to account for heterogeneity between domestic and imported goods.

2.2.3. Quantity Impact Measures

A quantity impact method investigates if the presence of NTMs leads to lower trade flows or if the presence of some policies actually leads to higher trade flows. This method involves statistical analysis of data by using models such as the gravity model (which depends on country size and on economic distance between countries as factors explaining trade), factor-content models (which emphasize differing availability or resources in different countries) and models blending features of gravity models and factor-content models. Quantity methods provide results of more interest to policy makers since the influence on trade flows provides more interesting results for them than the influence on prices (Laird and Yeats, 1990).

The predictions of anticipated trade estimated using gravity models are taken as proxies for the free trade import volumes. The impact of NTMs is calculated as the positive deviation between the predicted trade flows from the actual trade flows. The advantage of this approach is that the trade data which are required for the analysis are readily available. Some studies that

have employed this method include an additional variable to the formal gravity covariates to account for the NTMs.

Roningen (1978) uses this approach with a cross section model of fourteen OECD countries' aggregate annual bilateral trade flows over 1967-1973. To account for the NTMs, the author appends the formal gravity variables with a general index of restrictiveness for each country's exchange rate, payments, and trade regimes. The index of restrictiveness is a simple count of twelve specific restrictions listed in the IMF annual report on exchange restrictions. In a separate regression, separate indices are constructed for restrictions that are classified as applying primarily to exchange controls, payments requirements, or the control of trade levels.

Laird and Yeats (1990) note that gravity flow and related regression models can be potentially useful for NTM analysis but they seem to be insufficiently developed to be used without major reservations. Their major problem is that they attribute all the variation of actual flows from predicted flows to NTMs, yet the size of the residuals depend on the precision of the specification of the model. Laird and Yeats (1990) suggest that Ronigen's model can be improved by including NTM frequency and coverage indices as explanatory variables (Laird and Yeats, 1990, Pg. 35). Kee, Nicita and Olarreaga (2006) criticize the use of coverage and frequency indexes as aggregation methods because they lack a sound theoretical basis.

The general limitations of econometric work (using common methods may ignore product-specific information, choices about econometric specification may affect results) apply to both price-based and quantity-based methods and may be more severe for quantity-based methods. Results from quantity-based methods can only be expressed as tariff equivalents or price gaps by use of additional assumptions and information.

2.2.4. Price Effect Measures using Import Demand Elasticities

A recent method uses import demand elasticities to calculate *ad valorem* equivalents of two broad categories of NTMs (core NTMs & Domestic support). The method was introduced by Kee, Nicita, and Olarreaga (2006). The method involves the use of the comparative advantage approach to estimate the quantity impact of NTMs. The NTMs considered are categorized into two broad categories: core NTMs and agricultural domestic support. The quantity impact of these two broad categories on imports is estimated at the HS6 digit tariff line level[5]. The quantity impact of the NTMs is obtained as the deviation of actual imports from predicted imports (obtained using the factor endowment approach). The quantity impact is then converted into an *ad valorem* equivalent using the import demand elasticities.

This method of estimation is applied in Disdier, Fontagne and Mimouni (2008). The authors use the *ad valorem* equivalents calculated by Kee, Nicita and Olarreaga (2006) to account for the impact of NTMs (SPS & TBT). In addition to a simple dummy variable and a frequency index, Disdier, Fontagne and Mimouni (2008) append a gravity model derived from the monopolistic competition –constant elasticity of substitution demand –Iceberg costs with the *ad valorem* equivalents. Each of the variables: simple dummy, frequency index and *ad valorem* equivalents is used in separate estimations. The paper also concentrated on a sample of 29 OECD importers and 167 exporting countries. Their results reveal that overall, NTMs significantly reduce trade and that developing country exporters are affected the most. Specifically, the intra-OECD trade is not affected much compared to developing and least developed countries' exports to OECD countries.

[5]UN Comtrade currently classifies data according to three systems, the Harmonized System (HS), the Standard International Trade Classification and the Broad economic Categories (BEC). In this study, HS6 digit level – is the Harmonized system at the tariff line level. HS4 and HS6 are higher aggregation levels where HS2 is the sector / chapter level

The problem with Disdier, Fontagne and Mimouni's (2008) paper is that they attribute all the impact to a small category of NTMs (SPS & TBT). This means that the authors are making an implicit assumption that all measures in their data set are technical measures. However, according to the classification of NTMs given by the United Nations Conference on Trade and Development (UNCTAD), technical measures include all measures covered by the SPS and TBT agreements. These measures are coded with NTM codes at the 8000 level. The non-technical measures on the other hand include: price control measures (at the 3000 level), finance measures (at the 4000 level), automatic licensing measures (at the 5000 level), quantity control measures (at the 6000 level), and monopolistic measures (at the 7000 level)[6]. The fact that their data set contains measures: like authorization measures, surveillance measures, prohibition measures, monopolistic measures, and finance measures which are clearly coded with NTM codes below 8000 means that the impact these authors report is for the sample of both technical and non-technical measures to trade.

Also, Carrere and de Melo (2009) note that the ad valorem equivalent calculated by Kee, Nicita, and Olarreaga (2006) is an aggregate of the five core NTMs. The measures include: technical regulations, quantity restrictions, monopolistic measures, price control measures and agricultural domestic support. Disdier, Fontagne and Mimouni's (2008) addressed this issue by considering ad valorem equivalents from Kee, Nicita, and Olarreaga (2006) for which their dataset has a non-tariff barrier reported. The issue here is that, it is still not possible to isolate the impact of a single non-tariff measure in the dataset from the overall measure of the five core non-tariff measures.

[6] The levels or codes i.e., 8000, 7000 etc. are identification codes assigned to the different types of NTMs by the UNCTAD.

2.3 Limitations of the Current Literature

The studies that have worked with Africa's trade data have concentrated on Africa's exports to developed countries and they focus on a particular non-tariff barrier affecting a particular sector from a particular African country. For example Gebrehiwet, Ngqangweni and Kirsten (2007) consider only one African country –South Africa and one specific barrier –total aflatoxin standard set by five OECD countries. Scheepers, Jooste and Alemu (2007), concentrate on South Africa's avocado exports and the maximum residue limits standard of prochloraz set by the European Union. Although these results may be very accurate for the particular countries and measures considered, these results cannot be generalized to represent other African countries dealing with similar products.

Another limitation is that none of these studies quantifies and compares empirically which NTMs have more problematic effects on trade. Most studies consider either technical barriers, SPS standards, or the whole groups of NTMs but no comparisons are made among the various measures. These studies (I.e., Disdier, Fontagne and Mimouni, 2008; and Bao and Qui, 2010) do not clarify which measures need more careful attention in comparison to others.

Lastly, studies using the inventory approach and extracting NTM information from the United Nations Conference on Trade and Development are likely to underestimate the impact of NTMs. This is because the UNCTAD data base is built with data from official national sources which may not be accurate in cases where lack of transparency prevails. Also, the information in the database does not provide any indication of changes in the intensity of application of a measure (Liard and Yeats, 1990).

This study uses the database constructed by Disdier, Fontagne and Mimouni (2008) to fill the gaps in the current literature in the following ways. Instead of concentrating on a group of

developed importing countries[7] as in Disdier, Fontagne and Mimouni (2008), this thesis considers all importers in the sample and specifically considers intra-African trade. Specific attention is paid to intra-African trade and the effects on the trade in staple foods (rice, maize, tomatoes and plantain) resulting from the existing technical measures to trade.

Chapter 3: Data and Data Sources

This thesis uses two types of data; survey data and secondary data: built from existing online sources. The survey data are from studies conducted in Uganda, Senegal and Mali. The secondary data contain data on NTMs classified according to the United Nations Conference on Trade and Development (UNCTAD, 2010). The NTMs are based on notifications made by WTO member countries to the WTO for five reasons: to ensure human safety, to protect human health, to protect plant health, to protect environment and to protect wildlife. The secondary data are cross section for the year 2004 and thus consider NTMs notified up to that point in time. The cross section data are used with an assumption that once measures are notified and employed they don't change with time. The data on bilateral agricultural import flows and NTMs notified to the WTO are obtained from the database constructed by Disdier, Fontagné and Mimouni (2008)[8].

The import trade flow data provided on the authors' website are matched with the NTMs of various kinds. Disdier, Fontagne and Mimouni (2008) classify these measures as being in the category of SPS and TBT because they are notified to the WTO for the five reasons mentioned above. The problem is that, according to the UNCTAD classification of NTMs, measures are

[7] Disdier, Fontagne and Mimouni (2008) concentrate on a group of 29 developed countries that constituted the OECD by the year 2004 and 167 exporting countries of all categories (developed-OECD countries, developing and least developed countries)

[8] The database is available on the author's website: http://lionel.fontagne.free.fr/data.htm

grouped according to their NTM codes[9]. Following this classification, the NTMs in the database provided by Disdier, Fontagne and Mimouni (2008) are grouped into technical and non-technical measures based on their NTM codes.

The data contains 154 importing countries and 183 exporting countries organized in bilateral trade pairs. The import trade data are classified for 690 agricultural products based on the Harmonized System of Classification Codes (HS codes) at a six –digit level (tariff line level). The measures are coded with their four digit non-tariff measure codes as shown in Appendix A1. The list of countries included in this dataset is given in Appendix A2. Some country codes are updated here, for example, the International Organization for standardization (ISO) code for Zaire is changed from ZAR to COD and ROM is used for Romania instead of ROU. For the econometric section, other variables are added to this dataset such as; geographical distances, gross domestic product, ad valorem equivalents (AVEs), tariffs and geographical location as detailed below.

The geographical distance data are from Centre d'Etudes Prospectives et d'Informations Internationales (CEPII) files. The dist_cepii (dist_cepii.xls or dist_cepii.dta) file provides bilateral data on different distance measures and dummy variables. The dummy variables include those indicating whether the two countries are contiguous, share a common language, have had a common colonizer after 1945, have ever had a colonial link, have had a colonial relationship after 1945, and or are currently in a colonial relationship. The common languages dummy is subdivided into two dummies, the first one is based on whether that two countries share a

[9] The non-tariff measures are broadly grouped into two categories; technical measures (which include SPS and TBT) and non-technical measures (which include the rest of the non-tariff measures). The technical measures are coded with a non tariff barrier code at the 8000 level. The non-technical measures are coded with non-tariff measure codes raging from 2000 to the 7000 level. The non-technical measures included in the database fall in these levels; finance measures (4000), automatic licensing measures (5000), quantity control measures (6000), and monopolistic measures (7000).

common official language, and the other dummy equals one if a language is spoken by at least 9% of the population in both countries, and zero otherwise.

Data on Gross Domestic Product for both importers and exporters are available from the National Accounts of the United Nations Statistics Division (2010)[10]. Data for 2004 are used and are accessible through the National Accounts Main Aggregate Data base. In this database, GPD is calculated and reported in different ways such as; GDP per capita, GDP at current prices in US dollar, GDP purchasing power parity, GDP at constant prices in national currency, and many others. However, GDP at current prices (for 2004) in US dollars is used here. Also, some countries such as Falkland Islands and Taiwan are not reported in this data base.[11]

The tariffs data are for the year 2001and are obtained from the Market Access Map (MAcMap) database jointly developed by the International Trade Center (UNCTAD-WTO) and the CEPII. This database contains various kinds of tariffs including applied tariff, specific duties, tariff quotas, and anti-dumping duties. All these measures are converted into an *ad valorem* equivalent and summarized into one measure. This measure is provided at the HS6 digit level.

Data on *ad valorem* equivalents (AVEs) of NTMs are obtained from the World Bank website[12]. The AVEs of NTMs were calculated by Kee, Nicita and Olarreaga, (2006). This data set contains 104 importing countries and 4,546 HS6 tariff product lines classified at the HS6

[10] The National Accounts Main Aggregate Database of the United Nations Statistics Division (2010)., for GDP data is available at; http://unstats.un.org/unsd/snaama/selbasicFast.asp

[11] The GPG for Taiwan is obtained from; http://www.tradingeconomics.com/taiwan/gdp-fiscal-year-current-prices-imf-data.html The GDP for Falkland Island is calculated as follows; GDP data for Falkland is obtained from Central Intelligence Agency (CIA) World Fact Book 2004.The GDP is reported in purchasing power parity terms and calculated as per capita GDP. =$35,400 (2002 est). To calculate the GDP in National currency, a currency converter that uses the exchange rate of (1 USD =0.58851) 2004 is used. This was accessed from the http://www.oanda.com/currency/converter/. This gives the GDP (PPP) in national currency as 20,833.3 Falkland pounds. To make it national GDP, the 20, 833.3 is multiplied by the population of Falkland in the year 2004. The population of Falk land is obtained from http://en.wikisource.org/wiki/CIA_World_Fact_Book,_2004/Falkland_Islands_(Islas_Malvinas) Therefore Total GDP = 20833.3 *2,967= 61,812,401.1

[12] The data on ad valorem equivalents is available at the World Bank Web site http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/0,,contentMDK:22574446~pagePK:64214825~piPK:64214943~theSitePK:469382,00.html

digit level. The 4,546 HS6 tariff product lines, for which the AVEs are calculated, fall into 97 product chapters. Because the trade data contains 690 HS6 tariff product lines of which some products do not have non-tariff measures notified on them, the AVEs for non-tariff measures calculated by Kee, Nicita and Olarreaga, (2006) are used only if the product in their sample is also in the trade sample and has a barrier notified on it .

Data on the composition of macro geographical (continental) regions and geographical sub-regions are obtained from the United Nations Statistics Division database (2010). According to this data base, the world is made up of five macro geographical regions which include: Africa, Americas, Asia, Europe, and Oceania. Africa is subdivided into sub regions which are: Eastern Africa, Middle Africa, Northern Africa, Southern Africa, and Western Africa. Americas constitutes Latin America & the Caribbean, and Northern America. Asia is subdivided into Central Asia, Eastern Asia, Southern Asia, South Eastern Asia, and West Asia. Europe is comprised of Eastern Europe, Northern Europe, Southern Europe, and Western Europe. Finally, Oceania is made up of Australia & New Zealand, Melanesia, Micronesia, and Polynesia. However, the UN regional map does not contain Taiwan, and since the data used in this study considers Taiwan as an independent country, Taiwan is added to the Asian region.

3.1 Data Requirements for the Inventory Analysis

The data used for inventory analysis are constructed as follows: First, the trade and NTMs data provided on Disdier, Fontagne and Mimouni's website contains multiple observations by HS6, importer, exporter and import value for some bilateral country pairs. These multiple observations exist as a result of the differences in the type of measures notified for a given bilateral trade flow and for a given HS6 product (i.e., some importers notify different measures for the same product). For this study, these multiple observations are dropped. This is

done by sorting the data by product, importing country and exporting country. This sorting allows for the randomization of the NTM codes and the selection procedure maintains the first observation for cases where multiple observations exist.

However, this approach may provide biased estimates of the impact of NTMs especially when frequency-based measures (frequency index and coverage ratios) are use to account for the NTMs. This is because, since there are different types of NTMS (technical and Technical measures), the type of measure maintained might have a significant impact on the coefficient estimates of the impact of these different types of measures on agricultural trade.

Second, according to Vancauteren (2002) and Disdier, Fontagne and Mimouni (2008), the European Union (EU) applies the principle of mutual recognition on the use of SPS and TBT regulations within the EU. This principle states that *"a product lawfully produced and sold in any of the EU member states must be given free access to all other EU markets"*, Vancauteren (2002. Pg.2). This principle is basically intended to eliminate technical measures in trade among EU countries. Because this makes a profound difference in trade occurring between EU member states and trade between member and non-member states, observations for intra-EU trade are also dropped.

The resulting dataset contains 444,460 observations with 154 importing countries and 183 exporting countries trading in 690 HS6 tariff product lines. These tariff product lines constitute the 33 agricultural trade chapters or sectors (see table 2). The sample also contains 42 NTMs notified by 92 importing countries. Out of the 42 NTMs, 25 are technical measures (SPS &TBT category) and 17 are non-technical measures.

3.2 Quantification of Non-tariff Measures Using the Inventory Approach

In this section, the two most commonly used methods for quantifying NTMs are discussed in detail and then applied to the data. Bora, Kuwahara, and Laird (2002) discusses a number of approaches that can be used to quantify the NTMs, but for this thesis two of them are used. These two methods include the frequency index (FI) and the coverage ratio (CR). The two measures are used to investigate countries that make the most intensive use of NTMs and the products and sectors that are most affected by the measures considered in the data. The coverage ratio is calculated as the percentage of trade that is subject to NTMs for exporting country *i* at a desired level of product aggregation:

$$2) \quad CR_i = \left[\frac{\sum (D_k V_k)}{(\sum V_k)} \right] * 100$$

Where, D_k is a dummy variable equal to one if an NTM is applied to the tariff line item *k* and zero otherwise. V_k is the value of imports in item *k*. Because the data are cross section (for only one year 2004), there is no variability in the coverage ratios across time. Two important points are worth noting regarding the NTMs. First, the NTMs are based on the importer's notifications to the WTO. Second, the NTM data do not have a bilateral dimension as is typical of many SPS and TBT measures.

Coverage ratios have a problem with interpretation which originates from the endogeneity of the import value weights. At the extreme, if an NTM is so restrictive that it stops imports of product *k* from country *i*, the weight V_k will be zero. The result is that the coverage ratio will be downward biased. In addition, the coverage does not show how much the NTMs have reduced the imports of product *k*. The solution to this problem according to Bao and Qui (2010) would be to use trade data obtained under free trade, but this kind of data is not available

for this study. An alternative which does not suffer from the endogeneity problem is the frequency index (FI).

The frequency index accounts only for the presence or absence of the NTMs without showing the value of imports covered; as is the case with the coverage ratio. It is therefore not affected by the restrictive effect of NTMs as long as the imports of product *k* from the exporting country *i* are not completely stopped. The frequency index shows the percentage of import transactions covered by a selected group of NTMs for an exporting country *i*. According to Bora, Kuwahara, and Laird (2002), the frequency index is calculated as:

$$3) \quad FI_i = \left[\frac{\sum (D_k * M_k)}{(\sum M_k)} \right] * 100$$

Where D_k is a dummy variable equal to one if an NTM exists on a tariff line at the desired aggregation level, M_k is a dummy variable showing whether there are imports from the exporting country *i* of good *k.* Again, since the data used are cross sectional with measures notified by the importer, the frequency index does not vary inter-temporally. As these two measures have useful attributes and limitations, they are both used in this thesis. Because FIs and CRs are frequently used in empirical research (Bao and Qui (2010) and Disdier, Fontagne and Mimouni (2008) both indices are employed in this thesis.

3.3. Frequency Index and Coverage Ratio Results

The frequency index of all NTMs is calculated as the proportion of product items (e.g., HS6) covered by NTMs within a particular product aggregation (e.g., HS4 or HS2). This value ranges from 0 (when no coverage exists) to 100% (when all product items within the aggregate group are covered). At the HS4 product level, the number of HS6 product lines of the

corresponding HS4 product category covered by an NTM is counted and divided by the total number of product lines belonging to the HS4 product category. This yields the frequency index of NTMs at the HS4-digit level. For example, the HS4 product with a product code of HS4:1006 (Rice), has four HS6 product lines (i.e., HS6:100610- Rice in the Husk; HS6: 100620- Husked (brown) rice; HS6:100630-Semi-milled or wholly milled rice; and HS6:100640-Broken rice), with a total of 3,193 bilateral flows out of which 1,342 flows have an NTM notified. The resulting frequency index at the HS4 digit level then is equal to 42.03% (= 1342/3193). The same method is used to calculate the frequency index at the sector level (i.e., HS2) and the frequency indexes for technical and non-technical measures at HS4 and HS2 levels.

A frequency index of NTMs on a country by country basis at a given level of aggregation is also calculated as the proportion of product items per importing country covered by NTMs within a product category. This index also ranges from zero (with no coverage) to 100% (when all products are covered). For example, with the same HS4 product; HS4:1006 (Rice), the U.S.A imports all the four HS6 product categories within the HS4 category. Also, all imports are covered by NTMs, thus the frequency index is 100%.

On the other hand, the coverage ratio measures the proportion of the value of the trade affected by NTMs for a given product category. If for example, HS6:110812 –maize (corn) starch is considered, the value of total or world imports is 189.1million US dollars. However, out of the 139 countries that import this product, 47 countries notify a barrier. Thus the value of affected imports is 103.6 million US dollars. The coverage ratio of Maize (corn) starch (HS6:110812) therefore equals 54.75% (=103.6 /189.1). The coverage ratio at the HS4 digit level is calculated as the proportion (in value) of the non-tariff barrier affected imports at the HS4 digit level out of the total imports of that product category at the same level of aggregation. For

example, HS4:0401 (Milk and cream, neither concentrated nor sweetened) is imported by 145 countries with a total imports value of 560.4 million US dollars. Out of the 145 importing countries, 52 countries notify a barrier on this product which gives a value of affected imports of 355.0 million US dollars. The coverage ratio at this level of aggregation is then calculated as 354.0/560.4= 63.35%.

The coverage ratio at the country level is calculated as the proportion of the value of imports affected by NTMs for a given country. We shall refer to this as the "*country based coverage ratio"* (CBCR). This CBCR is calculated for both the exporting countries and importing countries. With the importing countries, the CBCR tells the proportion of a country's imports that are affected by the NTMs the country notified to the WTO by the year 2004. On the other hand, the CBCR for the exporting country tells the proportion of the value of a country's exports that face NTM restrictions in the different importing countries[13]. For example, Uganda imports 451 tariff line products from 65 exporting countries with a total import value of 242.6 million US dollars. Of the 451 HS6 product lines, 23 tariff product lines have a measure notified on them and these affect exports of 26 exporting countries with an import value of 2.23 million US dollars. Thus the coverage ratio for Uganda's imports equals 0.92% (= (2.23/242.6)*100). The same procedure is followed when working with the country-based coverage ratio for a country's exports.

Narrowing it further, the coverage ratio of a country for a given product category can also be calculated in a similar way. In this case, the value of affected imports within a given product group is divided by the total value of imports in that category. The equation is:

[13] The export flows are obtained by using the mirror flows. This same approach is used by Disdier, Fontagne and Mimouni (2008).

4) $$CBCR_i = \left[\frac{\sum (D_k V_k)}{(\sum V_k)} \right] * 100$$

Where, D_k is a dummy variable equal to one if an NTM is applied to the tariff line item *k* and zero otherwise. V_k is the value of imports in item *k* for a particular importing country *i*. This measure creates variation across products at a given level of product aggregation for a particular country. For this particular instance, CBCR of particular product category is calculated at a sector level. For example, the coverage ratio of Ugandan imports of "HS2: 01- live animals" is calculated as 0.86/ 0.87 = 98.92 %. Where; 0.86 million US dollars is the value of imports affected by non-tariff measures and 0.87 million US dollars is the total value of imports for this product category. The same procedure is followed to calculate the country specific coverage ratios for the different sectors (at the HS2-digit level). For each of the cases discussed, the coverage ratio for the technical and non-technical-measures is calculated following the same procedure. However, for the case of separating the two categories of NTMs, only import values affected by each of the barrier category are divided by the total import value of the product category under consideration.

3.3.1 Non-Tariff-Measure Affected Products, Sectors and Countries.

This section provides information on frequency and coverage ratios for the most frequently used measures, the most affected products and sectors, and the most protective countries along with the most affected exporting countries. The section also gives details the level of protection applied by African countries and the level of restrictions faced by the individual exporting African countries. Finally, the section investigates the level of use of NTMs (level of restrictions faced) by the three countries Uganda, Senegal and Mali.

As already mentioned, the sample data contains 154 importing countries and 183 exporting countries trading in 690 HS6 product lines. At higher levels of aggregation, these 690 tariff line products are contained in 217 HS4 product categories and 33 HS2 product chapters or sectors[14]. The sample also contains 42 NTMs notified by 92 importing countries. Out of the 42 NTMs, 25 are technical regulations (SPS &TBT category) and 17 are non-technical measures of the categories: finance measures; automatic licensing; authorization; quantity control measures; and monopolistic measures[15].

To investigate the most frequently used measures, all measures in the sample dataset are grouped into the two broad categories: technical and non-technical measures. Each category is further disaggregated into the actual types of measures as outlined on the UNCTAD website. The sample dataset contains only one type of technical measure: technical regulations (which include: technical measures related to product characteristics, technical measures related to marketing requirements, technical measures related to labeling requirements, technical measures related to packaging requirements, and technical measures related to testing, inspection or quarantine requirements). On the other hand, the dataset contains five types of non-technical measures. These measures include: finance measures, automatic licensing measures (e.g., surveillance measures which are categorized under the import monitoring measures), authorization, quantity control measures (e.g., prohibitions and quotas for sensitive products), and monopolistic measures[16].

[14] The aggregation is done based on product codes. To aggregate products to the HS4 digit level, the HS6 codes are used to create HS4 product codes by simply knocking off the last two digits. All import values with the same HS4 digit code are summed up to give HS4 imports. The same is done to get to the HS2 level.
The 33 sectors are contained within the first 53 chapters.

[15] Technical measures are those with NTM codes at the 8000 level. In this sample they range from 8111 to 8157. The non-technical measures include measures with NTM codes below the 8000 level. In this sample, the non-technical measures range from NTM code of 4174 to 7171.
See http://r0.unctad.org/trains_new/tcm_link.shtm

[16] See **Appendix A1 for** details.

Table 1 provides the results of the ranking of NTMs (technical and non-technical) based on number of affected products. The results reveal that generally technical measures are the most frequent measures in the sample. In particular, technical measures of the category *"technical measures related to product characteristics"* appear most frequently

Table 1: The Ranking of the Groups of Measures Based on Number of Affected Products

	No. of affected products		No. of affected products
All Technical measures	682	All Non Technical measures	674
Related to product characteristics	675	Authorization measures	673
Related to testing requirements	671	Surveillance measures	573
Related to labeling requirements	665	Prohibition measures	406
Related to marketing requirements	632	Monopolistic measures	78
Related to packaging requirements	582	Finance measures	26
		Quotas for sensitive products	3

Source: Table developed using the data provided by Disdier Fontagne and Mimouni (2008).
Note: See footnote 10 for details about technical measures.

followed by non-technical measures of the category *"Authorization measures".* The rest of the results are similar to those reported in Disdier, Fontagne, & Mimouni (2008), as might be expected.

The most affected products and sectors are investigated next. Starting with the most affected products, the tariff-line-level calculations of the frequency index and coverage ratios show that a total of 260 HS6 tariff product lines (37.7% of the 690 tariff product lines) have a coverage ratio of above 50%. This coverage ratio is accounted for by 42 NTMs which appear in 81,450 observations. Out of the 690 HS6 product lines in the sample data, four products do not have any measure notified on them and thus they have a coverage ratio of zero. These products include HS6:150510-Wool grease, crude; HS6: 151560-Jojoba oil or fractions not chemically modified; HS6:430140-Raw beaver furskins, whole; and HS6: 430150-Raw musk-rat furskins, whole. The remaining 686 products have at least one measure notified on them.

The most protected HS6-product (with the highest coverage ratio) is identified as HS6:120792- Shea nuts (karite nuts) with a coverage ratio of 100%. This product is followed by 121292- Sugar cane with a coverage ratio of 99.91. However, this could be misleading because the most protected product is imported by only one country (Singapore from Indonesia) in the

dataset, which notified a barrier with non-tariff barrier code -8113 (Product characteristics requirements to protect plant health).

By the definition in Bao and Qiu (2010), products with both the frequency index and coverage ratios above 50% are referred to as NTM-rocked products. This definition is applied to products (at the HS4 and HS2 digit level). The results in table 2 show that there are 78 HS4 products with a coverage ration above the threshold level of 50%. Thirty eight HS4 products are found to have a frequency index equal to or above 50%. However, not all products hitting or going beyond the threshold with the coverage ratio do the same with the frequency index and vice versa[17]. As consequence, only 28 HS4 products are found to be NTM-rocked products by year 2004.

At the sector level or chapter level as shown in table 3 below, out of the 33 agricultural sectors included in this dataset, nine (9) sectors have a coverage ratio equal to or above fifty per cent (>=50%). These sectors include; HS2:06- Live trees, plants, bulbs, roots, cut flowers; HS2:02- Meat and edible meat offal; HS2:01- Live animals; HS2:04- Dairy products, eggs, honey, edible animal product nes; HS2:19- Cereal, flour, starch, milk preparation and products; HS2: 05- Product animal origin, nes; HS2:10- Cereal, HS2:07- Edible vegetable and certain roots and tubers; and HS2:21- Miscellaneous edible preparation. Sector or Chapter 06 (HS2: 06 (Live trees, plants, bulbs, roots, cut flowers etc)) is the most protected sector with a coverage ratio of 76.50% and HS2: 53 (Vegetable textile fibers nes, paper yarn) is the least protected sector with a coverage ratio of 5.06%.

[17] There are nine products having a frequency index of above 50 % but do not have a coverage ratio of above 50%. These products include: HS4:4301-Raw furskins, pieces for furriers use, not hides etc (51.02%);HS4: 4102-Raw skins of sheep or lambs (51.57%); HS4:1109-Wheat gluten (51.90%); HS4:0202-Meat of bovine animals, frozen (54%), HS4:0206-Edible offal of domestic animals (54.05%); HS4:0101-Live horses, asses, mules and hinnies (57.37%); HS4:1506 -Animal fat, oil, fractions not chemically modified nes (59.56%); HS4:0410-Edible products of animal origin, nes (59.84%); and 1603-Extracts, juices of meat, fish, aquatic invertebrates (64.64%).

Because sectors indicating a higher coverage are not the same sectors indicating higher indexes when the frequency index is used, the results show that only four sectors have a frequency index above 50%. The results also show that the most protected sector by frequency index is sector HS2:01- Live animals, with a frequency index of 61.78 and the least protected sector is still HS2:53 (Vegetable textile fibers not elsewhere specified, paper yarn) with a frequency index of 12.18 %.

Further analysis to investigate the most affected sectors by the two categories of NTMs reveals that with technical measures to trade, only four products have a coverage ratio of above fifty percent (>50%). These products include; HS2:19-Cereals; HS2:04- Dairy products, eggs, honey, edible animal product nes; HS2:21- Miscellaneous edible preparation; HS2:02- Meat and edible meat offal. The most protected of the four sectors is HS2:19 –Cereal while HS2:43 is the least protected. With non-technical measures (column three), none of the sectors has a coverage ratio above fifty percent. However, sector HS2:06- Live trees, plants, bulbs, roots, cut flowers etc., is the most protected sector with a coverage ratio of 36.20% and sector HS2: 53-Vegetable textile fibers nes, paper yarn, is the least protected with a coverage ratio of 0.03%.

Table 2: Identifying HS4 products with both the Frequency Index and Coverage Ratios above 50%, 2004.

No.	HS4 Products	Description	Coverage Ratio (%)	Frequency index (%)
1.	4103	Raw hides and skins except bovine, equine, sheep	50.23	53.50
2.	2103	Sauce, condiments, mixed seasoning and mustard	50.39	--
3.	0505	Feathers, down, skins, other parts of birds, unworked	51.19	51.53
4.	2102	Yeast, dead unicellular organisms nes, baking powders	51.39	--
5.	1517	Margarine, edible animal or veg oil preparations nes	51.71	--
6.	1105	Potato flour, meal, flakes, etc	52.19	--
7.	2001	Vegetables, fruit, nuts, etc, preserved in vinegar	52.47	--
8.	1108	Starches, inulin	52.84	--
9.	2205	Vermouth and other flavoured grape wine	52.84	--
10.	1208	Flour, meal of oleaginous seed or fruit except mustard	53.01	--
11.	1904	Cereal food (roasted, swelled), cooked grain not maize	53.06	50.61
12.	1902	Pasta, couscous, etc.	53.17	--
13.	0407	Birds eggs, in shell, fresh, preserved or cooked	53.28	--
14.	0701	Potatoes, fresh or chilled	53.65	--
15.	1518	Processed animal, vegetable oils, industrial preps nes	54.02	53.16
16.	0406	Cheese and curd	54.84	--
17.	0506	Bones and horn-cores unworked or simply worked	55.07	61.24
18.	0906	Cinnamon and cinnamon-tree flowers	55.31	--
19.	1006	Rice	56.11	--
20.	2101	Extracts, essences, concentrates of tea, coffee, mate	56.40	--
21.	0508	Coral, shell, cuttle bone, etc, unworked, and waste	56.57	63.18
22.	0909	Seed spices	57.33	--
23.	2106	Food preparations, nes	57.33	--
24.	1007	Grain sorghum	57.36	--
25.	0808	Apples, pears and quinces, fresh	57.43	--
26.	2004	Vegetables nes, prepared, frozen	57.49	--
27.	1201	Soya beans	58.14	--
28.	0510	Ambergris, civet, musk, etc for pharmaceutical use	58.45	58.58
29.	0807	Melons, watermelons and papaws (papayas), fresh	58.75	--
30.	0713	Vegetables, leguminous dried, shelled	58.87	--
31.	1107	Malt	60.04	--
32.	0403	Buttermilk, cream, yogurt etc	60.22	--
33.	0709	Vegetables nes, fresh or chilled	60.61	--
34.	0405	Butter and other fats and oils derived from milk	61.58	--
35.	0704	Cabbage, cauliflower, kohlrabi & kale, fresh, chilled	61.89	--
36.	0706	Carrots, turnips, beetroot, etc. fresh or chilled	61.92	--
37.	1704	Sugar confectionery, non-cocoa, white chocolate	62.51	--
38.	0401	Milk and cream, neither concentrated nor sweetened	63.35	--
39.	1901	Malt extract, flour, dairy preparations, low cocoa	63.50	--
40.	1601	Sausages, similar products of meat, meat offal & blood	63.60	--

Table 2 Continues

1.	1905	Baked bread, pastry, wafers, rice paper, biscuits, etc	64.22	--
2.	0504	Guts, bladders and stomachs of animals except fish	64.92	57.47
		Table continues		
3.	0703	Onions, shallots, garlic, leeks, etc. fresh or chilled	65.93	
4.	2104	Soups, broths and homogenized food preparations	68.18	52.88
5.	0511	Animal products nes, dead animals (non-food)	68.42	60.48
6.	0103	Live swine	68.74	--
7.	0801	Coconuts, Brazil nuts and cashew nuts, fresh or dried	68.97	--
8.	1502	Bovine, sheep and goat fats, raw or rendered	69.07	50.00
9.	0404	Whey, natural milk products nes	69.50	57.37
10.	1501	Lard, other pig fat and poultry fat, rendered	69.60	--
11.	0105	Live poultry, domestic fowls, ducks, geese, etc.	70.30	50.69
12.	1104	Worked cereal grains except flour, groat, meal, pellet	71.03	--
13.	1202	Ground-nuts, not roasted or otherwise cooked	71.64	--
14.	0201	Meat of bovine animals, fresh or chilled	72.01	61.71
15.	0601	Bulbs, tubers, corms, etc., chicory plant (non-food)	72.19	68.69
16.	0705	Lettuce and chicory, fresh or chilled	72.82	--
17.	0402	Milk and cream, concentrated or sweetened	73.08	--
18.	1001	Wheat and meslin	73.09	--
19.	1507	Soya-bean oil, fractions, not chemically modified	74.04	86.88
20.	0104	Live sheep and goats	74.13	63.96
21.	0602	Live plants nes, roots, cuttings, mushroom spawn	74.80	57.02
22.	0603	Cut flowers, dried flowers for bouquets, etc,	76.44	61.62
23.	2301	Flour etc of meat, fish or offal for animal feed	76.51	51.56
24.	0907	Cloves (whole fruit, cloves and stems)	79.19	--
25.	1504	Fish, marine mammal fat or oil not chemically modified	80.08	63.89
26.	0102	Live bovine animals	80.21	58.39
27.	0702	Tomatoes, fresh or chilled	80.72	--
28.	0204	Meat of sheep or goats, fresh, chilled or frozen	82.23	57.11
29.	0209	Pig and poultry fat, unrendered	82.99	--
30.	0208	Meat, edible meat offal nes, fresh, chilled or frozen	83.17	59.60
31.	0106	Animals, live, except farm animals	83.64	72.64
32.	0210	Salted, dried or smoked meat or offal, flour and meal	83.94	56.52
33.	0903	Mate	84.00	--
34.	0604	Foliage etc except flowers for ornamental purposes	86.69	63.72
35.	0203	Meat of swine, fresh, chilled or frozen	87.15	51.24
36.	0205	Horse, ass, mule, hinny meat, fresh, chilled or frozen	87.70	78.13
37.	0707	Cucumbers and gherkins, fresh or chilled	89.05	--
38.	1004	Oats	89.85	--

Note: Frequency and Coverage Ratios are calculated by HS4 product.
According to Bao and Qui (2010), HS4 products with both the frequency index and coverage ratios above 50% are referred to as NTM rocked products.

Table 3: Identifying the Most Affected Sectors by Coverage Ratio and Frequency Index, 2004

HS2 Code	Product Name (description)	Coverage Ratio (All measures) (%)	Coverage Ratio (Tech measures) (%)	Coverage Ratio (Non Technical measures) (%)	Frequency Index (%)
01	Live animals	67.09	44.67	22.43	61.78
02	Meat and edible meat offal	68.77	50.54	18.23	49.57
04	Dairy products, eggs, honey, edible animal product nes	62.70	52.91	9.78	45.30
05	Product animal origin, nes	60.29	31.19	29.10	56.70
06	Live trees, plants, bulbs, roots, cut flowers etc.	76.50	40.31	36.20	61.04
07	Edible vegetable and certain roots and tubers	56.78	31.43	25.35	41.02
08	Edible fruit, nuts, peel of citrus fruit, melons	42.44	21.11	21.34	36.62
09	Coffee, tea, mate and spices	25.65	19.24	6.40	37.54
10	Cereal	59.53	48.87	10.66	43.78
11	Milling products, malt, starches, inulin, wheat gluten	49.47	41.34	8.14	40.59
12	Oil seed, oleagic fruits, grain, seed, fruit, etc, nes	49.26	43.95	5.31	40.54
13	Lac, gums, resins, vegetable saps and extracts nes	25.68	17.17	8.51	37.78
14	Vegetable plaiting materials, vegetable products nes	25.47	16.52	8.95	35.79
15	Animal, Vegetable fats and oils, cleavage products nes	47.05	40.97	6.11	39.18
16	Meat, fish and seafood preparations nes	44.07	34.67	9.40	46.75
17	Sugars and sugar confectionary	46.80	42.74	4.06	36.17
18	Cocoa and cocoa preparations	26.94	23.50	3.44	37.78
19	Cereal, flour, starch, milk preparation and products	61.08	**58.27**	2.80	48.35
20	Vegetable, fruit, nut, etc food preparations	41.85	40.35	1.50	37.16
21	Miscellaneous edible preparation	56.16	52.29	3.86	40.73
22	Beverages, spirit and vinegar	15.29	14.00	1.33	27.52
23	Residues, wastes of food industry, animal fodder	35.48	21.20	14.29	36.07
24	Tobacco and manufactured tobacco substitutes	23.63	21.31	2.32	26.21
29	Organic chemicals	20.56	17.16	3.40	27.70

	Table Continues				
HS2 Code	Product Name (description)	Coverage Ratio (All measures) (%)	Coverage Ratio (Tech measures) (%)	Coverage Ratio (Non Technical measures) (%)	Frequency Index (%)
33	Essential oils, perfumes, cosmetics, toileteries	13.63	9.72	3.91	24.93
35	Albuminoids, modified starches, glues, enzymes	12.51	10.71	1.80	22.49
38	Miscellaneous chemical products	11.62	10.88	0.74	17.27
41	Raw hides and skins (other than firkins) and leather	31.52	14.90	16.62	49.83
43	Furskins and artificial fur, manufacture fur, manufacture thereof	18.25	0.31	17.94	51.02
50	Silk	43.60	43.15	0.44	12.91
51	Wool, animal hair, horsehair yarn and fabric thereof	15.99	12.29	3.70	29.49
52	Cotton	23.62	22.60	1.02	21.97
53	Vegetable textile fibres nes, paper yarn	5.06	5.04	0.03	12.18

Note: The magnitude of protection decreases with higher levels of aggregation. Frequency and Coverage Ratios are calculated by HS4 product sector. The sectors with both the coverage ratio and frequency index above 50% are said to be NTM rocked.

Next is the investigation of the most affected countries. Table 4 and table 5 show results of the most affected exporting countries while tables 6 and table 7 show results of countries that have high levels of protection on their imports. In both cases, the investigation is based on both the frequency-based measures and the coverage ratios. The frequency measure is used in two ways, the first one counts the actual number of affected products per country (i.e., as in Disdier, Fontagne and Mimoini, 2008) and the second counts the number of product lines that are affected as a proportion of the total product lines a country exports. Under the second way of calculating the frequency measure, calculations are done in two ways.

One of the ways calculations are done is on a tariff line level in which case a particular HS6 product is considered per country. For example, United Arab Emirates (ARE) exports HS6:010111 to eight countries but three of these countries notify a barrier on this product. The frequency index for United Arab Emirates for this particular product is therefore calculated as 3/8 = 37.5 %. The second way involves counting the number of HS6 product lines (with a barrier) divided by the total number of HS6 products a country exports. It therefore calculates the proportion of non-tariff barrier affected product lines as a percentage of the total product lines a country exports. For example, Aruba (ABW) exports 66 HS6 different product lines to 17 importing countries. Because one product can be exported to a number of different countries (of which some notify barriers), the total number of observations are used to correspond to the total product lines and in this case this number equals to 119. However, some countries notify barriers on these 66 products and this occurs in 48 observations and thus the country based frequency index is calculated as 40.34 % (=48/119). Finally, the coverage ratio is calculated using value of imports as already explained**.**

Table 4: Identifying the Most NTM Affected Exporting Countries by Coverage Ratio and Frequency Index, 2004

No.	Country	By Coverage Ratio (%)	No. of Affected products	No.	Country	By Frequency index (%)	No. of affected products
		(1)	(2)			(4)	(5)
1.	Guinea Bissau	98.71	3	1.	Brunei	67.5	26
2.	Bhutan	98.41	21	2.	Tonga	66.04	21
3.	New Caledonia	96.75	60	3.	Bhutan	61.76	21
4.	Nepal	88.93	130	4.	Nepal	60.46	130
5.	Belarus	88.54	337	5.	Samoa	59.62	42
6.	Afghanistan	86.18	85	6.	Solomon Islands	59.57	13
7.	Bolivia	86.18	173	7.	Fiji	59.43	197
8.	Myanmar	84.53	137	8.	Myanmar	59.28	137
9.	Cambodia	84.23	78	9.	Cambodia	59.18	78
10.	Armenia	79.04	92	10.	Bolivia	58.54	173
11.	Uruguay	76.18	255	11.	Afghanistan	56.78	85
12.	Estonia	75.89	183	12.	Estonia	56.66	183
13.	Moldova	74.07	20	13.	Greenland	55.93	24
14.	Mauritania	70.41	202	14.	Latvia	54.37	224
15.	Paraguay	69.67	155	15.	Uruguay	53.94	255
16.	Somalia	67.34	26	16.	Sweden	52.99	506
17.	Mexico	65.93	453	17.	United Arab Emirates	52.98	528
18.	Canada	65.76	550	18.	Lithuania	52.06	290
19.	Latvia	65.04	224	19.	Finland	50.65	316
20.	Denmark	62.97	512	20.	Tajikistan	50.20	76

Note: Only the top 20 countries are reported in the table. The other 25 countries in order of decreasing coverage ratio are: Lithuania (61.97%), Azerbaijan (60.42%) , Peru (60.11%), Argentina (59.14%), Chile (58.71%), New Zealand (58.50), Poland (56.83%), Georgia (54.99%), Spain (54.07), Macao (53.22%), Finland (52.80%), French Polynesia (52.74%), United Arab Emirates (52.61%), Singapore (52.34%), Indonesia (52.32%), Lao (51.94%), Yemen (51.48%), Ecuador (51.14%), Kazakhstan (50.99%), Libya (50.78%), Colombia (50.71), Eretria (50.41), Samoa (50.25%), Syria (50.15%), Ukraine (50.05%). The number 21 country in ranking based on frequency index is Slovenia with a frequency index of 50.05 %.

Table 5: Identifying the Most NTM Affected Exporting Countries by Number of Affected Products, 2004

No.	Country	No. of Affected products (All Measures)	Number of products exported	No. of affected products Tech Measures	No. of affected products (Non-Tech Measures)	Coverage Ratio (%)	Frequency Index (%)
		(1)	(2)	(2)	(4)	(5)	(6)
1.	United States	663	680	653	577	46.91	37.58
2.	France	641	659	607	565	38.43	43.91
3.	Germany	633	661	597	544	48.92	44.90
4.	Netherlands	612	646	591	445	45.49	40.82
5.	Australia	610	646	552	557	38.89	46.45
6.	China	607	656	580	480	33.86	40.02
7.	India	601	643	585	383	43.19	40.95
8.	Italy	590	645	559	457	35.63	43.72
9.	South Africa	583	660	571	303	24.55	33.86
10.	Spain	574	613	551	336	54.05	48.09
11.	Great Britain	571	638	546	363	36.84	39.53
12.	Singapore	556	594	548	321	52.34	49.82
13.	Belgium	553	611	498	396	49.09	42.20
14.	Canada	550	640	483	405	65.76	36.69
15.	Thailand	531	598	516	300	48.57	40.08
16.	United Arab Emirates	528	575	499	178	52.61	52.98
17.	Malysia	525	566	509	269	41.62	45.99
18.	Brazil	513	595	456	369	38.69	39.59
19.	Denmark	512	574	490	260	62.97	45.82
20.	Sweden	506	578	491	142	40.07	53.00

Note: The country based frequency index considers all the HS6 tariff product lines the country exports and is based on number of observations. The coverage ratio reported here is the country based coverage ratio calculated by dividing the value of exports affected by non-tariff measures by the total value of exports a country exports.

The number of products affected by all measures is not simply the sum of the number of products affected by technical plus non-technical measures. This is because some products are exported to more than one country of which some countries may impose various kinds of barriers. Some importing countries impose technical measures while others non-technical measures for the same product. Therefore, the same product is counted for both the technical and non-technical measures. For example the United States (USA) exports HS6: 010512 to 16 different importing countries. Six of these countries notify barriers. Two of the countries notify non-technical measures (NTM code: 6172) and four notify technical measures with a (NTM code: 8152). As a consequence, this product is counted to be affected by technical measures and non-technical measures since it is affected by both categorizations of measures.

The country based frequency index for the specific HS6 products does not reveal relevant details for indentifying most affected exporting countries for specific products. This is because the results show that all the 183 exporting countries have at least one product with a 100% frequency index. The results indicate that 673 out of the 690 products have a country based frequency index of 100%.

In identifying countries with the largest number of restrictions, the results show that 46 importing countries have more than 50% of the value of their imports subjected to non-tariff restrictions. Thirteen of these countries have a coverage ratio of 100 %, which means that all imports are covered. Likewise, there are 46 importing countries with more than 50% of their bilateral trade flows having a measure notified on them. Also, the same 13 countries that report a coverage ratio of 100% report a frequency index of 100%. These countries include: Cote d'lvoire, Algeria, Egypt, India, Sri Lanka, Morocco, Maldives, Nigeria, Philippines, Sudan, Senegal, Tanzania, and Vietnam.

Table 5 displays results for the top twenty countries as ranked based on the coverage ratio and frequency index. The thirteen countries in each case are grouped into one category to represent one country. Column (1) gives the ranking of countries based on the coverage ratio while column (4) gives the ranking of countries based on the country-based frequency index. The other 14 countries that have a coverage ratio above 50% include: Kazakhstan (87.62%), Oman (83.28%), Uruguay (82.75%), Taiwan (82.64%), Nepal (82.29%), New Zealand (82.24%), Norway (81.16 %), Bhutan (68.36%), Lebanon (62.32%), Papua New Guinea (59.75%), United States (58.27%), Thailand (57.31%), Belarus (55.97%), Mauritius (50.70%). In addition, the other 14 countries with a country based frequency index above 50% (in order of decreasing frequency index) are: Norway (84.27 %), New Zealand (84.09%), Russia (84.06%), Kazakhstan (81.53%), Thailand (78.10%), Taiwan (77.79%), Bangladeshi (77.06%), Tunisia (74.76%), Latvia (71.54%), Bhutan (69.23%), United States (60.04%), Mauritius (57.97%), Lebanon (57.81%), Indonesia (51.74%).

The number of affected products for each of the countries is shown in Columns (3) and (6). The number of affected products for each of the 13 countries having full coverage is d'lvoire (389), Algeria (513), Egypt (471), India (587), Sri Lanka (546), Morocco (547), Maldives (464), Nigeria (439), Philippines (568), Sudan (278), Senegal (278), Tanzania (531), and Vietnam (545).

Table 6: Identifying the Most NTM Protected Importing Countries by Using Coverage Ratio and Frequency Index, 2004

No.	Country	By Coverage Ratio (%)	No. of Affected products	No.	Country	By Frequency index (%)	No. of affected products
	(1)	(2)	(3)		(4)	(5)	(6)
1.	13 countries	100	-	1.	13 countries	100	-
2.	Brazil	99.94	577	2.	Brazil	99.22	577
3.	Argentina	99.89	540	3.	Colombia	99.19	556
4.	Bolivia	99.85	410	4.	Argentina	98.90	540
5.	Colombia	99.75	556	5.	Ecuador	98.02	482
6.	Venezuela	99.63	502	6.	Bolivia	96.63	410
7.	Peru	99.34	505	7.	Chile	96.42	556
8.	Ecuador	99.28	482	8.	Peru	96.25	505
9.	Chile	99.05	556	9.	Uruguay	94.12	484
10.	Pakistan	98.12	517	10.	Australia	93.80	626
11.	Australia	97.07	626	11.	Venezuela	93.72	502
12.	Mexico	96.27	656	12.	Paraguay	92.85	373
13.	Guatemala	96.03	562	13.	Guatemala	92.21	562
14.	Bangladeshi	92.79	528	14.	Mexico	91.23	656
15.	Nicaragua	92.51	475	15.	Singapore	87.84	635
16.	Russia	91.45	648	16.	Oman	86.06	548
17.	Singapore	90.09	635	17.	Pakistan	85.75	517
18.	Malaysia	88.39	645	18.	Malaysia	85.64	645
19.	Tunisia	88.38	462	19.	Nicaragua	85.19	475
20.	Paraguay	88.32	373	20.	Nepal	84.33	445

Note: There are 13 importing countries with a country based coverage ratio and country based frequency index of 100%. These include: Cote d'lvoire, Algeria, Egypt, India, Sri Lanka, Morocco, Maldives, Nigeria, Philippines, Sudan, Senegal, Tanzania, and Vietnam.
The other 14 countries that have a coverage ratio above 50% include: Kazakhstan (87.62%), Oman (83.28%), Uruguay (82.75%), Taiwan (82.64%), Nepal (82.29%), New Zealand (82.24%), Norway (81.16 %), Bhutan (68.36%), Lebanon (62.32%), Papua New Guinea (59.75%), United States (58.27%), Thailand (57.31%), Belarus (55.97%), Mauritius (50.70%).

Table 7 below shows the ranking of the most protective importing countries based on the number of HS6 products covered. It involves counting the actual products at the HS6 digit level for which a measure is notified. The results displayed are for the top twenty countries. Column (1) shows the number of HS6 products affected by all measures in the dataset, column (2) shows the total number of HS6 products imported, column (3) shows the number of products affected by technical measures and column (4) shows the number of products affected by non-technical measures. Columns (5) and (6) show corresponding values for the coverage ratio and frequency index respectively for each of the countries listed.

Table 7: Identifying the Most NTM Protected Importing Countries by Number of Affected Products, 2004

No.	Country	No. of Affected products (All Measures)	Number of products imported	No. of affected products Tech Measures	No. of affected products (Non-Tech Measures)	Coverage Ratio (%)	Frequency Index (%)
		(1)	(2)	(3)	(4)	(5)	(6)
1.	Mexico	594	656	583	160	96.27	91.23
2.	India	587	589	566	251	100	100
3.	Australia	568	628	562	20	97.07	93.80
4.	Philippines	568	568	545	409	100	100
5.	Brazil	567	577	517	522	99.94	99.22
6.	Colombia	549	556	466	497	99.75	99.19
7.	Malaysia	549	645	521	96	88.39	85.64
8.	Sri Lanka	546	546	540	82	100	100
9.	Vietnam	545	545	543	20	100	100
10.	Morocco	543	547	33	33	100	100
11.	Singapore	543	635	500	509	90.09	87.84
12.	Argentina	537	540	473	322	99.89	98.90
13.	Tanzania	531	531	502	232	100	100
14.	Chile	530	556	510	140	99.05	96.42
15.	New Zealand	526	614	274	416	82.24	84.09
16.	Thailand	514	627	511	426	57.31	78.06
17.	Algeria	513	513	440	435	100	100
18.	Guatemala	512	620	112	426	96.03	92.21
19.	Taiwan	504	628	486	123	82.64	77.78
20.	Russia	496	648	496	0	91.45	84.06

Note: the coverage ratio reported here is the importing country based coverage ratio and to the frequency index is showing the proportion of HS6 trade flows that have a non tariff barrier on them

3.3.2 Most NTM-Affected Exporting and Most NTM-Protected Importing African Countries

This section reports African exporting countries that face the highest level of NTM restrictions on their exports and African countries that impose the highest level of NTM protection on their imports. The dataset contains forty (40) importing African countries and forty nine (49) exporting African countries. Table 8 and table 9 show the most restrictive African importing countries while table 10 and table 11 show the most affected African exporting countries. Table 8 reports the top twenty (20) most restrictive importing countries ranked according to the magnitude of the coverage ratio and frequency index (arranged in descending order). Table 9 reports the top twenty most restrictive importing African countries ranked according to the number of affected HS6 tariff line products. Table 9 also disaggregates the NTMs (into technical and non-technical measures) and presents the number of HS6 tariff line products that are affected by each kind of measure.

In table 10 the results for the top twenty most affected exporting countries are presented and they are ranked according to the magnitude of the both country-based coverage ratio and the country-based frequency index (same procedure as that of table 8). Table 11 reports the top twenty countries ranked according to the number of affected products. It also shows the number of products affected by the technical and the non-technical measures.

The results reveal that nine countries: Morocco, Tanzania, Algeria, Senegal, Egypt, Nigeria, Cote d'lvoire, Sudan, and Tunisia, which trade in the largest number of product items, have all their imports covered by non-tariff measures. This means all imports have an NTM notified on them and that the coverage ratio and frequency index for these countries is one hundred percent (100%). It is important to note that the other twenty importing countries that are

not included in table 8 and table 9 did not notify any measures on their imports by the year 2004. Thus they have both the coverage ratio and frequency index of zero[18].

Overall, African countries face more restrictions on their exports than what they impose on their imports. Uganda, Senegal and Mali, appear in the top twenty most NTMs affected importers with Senegal ranking forth, Mali seventeenth, and Uganda nineteenth when ranked by both coverage ratios and country based frequency index. However it is important to note that, as importers, Uganda and Mali have coverage ratios and frequency indexes below 50%.

[18]. These countries are; Angola, Burundi, Benin, Central African Republic, People's Republic of Congo, Democratic Republic of Congo, Djibouti, Guinea, Gabon, Gambia, Guinea Bissau, Kenya, Madagascar, Mauritania, Niger, Rwanda, Sierra Leone, Chad, Togo, and South Africa.

Table 8: Identifying the Most NTM Affected African Importers by Coverage Ratio and Frequency Index, 2004

No.	Country	Coverage Ratio (%)	No. of affected products (all measures)	No.	Country	Frequency index (%)	Number of affected products (all measures)
		(1)	(2)			(3)	(4)
1.	Morocco	100	547	1.	Morocco	100	547
2.	Tanzania	100	531	2.	Tanzania	100	531
3.	Algeria	100	513	3.	Algeria	100	513
4.	Senegal	100	478	4.	Senegal	100	478
5.	Egypt	100	471	5.	Egypt	100	471
6.	Nigeria	100	439	6.	Nigeria	100	439
7.	Cote d'lvoire	100	389	7.	Cote d'lvoire	100	389
8.	Sudan	100	278	8.	Sudan	100	278
9.	Tunisia	88.38	347	9.	Tunisia	74.76	347
10.	Mauritius	50.70	302	10.	Mauritius	57.97	302
11.	Mozambique	47.40	208	11.	Zambia	43.55	186
12.	Zimbabwe	43.87	46	12.	Ghana	31.40	212
13.	Burkina Faso	43.47	50	13.	Mozambique	31.14	208
14.	Ghana	35.82	212	14.	Malawi	28.57	174
15.	Malawi	34.60	174	15.	Burkina Faso	20.24	50
16.	Zambia	31.27	186	16.	Mali	19.35	71
17.	Mali	26.15	71	17.	Cameroon	12.61	37
18.	Cameroon	13.24	37	18.	Zimbabwe	11.16	46
19.	Uganda	0.92	23	19.	Uganda	4.90	23
20.	Equatorial Guinea	0.02	2	20.	Equatorial Guinea	0.40	2

Note: The other 20 countries have a coverage ratio and a frequency index of zero because they did not notify any barriers on their imports. These countries are; Angola, Burundi, Benin, Central African Republic, People's Republic of Congo, Democratic Republic of Congo, Djibouti, Guinea, Gabon, Gambia, Guinea Bissau, Kenya, Madagascar, Mauritania, Niger, Rwanda, Sierra Leone, Chad, Togo, and South Africa.

Table 9: Identifying the Most NTM Affected African Importers by Number of Affected Products, 2004

No.	Country	No of Affected Products (All measures)	No. of products imported products.	No. of Affected products (Tech measures)	No. of Affected products (Non-Tech measures)	Coverage Ratio (%)	Frequency Index (%)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1.	Morocco	547	547	543	33	100	100
2.	Tanzania	531	531	502	232	100	100
3.	Algeria	513	513	440	435	100	100
4.	Senegal	478	478	478	23	100	100
5.	Egypt	471	471	471	34	100	100
6.	Nigeria	439	439	408	286	100	100
7.	Cote d'lvoire	389	389	381	76	100	100
8.	Tunisia	347	462	347	8	88.38	74.76
9.	Mauritius	302	560	271	43	50.70	57.97
10.	Sudan	278	278	248	150	100	100
11.	Ghana	212	472	211	2	35.82	31.40
12.	Mozambique	208	540	200	9	47.40	31.14
13.	Zambia	186	519	186	9	31.27	43.55
14.	Malawi	174	506	173	1	34.60	28.57
15.	Mali	71	256	71	0	26.15	19.35
16.	Burkina Faso	50	279	50	0	43.47	20.24
17.	Zimbabwe	46	496	46	0	43.87	11.16
18.	Cameroon	37	321	28	9	13.24	12..61
19.	Uganda	23	451	23	0	0.92	4.90
20.	Equatorial Guinea	2	220	0	2	0.02	0.40

Note: There are 40 African importing countries in the dataset. The other of the 20 countries notified no barrier on their imports by the year 2004. These countries are; Angola, Burundi, Benin, Central African Republic, People's Republic of Congo, Democratic Republic of Congo, Djibouti, Guinea, Gabon, Gambia, Guinea Bissau, Kenya, Madagascar, Mauritania, Niger, Rwanda, Sierra Leone, Chad, Togo, and South Africa. The products are counted at the HS6 digit level.

Table 10: Identifying the Most NTM Affected African Exporters by Coverage Ratio and Frequency Index, 2004

No.	Country	Coverage Ratio (%)	No. of affected products (all NTMs)	No.	Country	Frequency index (%)	No. of affected products (all NTMs)
		(1)	(2)			(3)	(4)
1.	Guinea Bissau	98.71	3	1.	Libya	48.65	30
2.	Mauritania	70.41	20	2.	Djibouti	46.67	25
3.	Somalia	67.34	26	3.	Somalia	40.37	26
4.	Libya	50.78	30	4.	Equatorial Guinea	36.84	4
5.	Eritrea	50. 41	16	5.	Kenya	36.17	320
6.	Angola	49.03	6	6.	Mali	35.96	32
7.	Kenya	47.65	320	7.	Mauritania	34.52	20
8.	Djibouti	46.47	25	8.	Guinea	34.48	22
9.	Cape Verde	41.66	8	9.	Madagascar	34.02	108
10.	Gambia	37.87	3	10.	South Africa	33.86	583
11.	Mozambique	33.35	51	11.	Dem. Rep. of Congo	33.33	33
12.	Tanzania	32.19	168	12.	People's Rep. of Congo	33.02	18
13.	Egypt	31.64	285	13.	Eritrea	32.2	16
14.	Mali	27.23	32	14.	Ethiopia	31.45	63
15.	Benin	27.19	18	15.	Egypt	31.09	285
16.	Guinea	25.89	22	16.	Tunisia	31.05	164
17.	South Africa	24.55	583	17.	Sudan	30.58	42
18.	Sierra Leone	22.92	23	18.	Burundi	30.25	21
19.	Morocco	22.28	219	19.	Burkina Faso	29.68	60
20.	Togo	22.23	74	20.	Morocco	29.55	219

Note: Liberia has the smallest frequency index of 10%. Most African exporting countries face more restrictions than they impose on their own imports.

Table 11: Identifying the Most NTM Affected African Exporters by Number of Affected Products, 2004

No.	Country	No. of affected products (all measures)	Number of products exported	No. of affected products (Tech-measures)	No. of affected products (Non-Tech measures)	Coverage Ratio (%)	Frequency index (%)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1.	South Africa	583	660	571	303	24.55	33.86
2.	Kenya	320	474	274	126	47.65	36.17
3.	Egypt	285	424	247	126	31.64	31.09
4.	Morocco	219	352	179	112	22.28	29.55
5.	Zimbabwe	176	349	171	39	16.73	27.25
6.	Tanzania	168	366	151	56	32.19	27.58
7.	Tunisia	164	287	132	61	6.88	31.05
8.	Ghana	146	289	102	87	11.51	24.79
9.	Uganda	132	263	112	50	19.87	25.31
10.	Senegal	118	274	89	46	20.77	22.73
11.	Cote d'lvoire	114	233	86	44	13.36	29.07
12.	Madagascar	108	196	79	55	15.24	34.02
13.	Malawi	84	176	70	26	17.03	29.27
14.	Nigeria	81	204	55	38	13.03	25.83
15.	Mauritius	79	233	65	28	6.94	23.88
16.	Togo	74	173	58	25	22.23	27.65
17.	Zambia	63	254	54	18	18.08	19.57
18.	Ethiopia	63	143	44	36	19.61	31.45
19.	Algeria	63	136	43	26	19.84	29.53
20.	Cameroon	62	163	22	47	7.30	23.45

Note: All exporting countries have at least one of their products having a barrier notified on them by the importing countries. Countries with the least level of barrier notification on their exports include; Liberia, Guinea Bissau, and Gambia, and these have only three products with barriers.

3.4 NTM use in Uganda, Senegal and Mali for Trade in Food Staples

This section investigates first, the general levels of protection that apply to the food staples: maize, rice, tomatoes, and plantain in the world trade. Second, it presents results for the investigation of the overall level of NTM protection for all products in the three countries: Uganda, Senegal and Mali. The final section presents results of the level of NTM protection by the three countries in the four staples: rice, maize, tomatoes and plantain. The analysis is based on the frequency based measures: frequency index and the coverage ratio.

The product-based coverage ratio calculated at the HS6, HS4 and HS2 digit levels for each of the four crops; rice maize tomatoes and plantain are summarized in table 12 below. An analysis of table 12 together with the results obtained in table 2 and table 3 confirms that overall, none of these products (i.e., maize, rice, tomatoes, and plantain) is NTM-rocked. This means that none of the products at the three levels of aggregation (i.e., HS2, HS4, and HS6) has both the frequency index and coverage ratio above 50%. The meaning behind this is that the four products under consideration are not strictly protected in the world trade by NTMs. For convenience, the frequency index results at HS4 and HS2 levels of aggregation are reproduced in table 13 below.

To investigate overall trade (i.e., in all the 690 products) for the three countries, Uganda, Senegal, and Mali, the country-based frequency and coverage ratios are calculated as was described in section 3.4.1. Table 14 displays the results for the overview of the level of NTM protection and restrictions in Uganda, Senegal, and Mali, for the year 2004. The results are presented according to two criteria (i.e., criteria (a) and criteria (b)).

Table 12: Product Based Coverage Ratio for Maize, Rice, Tomatoes and Plantains, 2004[19]

Crop	HS6 Code	Coverage Ratio (%)	HS4 Code	Coverage Ratio (%)	HS2 Code	Coverage Ratio (%)
Rice	100610	77.12	1006	56.11	Chapter 10	59.53
	100620	35.53	1006	56.11	Chapter 10	59.53
	100630	53.96	1006	56.11	Chapter 10	59.53
	100640	75.40	1006	56.11	Chapter 10	59.53
	110230	53.28	1102	39.72	Chapter 11	49.47
Maize	100510	62.69	1005	43.98	Chapter 10	59.53
	100590	42.35	1005	43.98	Chapter 10	59.53
	110423	93.62	1104	71.03	Chapter 11	49.47
	110220	30.70	1102	39.72	Chapter 11	49.47
Tomatoes	070200	80.72	0702	80.72	Chapter 07	56.78
	200210	35.81	2002	35.78	Chapter 20	41.85
	200290	35.78	2002	35.78	Chapter 20	41.85
	210320	50.92	2103	50.39	Chapter 21	56.16
Bananas & Plantain	080300	33.67	0803	33.67	Chapter 08	42.44

Note: Descriptions of the HS commodity codes are given in Appendix A4. Detailed sector level analysis is given in table 3.The the coverage ratios and frequency index are based on imports of all countries in the dataset. It is also important to note that at the least level of disaggregation (080300), bananas cannot be separated from plantains.

[19]Note that 210320 is a code for tomato ketchup and other tomato sauces but at the HS4 digit level HS4:2103 is sauce, condiments, mixed seasoning and mustard; this description includes; HS6:210310 (soya sauce); HS6:210320 (Tomato Ketchup and other tomato sauces); HS6:210330 (Mustard flour or meal and prepared mustard); and HS6:210390 (Sauces nes, mixed condiments, mixed seasoning). HS4:1102 (cereal flours other than of wheat or meslin) includes four product lines at the hs6 digit level; HS6:110210 (Rye flour); HS6:110220 (Maize or corn flour), HS6:110230 (rice flour), HS6:110290 (cereal flour except wheat, meslin, rye, maize, and rice.

Also, HS4:1104 (worked cereal grains except flour, groat, meal, and pellet) includes eight product lines at the HS6 digit level; HS6:110411(Barley, rolled or flaked grains), HS6:110412 (Oats, rolled or flaked grains), HS6:110419 (Cereals, rolled or flaked grains nes), HS6:110421 (Barley, hulled, pearled, sliced or kibbled), HS6:110422 (Oats, hulled, pearled, sliced or kibbled) and HS6:110423 (Maize or Corn, hulled pearled, sliced or kibbled).

Table 13: Product Based Frequency Index for Maize, Rice, Tomatoes and Plantains, 2004

Crop	HS6 Code	HS4 Code	HS4 Frequency index (%)	HS2 Code	HS2 Frequency Index (%)
Rice	100610	1006	42.03	Chapter 10	43.78
	100620	1006	42.03	Chapter 10	43.78
	100630	1006	42.03	Chapter 10	43.78
	100640	1006	42.03	Chapter 10	43.78
	110230	1102	40.97	Chapter 11	40.59
Maize	100510	1005	42.09	Chapter 10	43.78
	100590	1005	42.09	Chapter 10	43.78
	110423	1104	38.10	Chapter 11	40.59
	110220	1102	40.97	Chapter 11	40.59
Tomatoes	070200	0702	31.72	Chapter 07	41.02
	200210	2002	36.96	Chapter 20	37.16
	200290	2002	36.96	Chapter 20	37.16
	210320	2103	37.47	Chapter 21	40.73
Bananas & Plantain	080300	0803	28.51	Chapter 08	36.62

Notes: Descriptions of the HS commodity codes are given in Appendix A4. The HS4 frequency index displayed here is calculated as the proportion of HS6 tariff line products with a barrier notified on them within a given HS4 product category. The HS2 frequency index is calculated as the proportion of HS6 tariff line products with a barrier notified on them within a given HS2 product category. All import flows are considered thus the values shown here are overall (imports for all countries in the data set) coverage ratios and frequency indexes.

Criteria (a) use the coverage ratio and the frequency index to rank the three countries while criteria (b) rely on the number of affected products. The table is divided into two panels; panel (1) shows results when the three countries are importers and panel (2) shows results when they are exporters.

In panel (1), the results show that both criteria identify Senegal as the most NTM protected importing country followed by Mali and Uganda. On the contrary, panel (2) shows that the different criteria yield different results i.e., Criteria (a) identifies Mali as the most NTM affected exporting country with a coverage ratio of 27.23% and frequency index of 35.98%, followed by Senegal with a coverage ratio of 20.77% and a frequency index of 22.73% and finally Uganda with a coverage ratio of 19.87% and a frequency index of 25.31%. Criteria (b) identifies Uganda as the most NTM affected exporting country with 132 out of 263 HS6 tariff line products the country exported in 2004, having an NTM notified on them by their destination countries. This is followed by Senegal which has 118 out of a total of 274 HS6 tariff line products and lastly Mali with 32 out of 87 HS6 products having an NTM notified on them by the importing countries.

Table 14 results also show that the three countries are not affected significantly by NTMs since none of them registers or goes beyond the threshold limit (i.e., 50% coverage and frequency index). Also by criteria (b), the results show that for both panel (1) and panel (b), technical measures are more frequently used than the non-technical measures.

A further analysis of criteria (a) results shows that by trade value, Senegal imported more agricultural products than it exported (I.e., 748,078.8 versus 245,824.9 USD) while Mali and Uganda exported more than they imported (i.e., 252,697.0 versus 118,463.7 and 473,174 versus 242,611.1 for Mali and Uganda respectively.

Table 14: Overview of Non-Tariff Barrier Protection and Restriction in Uganda, Senegal, and Mali, 2004

Panel (1): Imports					**Panel (2): Exports**				
Country	Value of Total Imports (million USD)	Value of Affected Imports (million USD)	Coverage Ratio (%)	Frequency Index (%)	Country	Value of Total Exports (million USD)	Value of Affected Exports (million USD)	Coverage Ratio (%)	Frequency Index (%)
Criteria (a)	(1)	(2)	(3)	(4)		(5)	(6)	(7)	(8)
1. Senegal	748.1	748.1	100	100	1. Mali	252.7	68.8	27.23	35.98
2. Mali	118.5	31.0	26.15	19.35	2. Senegal	245.8	51.05	20.77	22.73
3. Uganda	242.6	2.23	0.92	4.90	3. Uganda	473.1	94.0	19.87	25.31
Criteria (b)									
	No. of Affected Products (All NTMs)	No. of Affected Products (Tech NTMs)	No. of Affected Products (Non-Tech NTMs)	Total No. of Imported Products		No. of Affected Products (All NTMs)	No. of Affected Products (Tech NTMs)	No. of Affected Products (Non-Tech NTMs)	Total No. of Exported Products
1. Senegal	478	478	23	478	1. Uganda	132	112	50	263
2. Mali	71	71	0	256	2. Senegal	118	89	46	274
3. Uganda	23	23	0	451	3. Mali	32	16	18	87

Note: The coverage ratio and frequency index are country based. The value of affected imports is the value all of imports for a country with NTMs notified on them. The total imports are the total imports regardless of whether there are NTMs or not. The same definitions hold for the exports.

Next are the investigation results for the use on NTMs in the three countries; Uganda, Senegal, and Mali, in the four crops; rice, maize, tomatoes, and plantain. The results are presented for each country, one at a time. The results for Uganda are presented in table 15a & table 15b, those of Senegal in table 16a & 16b, and Mali in table 17 below. The results indicate that Uganda does not notify any measure for the four products under consideration. The twenty three HS6 affected products identified in table 14 fall under three chapters; HS2: 01 (Live Animals); HS2:06 Live trees, plants, bulbs, roots, cut flowers etc.); and HS2: 12 (Oil seed, Oleagic fruits, grain, seed, fruits etc, nes). Also, table 14 showed that Uganda's imports were mainly affected by technical measures and according to table 15, these measures are of two kinds; 8152 (Testing, inspection or quarantine requirements to protect animal health and life); and 8153 (Testing, inspection or quarantine requirements to protect plant health).

On the other hand, the country faces twenty five different kinds of NTMs on its exports. Four of these measures are non- technical and the rest are technical. These measures affect products falling under twenty nine chapters including cereals (HS: 10). The details of the measures and the affected sectors are displayed in table 15 (b) below.

The results for Senegal show that the country notified NTMs on all the four food staples including their products. Table 16 shows details of the kinds of measures notified at the sector level for the four food staples and their products. Further, Senegal notified NTMs with twenty three different NTM codes for twenty nine sectors of which two codes are for non-technical measures and the rest are codes for technical measures.

Table 15a: NTM use in Uganda, 2004

Imports			
HS6 Codes	HS4 Codes	Product description	NTM Code
010111; 010119	0101	Live horses, asses, mules and hinnies	8152
010210; 010290;	0102	Live bovine animals	8152
010420	0104	Live sheep and goat	8152
010511; 010519; 010599	0105	Live poultry i.e. fawls of the species *Gallus domesticus*, ducks, geese, turkeys and guinea fowls.	8152
010600	0106	Other live animals	8152
060110; 060120	0601	Bulbs, tubers, corms etc.	8153
060210; 060220; 060240	0602	Live plants nes, roots cuttings, mushroom spawn	8153
060310; 060390	0603	Cut flowers, dried flowers for bouquets	8153
060410; 060499	0604	Foliage except flowers for ornamental purposes	8153
120911; 120921; 120929; 120991; 120999	1209	Seed, fruit and spores, for sowing	8153

Note: More on descriptions on the non-tariff measures is give in Appendix 1A. The total number of affected products is 23. All the products fall under three chapters

Table 15b: NTMs Notified on Ugandan Exports, 2004

Exports Description	NTM Code	Affected HS2 Products
Authorization measures	6171	HS:07; HS:08; HS:09; HS:10; HS:12; HS:18; HS:20; HS22; HS:24
	6172	HS:15; HS:41
	6173	HS:06; HS:07; HS:08; HS:09; HS:12; HS:52
	6175	HS:01; HS:02; HS:05; HS:06; HS:14; HS:21; HS:41
Technical measures related to product characteristics	8111	HS:06; HS:07; HS;08; HS;09; HS:10; HS:12; HS:15; HS:20; HS:21; HS:22; HS:24
	8113	HS:06; HS:07; HS:08; HS:09; HS:10; HS:11; HS:12; HS:14; HS:52
	8114	HS:09
	8117	HS:12
Marketing requirements	8121	HS:01; HS:07; HS:23
	8123	HS:01; HS:10
	8124	HS:09
	8127	HS:06; HS:52
Labeling Requirements	8131	HS:02; HS:08; HS:09; HS:11; HS:12; HS:15; HS:19
	8132	HS:01; HS:18
	8133	HS:02; HS:07
	8134	HS:02; HS:04; HS:11; HS:22; HS:24
	8135	HS:02; HS:15; HS:17
	8137	HS:01; HS:09; HS:10; HS:14; HS:22; HS:24; HS:41; HS:52
Packaging Requirements	8141	HS:04; HS:05; HS:10; HS:15; HS:21; HS:22
	8142	HS:52
	8147	HS:04; HS:06; HS:09; HS:17; HS:18; HS:21; HS:21; HS:24; HS:52
Testing, Inspection and Quarantine	8151	HS:02; HS:04; HS:08; HS:09; HS:10; HS:12; HS:15; HS:16; HS:17; HS:18; HS:19; HS:20; HS:21; HS:22; HS:23; HS:24; HS:52
	8152	HS:01; HS:02; HS:04; HS:05
	8153	HS:06; HS:07; HS:09; HS:18; HS:24
	8157	HS:01

Note: Details on the description of non-tariff measures are given in Appendix A1. The descriptions for sectors or chapters are in table 3.

Table 16a: NTM Use in Senegal, 2004

Food Staple	Sector	NTM Codes
Cereals and Cereal products	HS2:10 (Cereal –Rice &Maize)	7171, 8111, 8121, 8123, 8124, 8127, 8141, 8142, 8147
	HS2:11(Milling products, malt, starches, inulin, wheat gluten)	8111, 8121, 8123, 8124, 8127, 8141, 8142, 8147
Tomato and tomato products	HS:07(Edible vegetables and certain roots and tubers)	8111, 8113, 8121, 8123, 8124, 8127, 8141, 8142, 8147
	HS:20 (Vegetable, fruit, nut, etc food preparations)	8111, 8112, 8113, 8114, 8115, 8117, 8121, 8123, 8124, 8127, 8131, 8132, 8133, 8134, 8135, 8137, 8141, 8142, 8147
Bananas and Plantains	HS:08 (Edible fruit, nuts, peel of citrus fruit, melons)	8111, 8121, 8123, 8124, 8127, 8141, 8142, 8147
	HS:21 (Miscellaneous edible preparations)	8111, 8121, 8123, 8124, 8127, 8131, 8132, 8133, 8134, 8135, 8137, 8141, 8142, 8147

Note: Other 25 affected sectors include; HS2:01; HS2:02; HS2:04; HS2:05; HS2:06; HS2:09; HS2:12; HS2:13; HS2:14; HS2:15; HS2:16; HS2:17; HS2:18; HS2:19; HS2:22; HS2:23; HS2:24; HS2:33; HS2:35; HS2:38; HS2:41; HS2:52; HS2:53.

Table 16b: NTMs Notified on Senegalese Exports, 2004

Food Staple	Sector	NTM Codes
Cereals and Cereal Products	HS2:10 (Cereal –Rice &Maize)	6173, 8111, 8113, 3131
	HS2:11(Milling products, malt, starches, inulin, wheat gluten)	8111, 8137, 8151
Tomato and Tomato Products	HS:07(Edible vegetables and certain roots and tubers)	6173, 8111, 8113, 8131, 8137
	HS:20 (Vegetable, fruit, nut, etc food preparations)	8133, 8141, 8151
Bananas and Plantains and their Products	HS:08 (Edible fruit, nuts, peel of citrus fruit, melons)	5271, 6173, 6373, 8111, 8137, 8153
	HS:21 (Miscellaneous edible preparations)	6175, 8111, 8137, 8151, 8153

Senegal exports 274 HS6 tariff line products which fall under 29 sectors. These products are reported to face NTMs with twenty different NTM codes of which seven of the codes are for non-technical measures. Table 16 (b) reports the results for the four staples.

The results show that Mali's imports face NTMs with twelve different NTM codes. These measures are notified for products falling under twenty three chapters. However, the food staples under consideration are protected with four measures. The details of these measures are given in table 17a. These results report that Mali notified no measures on imports of maize and rice by the year 2004. Bananas and Plantains have the largest number of measures (i.e., 6173-Authorisation to protect pant health, 8111-Product characteristics requirement to protect human health, 8113-Product characteristics requirement to protect plant health, and 8137-labelling requirements to ensure human safety).

Table 17: NTM Use in Mali, 2004

Food Staple	Sector	NTM Codes
Cereals and Cereal Products	HS2:10 (Cereal –Rice &Maize)	None
	HS2:11(Milling products, malt, starches, inulin, wheat gluten)	8113
Tomato and Tomato Products	HS:07(Edible vegetables and certain roots and tubers)	6173
	HS:20 (Vegetable, fruit, nut, etc food preparations)	8151
Bananas and Plantains and their Products	HS:08 (Edible fruit, nuts, peel of citrus fruit, melons)	6173, 8111, 8113, 8137
	HS:21 (Miscellaneous edible preparations)	8151

Note: other nineteen sectors with non-tariff measures are: HS2:01; HS2:02; HS2:04; HS2:05; HS2:06; HS2:07; HS2:08; HS2:09; HS2:12; HS2:13; HS2:15; HS2:17; HS2:18; HS2:19; HS2:22; HS2:23; HS2:24; HS2:41; HS2:52.

Chapter 4: Overview of Agricultural Trade in Uganda, Senegal, and Mali

This chapter gives an overview of agricultural trade in Uganda, Senegal, and Mali. The chapter uses data from the United Nations Commodity Database (2010) for years 1994 to 2009. This chapter is intended to shed light on the past trends in agricultural trade with a concentration on the major food staples in East and West Africa which are identified for this study as maize, rice, tomatoes, and plantain.

4.1 Exports and Imports of Rice

Figure 1 shows that rice exports are highly variable in the three countries. The data shows that of the three countries, Senegal takes the leading position in the export of rice. An important aspect of Senegal's rice exports is that they are from local production with re-exports contributing only 48.3 % in 2002 and 49% in 2006. Senegal exports rice regionally and its major partners are Mali, Guinea-Bissau, Gambia, Côte d'lvoire, and Mauritania. For the period ranging from 1996 to 2009, Mali has imported 65.3 % of the total export value of rice from Senegal, Guinea-Bissau 24.9%, Gambia 3.4%, Côte d'lvoire 2.7%, and Mauritania 1.7%.

In contrast to Senegal, Uganda's rice exports are mainly composed of re-exports. That is, the data reveals that re-exports contributed 96.6% in 2002, 93.02% in 2003, 90.74% in 2004, 91.11% in 2005, 73.06% in 2007 and 77.38% in 2008. Like Senegal, Uganda exports rice regionally. For the period ranging from 1994 to 2008, most of the rice was destined to neighboring countries like Democratic Republic of Congo, Rwanda, Sudan, and United Republic of Tanzania. The Democratic Republic of Congo imported 38.8% of the total value of rice while Rwanda, Sudan, and United Republic of Tanzania imported 30.7 %, 13 %, and 6.7% of Ugandan rice respectively.

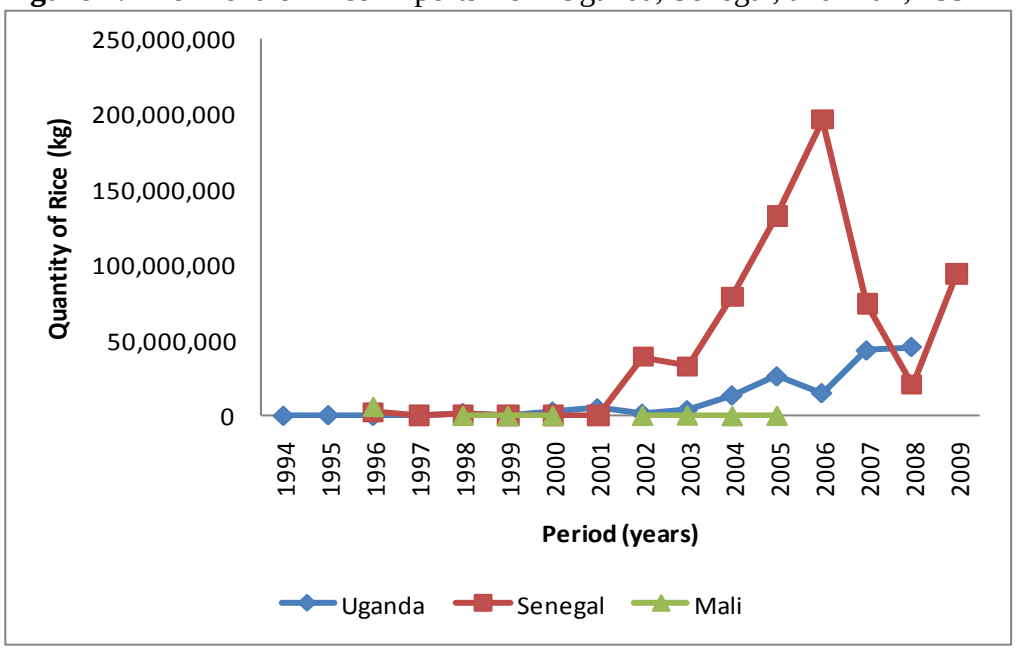
Like Senegal, Mali has no reported rice re-exports. It also exports its rice to neighboring countries like Côte d'lvoire, Burkina Faso, Mauritania, and Senegal. These countries are reported to be the major partners with rice import values of 30.8%, 29.7%, 18.9%, and 17.6%, of the total value of the rice exported from Mali for Côte d'lvoire, Burkina Faso, Mauritania, and Senegal respectively for the period 1996 to 2005.

On the import side, there is a general decline in the level of rice imports since 2007 as is shown in Figure 2 below. The reasons behind this decline vary across countries although it is highly attributable to the 2007/2008 food crisis[20]. In terms of volumes, Senegal is the largest importer of rice compared to Uganda and Mali. Senegal's major rice suppliers for the period 1996/2009, according to their relative contribution to the total volume of rice imports, are: Thailand 55%, Viet Nam 14%, India 13%, Brazil 6%, Uruguay 4% and other partners 8% (Appendix B1).

Uganda imports most of its rice from five suppliers which include; Vietnam, Pakistan, United Republic of Tanzania, Italy and other partners. For the past 12 years (1996-2008), Viet Nam has been the biggest rice import source for Uganda contributing 37% of the total rice imports in that period. Pakistan rice accounts for 27% of the total rice imports, United Republic of Tanzania Rice accounts for 10%, and Italian rice accounts for 5%, and rice from other partners' accounts for 21% (Appendix B2).

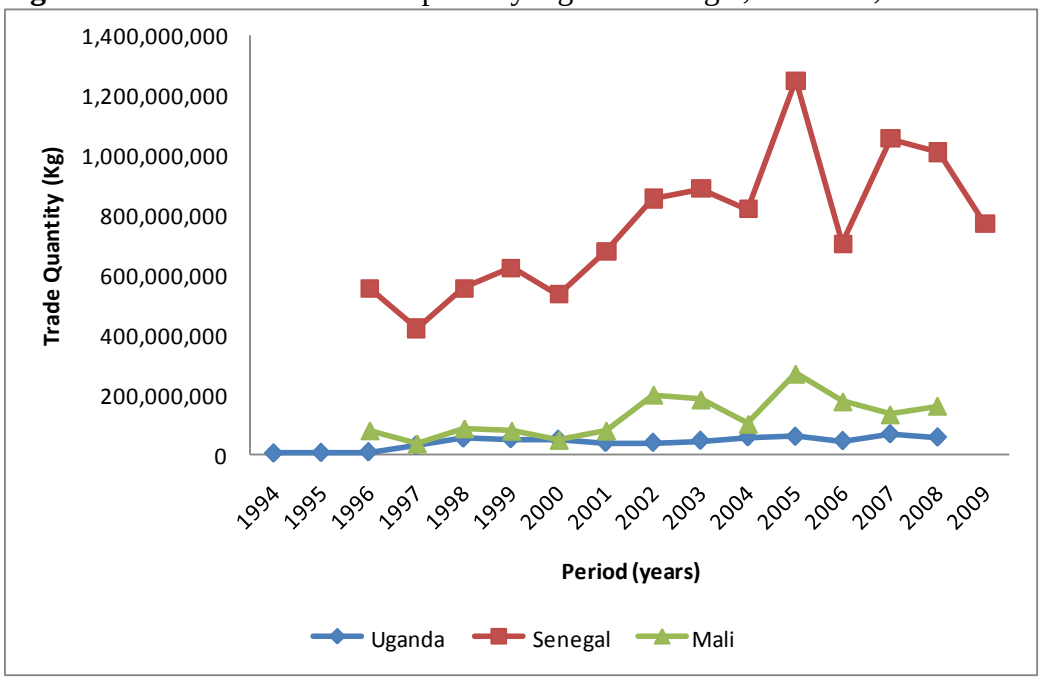
[20] A special case exists for Uganda where the reduction in rice imports are partly because of the current proliferation of the New Rice for Africa (NERICA) that was introduced in Uganda in 2000 (Muhapatra 2009; Odongola 2006; & MAAIF 2009).

Figure 1: The Trend of Rice Exports from Uganda, Senegal, and Mali, 1994 -2009



Source: UNCOMTRADE, 2010.
Note: Exports denote the sum of rice products from both local production and re-exports sold to other countries.

Figure 2: The Trend of Rice Imports by Uganda Senegal, and Mali, 1994-2009



Source: UNCOMTRADE, 2010

Like Uganda and Senegal, Mali also imports most of its rice from Asian countries. Based on overall volumes contributed since 1996 (1996-2009), India is the largest supplier contributing

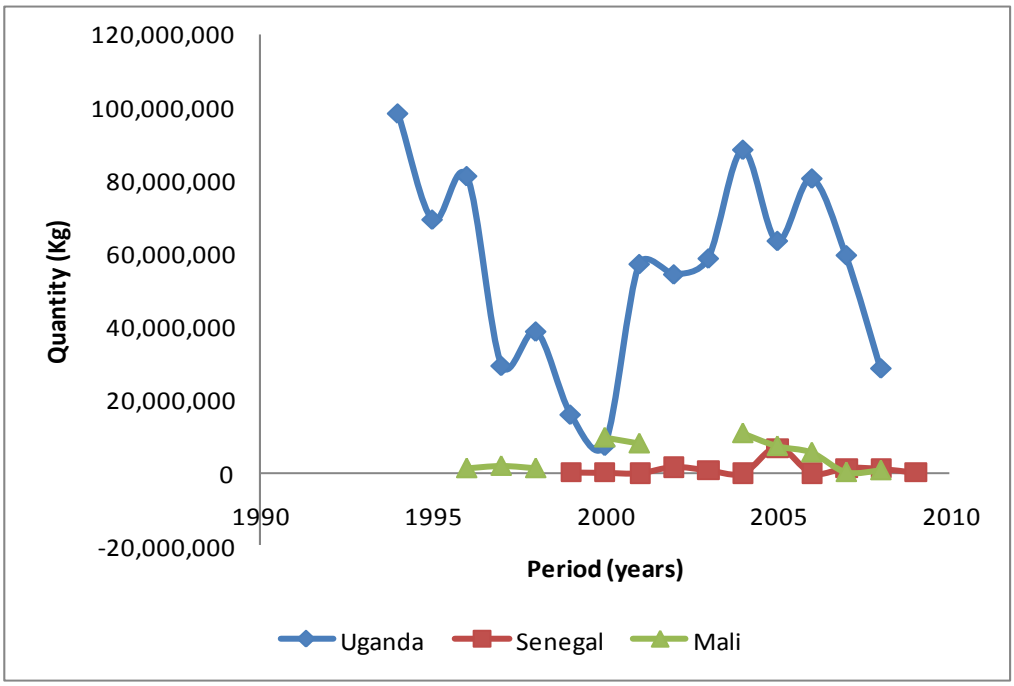
about 29 % of the rice, Thailand 21%, Viet Nam 15%, Pakistan 11%, China 6% and other countries 18% (Appendix B3).

4.2 Exports and Imports of Maize (Corn)

Overall, maize exports have declined in Uganda, Senegal and Mali (figure 3). Also, of the three countries, Uganda takes the leading position in the export of Maize. However, not all maize comes from local production; volumes are composed of re-exports which have contributed varying quantities over the years. For example in 2000, maize re-exports made up to 44.7% of total maize exports, 26.4 % in 2001, 23.5% in 2002, 33.3% in 2003, 30.7% in 2004, 7.2 % in 2005, 5% in 2007, and 1.3% in 2008. The proportion of re-exports has declined over time together with exports from local production since the overall exports have also declined. Uganda's main destination countries include; Democratic Republic of Congo, Rwanda, Kenya, Burundi, United Republic of Tanzania, and other partners each accounting for 22%, 21%, 20%, 17%, 7%, and 13% of the total trade value respectively, for the time period 1994/2008.

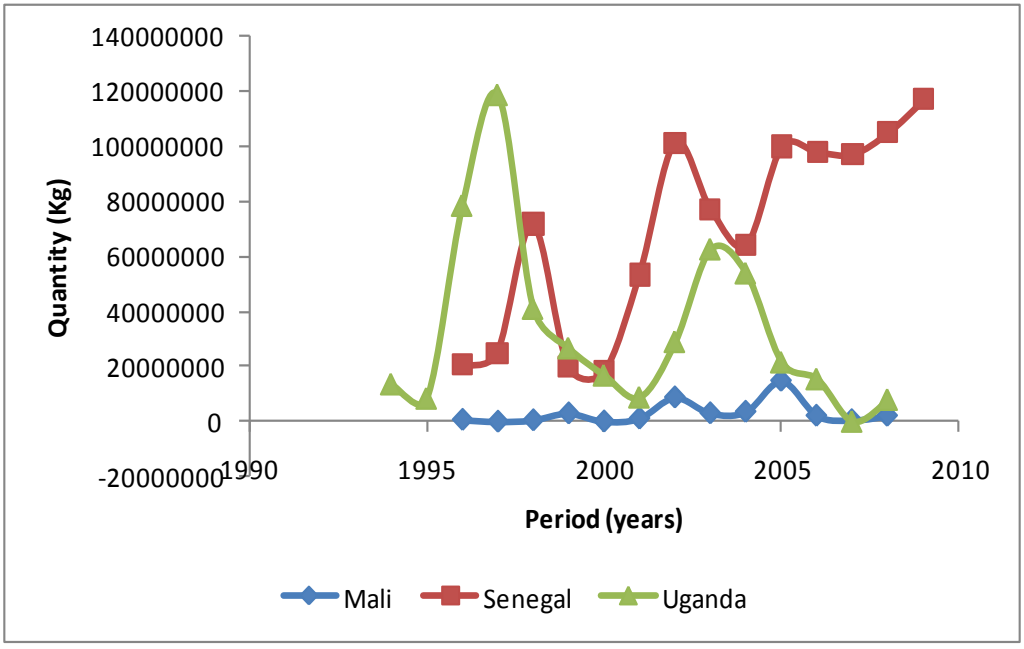
Senegal's exports are heavily dependent on own production except for 2002 when the exports consisted of 49.4% maize re-exports. Main destination countries include; Mali (47%), United Kingdom (19%), Algeria (10%), Cape Verde (9%), France (7%), other partners (8%). In the same way, Mali exports maize to its neighbors solely from own production. In the years 1996/2008, Mali's main destination countries constituted of Niger (30%), Cote dlvoire (28%), Senegal (23%), Burkina Faso (9%), Mauritania (8%) and other partners (2%).

Figure 3: The Trend of Maize Exports from Uganda, Senegal, and Mali, 1994-2009



Source: UNCOMTRADE 2010

Figure 4: The Trend of Maize Imports by Uganda, Senegal, and Mali, 1994-2009



Source: UNCOMTRADE 2010

On the import side, Uganda and Mali have reduced their maize imports drastically since 2004. In Uganda, Maize imports kept on declining until they reached their lowest value in 2007 and then started rising again by 2008. Mali's maize imports started declining in 2000s until 2007 and rose again in 2008 (Figure 4). Senegal imports maize from Argentina, United States, Brazil, France, South Africa, and other partners with these contributing 70%, 10%, 7%, 4%, 3% and 6% respectively of the total value of maize imported in the time period. Likewise, Uganda imports maize from United States, Italy, Kenya, United Kingdom, So. African Customs Union, and other partners with these countries contributing 37%, 34%, 16%, 4%, 3% and 6% of the total trade value respectively. Mali's maize imports for the period 1996/2008 came from Senegal, Cote d'lvoire, Burkina Faso, Argentina, France, and other partners.

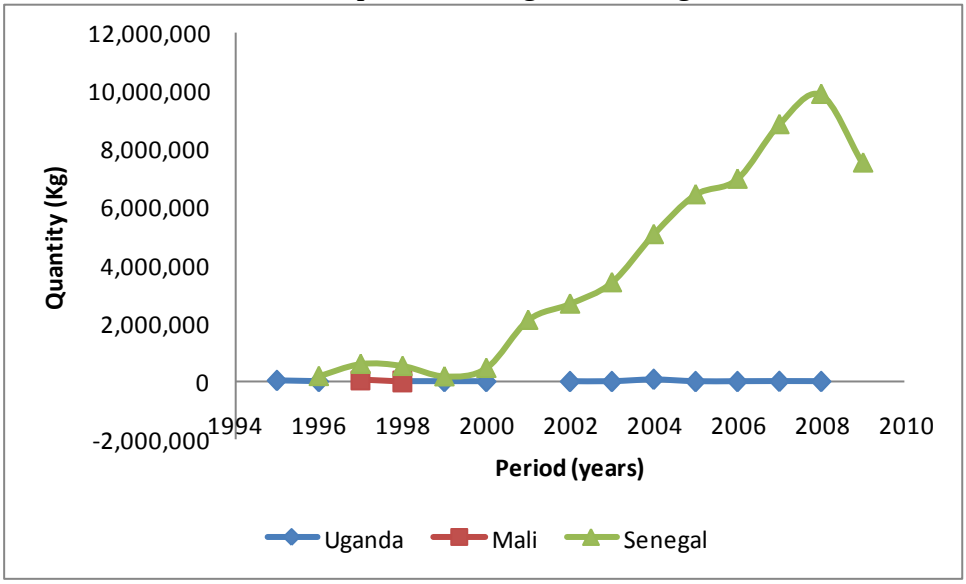
4.3 Exports and Imports of Tomatoes (fresh tomatoes and tomato products)

Tomatoes are not a highly traded crop. According to the United Nations Commodity Statistics database (2010), Senegal has the most active trade in tomatoes of the three countries although trade quantities are on a small scale. For example, the largest quantity ever exported from Senegal is 9,901,269 kg and this happened in 2008 (figure 5). From 1996 to 2009, Senegal's major destination countries for its tomato exports were; France, Germany, United Kingdom, Netherlands, Belgium, and other partners. However, most of the tomatoes were taken to France which accounted for 62% of the total value of tomatoes exported in the period. Other countries contributed; 12% German, 9% United Kingdom, 6% Netherlands, 6% Belgium, and 5% Other partners. Also, Senegal's tomatoes exports are from own production for all the years except 2006 when it re-exported 479 US dollars worth of tomatoes (approx 300kg).

In Uganda, tomato exports are on and off and are in very small quantities indicating that the industry is still very small. The major trade partners with their respective contributions in terms value of tomatoes purchased for the time period 1995-2008 include; Belgium-Luxemburg (47%), Rwanda (24%), Democratic Republic of Congo (20%), Oman (3%), Kenya (3%), and other partners (3%). With the small locally produced quantities, Uganda has not had many re-exports. It is reported that there are only two incidences of re-exports which contributed only 2.95% in 2000 and 42.1% in 2004 of the total quantity exported.

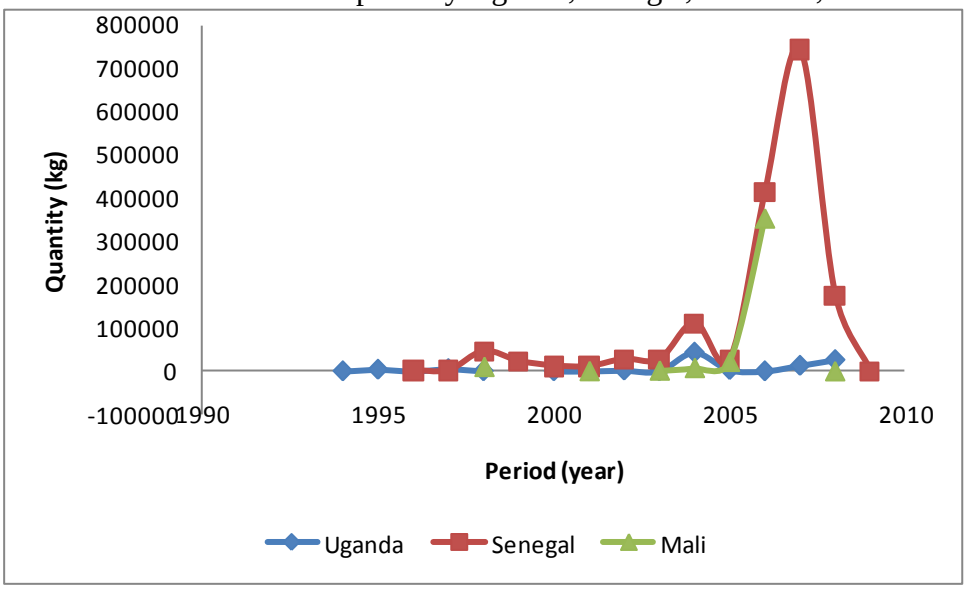
There are few tomato imports, with small inconsistent volumes across the three countries (figure 6). Senegal imports tomatoes from Morocco, France, Spain and other partners with Morocco contributing 82 % of the total value of imports and France, Spain and other partners contributing 8%, 5%, and 5% respectively. Uganda's main suppliers with their relative importance in terms of amounts sold include: Kenya (46%), United Arab Emirates (32%), Italy (15%), and Other partners (7%). In Mali, tomatoes are imported from Burkina Faso, areas, not elsewhere specified , Gambia and Other partners each accounting for 77%, 12%, 10%, and 1% of the total trade value (measured in US dollars) respectively.

Figure 5: The Trend of Tomato Exports from Uganda, Senegal, and Mali, 1994-2009



Source: UNCOMTRADE 2010

Figure 6: The Trend of Tomato Imports by Uganda, Senegal, and Mali, 1994-2009



Source: UNCOMTRADE, 2010

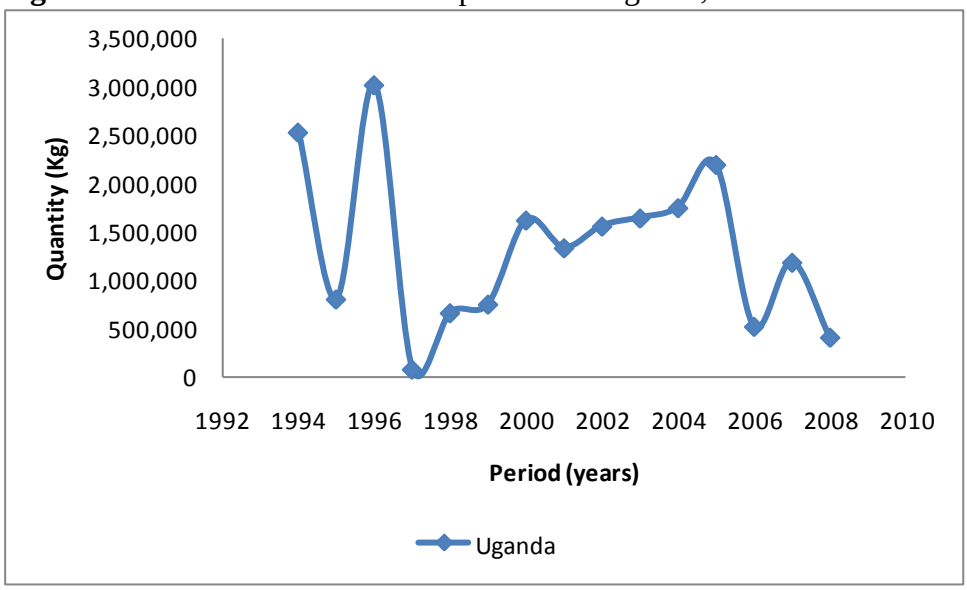
4.4 Exports and Imports of Plantain

Of the three countries under consideration, Uganda takes the leading position in exporting Plantain (Figure 7). Mali exported plantain for only two years; 2001 and 2003 while Senegal Participated in three years; 2005, 2007 and 2008. Uganda exports plantain to United Kingdom, Kenya, Belgium, Switzerland Netherland, and Other partners. For the time period from 1994 to 2008, United Kingdom was the largest importer accounting for 58% of the total value of the plantain exports while Kenya, Belgium, Switzerland, Netherlands and other partners represented 33%, 3%, 2%, 1% and 3% respectively.

Plantain imports are highly variable in Mali but almost steadily increasing in Senegal for the years 1996 to 2009 (Figure 8). There are few instances where Uganda imported plantain and the sources are reported to be South Africa (79%), China, Hong Kong SAR (12%), Areas not elsewhere specified (6%), and Kenya (3%). The largest supplier for both Senegal and Mali is Côte d'Ivoire which supplies almost 100% of the plantain imported in both countries. Other suppliers for Mali include; Areas not elsewhere specified, Burkina Faso, Togo and Guinea while those of Senegal include; Cameroon, France, Ghana, Guinea, and Other partners.

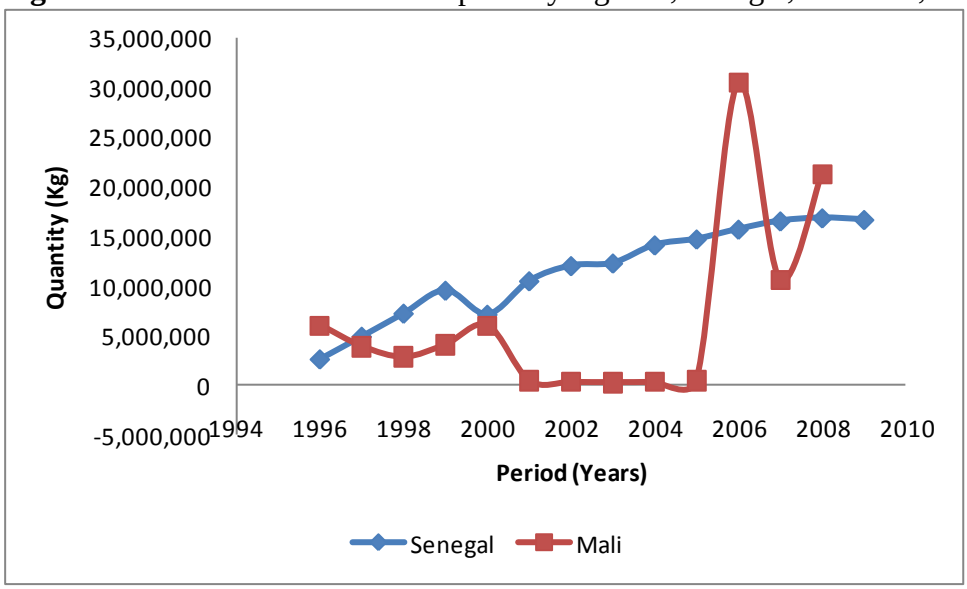
A consistent observation of agricultural trade in these countries is that Uganda is only trading with fellow East African countries while Senegal and Mali trade with their neighboring West African countries and others. This may be contributing to the clear difference in food security status between the West and East African countries. As indicated earlier most of the West African Countries are food secure while East African Countries are food insecure.

Figure 7: The Trend of Plantain Exports from Uganda, 1994-2009[21]



Source: UNCOMTRADE 2010

Figure 8: The Trend of Plantain Imports by Uganda, Senegal, and Mali, 1994-2009



Source: UNCOMTRADE 2010

[21] Mali and Senegal are not represented because they do not export planatains

Chapter 5: Survey Data and Results

This section describes the data and summarizes the responses obtained during the surveys conducted in Uganda, Senegal, and Mali. Data are described per country. This information is intended to provide an overview of the technical measure regimes currently in place in the three countries. Understanding the status of these measures in these countries is key to understanding their impact on trade for agricultural products. The surveys targeted both exporters and importers of major food staples and their supporting institutions both private and public.

5.1 Description of the Data Collection Procedure in Uganda

The data described were collected in a person-to-person interview survey. The major aim of the survey was to collect information and create an understanding of the existing technical measures (SPS and TBTs) that are used in the trade of agricultural products. Two kinds of data were collected; primary and secondary. The primary data were collected through interviews with the individuals from companies involved in the agricultural trade. Similarly, the secondary data were collected through interviewing individuals from different public institutions involved in trade. These interviews provided existing legal documents related to food safety regulations. Some of these institutions included Ministry of Trade, Tourism, & Industry (MTTI), Ministry of Agriculture Animal Industry & Fisheries (MAAIF), Ministry of Finance, Planning, & Economic Development, Bank of Uganda, and Uganda National Bureau of Standards (UBOS).

The sample of companies surveyed was purposively selected from a list of trading companies in Uganda. The list was obtained from the Uganda Export Promotions Board. The list contains a total of 382 registered companies, of which, 80 were found to be dealing with agricultural products. Because the study focuses on four crops: maize, rice, tomatoes, and

plantain, only 37 companies were considered to be appropriate for the interviews. However, only 20 company representatives were interviewed. The other 7 respondents were from institutions providing support to the companies. The interviews were conducted with a structured questionnaire (See Appendices D1 and D2[22]).

5.1.1 A Qualitative Analysis of the Survey Data

Importers and institutions

In general, a large share of agricultural products crossing the boarders of Uganda from (and/or to) the surrounding countries such as Kenya, Tanzania, Burundi, Southern Sudan, and Democratic Republic of Congo move through informal means. This means that no technical measures (SPS and TBTs) affect this kind of trade. All companies dealing with formal markets, especially outside of Africa, were found to have structures that they use to meet the requirements in the partnering countries. Also, different companies face different requirements depending on the nature of the client or target market.

The respondents represented companies that have been in business for an average of 8 years, although this value is influenced by two firms that reported 25 years in business. The minimum time of operation was 2 years and the maximum was 25 years. Seven out of the 14 exporting companies export maize, 6 export rice, 1 exports tomato & tomato products, and 8 export plantain and plantain products. Major export destinations were classified as African or non-African. Among the African destinations, the most frequently reported ones included Kenya, Southern Sudan, DR. Congo, Rwanda, Burundi, and Tanzania. The non African destinations included Italy, Netherlands, United Kingdom, France, Denmark, United Arab Emirates, Belgium, Poland, Ireland, German, and the United States. On the import side, five companies

[22] Questionnaire in Appendix D1is for the importers and D2 is for the exporters.

reported being importers of rice, and none was found to be importing tomatoes, maize, or plantain. The reason given is that products like tomatoes, maize, and plantain are imported from neighboring countries at a very small scale. Such products are imported through informal channels where no record is taken or documents required. The rice importers reported their major rice sources as Viet Nam, Pakistan, Thailand, and India (see table 18 for the summary).

Institutionally, these companies are supported by the Uganda Export Board. This is a government body which was created in 1969 as a council and later became a Promotions Board in 1983. This agency is mandated to help exporters with issues concerned with finding and accessing international markets. However, at the present, the roles and activities have changed as they depend on the funding by private donors due to insufficient funding from the government. Exporters also work with the Ministry of Agriculture, and Ministry of Trade. Technically, some private companies are currently in place and have established laboratories to provide technical services such as food composition testing, as a partial fulfillment of the requirements imposed by foreign markets. These companies include; CHEMIPHOR, SGS, INTERTEK, BUREAU VERITAS and the Uganda National Bureau of Standards laboratory (UNBS) (UNBS laboratory is owned by the government).

All the respondents reported that there is no financial support for them in forms such as bank loans, grants or development funds for export promotion or development. They report that commercial banks are also not interested in lending to agricultural export related businesses due the high risks associated with them. However, some companies reported previous cases where funding was available from specified agencies. For example, in 2001, USAID supported a credit Guarantee scheme (ECGS) which was managed by the Bank of Uganda.

Table 18: Data Composition for Uganda Survey

Category of the company	No.	Products traded	Product destination or source
Total No. of Respondents	27		
No. of Export Companies	14	Maize-7 responses Rice- 6 responses Tomatoes- 1response Plantain- 8 responses	African destinations; –Kenya, Southern Sudan, DR. Congo, Rwanda, Burundi, Tanzania. Non African Destinations; -Italy, Netherlands, United Kingdom, France, Denmark, Unite Arab Emirates, Belgium, Poland, Ireland, German, USA.
No. of Importing Companies	3	Rice – 5 Companies Maize- None Tomatoes- None Plantain-None	Viet Nam, Pakistan, Thailand, and India.
Both Importing and Exporting Companies	3		
Local Producing Company	1		
Respondents from supporting organizations	6		

Source: Survey data, 2010

The scheme was aimed at providing investment loans to export companies. The support was to cover 75% of the likely risks in the export business, leaving commercial banks with the obligation to cover the other 25%. In 1991, there was the Export Refinance Scheme (ERS). Also, in 1995, the APEX program from the European Investment Bank provided loans to private export companies dealing in traditional exports. The most recent program was in 2006 from the USAID-APEP program. This program funded 50 % of company budgets whose proposals met the requirements of the program.

There seem not to be any stringent quantitative restrictions on the amounts of agricultural imports allowed into the country. On the other hand, importers reported that the Government of Uganda requires them to have an import permit. Detailed in this document are amounts allowable within a specified period of time, normally 6 months. Importers are not allowed to go beyond these amounts. However, the amounts allowed within this period tend to be large enough that it is not very restrictive. In addition, the permit is only valid for six months. The importers of rice noted that in 2008, the Government of Uganda, together with the other countries constituting the East African Community (EAC), instituted a 75% import duty (common external tariff) on any local sales of imported rice. They also noted that this tariff is a government initiative to promote local rice production. Consequently, local rice appears cheaper, making local sales of imported rice almost zero. Most of the imported rice is currently destined for re-export and is not subject to the tariff.

To check respondents' awareness of SPS and TBT measures, they were asked questions which checked their knowledge to make sure they can report the technical measures they face in their operations appropriately. Fourteen out of the 20 company respondents were aware of food

safety standards, one respondent had never heard about them, while the rest did not provide a response (not sure). The 5 rice importers reported that until 2009, the technical measures (SPS and TBTs) included checking for parameters like expiration dates, presence of live pests, quantities and the kind or variety of the rice imported, and labeling requirements. In cases of suspicion, a check would normally be made with a microbial test after which a certificate (release certificate) that indicates whether or not the food products presented is fit for human consumption. However, recently, there is a new policy that was put forward by UNBS starting from June 2010. This policy requires that before importing food items, the importer must have a certificate of conformity. All imports are required to be subjected to import verification at the country of origin. Also, products are required to be certified as conforming to international standards and only results from three laboratories; SGS, BV, and Chemiphar, appointed by UNBS are accepted.

Importers report required documents to successfully import agricultural products. These documents include an import permit, Phytosanitary certificate, a fumigation certificate, certificate of origin, certificate of analysis, packing list, and a commercial invoice in addition to the certificate of conformity introduced in June 2010. The import permit is obtained from the Ministry of Agriculture Crop Protection Department. This document specifies the amounts of imports that are allowed within the 6 months period, the address of the consignee, the conditions under which the consignment must be and the necessary tests that must be carried out once the consignment gets to the border. The exporting country must then issue a Phytosanitary certificate. The Phytosanitary certificate indicates how the requirements indicated in the import permit have been met by the exporting country. This document is followed by confirmatory documents for the necessary tests such as certificate of analysis and certificate of Origin. The

fumigation certificate is very important especially for cereals in an unprocessed form. If products are found with live pests, the importer is required to fumigate the products before entry is permitted at his or her own cost.

More important to note is that the need for testing produce in the laboratory only arises when there is suspicion about the consignment or a global alert for a particular kind of food, i.e. the case of Chinese powdered milk. Otherwise, imports are passed based on physical inspections. This kind of inspection is done with the help of basic equipment such as a hand lens or a magnifying glass, spatula, and a shovel. If there is a cause for suspicion, (i.e. abnormal or altered physical appearance) the products are required to undergo a laboratory test in one the laboratories appointed by the UNBS. For rice in particular, if the need for testing arises, there are set quality parameters or safety parameters to refer to as detailed in the rice standard such as heavy metals, and other contaminants and toxins, microbial levels as set by the UNBS, and pesticide residue levels (according to CODEX - rarely called for - nonexistent). However, since all these tests require more detailed lab studies and resources, the inspectors normally let the products pass based on physical examinations unless there is a serious suspicion.

Four of the six importers reported that they were aware of international standards such as CODEX and ISO standards. The importers also noted that these kinds of standards are not followed in Uganda. However, responses from the institutional bodies revealed that most of the international standards were tailored to suit the Ugandan situation. In addition, standards that have not been localized are those that are not commonly used or necessary. Even for those standards that are localized, there are still some that are difficult for the government to implement especially those requiring laboratory testing. This is because there is currently no technical and financial capacity to sustain the procedures. Apart from the pre-verification

certificate of conformity introduced in 2010 for ensuring that imports conform to international standards, there is no other international standard requirement for food related imports.

Importers also reported that there are no private standards in Uganda. This means that there are no groups of consumers or groups of retail markets with special food safety requirements. Overall, Ugandan importers don't face limitations or difficulties in complying with technical (SPS & TBTs) measures in Uganda. This is because the most of the countries that export to Uganda are more advanced and thus their products are of acceptable quality.

To obtain more specific details, the technical measures were classified into those required to ensure food safety, ensure animal and plant health, ensure quality or proper technical attributes, and to protect the environment. Measures considered to ensure food safety were classified as pesticide residue limits, microbial standards, and mycotoxin levels. Those that are required to ensure animal and plant health included only fumigation requirements. The quality and or proper technical attributes were measured with requirements associated with quality grades, GMO labeling, and restrictions on animal feed ingredients. Finally, the parameters related to environmental protection included existence of a Bio-safety law and codes for organic practices and certification.

Pesticide residue limits do not apply to Ugandan imports due to lack of both financial and technical capacity to carry out the testing. For the case of rice however, the importing companies surveyed have branches in different countries so this provides a basis for some level of trust. To meet the microbial standards requirements, importers are required to present the certificate of analysis from the country of origin. In case the importer doesn't have one, then a sample is taken for analysis in one of the public laboratories while the consignment is held at the border. Such analysis takes about 4 to 6 months and all costs are born by the importer. Therefore, importers

are strictly advised to have the necessary documents before they import, especially for agricultural products which are perishable. Unfortunately, there are no records kept to show the number of rejections based on this parameter. With mycotoxin levels, it is reported that Uganda has difficulty setting these standards. This is because Uganda has a very favorable climate and environments for the growth of moulds, insects, and other microbes responsible for contaminating food. Therefore, Ugandan products are much more likely to be contaminated with mycotoxins compared to similar products from other countries. This vulnerability is largely attributed to the poor post-harvest handling practices such as poor storage, product management practices including moisture content, and hygiene in addition to the tropical climatic conditions. Therefore in situations where a reference is required, CODEX standards are used. However, mycotoxin levels are not an important requirement for Ugandan imports because Uganda does not normally import maize or nuts that could harbor mycotoxins. There are some standards in place based on CODEX levels which can be referenced if a need arises.

Because the study is mainly focusing on foods of crop origin, in the classification of animal and plant health protection only measures related to plant health protection were considered. The commonly used measure for unprocessed cereal crops is fumigation. All six respondents who represented importing companies reported that they have to ensure that their products are free from live pests or must have their products fumigated prior to importing them. In addition, the government of Uganda requires that importers fumigate their products with aluminium phosphate. This requirement also applies to food that arrives as food aid.

With quality or technical attributes, aspects such as quality grades, GMO labeling, and restrictions on animal feed ingredients were considered. Responses obtained from the supporting institutions indicated that at the inspection level, quality grades are not a concern as long as the

product is fit for human consumption. It is also stated clearly and it is well known country wide that GMOs are not allowed in Uganda. Furthermore, there are restrictions on animal feed ingredients. Animal feed ingredients with animal parts in them are not allowed in the country. Such parts were reported as blood, bones, and other related animal parts. Considering environmental protection requirements, Uganda has a bio-safety law and Genetically Modified Organisms are not allowed into the country.

In trying to pin down a specific technical requirement, maximum residue limits were given attention. This is because they are a major concern in developed nations like those of the European Union who are the largest importers of African agricultural produce. Surprisingly, responses from the supporting institutions revealed that there are no set maximum residue limits in Uganda. Thus no monitoring is done in this area. However, the Ministry of Agriculture instituted the Uganda Chemicals Board (UCB) which is responsible for regulating agricultural chemicals in Uganda. Although some laboratories have been established, they are not yet used regularly. In addition, the laboratories have been put in place by private companies due to private sector demand for documentation in their export markets. The public laboratories that are in place are not used regularly because of financial constraints and the current absence of technical expertise.

Uganda has not yet participated in any international efforts to harmonize technical measures (SPS and TBTs). It is reported that participation in such efforts requires a country to have something on the ground as a reference point. Thus the interest in being involved in such efforts is minimal since only decisions of countries with some experience and empirical data to demonstrate their arguments are considered. Nevertheless, there have been some internationally funded projects and programs that aimed at boosting agricultural trade and helping farmers

improve their standards of living through market access. Such programs include Export Promotions for Organic Products from Africa (EPOPA), Agricultural Productivity Enhancement Program (APEP), Pesticide Initiative Program (PIP), East African Grain Council (2007), East African Business Council (2009), and the East African Farmers Federation.

Exporters and institutions

Fourteen export companies were surveyed in addition to the three companies that engaged in both the export and import business. Some of these companies export three of the products; others two, while others reported one product. Seven respondents exported maize, six exported rice, one exported tomatoes, and 8 exported plantain and bananas. There are no regulatory restrictions imposed on the amounts of agricultural exports by the Ugandan Government. Respondents mention limitations posed by environmental, transportation (air craft space), and allowable volumes on the import permits. Three exporters reported changes in their destination countries and nine exporters had not made any changes in their destinations. Those that reported changes gave reasons such as some buyers offer a one-time business and they never send requests again, especially those in German and United Kingdom.

Food safety requirements were reported by crop. The requirements for maize were reported as moisture content, packaging requirements, and hygiene requirements. Rice faces packaging requirements, labeling requirements, hygiene requirements, and fumigation requirements. Tomatoes product like concentrate require a certificate of product with a quality mark from the Uganda National Bureau of Standards (UNBS). The plantain and bananas face hygiene rules, packaging requirements, certification requirements, traceability requirements, and labeling on each box with a batch number.

With the exports especially those of rice and maize, the requirements are normally detailed in the import permits of the importing countries. Therefore, different countries may have different requirements. However, countries to which Uganda exports were reported to have similar measures as those in Uganda. Also, these countries rely on physical checks to let products across their borders. Other exporters with products destined for markets outside Africa reported compliance requirements. Those requirements include traceability, pesticide residue limits, organic certification, and others depending on the buyer.

Like importers, exporters reported a list of documents needed to have their products exported. These include an export license or movement certificate, a valid organic certificate (for exporters targeting organic markets), and a Phytosanitary certificate. The exporter of tomatoes reported that tomato products need to be tested before they are exported. The parameters checked (with their recommended levels) include the total plate count (<10cfu/g), yeast and moulds (<1 cfu/g), and E. coli (mpn/g). For plantains and bananas, only products such as plantain chips especially dried and frozen, require testing. These are tested for Staphylococcus (cfu/g) -1000 maximum, total coliform (mpn/g)-100 maximum, and Escherichia coli (mpn/g)- <3. No tests are required for rice and maize exports apart from those destined to Sudan and Kenya where a certificate of analysis is required. The exporters also noted that before exporting their products, the requirements indicated on their import permits must be met. Compliance for these conditions is met with a Phytosanitary certificate.

To identify the level of awareness of food safety standards, respondents were asked whether they have ever heard about food safety standards. They were also asked to identify the difference between international, public, and private standards by giving examples of each. Twelve respondents said they had heard about food safety standards and 5 said they had not. The

twelve outlined an overall list of international standards that included codex standards, EU food laws and standards, Global Good Agricultural Practices (Global Gap), National Organic Program (NOP), Hazard Analysis and Critical control Point (HACCP), and Good Manufacturing practices (GMP). Seven of the respondents reported having requirements to meet them while ten did not give a response. The difficulties in complying with these standards are mainly due to limited access to certification. It is reported that only two kinds of certificates are available in Uganda, the Organic and the Global Gap certificates.

5.2 Description of Data Collection Procedure in Senegal

The data was collected in four major sites; Dakar, Pikine, Pout, and Thiess. A total of forty one respondents participated in the survey. The respondents constituted both traders (i.e., exporters and importers) and representatives from the Senegalese department of domestic and international trade. The trade participants for this survey were identified by using a list of trading companies in Senegal which was provided by the Chamber of Commerce and Industry of Senegal. This list contains twenty four companies which deal in agricultural trade. Of these, four importers and nine exporters were surveyed. Since the number of traders dealing with agricultural produce is small, random selection was not possible. Respondents were selected for the interviews based on agricultural commodities chosen for this study including tomatoes, plantain, maize and rice. The interviews were administered through the use of a questionnaire[23]

Other respondents from the supporting institutions included those from the Ministry of Commerce and of small and large enterprises, Ministry of Agriculture and Livestock, Ministry of Environment, Ministry of Economy and Finance, Ministry of Interior, and Quality Control Laboratories. These made a total of seventeen respondents and these provided information on

[23] See sample copy of the questionnaire in Appendix D1 for the importers and D2 for the exporters.

regulations followed in the country that would otherwise be difficult to obtain from the other categories of respondents. Each ministry was represented by participants from different departments. For example, the Ministry of Commerce and Small and Large Enterprise was represented by respondents from four departments; the department of domestic trade; the department of international trade; the Chamber of Commerce and Industry of Senegal, and the Regulation Unit of the Department of Domestic Trade. Also, three national labs were visited and these include Quality and Quarantine Laboratory (Phytosanitary Department –DPV), ITA (Laboratory of Processed Foods Analysis), and the Laboratory of quality control of the Ministry of Commerce.

5.2.1 A Qualitative Analysis of Survey data

Eight importers were surveyed but only four provided responses. The average number of years in business for these four importers is around twelve years with a maximum of twenty one and minimum of four years in business. These importers reported private partnering companies which include NIDERA HOLDING SA, CPINTER TRADE (THAILANDE), CIC INTERNATIONAL, PUNJABI, AGROSEMS, and SEACOR (USA).These importers trade in maize, rice, tomatoes, and none of them deal in plantain or bananas. All the four importers import rice and only in the form of grains. Two of them import maize grain and none for the maize flour. Only one importer deals with tomatoes and these are imported in a processed form e.g., canned tomatoes. (See table 19 for the summary). These products are sourced from seven major suppliers which include: Thailand, Viet Nam, Argentina, USA, Uruguay, Pakistan, and Egypt.

Interviews with government officials from the sanitary and phytosanitary unit, quality control Labs, and the trade regulation unit revealed that that the government has imposed some measures on food or agricultural imports to protect animal and human health. The restrictions include animal products such as dairy products from china and a ban on beef and poultry imports due to rinderpest and Avian influenza. Generally, however, the restrictions are imposed to protect local markets. In 2009, the Morocco traders blocked the Senegalese traders from accessing the Morocco vegetable market. As a result, Senegal traders retaliated by imposing technical measures related to quality requirements on Morocco tomatoes. There are also mandatory standards (such as the Senegalese paddy rice standards, Senegalese standards for fresh tomatoes for industrial processing, standards for fruits and vegetables including tomatoes for direct consumption, Senegalese standards for tomato concentrate , and so forth) that are applied to certain products such as tomato concentrate, edible oils, and so forth.

For specific details about technical measures to trade (SPS and TBT measures), the importers were asked if they have ever heard about food safety standards. They were also asked other details that involved classifying the technical measures into private, international, and public standards. Within each of these categories, measures were classified as those pertaining to food safety, animal and plant health, those for ensuring product quality and technical attributes, those for protecting the environment, and those for capturing social attributes. All the surveyed importers had heard about food safety standards but knew less about their specific details.

Table 19: Summary Statistics Results for Senegal Survey, 2010

Product	Product Categories	No. of Importers	Source Country
Maize	Maize grain	4	Thailand, Viet-Nam, Pakistan, Argentina, USA, Uruguay, Egypt,
	Maize flour	2	Thailand, Argentina, Viet Nam, Uruguay
Rice	Rice grain	4	Thailand, Viet-Nam, Pakistan, Argentina, USA, Uruguay, Egypt
	Rice flour	0	None
Tomatoes	Fresh tomatoes	0	None
	Canned tomatoes	1	Thailand, Viet-Nam, Pakistan, Egypt,
	Tomato Concentrate (Tomato paste and puree)	1	Thailand, Viet-Nam, Pakistan, Egypt,
	Tomato juice	0	None
	Dried Tomato	0	None
	Highly seasoned (Sauce and Ketchup)	0	None
Plantain	Plantain Chips	0	None
	Fresh fingers	0	None
	Plantain Four	0	None

Note: Some importers import more than one commodity; the values reported are per commodity.

The private standards related to food safety regulations were classified to include such parameters as pesticide residue limits, microbial standards, traceability requirements, hygiene requirements, and mycotoxin standards. The importers acknowledged that Senegalese consumers have not made the step of developing or pushing the government to develop such measures. Thus microbial standards, traceability requirements, hygiene requirements, and mycotoxin standards that are privately imposed do not exist in Senegal. Therefore, there are no effects on imports stemming from these measures. Other private standards related to Animal health, Quality and technical, environment protection, and social aspects also seem to be non-existent in Senegal. Therefore in general, there are no privately imposed standards in Senegal.

The four categorizations of international standards investigated include: food safety requirements; animal and plant health protection requirements; product quality and technical attributes; and regulations for protecting the environment. With the international standards for ensuring food safety, four parameters were looked at and these include: codex pesticide residue limits; codex microbial standards; ISO 9000 standards to facilitate quality management; and codex mycotoxins. ISO 9000 standards concern the processes through which an organization manages its work but may not directly impact the end product. Three of the importers reported that microbial standards and mycotoxin levels are not a requirement and that ISO 9000 is one of the adopted international standards required when importing rice, maize and tomatoes in Senegal.

The public standards considered include national set maximum residue limits, microbial standards, traceability requirements, hygiene requirements, mycotoxin levels, plant material quarantine, pest risk analysis, fumigation requirements, Phytosanitary certificates, general

labeling requirements, packaging standards, and pesticide use restrictions. Three of the importers reported that hygiene requirements, pest risk analyses, Phytosanitary certificates, labeling requirements and packaging requirements are mandatory requirements when importing agricultural and food products in Senegal. The remaining requirements were not found to be important.

The country has 11 inspection points and 25 inspectors. The inspection points are at the Port, Airport, Railway Station in Dakar Bargny, Kaola, Tamba, Zinginchor, Kolda, Senegal Rosso, Kidira, Diaobé. The country has also established national labs and the importers are required to carry out or provide confirmatory test results. However the importers of maize, rice and tomatoes interviewed had no knowledge of which tests are required or done. It turns out that these traders do not pay attention to the details of what tests are actually done. All that is important to them is the conformation that their imports are fit for human consumption and that they are allowed for distribution in the country.

This gap in information was covered by consulting the national laboratories that are mandated to carry out such analyses. The country has quite a number of them such as the Quality Labs of the ministry of commerce, Food quality control Lab of DPV, Pesticide residues lab (Cerex-Locustox), the four laboratories of the Institute of Food technology - the food chemistry lab; Mycotoxins lab; the plant health analysis lab; and Microbiology lab. The responses from the microbiology laboratory showed that the country has not yet established national standards to deal with microbiological issues. The Senegalese Association of Standards (ASN) mandated with developing such specific standards is still in its initial stages. However, at the regional level, the West African Economic and Monetary Union (WAEMU) procedures are underway.

The mycotoxin lab deals with testing mycotoxins in food such as aflatoxins. The commodities of interest include maize. The analyses are based on international standards such as the ISO and CODEX standards. The inspectors collect samples at the entry points of 7.5 kg per ton, or 30kg per ton of product for mycotoxin analysis. The food quality control lab is responsible for the analysis of products imported or manufactured locally. There is monitoring done in the country to regulate the sale of unsafe products. This is done by monitoring both the producers during the production phase and the products already in circulation. The laboratory is accredited with ISO 17025 requirements. However, the lab is not equipped for testing or working with GMOs. The laboratory cooperates with other labs in the region such as those in Morocco. At the regional level, UEMOA has developed and established community standards.

The government of Senegal requires the importers of food products to have some documentation for their imports. These documents include a certificate of origin, certificate of analysis (this is obtained after testing the products), Phytosanitary certificate, and an import certificate. Certifications such as the organic certificates, HACCP certificates, and fumigation certificates are not required. Most of the food grains are required to be of grade A or B[24].

A more detailed analysis was conducted for food safety standards. These were categorized as international, public, and private food safety standards. For international standards, the importers were asked to identify the standards or regulations that are familiar to them[25]. In this way, they would identify standards that are more troublesome or costly. A list of

[24] Grade A: high-quality rice with less than 10% of broken grains. Grade B: 15-20% broken (Medium-quality rice) Grade C: 25% up to 100% broken grains (low-quality rice). Note: Consumers in Senegal prefer broken rice (which is internationally recognized as the lowest quality). Thus in Senegal, there are some small industries that break grade A and B rice in order to have broken rice needed by the market.

[25] International standards are developed and disseminated by international governmental and non-governmental standards development organizations, such as International Standardization Organization, International Electro technical-Commission, the International Telecommunication Union or Codex Alimentarius. These international standards are voluntary standards. At the international, regional or sub-regional level, harmonization of standards is done through regional standards bodies or sub-regional standards organizations.

nineteen different international standards was used. (See imports questionnaire in Appendix D1). The measures or standards the importers identified include ISO 9000 and Codex labeling requirements.

On the export side, nine traders were interviewed with an average of 12 years of experience in the field of trade. The minimum number of years of experience is 2 years and the maximum is 28 years. There are three government agencies that are partnering with these traders and they include Ministry of commerce Senegal, French Cooperation, and Canadian Cooperation. Other partnering private institutions include EXOFARM, DOLE FRANCE, COMPAGNIE FRUITIERE (France), Netherland government, ENDA/SISPRO, GDS-FILFILI, NIDERA, CPINTER TRADE (Thailand), CIC International, SOCAS, PUNJABI, SEACOR (USA), and the Moroccan government. These exporters also reported their export destinations as being United Kingdom, France, Mali, and Cape Verde, Guinea Bissau, Belgium, Italy, Morocco Spain Gambia, Mauritania, and Niger.

Most of the trade restrictions the Senegal exporters face are regulatory in nature or standards related. For example, the European importers (i.e., United Kingdom, France, Italy, Belgium, Holland and Netherland) require Senegalese exporters to comply with the EU standards, Global Good Agricultural Practices (Global GAP), private standards such as the Tesco Natures Choice (TNC), British Retail Consortium (BRC), and Ethical Trading Initiative (ETI). The Other African importers (such as Mali, Gambia, Guinea Bissau, Morocco, Niger and Cape Verde) do not have strict standards to follow but have restrictions which may not be classified as standards but impact trade. Such restrictions include custom procedures, bureaucracies, time wasting road blocks and so forth. Further, there are no restrictions on the amount of exports the

traders wish to export (i.e. quotas). However, it is reported that the government banned the re-export of cereals in 2008 to the sub-region. The intention was to ensure food security in the country due to the food insecurity threats that arose as a result of the high food prices during that time.

The interviews involved five exporters of fresh tomatoes, one exporter of dried tomatoes, one exporter of canned tomatoes, three exporters of tomato concentrate, three exporters of maize grain, three exporters of rice grains, and one exporter of plantain chips. No exporters could be found for tomato juice, tomato sauce/ ketchup, maize flour, rice flour, plantain figures and plantain flour. See table 20(a) for the summary.

Concentrating on food safety standards, the results show that eight out of nine exporters had heard about food safety standards and five of these reported their major customers as being chain retailers. Others also reported Processing companies in the region, wholesalers in Mali, Morocco, Gambia, and Guinea Bissau. Five of the nine exporters reported that their products need to comply with the EU maximum residue limits and four exporters reported traceability requirements on their exports to United Kingdom, France, Netherland, and Italy. See table 20(b) for more food safety requirements and destination countries imposing them.

The public standards that were reported include; two for maximum residue limits, one for Microbial standards, four for EU food laws, hygiene requirements, two for mycotoxin, two for quarantine requirements, four for pest risk analysis, two for fumigation analysis, four for Phytosanitary certificate, four for labeling requirements, packing requirements, and two for pesticide use restrictions (see tables 20 (c) for international standards and 20 (d) for the public standards).

Table 20a: Summary results for the exporters and products dealt in, 2010

Product	Product Categories	No. Of Exporters	Export Country
Tomatoes	Tomato fresh	5	France, Netherlands, Morocco,
	Dried tomato	1	France, Italy, Spain, Germany, UK, Netherlands
	Canned tomato	1	Guinea Bissau, Gambia, Mauritania,
	Tomato Juice	0	-
	Tomato concentrate (Ketchup and sauce)	3	France, Mali, Italy, Guinea Bissau, Spain Germany, UK, Netherlands, Mali, Morocco, and Mauritania
Maize	Maize grain	3	United Kingdom, France, Netherlands, Spain, Mauritania, Guinea Bissau, Cape Verde, Mali, Niger, and Morocco
	Maize flour	0	-
Rice	Rice grain	3	Mali, Guinea Bissau, Gambia, Mauritania, and Niger
	Rice four	0	-
Plantain or Bananas	Plantain fingers	0	-
	Plantain chips	1	Belgium, France, Holland
	Plantain flour	0	-

Note: The number of exporters does not add up to nine because some companies deal with more than one product. So the numbers shown are per product.

Table 20(b) Private Food Safety Requirements and Importing Countries Imposing the Measures, Senegal 2010

Measures	No. of exporters	Importing countries imposing them
Hygiene requirements	4	Italy, France, Belgium, Netherlands, Spain, Germany, United Kingdom
Mycotoxin	2	France, Italy, Netherlands, Spain, Germany, United Kingdom
Quarantine requirements	2	France, Italy, Netherlands, Spain, Germany, United Kingdom
Pest risk analysis	4	France, Italy, Netherlands, Spain, Germany, United Kingdom
Fumigation requirements	3	France, Italy, Netherlands, Spain, Germany, United Kingdom
Phytosanitary certificates	4	Italy, France, Belgium, Netherlands, Spain, Germany, United Kingdom
Quality grades	4	Italy, France, Belgium, Netherlands, Spain, Germany, United Kingdom
Labeling requirements	4	Italy, France, Belgium, Netherlands, Spain, Germany, United Kingdom
Packaging requirements	4	Italy, France, Belgium, Netherlands, Spain, Germany, United Kingdom
Pesticide use restrictions	4	Italy, France, Belgium, Netherlands, Spain, Germany, United Kingdom
Water and soil contamination	4	Italy, France, Belgium, Netherlands, Spain, Germany, United Kingdom
Organic certification	3	United Kingdom, France, Italy, Netherlands, Spain, Germany
GMO labeling	3	United Kingdom, France, Italy, Netherlands, Spain, Germany
Accountability 8000	3	France, Italy, Netherlands, Spain, Germany, United Kingdom
Marine stewardship initiative	2	France, Italy, Netherlands, Spain, Germany, United Kingdom
Child labor Restrictions	3	France, Italy, Netherlands, Spain, Germany, United Kingdom
Occupational health standards	4	Italy, France, Belgium, Netherlands, Spain, Germany, United Kingdom
Global GAP standards	5	Italy, France, Belgium, Netherlands, Spain, Germany, United Kingdom
British retail consortium (BRC)	3	United Kingdom, France, Italy, Netherlands, Spain, Germany
Tesco Natures Choice,	2	United Kingdom, France, Italy, Netherlands, Spain, Germany
Ethical trading initiative (ETI)	3	United Kingdom, France, Italy, Netherlands, Spain, Germany
Save quality food program	1	United Kingdom, France, Italy, Netherlands, Spain, Germany

Note: Other private standards such as *terre et Saveur of Casino, Filiere Agriculture Raisonnee of Auchan, Qualite of Carrefour,* do not apply.

Table 20 (c): International Standards, Affected Products and the Importing Countries Imposing them, 2010

Measures	No. Reporters	Products Affected	Importing Countries
Maximum residue limits,	5	Fresh tomatoes, Dried tomatoes, Maize grain, & Rice grain	France, Cape Verde, Italy, Guinea Bissau, Belgium, Germany, United Kingdom, Netherlands, Spain, Morocco & Mauritania
Microbial standards	2	Fresh tomatoes, tomatoes concentrate, maize grain, & rice grain	France Cape Verde, Italy, Guinea Bissau, Spain, Germany, United Kingdom, Netherlands, Mali & Niger
ISO 9000	5	Rice grain, Maize grain, dry tomatoes, tomato concentrate	France, Mali, Cape Verde, Belgium, Italy, Netherlands, Guinea Bissau, Germany & Spain
Mycotoxin levels,	3	Fresh tomatoes, tomatoes concentrate, maize grain, & rice grain	France Cape Verde, Italy, Guinea Bissau, Spain, Germany, United Kingdom, Netherlands, Mali, Niger, & Mauritania
ISO2000,	4	Rice grain, Maize grain, dry tomatoes, & tomato concentrate	France, Mali, Cape Verde, Belgium, Italy, Netherlands, Guinea Bissau, Germany & Spain
HACCP	4	Fresh tomatoes, Dried Tomatoes, Tomato concentrate, Maize grain, Rice grain & Plantain chips	France, Cape Verde, Belgium, Netherlands, Italy, Guinea Bissau, Spain, United Kingdom, Mali, & Mauritania.
Good Manufacturing Practices	4	Rice grain, Maize grain, dry tomatoes, & tomato concentrate	France, Mali, Cape Verde, Belgium, Italy, Netherlands, Guinea Bissau, Germany & Spain
Codex Labeling requirements	6	Fresh tomatoes, Dried Tomatoes, Tomato concentrate, Maize grain, & Plantain chips	France, Mali, Cape Verde, Belgium, Italy, Netherlands, Guinea Bissau, Germany, and Spain
Codex processed tomato concentrates standards	2	Fresh tomatoes, Dried Tomatoes, Tomato concentrate,	France, Italy, Spain, Germany. United Kingdom, Netherland, Mali, Morocco, Mauritania.
Codex standard for maize corn-1995	1	Maize	Mali, France, Cape Verde, Guinea Bissau, Gambia, Niger, Mauritania
Codex rice standard	2	Rice	Mali, France, Cape Verde, Guinea Bissau, Gambia, Niger, Mauritania

Note: HACCP stands for –Hazard Analysis and critical Control point. is a systematic preventive approach to food safety and pharmaceutical safety that addresses physical, chemical, and biological hazards as a means of prevention rather than finished product inspection.

Table 20 (d): Public Standards, Affected Products and the Importing Countries Imposing them, 2010

Measure/ Standard	No. of reporters	Products Affected	Countries imposing the measure
Maximum residue limits	2	Fresh tomatoes, dry tomatoes, tomato concentrate, maize gain, rice grain	France, Italy, Netherlands Spain, Germany, United Kingdom, Mauritania. Mali, and Morocco
Microbial standards	1	Fresh tomatoes, dry tomatoes, tomato concentrate	France, Italy, Netherlands, Spain, Germany, United Kingdom, Mauritania, Mali, & Morocco
EU food laws	4	Fresh tomatoes, dry tomatoes, tomato concentrate, maize gain, rice grain	France, Italy,dNetherlands Spain, Germany, United Kingdom, Mauritania. Mali, and Morocco, Guinea Bissau, & Gambia
Hygiene requirements	4	Fresh tomatoes, dry tomatoes, tomato concentrate, maize gain, rice grain	France, Italy, Netherlands Spain, Germany, United Kingdom, Mauritania. Mali, and Morocco, Guinea Bissau, & Gambia
Mycotoxin	2	Fresh tomatoes, dry tomatoes, tomato concentrate, maize gain, rice grain	France, Italy, Netherlands Spain, Germany, United Kingdom, Mauritania. Mali, and Morocco
Quarantine requirements	2	Fresh tomatoes, dry tomatoes, tomato concentrate, maize gain, rice grain	France, Italy, Netherlands Spain, Germany, United Kingdom, Mauritania. Mali, and Morocco
Pest risk analysis	4	Fresh tomatoes, dry tomatoes, tomato concentrate, maize gain, rice grain	France, Italy, Netherlands Spain, Germany, United Kingdom, Mauritania. Mali, and Morocco, Guinea Bissau, & Gambia
Fumigation analysis	2	Fresh tomatoes, dry tomatoes, tomato concentrate, maize gain, rice grain	France, Italy, Netherlands Spain, Germany, United Kingdom, Mauritania. Mali, and Morocco
Phytosanitary certificate	4	Fresh tomatoes, dry tomatoes, tomato concentrate, maize gain, rice grain	France, Italy, Netherlands Spain, Germany, United Kingdom, Mauritania. Mali, and Morocco, Guinea Bissau, & Gambia
Labeling requirements	4	Fresh tomatoes, dry tomatoes, tomato concentrate, maize gain, rice grain	France, Italy, Netherlands Spain, Germany, United Kingdom, Mauritania. Mali, and Morocco, Guinea Bissau, & Gambia
Packing	4	Fresh tomatoes, dry tomatoes,	France, Italy, Netherlands Spain, Germany, United

requirements			tomato concentrate, maize gain, rice grain	Kingdom, Mauritania. Mali, and Morocco, Guinea Bissau, & Gambia
Pesticide restrictions	use	2	Fresh tomatoes, dry tomatoes, tomato concentrate, maize gain, rice grain	France, Italy, Netherlands Spain, Germany, United Kingdom, Mauritania. Mali, and Morocco

The exporters also noticed changes in the measures and regulations they face. For example, the requirement to comply with the British Retail Consortium (BRC) spread from the individual market that developed it to the rest of the United Kingdom markets. The exporters also recognized that the private standards are more difficult to comply with.

However, when asked, most exporters did not know the specific details of the nature of the tests they were required to conduct. Exporters typically rely on the institutions to do their paper work and analysis whereas the business people involved in trade are more concerned about delivering their produce to markets without paying much attention to specific product requirements. One exporter reported a requirement to have an organic certificate for their products. Six of the nine exporters need an export certificate, two of the exporters have to be HACCP certified, six of the exporters need global gap certification, and three of the exporters need a Tesco Natures choice certification to get to export their product.

Eight out of the nine exporters surveyed mentioned that their export destination countries, especially those in Europe, monitor maximum residue limits. However the exporters cannot tell if the measures imposed on their exports are administered according to the Codex international standards or consumer protection needs.

These survey results show that Senegal has some food safety infrastructure in place (such as Laboratories, certification bodies and private institutions). However, more remains to be put in place to match the existing technologies in the developed world. Also, at the local level, the traders who are one of the major stake holders in meeting the food safety requirements seem not to appreciate what food safety standards really are. Some training tailored to improve on their knowledge related to these standards is expected to produce positive results. Some of the challenges identified by the traders include poor analysis technologies for most of the products

(for example the analysis is based on physical observations) and failure to have consistent documents on time.

5.3 Description of Data Collection Procedure in Mali

The study was conducted in two cities; Bamako and Baguineda. The survey targeted supporting institutions (local and international) and traders; both importers and exporters. The institutions interviewed included: The Ministry of Agriculture, Livestock, and Fishing; Ministry of Health; Ministry of Economy and Finance; and Ministry of Industry and Small and Medium Scale Enterprises. The exporting and importing organizations included: Association of Young Exporters (AJEX), Afrique Verte, Association of Producer Exporters (APEX), Malian Association of Fruits and Vegetable Exporters (AMELEF), Malian Association of Producers and Exporters of Fruits and Vegetables (APEFEL), Fruits and Vegetables of Mali (FRUITLEMA), and Association of Professional Farmers Organizations (AOPP). Finally, international institutions included: IICEM, and PCDA. Some responses were obtained from local traders of rice and maize in Bamako, Baguineda, and Niarela markets. A total of six exporters and four importers were surveyed

Overall, most of the trade in Mali is informal. There are no restrictions on imports of rice apart from high import tariffs. Because Mali is a landlocked country, all the products that it imports go through ports of other countries which impose certain restrictions on them. Internally, Mali takes the measures of the countries through which goods are received as equivalent. Importers reported that the only documents that accompany their imports of rice are: the specification of the amount of rice, the proportion of breakage, the origin of the produce, and the expiration date. The importers of plantain, which mainly comes from Cote d'lvoire, only

need an import permit and a Phytosanitary certificate which is accessible at Géguoua- the border between Mali and Cote d'Ivoire. Also, the importers of tomatoes noted that they only need a Phytosanitary certificate from the Phytosanitary Department (OPV) and the approval from the Bureau Inspection Valuation Assessment Control (BIVAC) which controls the quality of the goods.

There are no major restrictions on agricultural exports apart from the 2007/2008 ban the government put on grain exports. This was intended to ensure food security in the country. Otherwise, the exporters are only required to have the required documentation as dictated by the different partnering countries. Some of these documents include: Phytosanitary certificate issued by the Department of Agriculture, and Certificate of Origin issued by the Department of Domestic Trade and Concurrence **(**DNCC).

The traders interviewed mentioned that they have heard about food safety regulations and standards but none of the measures or standards listed in the questionnaire applied to their trade. It turns out that most of the trade between Mali and its neighbors is informal with no serious regulations followed. The challenges reported included bureaucratic customs procedures, police harassment and time-wasting police checks (road blocks). The traders also noted that the country lacks well formulated quality criteria which the traders can use to grade their product and sell accordingly. Currently, judgments are based of physical measures such as color, presence or absence of stones, or chuff which are not well developed.

Chapter 6.0 Methodology for Quantitative Analysis

6.1 The Gravity Equation

The concept of the gravity model utilizes the gravitational force analogy to explain volumes of trade, capital flows, and migration across countries. In its simple form, the gravity model of international trade predicts that bilateral trade flows are proportional to the economic size of the importing and exporting country and inversely related to the distance between the two countries (Helpman, 1987; Tinbergen, 1962; Bergstrand, 1989). In a cross section setting, the simplest specification of the gravity model takes the following form:

5) $X_{ij} = \beta_0 (GDP_i)^{\beta 1} (GDP_j)^{\beta 2} (DIST_{ij})^{\beta 3} \varepsilon_{ij}$

Where: X_{ij} is the value of bilateral trade (in current prices) from exporter *i* to the importer *j*, GDP_i ((GDP_j) is the level of nominal or real gross product in country i (j), $DIST_{ij}$ is the bilateral geographical distance between the economic centers of countries i and j, and ε_{ij} is assumed to be a log normally disturbed error term. After taking natural logs of equation (1), the specification becomes:

6) $\ln X_{ij} = \ln \beta_0 + \beta_1 \ln GDP_i + \beta_2 \ln GDP_j + \beta_3 \ln DIST_{ij} + \ln \varepsilon_{ij}$

The intuition suggested by these two equations is that $\beta_1 > 0$, $\beta_2 > 0$ & $\beta_3 < 0$. The coefficient β_3 represents the trade friction resulting from trade costs especially transportation costs.

The gravity model has had various applications in international trade. The model has been used to deduce trade flow effects of institutions such as customs unions, international borders, religion, ethnic ties, communication links, cultures, and multilateral trading blocs. For

example, Helpman (1987) used the gravity model to study trade within and outside OECD countries, McCallum (1995) used the gravity model to study trade within and between Canadian provinces and US states, Rose (2004) used the gravity model to study the impact of multilateral trading systems such as the WTO and the Generalized System of Preferences extended by developed nations to developing countries, and Rauch and Trindade (2002) used the gravity model to study Ethnic Chinese networks in international trade.

The specification of the gravity model for use in studying international trade flows started with Tinbergen (1962). His specification included the three variables in equation (5) & (6) in addition to a fourth variable (A) that accounts for other variables that are either promoting or restricting trade as is shown in the following equation:

7) $X_{ij} = \beta_0 (GDP_i)^{\beta 1} (GDP_j)^{\beta 2} (DIST_{ij})^{\beta 3} (A_{ij})^{\beta 4} \varepsilon_{ij}$

As Bergstrand (1985) notes, this same specification was used in Poyhonen (1963a, 1963b), Pulliainen (1963), Geraci and Prewo (1977), Prewo (1978), and Abrams (1980). In all these studies, the gravity model proved successful in fitting the data with high levels of statistical explanatory power. Despite this success, the absence of a strong theoretical foundation limited its application for predictive purposes.

This void spurred a stream of literature that has tried to provide a theoretical foundation for the gravity equation (Anderson, 1979; Bergstrand, 1985; Bergstrand, 1989; Anderson and van Wincoop, 2003). Anderson (1979) provided the first formal theoretical gravity estimation which he derived based on Cobb-Douglas preferences and on the properties of the constant elasticity of substitution (CES) expenditure system where goods are differentiated by country of origin.

Bergstrand's contribution provides a wide exploration of approaches to determine the theoretical foundation of bilateral trade flows. First, Bergstrand (1985) uses the constant elasticity of substitution preferences over Armington-differentiated goods to derive a reduced form equation for bilateral trade involving price indices. He uses GDP deflators to calculate the price indices and he estimates the system of equations in order to test the assumption of product differentiation. Further extensions to Anderson's work which includes Bergstrand, (1989) and Deardorf, (1998) preserves the CES preference structure and adds monopolistic competition or a Heckscher-Ohlin structure to explain specialization for each variety.

6.2 Mathematical Derivation of the Gravity Model

The most recent derivation of the gravity model is provided by Anderson and van Wincoop (2003), who derive a one sector general equilibrium model in which goods are differentiated by country of origin with identical homothetic preferences approximated by a constant elasticity of substitution (CES) utility function. Under the assumption of monopolistic competition and complete specialization, they derive a theoretically consistent way to estimate gravity equation coefficients in a cross-section setting. Another important contribution made by Anderson and Van Wincoop is the identification of an omitted variable bias.

The issue is that after controlling for economic size, most gravity estimations include a remoteness variable related to distance to all trade partners but do not account for multilateral resistance that each trading partner faces from all other countries. Failure to account for this resistance results into biased estimates. Trade depends not only on the bilateral barriers separating *i* and *j* but also on the multilateral price indices they face with their partners in the rest of the world (multilateral resistance).

Although the Anderson and Van Wincoop gravity model is a one sector model, it still provides a useful framework from which to extend the analysis to the product level or industry level. Chen and Novy (2008) extended Anderson and Van Wincoop's model to industry level analysis. This thesis outlines a gravity model for agricultural products aggregated at the HS4 product level following Anderson and Van Wincoop and Chen and Novy. There are 217 HS4 agricultural products and they are denoted by *k.* Anderson and van Wincoop assumed that goods are differentiated by place of origin, each region is specialized in the production of only one good, the supply of each good is fixed, and that there are identical homothetic preferences approximated by a constant elasticity of substitution utility function. These assumptions are considered below.

If C_{ij}^{k} is the consumption of HS4 product *k* from country *i* by country *j* consumers, X_{ij}^{k} is the nominal value of exports from country *i* to country *j* of HS4 product k, and consumers in country j spend an amount X_j^k on HS4 product *k* and that their preferences over all the HS4 products can be expressed by a constant elasticity of substitution (CES) utility function as:

$$8) \qquad C_j^k = \left(\sum_{i=1}^{j} (C_{ij}^k)^{\frac{\sigma_k - 1}{\sigma_k}}\right)^{\frac{\sigma_k}{\sigma_k - 1}}$$

subject to a budget constraint

$$9) \qquad X_{ij}^k = p_{ij}^k c_{ij}^k$$

where σ_k is the elasticity of substitution between all goods *k* and is product specific and assumed to exceed one. Also, if the farm gate price of HS4 product *k* goods from country I is denoted by P_i^k and trade costs associated with the trade cost factor $t_{ij}^k \geq 1$ are incurred when the products are transported to country *j* such that the price face by country *j* consumers becomes $P_{ij}^k = t_{ij}^k P_i^k$, solving equations (8) and (9) yields the following demand function:

10) $$X_{ij}^{k} = \left(\frac{P_{ij}^{k}}{P_{j}^{k}} \right)^{1-\sigma_k} X_{j}^{k} = \left(\frac{t_{ij}^{k} P_{i}^{k}}{P_{j}^{k}} \right)^{1-\sigma_k} X_{j}^{k},$$

And this represents the demand side, where the price index P_j^k can be written as:

11) $$P_{j}^{k} = \left(\sum_{i=1}^{j} (P_{ij}^{k})^{1-\sigma_k} \right)^{\frac{1}{1-\sigma_k}},$$

On the supply side, if the exogenous amount of production of HS4 product *k* by country *i* firms is y_i^k, then the market clears at:

12) $$y_{i}^{k} = \sum_{j=1}^{J} X_{ij}^{k},$$

Substituting the demand function (10) into the market clearing condition (12) and rearranging the terms gives:

13) $$P_{i}^{k} = \left(\sum_{j=1}^{J} \left(\frac{t_{ij}^{k}}{p_{j}^{k}} \right)^{1-\sigma_k} \frac{X_{j}^{k}}{y_{i}^{k}} \right)^{\frac{1}{\sigma_k - 1}},$$

Substituting (13) into the demand function (10), the multilateral resistance for HS4 product *k* from country *i* is

14) $$\prod_{i}^{k} = \left(\sum_{j=1}^{J} \left(\frac{t_{ij}^{k}}{p_{j}^{k}} \right)^{1-\sigma_k} \frac{X_{j}^{k}}{y_{i}^{k}} \right)^{\frac{1}{1-\sigma}},$$

Substituting P_i^k and Π_i^k into the price index in equation (11) yields the multilateral resistance terms for HS4 product K entering the country *j* as:

15) $$P_{j}^{k} = \left(\sum_{i=1}^{J} \left(\frac{t_{ij}^{k}}{\prod_{i}^{k}} \right)^{1-\sigma_k} \frac{y_{i}^{k}}{y_{i}} \right)^{\frac{1}{1-\sigma_k}},$$

The gravity equation then becomes:

16) $$X_{ij}^{k} = \frac{y_i^k X_j^k}{y^i} \left(\frac{t_{ij}^k}{P_j^k \prod_i^k} \right)^{1-\sigma_k},$$

The estimation in (16) means that after controlling for size, bilateral trade also depends on the bilateral trade barrier between *i* and *j* relative to the product of their multilateral resistance indices. A higher multilateral resistance of the importer *j* raises its trade with *i*. Also a high multilateral resistance of the exporter *i* raises trade.

6.2.1 Cross Section Data Issues

As mentioned in chapter 3, the trade data used in this thesis is cross sectional. This cross-sectional sample provides us with a snapshot understanding, at that one point in time (2004 in this case). Therefore we cannot know based on one a cross section sample if the impact of NTMs (i.e., technical and non-technical measures) is increasing or decreasing over time. Although the variability in NTMs imposed by importing countries is not expected to be that much, results obtained with this kind of data can only explain the situation for only 2004 with confidence.

6.2.2 Excluding Zeros Issues

Recent findings (I.e., Santos Silva and Tenreyro, 2006; Martin and Pharm, 2008) reveal that excluding zero trade flows may lead to biased estimates due to sample selection. The issue is that excluding zero flows from the model makes the bilateral trade conditional on a trade relationship occurring. According to Santos Silva and Tenreyro (2006), zero trade flows arise in sample data are a result of data entry errors, editing errors or no trade between the countries in the bilateral pair. These zero trade flows are quite common in trade analyses for example, in Santos Silva and Tenreyro data almost half of the trade flows are zero. These zero trade flows are even more frequent in analyses using disaggregated data because there are many factors (the

ones in mind are: geography, climatic conditions, level of development, consumer preferences, and culture) may determine whether the product can be produced by the exporting county or can be acceptable by the importing country. Given the possibility of getting biased estimates, the results obtained in this study may also be biased since the zero trade flows are not considered.

6.3 Empirical Approach

Feenstra (2004) notes that while complete specialization can be achieved in various ways; the constant elasticity of substitution (CES) monopolistic competition model provides a handy way to derive the gravity equation. This is particularly true when transportation costs and other trade barriers are introduced in the estimation. Once these costs and barriers are introduced, prices must differ internationally and the overall price indexes have to be taken into consideration. Earlier works assumed identical prices across countries (McCallum, 1995). Three methods can be used to account for overall price indexes in each country. These methods include: using published data on price indexes (Bergstrand, 1990); using the computational method of Anderson and van Wincoop (2003) which solves a non-linear system of equations subject to each country's unobserved but endogenous multilateral prices; or using the country fixed effects to measure importer and exporter price indices. The computation approach followed by Anderson and Van Wincoop is quite complex as it uses non-linear estimation. Feenstra provides an alternative approach that uses country-specific fixed effects. The advantage with this approach is that the gravity model can be estimated with Ordinary Least Squares (OLS) and the resulting estimates are still consistent. Feenstra's approach is adopted in this thesis.

6.3.1 Benchmark Specification

Various specifications of the gravity model are estimated to identify and quantify the impact of NTMs on agricultural trade. From equation (16), the basic gravity specification for this study is specified as:

$$\log X_{ijk}^{HS4} = \alpha_0 + \beta_1 \log GDP_i + \beta_2 \log GDP_j + \beta_3 \log dist_{ij} + \beta_4 cbord_{ij} + \beta_5 colonlink_{ij} + \beta_6 comlang_{ij} + \beta_7 RTA_{ij} + \beta_8 tar_{ijk}^{HS4} + \beta_9 NTM_{ijk}^{HS4} + \varepsilon_{ijk}^{HS4} \quad (17)$$

where: X_{ijk}^{HS4} is the value of agricultural imports of country *j* from exporting country *i* at the Harmonized System of Classification at the four digit level (HS4-digit level). GDP_i (GDP_j) is the gross domestic product of the exporting (importing) country. These variables are used to proxy for the economic size of the exporter (importer). They are measured in terms of United States dollars at current prices and it is expected that the larger the country the more it will export (import).

$dist_{ij}$ is the natural log of geographical distance measured in kilometers between the most populated cities of the importing country *j* and the exporting country *i*. It is used to proxy for trade costs mainly the transportation costs. Greater distances between countries are expected to affect trade negatively due to the high transaction costs associated with larger distances.

$cbord_{ij}$ is a dummy variable equal to unity if both countries in the bilateral pair share a common border and zero otherwise, $colonlink_{ij}$ is a dummy variable equal to unity if both countries in a bilateral pair have ever had a colonial relationship and zero otherwise, $comlang_{ij}$ Is a dummy variable equal to one if both countries in the bilateral pair have a common official language. These three variables are expected to promote trade.

tar_{ijk}^{HS4} is the HS4 tariff imposed by the importing country *j* on exports from the exporting country *i*. Recall, the tariff data are taken from the Market Access Maps dataset at the HS6-digit level. These tariffs are aggregated to the HS4 digit level using two approaches: the import weighted and the simple average. These approaches are used in separate estimations for comparison purposes. The tariffs are added in order to be able to separate the impact of tariffs from that of the NTMs. Moreover, if tariffs were not included in the analysis then the specification would suffer from omitted variable bias because it would not be possible to uniquely identify the trade impacts of NTMs.

NTM_{ijk}^{HS4} is a variable used to account for the existence of NTMs notified by the importing country *j*. This variable is estimated using four different types of variables: a simple dummy variable equal to one whenever an NTM is notified by the importing country at the HS6 digit level, a coverage ratio, frequency index, and *ad valorem* equivalents of NTMs. ε_{ijk}^{HS4} is an error term which is assumed to be normally distributed.

RTA_{ij} is a dummy variable equal to unity if the two countries are in a regional trade agreement and zero otherwise. The results obtained by Grant and Lambert (2008) and Magee (2008) reveal that regional trade agreements have a positive and significant impact on agricultural trade. In this study, three different types of regional trade agreements are used to construct the RTA dummy so as to control for the regional biases in agricultural trade. The three different types of regional trade agreements are: customs unions (CU), free trade agreements (FTA) and partial scope agreements (PSA)[26]. For all three types of regional trade

[26] The Regional Trade Agreements (RTAs) chosen for this study are those that are reported to have been in force by the year 2004. However, some of the RTAs reported in the WTO RTA database have members varying by original signatories and current signatories. For some cases it is very difficult to tell when the additional members joined or the original members left the RTA. For such cases the current signatories are considered. Particular attention is paid

agreements, only RTAs that were in force by the year 2004 are considered[27]. For example, SACU is an intra African Customs Union which began 2004, but it is considered for this analysis because, according to Magee (2008), there are significant anticipatory effects of regional trade agreements, with trade estimated to increase by 26% on average in the four years preceding the start of a trade agreement.

Fourteen customs unions are considered and these include: East African Community (EAC), Economic and Monetary Community of Central Africa (CEMAC), Economic Community of West African States (ECOWAS), West African Economic and Monetary Union (WAEMU), Southern African Customs Union (SACU), Caribbean Community and Common Market (CARICOM), Central American Common Market (CACM), Andean Community (CAN), Southern Common Market (MERCOSUR), the European Union (EU-25), EC-Treaty, EC-Turkey, the Gulf Cooperation council (GCC),and Eurasian Economic Community (EAEC)[28].

Twenty nine free trade agreements are considered and these include: the Common Market for Eastern and Southern Africa (COMESA), Southern African Development Community (SADC), EC-Egypt EC-Morocco, EC-Overseas Countries and Territories (OCT), EC-South Africa, EC-Tunisia, European Free Trade Association (EFTA), EFTA-Morocco, Pan Arab Trade Area (PAFTA), EFTA-Mexico, Canada-USA (CUSA), NAFTA, EC-Mexico, Canada-Chile, Chile Mexico, Colombia-Mexico, EFTA-Chile, USA-Chile, EFTA-Singapore, EFTA-Israel, EFTA-Jordan, EC-Israel, USA-Israel, Jordan-USA, Turkey-Israel, Israel-Mexico and Australia- New Zealand (ANZCERTA), and ASEAN Free Trade Area (AFTA)[29].

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to the agreements made by the European Union and other countries for example EC-Morocco. In this case the EU-25 is considered in addition to the county to which preferences are extended in this case Morocco.

[27] The Regional Trade Agreements are obtained from the World Trade Organization Regional Trade Agreement online database accessible through; http://rtais.wto.org/UI/PublicMaintainRTAHome.aspx

[28]See Appendix A5 for the details about these Customs Unions.

[29] See details in Appendix A5

Six Partial Scope Agreements (PSA) are considered and they include: the Global System of Trade Preferences among Developing countries (GSTP), Protocol on Trade Negotiations (PTN), Latin American Integration Association (LAIA), Asia Pacific Trade Agreement (APTA), Economic Cooperation Organization (ECO) and the South Pacific Regional Trade and Economic Cooperation Agreement (SPARTECA). See table 21 for the different regional trade agreements considered for Africa.

All gravity estimations are estimated using the ordinary least squares (OLS). However, various specifications are used (as shown in table 22, section 6.5.1). The benchmark specification is considered for specification one. This estimation contains no fixed effects and its used to test if the gravity model covariates exhibit the expected signs of the gravity results.

Specification 2 includes the sector fixed effects as indicated below

18) $$\log X_{ijk}^{HS4} = \alpha_k^{HS2} + \beta Z_{ij} + \beta_6 tar_{ijk}^{HS4} + \sigma NTM_{ijk}^{HS4} + \varepsilon_{ijk}^{HS4}$$

Where Z_{ij} is a list of variables including the geographical distance measured in kilometers between the most populated cities of the importing country *j* and the exporting country *i*, common border, colonial link, common language, and regional trade agreement. Essentially the list includes all the gravity model covariates varying by importing and exporting country indicated in the benchmark specification (specification 1).

Specification 3

This specification includes importer and exporter fixed effects.

19) $$\log X_{ijk}^{HS4} = \delta_j + \delta_i + \beta Z_{ij} + \beta_6 \log tar_{ijk}^{HS4} + \sigma NTM_{ijk}^{HS4} + \varepsilon_{ijk}^{HS4}$$

Specification 4

This specification includes importer, exporter, and sector fixed effects

20) $$\log X_{ijk}^{HS4} = \delta_j + \delta_i + \alpha_k^{HS2} + \beta Z_{ij} + \beta_6 \log tar_{ijk}^{HS4} + \sigma NTM_{ijk}^{HS4} + \varepsilon_{ijk}^{HS4}.$$

Specification 5

This specification includes importer, and exporter sector fixed effects. The exporter fixed effects are interacted with sector dummies as indicated blow.

21) $$\log X_{ijk}^{HS4} = \delta_j + \delta_{ik}^{HS2} + \beta Z_{ij} + \beta_6 \log tar_{ijk}^{HS4} + \sigma NTM_{ijk}^{HS4} + \varepsilon_{ijk}^{HS4}.$$

Specification 6

This specification includes exporter and importer-sector fixed effects

22) $$\log X_{ijk}^{HS4} = \delta_i + \delta_{jk}^{HS2} + \beta Z_{ij} + \beta_6 \log tar_{ijk}^{HS4} + \sigma NTM_{ijk}^{HS4} + \varepsilon_{ijk}^{HS4}.$$

Specification 7

This specification includes exporter-sector and importer sector fixed effects

23) $$\log X_{ijk}^{HS4} = \delta_{jk}^{HS2} + \delta_{ik}^{HS2} + \beta Z_{ij} + \beta_6 \log tar_{ijk}^{HS4} + \sigma NTM_{ijk}^{HS4} + \varepsilon_{ijk}^{HS4}.$$

In specifications 2 through 6, the standards errors are robust to clustering by country-pairs. The country and product sector fixed effects are included to account for country specific factors that do not vary bilaterally such as the sector level price indexes. Also, as described in the data section, the trade data and other variables such as tariffs, and ad valorem equivalents are provided at the HS6 digit level. At the product line level, there is a risk of endogeneity bias, especially in situations where the NTMs are used for protectionist purposes. Therefore the HS4 level of aggregation is chosen to reduce this bias and to maintain the variance among product groups. The same level of aggregation is used by Disdier, Fontagne and Mimouni (2008).

Table 21: African Regional Trade Agreements, 2004[30]

Type of Regional Trade Agreement (RTA)	Notification	Date of entry into force
Intra Regional Customs Union (Africa)		
East African Community (EAC)	Enabling Clause	07-Jul-2000
Economic and Monetary Community of Central Africa (CEMAC)	Enabling Clause	21-Jul-1999
Economic Community of West African States (ECOWAS)	Enabling Clause	24-Jul-1993
West African Economic and Monetary Union (WAEMU)	Enabling Clause	01-Jan-2000
Southern African Customs Union (SACU)	GATT Art. XXIV	15-Jul-2004
Intra Regional Free Trade Agreements (Africa)		
Common Market for Eastern and Southern Africa (COMESA)	Enabling Clause	08-Dec-1994
Southern African Development Community (SADC)	GATT Art. XXIV	01-Sep-2000
Extra Regional Free Trade Areas (FTAs)		
EC-Egypt	GATT Art. XXIV	01-Jun-2004
EC-Morocco	GATT Art. XXIV	01-Mar-2000
EC-Overseas Countries and Territories (OCT)	GATT Art. XXIV	01-Jan-1971
EC-South Africa	GATT Art. XXIV	01-Jan-2000
EC-Tunisia	GATT Art. XXIV	01-Mar-1998
EFTA-Morocco	GATT Art. XXIV	01-Dec 1999
Pan Arab Trade Area (PAFTA)	GATT Art. XXIV	01-Jan-1998
Partial Scope Agreement (PSA)		
Global System of Trade Preferences among Developing Countries (GSTP)	Enabling Clause	19-April-1989
Protocol on Trade Negotiations (PTN)	Enabling Clause	11-Feb -1973

Note: Libyan Arab Jamahiriya is not considered as a member of COMESA for this analysis because it joined in 2006[31]. Also, Mozambique and Tanzania are also not considered because they withdrew from COMESA in 1998 and 2000 respectively.

[30] The Enabling Clause- was adopted during the 1979 Tokyo Round of General Agreement on Tariffs and Trade (GATT) in order to allow trading preferences targeted at developing and least developed countries which would otherwise go against Article I of the GATT. The clause provides a legal basis for extending the Generalized System of Preferences (GSP) beyond the original 10 years which gave permanent validity to the GSP. The enabling clause permits developed countries to discriminate between different categories of trading partners (in particular, between developed, developing and least developed countries) which would otherwise violate Article I of the GATT which stipulates that no GATT contracting party must be treated worse than any other (this is known as most favored nation treatment). The clause therefore allows developed countries to grant preferential treatment to poorer countries, particularly to least developed countries. Paragraph 2(c) authorizes developing countries to enter into preferential trade agreements which do not meet the strict criteria laid out in GATT Article XXIV for regional free-trade agreements. It allows developing countries to enter into agreements which may be non-reciprocal, or cover a very limited range of products (which would otherwise contravene the GATT).

The GATT. Art. XXIV- stipulates the reasonable time during which the RTA must be formed. It defines the meaning of customs Union and Free trade area both of which are regional trade agreements. The article imposes obligations as the process of notification.

6.4 Hypothesis Tests

There are several ways in which NTMs may affect agricultural imports. For example, in addition to the general impact the NTMs may have, their effects may vary by the classification of the non-tariff measure (technical and non-technical measures), by NTM type under each classification (for example, under technical measures: technical measures related to product characteristics, technical measures elated to marketing requirements, technical measures related to labeling requirements, technical measures related to testing inspection and quarantine; or non-technical measures: finance measures, monopolistic measures, prohibitions, quotas for sensitive products, surveillance measures and authorization measures). The impacts of NTMs may also vary by the development status of the importer and exporter (that is, industrialized versus non-industrialized countries), geographical location of importer and exporter (that is, Americas, Africa, Asia, Europe and Oceania).

By considering these possible causes of variations in how NTMs can impact agricultural trade, together with the objectives of this thesis which were outlined in chapter one, the following hypotheses are developed to provide information on the various scenarios under which the NTMs impact agricultural trade.

Hypothesis1: The technical and non-technical measures impact agricultural trade equally.

Hypothesis 2: All types of NTMs affect agricultural trade equally

Hypothesis 3: The level of development of the exporter has no effect on its ability to meet the technical and non-technical measures of the importing countries.

Hypothesis 4: Geographical location of countries has no effect on their ability to meet technical and non-technical requirements in their import countries.

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[31]http://www.ecdpm.org/Web_ECDPM/Web/Content/Navigation.nsf/index2?readform&http://www.ecdpm.org/Web_ECDPM/Web/Content/Content.nsf/0/F625E25074D98617C12573530031E8EC?Opendocument

Hypothesis 5: The effect of technical measures on agricultural trade differs for Uganda, Senegal and Mali from other African countries and other countries in the different geographical regions. These hypotheses are elaborated as follows:

H_1: *The technical and non-technical measures impact agricultural trade equally.*

Do the impacts of technical and non-technical measures on agricultural trade differ? To test this hypothesis, the dummy variable used to account for NTMs as shown in the benchmark specification is now disaggregated into the technical and non-technical measures. The generic hypothesis is stated as: H1: $\theta_1=\theta_2$. The estimated equation for this hypothesis is specified as:

$$\log X_{ijk}^{HS4} = \alpha_{ik}^{HS2} + \alpha_{jk}^{HS2} + Z(j,i)\beta + \beta tariff_{ijk}^{HS4} + \theta_1 Tech\_NTM_{ik}^{HS4} + \theta_2 NTech\_NTM_{jk}^{HS4} + \varepsilon_{ijk}^{HS4} \quad (24)$$

Where α_{ik}^{HS2} is the exporter-sector-fixed effects and α_{jk}^{HS2} is the importer-sector-fixed effects for accounting for the multilateral resistance terms, $Tech\_NTM_{ik}^{HS4}$ and $NTech\_NTM_{jk}^{HS4}$ are the variables accounting for technical and non-technical measures respectively.

H_2: *All types of non-tariff measures affect agricultural trade equally.*

To test this hypothesis, the technical and non-technical measures are further disaggregated into the component types. For example, the technical measures include: technical related to product characteristics, technical measures related marketing requirements, technical measures related to labeling requirements, technical measures related to packaging requirements, and technical measures related to testing, inspection and quarantine. The non-technical measures include non-technical measure related to finance, non-technical measures related to surveillance, non-technical measures to authorization, non-technical measures related to quotas for sensitive

products, non-technical measures related to prohibitions and non-technical measures related to monopolistic requirements. This hypothesis involves testing if the coefficients on the dummies are significantly different from each other. This is done comparing all the measures using the pair wise approach. *The first sub-hypothesis tested states that different types of technical measures have the same impact on agricultural trade* (H_{2A}: $\gamma_\lambda = \gamma_N$, where $\gamma_\lambda \neq \gamma_N$). *The second sub-hypothesis states that all the non-technical measures have the impact agricultural trade equally* (H_{2B}: $\phi\lambda = \phi N$ where, $\phi\lambda \neq \phi N$).

The estimated equation is specifies as:

$$\log X_{ijk}^{HS4} = \alpha_{ik}^{HS2} + \alpha_{jk}^{HS2} + \beta Z_{ij} + \beta_6 \log tar_{ijk}^{HS4} + \sum_{\substack{\lambda=1 \\ (\gamma\lambda \neq \gamma N)}}^{5} \gamma_\lambda Tech_{ik}^{HS4} + \sum_{\substack{\lambda=1 \\ (\phi\lambda \neq \phi N)}}^{6} \phi_\lambda Ntech_{ik}^{HS4} + \varepsilon_{ijk}^{HS4} \quad . \tag{25}$$

where $tech_{ik}^{HS4}$ includes a list of five technical measure dummies[32] and $Ntech_{ik}^{HS4}$ includes a list of six non-technical measure dummies[33].

H3: *The level of development has no impact on way the technical measures impact trade.*

As was mentioned in the chapters 2, 3, and 4 that studies conducted to analyze the impact of technical measures (such as Disdier, Fontagne and Mimouni) report that the impacts of

[32] The technical dummies include: $Techproduct\_xtric$ a dummy =1 if technical measures related to Product characteristics exits and zero otherwise, $Tech\_Marketing$ is a dummy =1 if technical measures related to marketing requirements exist and zero otherwise, $Tech\_labeling$ is a dummy =1 if technical measures related to labeling requirements exist and zero otherwise, $Teck\_packaging$ is a dummy =1 if technical measure related to packaging requirements exist and zero otherwise, $Tech\_TIQ$ is a dummy =1 if tech measures related to testing, inspection and quarantine exist and zero otherwise.

[33] $Ntech\_finance$ is a dummy =1 if finance measure exists and zero otherwise, $Ntech\_surveillance$ is a dummy =1 if surveillance measure exists and zero otherwise, $Ntech\_Autho$ is a dummy =1 if authorization measure exist and zero otherwise, $Ntech\_QSP$ is a dummy =1 if quotas for sensitive products exist and zero otherwise, $Ntech\_prohibition$ is a dummy =1 if prohibition measures exist and zero otherwise, $Ntech\_monopoly$ is a dummy =1 if monopolist measures exist and zero otherwise.

technical measures on agricultural trade vary by development status. This hypothesis has two sub-hypotheses, the first sub-hypothesis states that: *The technical measures impact industrialized and non-industrialized country agricultural trade equally* (H_{3A}: $\Pi_1=\Pi_2$) and that: *The non-technical measures impact industrialized and non-industrialized country trade equally* (H_{3B}: $\rho_1=\rho_2$). This hypothesis enables the analysis of the overall impact of technical and non-technical measures imposed by the industrialized and non-industrialized countries overall. The estimation equation used to test this hypothesis is specified as:

$$\log X_{ijk}^{HS4} = \alpha_j + \alpha_i + \delta_k^{HS2} + Z_{ijk} + \beta_6 \log tar_{ijk}^{HS4} + \sum_{d=1}^{2} \pi_d Tech_{ijk}^{HS4} + \sum_{d=1}^{2} \rho_d Ntech_{ijk}^{HS4} + \varepsilon_{ijk}^{HS4} \quad (26)$$

where d ϵ (industrialized countries; non-industrialized countries)

$Tech_{ijk}^{HS4}$ includes two dummy variables representing the development status of the importer interacted with the technical dummy variable. $NTech_{ijk}^{HS4}$ includes two dummy variables representing the development status of the importer interacted with the non-technical measures dummy variable[34].

The second sub-hypothesis states that: *The level of development of the exporting country has no effect on its ability to meet the technical requirements of the importing country.* To test this hypothesis, the importing and exporting countries are categorized according to their level

[34] The dummy variables for technical measure are: T_tmic2_impIND (a dummy equal to one if the importing country is an industrialized country and a technical measure exists). $T\_tmic2\_impNIND$ (a dummy equal to one if the importing is non-industrialized and a technical measure exists).
The variables for the non-technical measures are: NT_tmic2_impIND (a dummy equal to one if the importing country is industrialized and non-technical measure exists). The dummy variables with non-industrialized importers are: $NT\_tmic2\_impNIND$ (a dummy variable equal to one if the importing country is non-industrialized and a non-technical measure exists).

industrialization (the industrialized and non-industrialized countries)[35]. The hypotheses tested are: *The impact of technical measures on industrialized country imports does not vary by the level of development of the exporting country* (H_{3C}: $\mu_1=\mu_2$).

The impact of technical measures on non-industrialized country imports does not vary by the level of development of the exporting country (H_{3D}: $\psi_1=\psi_2$).

The impact of non-technical measures on industrialized country imports does not vary by the level of development of the exporting country (H_{3E}: $\eta_1=\eta_2$).

The impact of non-technical measures on non-industrialized country imports does not vary by the level of development of the exporting country (H3F: $\varphi_1=\varphi_2$).

The estimated equation for this hypothesis is specified as:

$$\log X_{ijk}^{HS4} = \alpha_j + \alpha_i + \delta_k^{HS4} + \beta Z_{ij} + \beta_6 \log tariff_{ijk}^{HS4} + \sum_{dv=1}^{2}\sum_{d=1}^{2} \mu_{dvd} Tech_{jk}^{HS4} + \sum_{di=1}^{2}\sum_{d=1}^{2} \psi_{did} Tech_{jk}^{HS4} + \sum_{dv=1}^{2}\sum_{d=1}^{2} \eta_{dvd} NTech_{jk}^{HS4} + \sum_{di=1}^{2}\sum_{d=1}^{2} \varphi_{did} NTech_{jk}^{HS4} + \varepsilon_{ijk}^{HS4} \quad (27)$$

where *dv* denotes industrialized countries; *di* denotes non-industrialized countries and d ϵ (industrialized countries; non-industrialized countries). $Tech_{jk}^{HS4}$ and $NTech_{jk}^{HS4}$ includes a list of dummy variables representing the development status of the exporting country and importing country together with the type of measure (technical or non-technical measure) the importing countries notified on their imports[36].

[35] The categorization of countries according their level of industrialization is based on the United Nations Statistical data base classification of countries according to development status. Developed countries are the industrialized countries and the least developed and developing countries are the non-industrialized countries.

[36] The variables include: $T\_tmic2\_impIND\_\exp IND$ (a dummy equal to one if *j* and *i* are industrialized countries *j* a technical measure exists, zero otherwise). $NT\_tmic2\_impIND\_\exp IND$ (a dummy equal to one if *j* and *i* are industrialized countries *j* and a non-technical measures exists, zero otherwise). $T\_tmic2\_impIND\_\exp NIND$ (a dummy equal to one if *j* is industrialized and *i* non-industrialized and a technical measures exists, zero otherwise). $NT\_tmic2\_impIND\_\exp NIND$ (a dummy equal to one if *j* is

H4: *Geographical location of exporting countries has no effect on their ability to meet the technical requirements in the import countries.*

Testing this hypothesis has two stages; the first stage tests if there are differences in how geographical location of the exporter affects their ability to meet the technical requirements in the industrialized and non-industrialized importing countries. The hypotheses tested are:

The effects of technical measures on industrialized country imports from Africa and America are equal (H_{4A}: $\lambda_1=\lambda_2$). *The effects of technical measures on industrialized country imports from Africa and Asia are equal* (H_{4B}: $\lambda_1=\lambda_3$). *The effects of technical measures on industrialized country imports from Africa and Europe are equal* (H_{4C}: $\lambda_1=\lambda_4$). *The effects of technical measures on industrialized country imports from Africa and Oceania are equal* (H_{4D}: $\lambda_1=\lambda_5$). *The effects of technical measures on non-industrialized country imports from Africa and America are equal* (H_{4E}: $\vartheta_1=\vartheta_2$). *The effects of technical measures on non-industrialized country imports from Africa and Asia are equal* (H_{4F}: $\vartheta_1=\vartheta_3$).*The effects of technical measures on non-industrialized country imports from Africa and Europe are equal* (H_{4G}: $\vartheta_1=\vartheta_4$). *The effects of technical measures on non-industrialized country imports from Africa and Oceania are equal* (H_{4H}: $\vartheta_1=\vartheta_5$). Recall, the geographical locations are Americas, Africa, Asia, Europe, and Oceania, and these are grouped according to the United Nations statistical database. The estimation for the first stage is:

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industrialized and *i* non-industrialized and a non-technical measures exists, zero otherwise). $T\_tmic2\_impNIND\_\exp IND$ (a dummy equal to one if *j* is non-industrialized and *i* industrialized and a technical measures exists, zero otherwise). $NT\_tmic2\_impNIND\_\exp IND$ (a dummy equal to one if *j* is non-industrialized *i* is industrialized nation and a non technical measure exists, zero otherwise). $T\_tmic2\_impNIND\_\exp NIND$ (a dummy variable equal to one if *j* and *i* are non-industrialized and a technical measures exists, zero otherwise). $NT\_tmic2\_impNIND\_\exp NIND$ (a dummy variable equal to one if *j* and *i* are non-industrialized countries and a non-technical measures exists, zero otherwise).

$$\log X_{ijk}^{HS4} = \alpha_{ik}^{HS2} + \alpha_{jk}^{HS2} + \beta Z_{ij} + \beta_6 \log tar_{ijk}^{HS4} + \sum_{dv}\sum_{c=1}^{5} \lambda_{dvc} Tech_{jk}^{HS4}$$

28)

$$+ \sum_{di}\sum_{c=1}^{5} \vartheta_{dic} Tech_{jk}^{HS4} + \sum_{dv}\sum_{c=1}^{5} \omega_{dvc} NTech_{jk}^{HS4} + \sum_{di}\sum_{c=1}^{5} \theta_{dic} NTech_{jk}^{HS4} + \varepsilon_{ijk}^{HS4}$$

where *dv* denotes industrialized countries; *di* denotes non-industrialized countries; c ϵ (geographical locations: - Americas, Africa, Asia, Europe, and Oceania) and d ϵ (industrialized countries; non-industrialized countries). $Tech_{jk}^{HS4}$ and $NTech_{jk}^{HS4}$ constitute a list of dummy variables that vary by NTM type, development status and geographical location[37].

The second stage tests if there are differences in how geographical location impacts on the way the technical measures affect agricultural imports. This is tested with two scenarios: the first scenario involves testing if there are differences in the way the technical measures affect agricultural imports from the rest of the World to the different geographical regions. The following specific sub-hypotheses are tested. *The impact of technical measures on African agricultural imports equals the impact of technical measures on agricultural imports by other*

[37] The list of dummy variables include: $T\_tmic2\_impIND\_\exp AFR$ (a dummy variable equal to one if j is industrialized and *i* is an African country and a technical measure exists and zero otherwise). $NT\_tmic2\_impIND\_\exp AFR$ (a dummy variable equal to one if *j* is industrialized and *i* is an African country and a non-technical measure exists and zero otherwise). $T\_tmic2\_impIND\_\exp Am$ (a dummy variable equal to one if *j* is industrialized and *i* is an American country and a technical measure exists and zero otherwise). $NT\_tmic2\_impIND\_\exp Am$ (a dummy variable equal to one if *j* is industrialized and *i* is an American country and a non-technical measure exists and zero otherwise). $T\_tmic2\_impIND\_\exp Asia$ (a dummy variable equal to one if *j* is industrialized and *i* is an Asian country and a technical measure exists and zero otherwise). $NT\_tmic2\_impIND\_\exp Asia$ (a dummy variable equal to one if j is industrialized and *i* is an Asian country and a non-technical measure exists and zero otherwise). $T\_tmic2\_impIND\_\exp Eur$ (a dummy variable equal to one if *j* is industrialized and *i* is a European country and a technical measure exists and zero otherwise). $NT\_tmic2\_impIND\_\exp Eur$ (a dummy variable equal to one if *j* is industrialized and *i* is a European country and a non-technical measure exists and zero otherwise). $T\_tmic2\_impIND\_\exp Oce$ (a dummy variable equal to one if *j* is industrialized and *i* is an Ocean country and a technical measure exists and zero otherwise). $NT\_tmic2\_impIND\_\exp Oce$ (a dummy variable equal to one if *j* is industrialized and *i* is an Ocean country and a non-technical measure exists and zero otherwise). The same descriptions hold for the non-industrialized importers.

geographical regions (Americas, Asia, Europe, and Oceania). The generic hypotheses tested are; H_{4A}:$\mu_1=\mu_2$; H_{4B}:$\mu_1=\mu_3$; H_{4C}:$\mu_1=\mu_4$; H_{4D}:$\mu_1=\mu_5$. The estimation equation is specified as:

$$\log X_{ijk}^{HS4} = \alpha_{ik}^{HS2} + \alpha_{jk}^{HS2} + \beta Z_{ij} + \beta_6 \log tar_{ijk}^{HS4} + \sum_{c=1}^{5} \mu_c Tech_{jk}^{HS4} + \sum_{c=1}^{5} \sigma_c NTech_{jk}^{HS4} + \varepsilon_{ijk}^{HS4} \quad (29)$$

where c ϵ (Africa, Americas, Asia, Europe, and Oceania). $Tech_{jk}^{HS4}$ and $NTech_{jk}^{HS4}$ include a list of dummy variables which account for the impact of technical and non-technical measures on the imports of the different geographical locations[38].

The second scenario involves testing if there are differences in the way the technical measures affect African agricultural imports from the different geographical regions. This involves grouping both importers and exporters according to their geographical locations. The hypothesis tested states that the impact of technical measures on Africa's imports from Africa is equal to the impacts of technical measures on imports from other regions. The generic hypotheses tested are: The hypotheses tested state that *Africa's imports from the different geographical regions are affected equally by the technical measures to trade*. i.e., H_{4A}: $\Omega_1=\Omega_2$; H_{4B}:$\Omega_1=\Omega_3$; H_{4C}: $\Omega_1=\Omega_4$ and H_{4D}: $\Omega_1=\Omega_5$. The estimated gravity equation used is specified as:

[38]The dummy variables include: T_tmic2_impAFR (a dummy equal to one if *j* is an African country and a technical measure exists and zero otherwise). NT_tmic2_impAFR (a dummy equal to one if *j* is an African country and non-technical measure exists). T_tmic2_impAm (a dummy equal to one if *j* is an American country and a technical measure exists and zero otherwise). NT_tmic2_impAm (a dummy equal to one if *j* is an American country and non-technical measure exists). $T\_tmic2\_impAsia$ (a dummy equal to one if *j* is an Asian country and a technical measure exists and zero otherwise). $NT\_tmic2\_impAsia$ (a dummy equal to one if *j* is an Asian country and non-technical measure exists). T_tmic2_impEur (a dummy equal to one if *j* is European country and a technical measure exists and zero otherwise). NT_tmic2_impEur (a dummy equal to one if *j* is a European country and non-technical measure exists and zero otherwise). T_tmic2_impOce (a dummy equal to one if *j* is Ocean country and a technical measure exists and zero otherwise). NT_tmic2_impOce (a dummy equal to one if *j* is an Ocean country and non-technical measure exists).

$$\log X_{ijk}^{HS4} = \alpha_{ik}^{Hs2} + \alpha_{jk}^{HS4} + \beta Z_{ij} + \beta_6 \log tar_{ijk}^{Hs4}$$
$$+ \sum_{Af}\sum_{c=1}^{5} \Omega_{Afc} Tech_{jk}^{HS4} + \sum_{Af}\sum_{c=1}^{5} \psi_{Afc} Ntech_{jk}^{HS4} + \varepsilon_{ijk}^{HS4} \quad 30)$$

Where *Af* denotes African importing countries and c ϵ (geographical locations: - Americas, Africa, Asia, Europe, and Oceania). $Tech_{jk}^{HS4}$ and $NTech_{jk}^{HS4}$ constitute a list of dummy variables which measure the impact of technical measures on Africa's imports from the different geographical regions[39].

H5: *The effect of technical measures on trade in food staples for Uganda, Senegal and Mali differs from other African countries and other countries in the various geographical regions.*

This hypothesis tests whether the impact of technical measures on imports of rice, maize, tomatoes, and plantain faced by Uganda, Senegal and Mali (USM) differs from those faced by other African countries and other geographical locations. The hypothesis is tested by creating a dummy variable which equals one if USM import rice, maize, tomatoes and plantain

[39] The dummy variables for equation 30) are: $T\_tmic2\_impAFR\_\exp AFR$ (a dummy equal to one if *j* is an African country and a technical measure exists and zero otherwise). $NT\_tmic2\_impAFR\_\exp AFR$ (a dummy equal to one if *j* is an African country and non-technical measure exists). $T\_tmic2\_impAFR\_\exp Am$ (a dummy equal to one if *j* is an American country and a technical measure exists and zero otherwise). $NT\_tmic2\_impAFR\_\exp Am$ (a dummy equal to one if *j* is an American country and non-technical measure exists). $T\_tmic2\_impAFR\_\exp Asia$ (a dummy equal to one if *j* is an Asian country and a technical measure exists and zero otherwise). $NT\_tmic2\_impAFR\_\exp Asia$ (a dummy equal to one if *j* is an Asian country and non-technical measure exists). $T\_tmic2\_impAFR\_\exp Eur$ (a dummy equal to one if *j* is European country and a technical measure exists and zero otherwise). $NT\_tmic2\_impAFR\_\exp Eur$ (a dummy equal to one if *j* is a European country and non-technical measure exists). $T\_tmic2\_impAFR\_\exp Oce$ (a dummy equal to one if *j* is Ocean country and a technical measure exists and zero otherwise). $NT\_tmic2\_impAFR\_\exp Oce$ (a dummy equal to one if *j* is an Ocean country and a non-technical measure exists).

or bananas and a technical measure exists and zero otherwise. Other regional dummies are also restricted to imports of food staples (rice, maize, tomatoes and plantains/ bananas).

The generic hypotheses tested are: *The impact of technical measures on USMi imports of staple foods from the rest of the world equals the impact of technical measures on the imports of staple foods by other African countries.* H_{5B}:$\varphi_1=\varphi_2$; by Americas (H_{5A}: $\varphi_1=\varphi_3$); by Asia (H_{5B}:$\varphi_1=\varphi_4$); by Europe (H_{5B}:$\varphi_1=\varphi_5$); by Oceania (H_{5C}: $\varphi_1=\varphi_6$)

The estimation equation used for this hypothesis is specified as:

$$\log X_{ijk}^{HS4} = \alpha_{ik}^{Hs2} + \alpha_{jk}^{HS4} + \beta Z_{ij} + \beta_6 \log tar_{ijk}^{Hs4} + \sum_{c=1}^{6}\sum_{St} \varphi_c Tech_{jk}^{HS4} + \sum_{c=1}^{6}\sum_{St} \theta_c NTech_{jk}^{HS4} + \varepsilon_{ijk}^{HS4} \quad (31)$$

where c ϵ (USM; Other African countries; Americas, Asia, Europe, and Oceania). St denotes the food staples identified for the study which are: maize, rice, tomatoes and plantains/bananas. $Tech_{jk}^{HS4}$ and $NTech_{jk}^{HS4}$ constitute a list of dummy variables which measures the impact of technical measures on imports of food staples by the different geographical regions[40]

[40] Where $T\_tmic2\_USMStp_{jk}^{HS4}$ is a dummy variable equal to one if USM are the Importers are a technical measure exists and zero otherwise. $NT\_tmic2\_USMStp_{jk}^{HS4}$ is a dummy equal to one if Uganda, Senegal and Mali are the importers and a non-technical measure exists and zero otherwise. $T\_tmic2\_OtherAFRStp$ is a dummy equal to one if Other African countries with the exception of Uganda, Senegal and Mali are the importer and a technical measure exists. $NT\_tmic2\_OtherAFRStp$ is a dummy equal to one if Other African countries with the exception of Uganda, Senegal and Mali are the importers and a non-technical measure exists. Other dummy variables for America, Asia, Europe and Ocean carry the same description.

Chapter 7.0 Results

The results are organized in six sections. The first section provides the general overview of the influence of NTMs. All NTMs are accounted for by a dummy variable which equals one if an NTM exists and zero otherwise. This section is used to develop the gravity model specification that fits the data the best. Section two tests if the impact of technical measures on agricultural trade differs from that of non-technical measures. In this section, results using the frequency index, coverage ratio and *ad valorem* equivalents to account for the NTMs are presented. Section three tests if the impact of NTMs differs by the type of the measure. Section four tests whether the impact of technical measures differ by the level of development of the exporting and importing country. Section five tests how the impact of technical measures differs by the geographical location of the exporter and importer. Finally, section six tests whether the impact of technical measures on the trade of rice, maize, tomatoes and plantain in (Uganda, Senegal, and Mali) differs from that in the other African countries and other geographical regions in the world.

7.1 The General Overview of Non-tariff Measures on Agricultural Trade.

The results of the general overview of the influence of NTMs in agricultural trade are presented in table 22 below. Column (1) shows the basic gravity model results with no fixed effects with the tariff variable aggregated to the HS4 digit level using import weights. Column (2) is the same as column (1) but with tariffs aggregated to the HS4 digit level using the simple mean (simple average). Because the method of aggregating tariffs does not influence the results in any significant way, the remaining columns in table 22 use simple averaged tariff rates. Column (3) shows the gravity model results with sector (HS2) fixed effects as was shown in

specification2 equation (18). Column (4) shows results for specification 3 equation (19), column (5) shows the results for specification (4) equation (20), column (6) shows the results for specification 5 in equation (21), column (7) shows the results of specification 6 equation (22) and column 8 shows the results for specification 7 equation (23).

Estimation of the simple gravity equation produces results which are consistent with previous studies even at the HS4-digit sector level. For example, a higher gross domestic product of the importer and exporter promotes trade; increase in transaction costs as measured by economic distance reduces trade; sharing a border and having a colonial link fosters trade; and participation in a regional trade agreement promotes trade while tariffs reduce imports. These variables are significant at the 1% level. The coefficient on the NTM dummy indicating the presence of technical or non-technical measures is small and statistically insignificant in the traditional gravity equation devoid of country or commodity fixed effects to control for each nation's overall price levels (i.e., resistance to trade).

On the other hand, although the signs of the coefficients are similar to those of the simple gravity estimation, the fixed effects models provide more precise predictions as they control for more factors. Referring to columns (4), (5), (6), (7), and (8) in table 22, NTMs have a negative impact on agriculture trade as predicted in theory. However, the difference specifications of the gravity model provide the impact of NTMs with different magnitudes. The estimation in column (8) includes both import-sector and export-sector fixed effects and these are expected to control for unobserved price indexes at the sector level between the exporter and importer. The coefficient on the dummy variable accounting for NTMs shows that, in general terms, a one percent increase in the level of NTMs is predicted to reduce agricultural trade by 25% ((exp 0.22) -1)*100.

Table 22: Overview of the Impact of Non-Tariff Measures, 2004

Model Dependent Variable: Log imports.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log GDP exporter	0.05***	0.05***	0.06***					
	(0.002)	(0.00)	(0.01)					
Log GDP importer	0.11***	0.11***	0.11***					
	(0.002)	(0.002)	(0.01)					
Log Distance	-0.13***	-0.13***	-0.13***	-0.44**	-0.46***	-0.60***	-0.50***	-0.65***
	(0.01)	(0.01)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)
Common Border	0.63***	0.63***	0.62***	0.44***	0.46***	0.50***	0.47***	0.52***
	(0.03)	(0.03)	(0.13)	(0.08)	(0.08)	(0.08)	(0.08)	(0.03)
Colonial links	0.49***	0.49***	0.50***	0.27***	0.29***	0.38***	0.33***	0.40***
	(0.03)	(0.03)	(0.09)	(0.06)	(0.06)	(0.06)	(0.06)	(0.03)
Common language official	0.02	0.02	0.02	0.16***	0.17***	0.24***	0.20***	0.28***
	(0.02)	(0.02)	(0.07)	(0.04)	(0.04)	(0.04)	(0.04)	(0.02)
RTA dummy	-0.004	-0.003	0.01	0.24***	0.23***	0.27***	0.23***	0.27***
	(0.01)	(0.01)	(0.04)	(0.05)	(0.05)	(0.05)	(0.05)	(0.02)
Bilateral tariff (Import weighted	-0.46***							
	(0.04)							
Bilateral tariff (simple average)		-0.39***	-0.75***	-0.19***	-0.67***	-0.70***	-0.35***	-0.41***
		(0.04)	(0.08)	(0.05)	(0.05)	(0.05)	(0.07)	(0.05)
NTM (dummy variable)	0.0005	0.002	-0.02	-0.12***	-0.13***	-0.09***	-0.27***	-0.22***
	(0.01)	(0.01)	(0.04)	(0.02)	(0.02)	(0.02)	(0.04)	(0.03)
HS2 fixed effects	No	No	Yes	No	No	No	No	No
Importer & Exporter FE.	No	No	No	Yes	No	No	No	No
Exporter, HS2 & Importer FE	No	No	No	No	Yes	No	No	No
Importer, Exporter-HS2 FE	No	No	No	No	No	Yes	No	No
Exporter, Importer-HS2 FE	No	No	No	No	No	No	Yes	No
Exporter-HS2, Importer-HS2 FE	No	No	No	No	No	No	No	Yes
No. Of Observation	165,751	165,751	165,751	166,775	166,775	166,775	166,775	166,775
R-squared	0.0227	0.0224	0.0472	0.1444	0.1710	0.2801	0.2201	
Root MSE	2.649	2.649	2.6161	2.479	2.4404	2.3042	2.3892	

Note: All the 154 importers and 183 exporters are considered. *, **, and *** denote significance at the ten, five, and one percent levels, respectively. FE denotes fixed effects.

7.2 The Comparison between the Technical and Non-Technical Measures to Trade.

Do the technical measures and non-technical measures affect trade equally? The results of this analysis are presented in table 23. The NTM variable is disaggregated into technical and non-technical dummy variables. The technical dummy equals one if a technical measure exists at the HS6 digit level and zero otherwise and the non-technical dummy equals one if a non-technical measure exists at the HS6 digit level and zero otherwise. Recall that some of the examples of the technical measures included in this sample data are: technical measures related to product characteristics, technical measure related to marketing requirements, technical measures related to labeling requirements, technical measures related to testing, inspections and quarantine requirements, while the non-technical measures include: finance measures, monopolistic measures, surveillance measures, prohibitions, authorization measures, and quotas for sensitive products.

The results in table 23 show that the technical and non –technical measures have different impacts on agricultural trade. These results reject the hypothesis that technical measures and non-technical measures impact trade equally. On average, the technical measures promote trade while the non-technical measures reduce trade. However, the magnitudes on the coefficients vary across the different specifications. For example, in column (1) technical measures are predicted to promote trade by 11.63%, in column (2) technical measures do not have an impact on trade, in column (3), technical measures are predicted to increase trade by 8.3%, in column (4) technical measures are predicted to increase trade by 11.63 % while in column (5) they are predicted to increase trade by 17.4%, the same pattern is present with non-technical measures. Because the estimation in column (5) controls for more variables than any other estimation in table 23, the results in column (5) are the most preferred.

Table 23: A Comparison between Technical and Non-Technical Measures to Trade, 2004

Model	(1)	(2)	(3)	(4)	(5)
Importers	All countries				
Log Distance	-0.45***	-0.47***	-0.60***	-0.50***	-0.65***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)
Common Border	0.45***	0.46***	0.51***	0.48***	0.52***
	(0.08)	(0.08)	(0.08)	(0.08)	(0.03)
Colonial links	0.27***	0.29***	0.37***	0.32***	0.40***
	(0.06)	(0.06)	(0.06)	(0.06)	(0.03)
Common language official	0.16***	0.17***	0.24***	0.20***	0.28***
	(0.04)	(0.04)	(0.04)	(0.04)	(0.02)
RTA dummy (=1 if both are in and zero otherwise)	0.24***	0.23***	0.27***	0.23***	0.26***
	(0.05)	(0.05)	(0.05)	(0.05)	(0.02)
Bilateral tariff (simple average)	-0.22***	-0.66***	-0.70***	-0.39***	-0.45***
	(0.05)	(0.05)	(0.05)	(0.07)	(0.05)
Dummy =1 if Technical Measure exists	0.11***	0.04	0.08***	0.11**	0.16***
	(0.03)	(0.03)	(0.02)	(0.04)	(0.04)
Dummy = 1 if Non-Technical Measure exists	-0.44***	-0.38***	-0.36***	-0.57***	-0.52***
	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)
Exporter, importer fixed effects	Yes	No	No	No	No
Exporter, HS2, importer	No	Yes	No	No	No
Importer, Exporter-HS2	No	No	Yes	No	No
Exporter, Importer-HS2	No	No	No	Yes	No
Exporter-HS, Importer-HS2	No	No	No	No	Yes
No. Of Observation	166,775	166,775	166,775	166.775	166,775
R-squared	0.1452	0.1713	0.2813	0.2216	
Root MSE	2.4781	2.4403	2.3022	2.3868	

Note: All the 154 importers and 183 exporters in the dataset are considered. Technical measures are those with non-tariff barrier codes at the 8000 level and the non-technical measures are these with non-tariff measure codes below 8000 level. *, **, *** denote the significance at the ten, five and one percent level, respectively. The standard errors are importer and exporter clustered. Estimation in column (1) follows the fixed effects estimation in specification 3 equation (19). Column (2) follows the fixed effects specification in 4 equation 20. Column (3) follows the fixed effects specification 5 equation (21). Column (4) follows the fixed effects specification 6 equation (22) and column (5) follows the fixed effects specification in equation (23)

These results indicate that a one percent increase in the level of technical measures is predicted to increase agricultural trade by 17.4% ((exp0.16)-1)*100. While a one percent increase in the level of non-technical measure reduces trade by 68.2 % ((exp0.52)-1)*100. These results are both significantly different at the 1 % level. Also, these results are similar to those obtained by Nardella and Boccaletti (2003). The authors compared the impact of the technical and non-technical measures between the US and the EU. Their results were that the non-technical measures have a negative impact with an estimated elasticity of -0.43 (i.e., = ((exp 0.43)-1)*100) = 53.7%). A possible explanation for these results is that, it could be the case that the technical measures imposed by the importing country reduce transaction costs such as information costs on the import products. This may happen because the importing countries normally set standards that are comfortable for their consumers. This builds confidence of the consumers for the particular product that complies with the importing countries standards.

In addition, Moenius, (2004) argues that the producer does not need to worry about the appropriate quality level at which to produce since all these information are made available in the standards, this saves the producers information search and research and development costs. However, the results show that the variables controlled for do not explain much of the variation in the dependent variable. This is expected since the data is cross sectional as the model specifications cannot include all the factors that affect trade. For example, the time constant variables that vary bilaterally are not controlled for in the cross section setting.

7.3 Trade Impacts by the Specific Types on NTMs

Do the different types of trade measures affect trade equally? This question is answered by using the estimation in equation 25 although results applying different specifications are also reported. The results are shown in table 24. The table basically repeats the same gravity model specification as those already displayed in table 23. The only difference is the disaggregation of the NTM dummy variables. As shown in table 23, the technical measures generally increase trade and the non-technical measures generally reduce trade.

Also, the individual types of technical measures generally promote trade with the exception of marketing and packaging requirements whose impact varies across estimations. Concentrating on the results in column (5) for reasons already explained, the technical measures related to product characteristics are predicted to facilitate 11% more trade holding all the other factors constant. The technical measures related to marketing requirements have no impact on trade. Technical measures related to labeling requirements are predicted to increase trade by 21% ((=exp 0.19)-1)*100. The technical measures related to packaging requirements are predicted to facilitate 26 % ((=exp 0.23)-1)*100 more trade while technical measures related to testing, inspection and quarantine measures are predicted to facilitate 30% more trade. With the exception of the coefficient on the technical measures related to marketing requirements, the rest of the technical requirements are individually statistically significant from zero. The technical measures related to marketing requirements, have no impact on trade since the trade coefficient on them is not significant.

On the other hand, the non-technical measures generally have a negative impact on trade with the exception of finance measures whose impact varies between promoting trade and having no impact across the different estimations. Considering column (5), the results show that a one

percent increase in the level of NTMs related to surveillance is predicted to reduce trade by 39% (((=exp 0.33)-1)*100.), authorization measures are predicted to reduce trade by 73.3%, quotas for sensitive products are predicted to reduce trade by 144% ((=exp -0.89)-1)*100, and prohibition measures are predicted to reduce trade by 31%. These results rank quotas for sensitive products to be the most restrictive non-technical measures out of the six non-technical measures considered in this study while monopolistic measures are considered to have no impact on trade. This is an important finding showing that quantitative restrictions on trade are by far the most trade distorting measures compared to other forms of trade restrictions[41]. With the exception of finance and monopolistic measures, the rest of the non-technical measures are individually statistically significant from zero.

A test of joint significance reveals that the technical measures are jointly statistically significant at the 1% level of significance. Likewise, a joint test of significance with the non-tariff measures also reveals that the non-technical measures are jointly statistically significant at the 1% level of significance.

Also, the difference among the coefficient estimates of the NTM types is supported by the joint hypothesis test, allowing the rejection of the hypothesis that effects of NTMs are equal across the specific NTM types. Note: tests for each category (technical and non-technical report that the specific measures are also statistically significantly different from each other within each category.

[41] "*When a trading partner uses tariffs to restrict imports, it is still possible to increase exports as long as foreign products become price competitive enough to overcome the barriers created by the tariff. When a trading partner uses quantitative restrictions, however, it is impossible to export in excess of the quota no matter how price competitive foreign products may be. Thus, quantitative restrictions are considered to have such a greater distortional effect on trade than tariffs that their prohibition is one of the fundamental principles of the GATT". From: http://www.meti.go.jp/english/report/data/gCT9903e.html*

Table 24: Identifying Most Trade Restrictive Non-Tariff Measures, 2004

Model	(1)	(2)	(3)	(4)	(5)
Log Distance	-0.45***	-0.47***	-0.60***	-0.50***	-0.65***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)
Common Border	0.45***	0.46***	0.50***	0.48***	0.53***
	(0.08)	(0.08)	(0.08)	(0.08)	(0.03)
Colonial links	0.27***	0.29***	0.38***	0.32***	0.40***
	(0.06)	(0.06)	(0.06)	(0.06)	(0.03)
Common language official	0.16***	0.17***	0.24***	0.20***	0.28***
	(0.04)	(0.04)	(0.04)	(0.04)	(0.02)
RTA dummy (=1 if both are in)	0.24***	0.23***	0.27***	0.23***	0.26***
	(0.05)	(0.05)	(0.05)	(0.05)	(0.02)
Bilateral tariff (simple average)	-0.25***	-0.67***	-0.70***	-0.40***	-0.46***
	(0.05)	(0.05)	(0.05)	(0.07)	(0.05)
Tech-Product dummy	0.06*	0.05	0.07**	0.09*	0.11**
	(0.04)	(0.03)	(0.03)	(0.05)	(0.04)
Tech-Marketing dummy	-0.17**	-0.21***	-0.15**	-0.01	0.06
	(0.09)	(0.08)	(0.08)	(0.09)	(0.07)
Tech-Labeling dummy	0.07**	-0.08**	-0.03	0.14**	0.19***
	(0.04)	(0.04)	(0.03)	(0.06)	(0.05)
Tech-Packaging dummy	0.05	-0.03	0.04	0.11	0.23***
	(0.09)	(0.09)	(0.08)	(0.11)	(0.08)
Tech-TIQ dummy	0.20***	0.12***	0.16***	0.20***	0.26***
	(0.04)	(0.04)	(0.03)	(0.05)	(0.04)
Ntech-Finance dummy	0.66***	0.54***	0.44**	0.41	0.73
	(0.19)	(0.19)	(0.17)	(0.41)	(0.47)
Ntech-Surveillance dummy	-0.55***	-0.57***	-0.56***	-0.30*	-0.33***
	(0.16)	(0.15)	(0.15)	(0.16)	(0.11)
Ntech-Autho dummy	-0.49***	0.41***	-0.38***	-0.61***	-0.55***
	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)
Ntech-QSP dummy	-0.96***	-0.75)***	-0.67**	-1.06)***	-0.89***
	(0.28)	(0.28)	(0.30)	(0.32)	(0.35)
Ntech-Prohibition dummy	0.09	-0.07	-0.17**	-0.23**	-0.27***
	(0.09)	(0.09)	(0.08)	(0.10)	(0.09)
Ntech-Monopoly dummy	-0.19	-0.46	-0.17	-0.72	-0.46
	(0.76)	(0.72)	(0.65)	(0.68)	(0.48)
Importer, Exporter fixed effects	Yes	No	No	No	No
Exporter, Importer, HS2 FE	No	Yes	No	No	No
Importer, Exporter-HS2 FE	No	No	Yes	No	No
Exporter, Importer-HS2 FE	No	No	No	Yes	No
Exporter-HS2, Importer-HS2 FE	No	No	No	No	Yes
No. Of Observation	166,775	166,775	166,775	166,775	166,775
R-squared	0.1473	0.1727	0.2816	0.2218	
Root MSE	2.475	2.4381	2.3018	2.3866	

Note: All countries are considered. *, **, *** denote the significance at the ten, five and one percent level, respectively. The standard errors are importer and exporter clustered

Because the dummy variable can only account for the presence or absence of the NTMs, it can only account for the overall effect of the presence or absence of NTMs. It does not provide information on the magnitude of the impact the NTMs cause. To address this limitation, the next section discusses the results using the coverage ratio, frequency index, and *ad valorem* equivalents of NTMs.

7.3.1 Estimating the Impact of Non-Tariff Measures Using the Coverage Ratio

Since the coverage ratios are calculated as trade shares, they account for the value of imports that are affected by NTMs. Thus they provide more detailed results compared to those with just the dummy variable. The coverage ratios are calculated at the HS4 digit level and the sector fixed effects are at the HS2 digit level. The results are displayed in table 25 below[42].

CBCR-HS4 is the Country based coverage ratio for all measures aggregated at the HS4 digit level, *TCBCR-HS4* is the Country based coverage ratio for technical measures aggregated at the HS4 digit level, and *NTCBCR-HS4* is the Country based coverage ratio for non-technical measures aggregated at the HS4 digit level.

The results in table 25 portray a trend similar to the one depicted when using the NTM dummy variable. The coverage ratios show that overall non tariff measures have no impact on trade flows since the coefficient on *CBCR-HS4* is not significant.

[42] The coverage ratios used are calculated at the HS4 digit level for each of the importing country and the fixed effects for products are at the sector level. This is intended to avoid perfect collinearity between the coverage ratios and the sector or product fixed effects.

Table 25: Influence of Non-Tariff Measures using the Country Based Coverage Ratios, 2004

Model	(1)a	(1)b	(2)	(3)	(4)	(5)a	(5)b
Dep.var =log(imports)							
Log Distance	-0.45**	-0.45***	-0.46***	-0.60***	-0.50***	-0.65***	-0.65***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)
Common Border	0.44***	0.44***	0.46***	0.52***	0.47***	0.52***	0.52***
	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.03)	(0.03)
Colonial links	0.27***	0.27***	0.29***	0.38***	0.33***	0.40***	0.41***
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.03)	(0.03)
Common language official	0.16***	0.16***	0.17***	0.24***	0.20***	0.28***	0.28***
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.02)	(0.02)
RTA dummy (=1 if both are in)	0.24***	0.24***	0.23***	0.27***	0.23***	0.26***	0.26***
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.02)	(0.02)
Bilateral tariff (simple average)	-0.21***	-0.22***	-0.67***	-0.70***	-0.39***	-0.43***	-0.45***
	(0.05)	(0.05)	(0.05)	(0.05)	(0.06)	(0.05)	(0.05)
CBCR-HS4	-0.02					0.13***	
	(0.02)					(0.04)	
TCBCR-HS4		0.15***	0.08***	0.11***	0.46***		0.45***
		(0.03)	(0.03)	(0.03)	(0.05)		(0.05)
NTCBCR-HS4		-0.25***	-0.16***	-0.17***	-0.13***		-0.19***
		(0.03)	(0.03)	(0.03)	(0.05)		(0.06)
Importer & exporter ffe	Yes	Yes	No	No	No	No	No
Exporter, importer & HS2	No	No	Yes	No	No	No	No
Importer & Exporter-HS2	No	No	No	Yes	No	No	No
Exporter & importer-HS2	No	No	No	No	Yes	No	No
Exporter-HS2 & importer-HS2	No	No	No	No	No	Yes	Yes
No. Of Observation	166,775	166,775	166,775	166,775	166,775	166,755	166,755
R-squared	0.1442	0.1452	0.1711	0.2804	0.2204		
Root MSE	2.4794	2.4779	2.4403	2.3037	2.3887		

Note: All importers and Exports are considered. *, **, *** denote the significance at the ten, five and one percent level, respectively. The standard errors are importer and exporter clustered. *CBCR-HS4* is the Country based coverage ratio for all measures aggregated at the HS4 digit level, *TCBCR-HS4* is the Country based coverage ratio for technical measures aggregated at the HS4 digit level, and *NTCBCR-HS4* is the Country based coverage ratio for non-technical measures aggregated at the HS4 digit level.

However, when the measures are separated into technical (*TCBCR-HS4*) and non-technical (*NTCBCR-HS4*), the results suggest that a one percent increase in the technical and non-technical country-based coverage ratios leads to a 57 percent increase and a 12% decrease in trade, respectively (from column 5b).

7.3.2 Estimating the Impact of Non-Tariff Measures Using the Frequency Index

Because the coverage ratios are suspected to be affected by endogeniety bias[43], a count measure which does not suffer from this problem is employed for comparing results. This measure is called the frequency index. The index is also calculated at the HS4 digit level for each of the importing countries. The results are displayed in table 26. The variable labeled *CBFQ-HS4* is the country-based frequency index of NTMs aggregated at the HS4 digit level for each importing country, whereas *TCBFQ-HS4* and *NTCBFQ-HS4* are the country-based frequency indices of technical and non-technical measures, respectively, aggregated to the HS4 digit level for each importing country.

The results show that the NTMs measured by the *CBFQ-HS4* have no impact on agricultural trade for the two specifications used. However, when NTMs are disaggregated into the technical and non-technical measures, although the magnitude of the coefficients vary across specifications, *TCBFQ-HS4* predicts that technical measures promote trade while *NTCBFQ-HS4* predicts that the non-technical measures reduce trade which is also a basis for rejecting the hypothesis (Hypothesis 1) that the technical measures and non-technical measures affect trade equally. The results are statistically significant at the one percent level of significance across all specifications.

[43] Bao and Qui (2010) note that the coverage ratio is affected by the problem of endogeneity resulting from the weighting of import values. This is because if the TBT is trade restrictive, the affected products will systematically have lower weights and consequently the coverage ratio is downward biased.

Table 26: Influence of Non-Tariff Measures using the Country Based Frequency Indexes, 2004

Model Dep.var =log(imports)	(1)a	(1)b	(2)	(3)	(4)	(5)a	(5)b
Log Distance	-0.45***	-0.45***	-0.46***	-0.60***	-0.50***	-0.65***	-0.65***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)
Common Border	0.44***	0.44***	0.46***	0.50***	0.47***	0.52***	0.52***
	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.03)	(0.03)
Colonial links	0.27***	0.27***	0.29***	0.38***	0.33***	0.40***	0.41***
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.03)	(0.03)
Common language official	0.16***	0.16***	0.17***	0.24***	0.20***	0.28***	0.28***
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.02)	(0.02)
RTA dummy (=1 if both are in)	0.24***	0.24***	0.23***	0.27***	0.22***	0.26***	0.26***
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.02)	(0.02)
Bilateral tariff (simple average)	-0.21***	-0.23***	-0.67***	-0.70***	-0.40***	-0.43***	-0.46***
	(0.05)	(0.05)	(0.05)	(0.05)	(0.07)	(0.05)	(0.05)
CBFQ-HS4	-0.02					0.07	
	(0.02)					(0.04)	
TCBFQ-HS4		0.17***	0.08***	0.11***	0.58***		0.59***
		(0.03)	(0.03)	(0.03)	(0.06)		(0.05)
NTCBFQ-HS4		-0.29***	-0.18***	-0.19***	-0.32***		-0.40***
		(0.03)	(0.03)	(0.03)	(0.06)		(0.05)
Importer & exporter FE	Yes	Yes	No	No	No	No	No
Exporter, importer & HS2 FE	No	No	Yes	No	No	No	No
Importer & Exporter-HS2 FE	No	No	No	Yes	No	No	No
Exporter & importer-HS2FE	No	No	No	No	Yes	No	No
Exporter-HS2 & importer-HS2 FE	No	No	No	No	No	Yes	Yes
No. Of Observation	166,775	166,775	166,775	166,775	166,775	166,755	166,755
R-squared	0.1442	0.1453	0.1711	0.2804	0.2206		
Root MSE	2.4793	2.4778	2.4403	2.3037	2.3883		

Note: Note: All importers and Exports are considered. *, **, *** denote the significance at the ten, five and one percent level, respectively. The standard errors are importer and exporter clustered. labeled *CBFQ-HS4* is the country-based frequency index of NTMs aggregated at the HS4 digit level for each importing , whereas *TCBFQ-HS4* and *NTCBFQ-HS4* are the country-based frequency indices of technical and non-technical measures, respectively, aggregated to the HS4 digit level for each importing country.

The results in column(5b) suggest that a one percent increase in the increase in the technical measures measured by the *TCBFQ-HS4* leads to a 80.4 percent increase in trade while a an increase in the non-technical measures measured by *NTCBFQ-HS4* leads to a 49.2 percent decrease in trade. These effects are statistically significant at the one percent.

7.3.3 Estimating the Impact of Non-Tariff Measures Using the AVEs of NTMs.

Because the frequency index also suffers with a similar problem as the dummy variable, that is it does not tell the value of imports that have been affected by NTMs, an alternative is the use of *ad valorem* equivalents to account for the impact of NTMs (see section 2.2.4 for details about how these *ad valorem* equivalents were calculated). Because the *ad valorem* equivalents (AVEs) provided by Kee Nicita and Olarreaga (2006) are at the HS6 digit level, these are aggregated to the HS4 digit level using two approaches: the import weights and the simple average. The results with *ad valorem* equivalents aggregated to HS4 using both the simple average approach and the import weights are reported in table 27.

Columns (1), (3), (5) and (7) show results for mean AVEs and results in columns (2), (4), (6) and (8) are for import weighted AVEs. Variable *lmAVEms* is the log AVEs of NTMs aggregated to the HS4 level using simple averages. *lTmAVEms* is the log of AVEs of technical measures) aggregated to the HS4 digit level using simple averages, and *lNTmAVEms* is the log of AVEs of non-technical measures) aggregated to the HS4 digit level using simple averages. Also, variable *lAVEsimp* is the log of AVEs of NTMs aggregated to the HS4 level using the import weights, *lTAVEsimp* is the log of AVEs of technical measures aggregated to HS4 using import weights, and *lNTAVEimp* is the log of non-technical measures) aggregated to the HS4 using import weights.

In tables 26 and 27, NTMs measured with a CBFQ-HS4 have no impact overall. With the *ad valorem* equivalents, both import weighted and simple averaged, the NTMs are reported to promote trade, and the coefficients are significant at the one percent level in both cases. When the NTMs are disaggregated into the technical and non-technical measures, the frequency measures report that a one percent increase in the level of the technical measure as measured by the *CBFQ-HS4* leads to an increase in trade by 80.4 percent ((=exp0.59)-1)*100. On the other hand, a one percent increase in the level of non-technical measures is predicted to reduce trade by 49.2 percent with (=exp-0.40)-1)*100.

With the *ad valorem* equivalents, both the import weighted and the mean AVEs report the same impact (column 7 and 8). These results mean that a one percent increase in the level of technical measures measured by the AVES of NTMs is predicted to increase trade by 84 percent more ((=exp0.61)-1)*100 while the non-technical measures are predicted to reduce trade by 82 percent. This means that the technical measures increase trade at the same rate as the non-technical measures reduce trade. This result explains some of the insignificance of the overall measure of NTMs that were obtained in the different specifications. It turns out that in those specifications the positive impact of the technical measures is counter balanced by the negative impact of the non-technical measures. Thus giving results which show that the NTMs have no impact overall.

Table 27: Influence of Non-Tariff Measures using AVEs of Non-tariff Measures, 2004

Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dep.variable =log(imports)								
Log Distance	-0.45***	-0.45***	-0.45***	-0.45***	-0.65***	-0.65***	-0.65***	-0.65***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
Common Border	0.44***	0.44***	0.44***	0.44***	0.52***	0.52***	0.52***	0.52***
	(0.08)	(0.08)	(0.08)	(0.08)	(0.03)	(0.03)	(0.03)	(0.03)
Colonial links	0.27***	0.27***	0.27***	0.27***	0.40***	0.40***	0.40***	0.40***
	(0.06)	(0.06)	(0.06)	(0.06)	(0.03)	(0.03)	(0.03)	(0.03)
Common language official	0.16***	0.16***	0.16***	0.16***	0.28***	0.28***	0.28***	0.28***
	(0.04)	(0.04)	(0.04)	(0.04)	(0.02)	(0.02)	(0.02)	(0.02)
RTA dummy	0.24***	0.24***	0.23***	0.23***	0.26***	0.26***	0.26***	0.26***
	(0.05)	(0.05)	(0.05)	(0.05)	(0.02)	(0.02)	(0.02)	(0.02)
Bil. tariff (simple average)	-0.23***	-0.23***	-0.22***	-0.22***	-0.44***	-0.44***	-0.43***	-0.43***
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
lAVEms	0.41***				0.37***			
	(0.04)				(0.05)			
lAVE-imps		0.41***				0.37***		
		(0.04)				(0.05)		
lTmAVEms			0.67***				0.61***	
			(0.05)				(0.05)	
lNTmAVEms			-0.59***				-0.60***	
			(0.08)				(0.08)	
lTAVE-imps				0.67***				0.61***
				(0.05)				(0.05)
lNTAVE-imps				-0.59***				-0.60***
				(0.08)				(0.08)
Importer & exporter FFE	Yes	Yes	Yes	Yes	No	No	No	No
Exporter-HS2 & importer-HS2	No	No	No	No	Yes	Yes	Yes	Yes
No. Of Observation	166,775	166,775	166,775	166,775	166,755	166,755	166,755	166,755
R-squared	0.1442	0.1442	0.1446	0.1446				
Root MSE	2.4793	2.4793	2.4766	2.4766				

Note: *, **, *** denote the significance at the ten, five and one percent level, respectively. The standard errors are importer and exporter clustered. lAVEms is the mean ad valorem equivalent for all measures. lTmAVEms is the mean ad valorem equivalent for technical measures. lNTmAVEms is the mean ad valorem equivalent for non-technical measures. lAVE-imps is the import-weighted ad valorem equivalent for NTMs. lTAVE-imps is the import weighted ad valorem equivalent for technical measures. lNTAVE-imps is the import weighted ad valorem equivalent for non-technical measures.

7.4 Development Status and the Influence of Non-Tariff Measures.

This section investigates how development status affects the way the NTMs impact on agricultural trade. Two questions derived from hypothesis three are answered. The first of these questions asks if the impacts of technical measures affect the industrialized and non-industrialized import trade equally. The second question asks if the development status of the importer and exporter has an impact of the way the NTMs affect trade. These questions are answered by creating four dummy variables as was shown in equation 26. The importing and exporting countries are categorized into two broad groups; the industrialized and the non-industrialized nations according to United Nations Database. By this classification the sample data contains 29 importing industrialized nations and 124 non-industrialized nations.

The results are shown in table 28. The results in column (1) are reporting the overall impact of NTMs on the imports of the industrialized and non-industrialized countries from the rest of the world. The results show that the industrialized country imports from the rest of the world are reduced by the presence of NTMs. A one percent increase in the level of NTMs is predicted to reduce imports of industrialized countries by 34 percent ((=exp-0.29)-1)*100. On the other hand, a one percent increase in the level of NTMs is predicted to increase non-industrialized country imports from the rest of the world by 0.09.4 percent ((=exp 0.09)-1)*100. These results are not very informative as it has been shown that the overall measure of NTMs is affected by the different impacts of the technical and non-technical measure.

The results in column (2) provide answers to the first question of hypothesis 3. The results show that the technical measures have no impact on the industrialized country imports from the rest of world and that it's the non-technical measures that reduce trade. A one percent increase in the level of non-technical measures in the industrialized country reduces trade by

with a 55.3 percent ((=exp -0.44)-1)*100). On the other hand, non-industrialized country imports from the rest of world are promoted by technical measures. A one percent increase in the level of technical measures as measured by the dummy variable is predicted to increase trade by 13 percent ((=exp0.12)-1)*100). The imports of the non-industrialized countries are also reduced by non-technical measures. A one percent increase in the non-technical measures as measured by the dummy variable is predicted to reduce imports of non-industrialized countries by 25 percent ((=exp -0.22)-1)*100). With the exception of the technical dummy for the industrialized countries, the rest of the coefficients are statistically significant and at the one percent level. The difference between the impact of technical measures on the imports of the industrialized and non-industrialized country imports from the rest of the world is supported by the t-test statistic. It is on this basis that the hypothesis that states that the impacts of technical measures do not differ by the development status of the importer is rejected. The test statistic is significant at the one percent level of significance (Prob>F= 0.0032).

The second question is to test if the development status of the exporting country has an impact on its ability to meet the technical requirements in the importing countries. The specification for this hypothesis is shown in equation 26. The results are also shown in table 28, column (4). Column (3) shows the results for the overall measure of NTMs.

The overall measure of NTMs (column (3)) reveals that the NTMs have no impact on industrialized imports from other industrialized countries. While imports from non-industrialized countries to industrialized countries are affected negatively. This result is similar to what Disdier, Fontagne and Mimouni (2008) obtained when they investigated the effect of NTMs on developed country imports. The problem with Disdier, Fontagne and Mimouni's (2008) study is

they grouped the technical and non-technical measures into one generic variable denoted as technical measures (SPS & TBT) which turns out to be quite misleading.

in addition, the results also show that imports of non-industrialized countries from industrialized countries are not affected by NTMs while imports of non-industrialized nations from fellow non-industrialized nations are increased in the presence of NTMs. Further disaggregation indicates why this occurs.

The results with a disaggregated NTM dummy are shown in column (4) of table 28. These results answer the second question of hypothesis 3 which asks if the development status of the exporting country has an effect on its ability to satisfy the technical measures of the importing country. The results reveal that technical measures promote trade between industrialized countries. It's the non-technical measures that are responsible for the negative trade impact of the NTMs on trade. The trade between industrialized country importers and non-industrialized country exporters is hampered by both technical measures and non-technical measures but the effect is larger with the technical measures. Trade between non-industrialized importers and industrialized exporters is promoted by technical measures to trade but reduced by the non-technical measures. Trade between non-industrialized nations is promoted with technical measures but reduced by non-technical measures.

These results suggest that developing nations are affected by NTMs when accessing developed import markets. This finding is important because agricultural exports represent the bulk of export earnings for the non-industrialized countries. Therefore, the barriers on their agricultural exports represent a threat to their balance of payments conditions.

Table 28: The Influence of Development Status of the Importer and Exporter on NTMs and, 2004

Model Dep. Var = Log (imports)	(1)	(2)	(3)	(4)
Log Distance	-0.46***	-0.46***	-0.46***	-0.46***
	(0.01)	(0.01)	(0.01)	(0.01)
Common Border	0.46***	0.50***	0.44***	0.44***
	(0.03)	(0.03)	(0.03)	(0.23)
Colonial links	0.29***	0.29***	0.29***	0.28***
	(0.03)	(0.03)	(0.03)	(0.03)
Common language official	0.17***	0.17***	0.20***	0.18***
	(0.02)	(0.02)	(0.02)	(0.02)
RTA dummy	0.23***	0.23***	0.20***	0.19***
	(0.02)	(0.02)	(0.03)	(0.03)
Bilateral tariff (simple average)	-0.65	-0.65	-0.66***	-0.67***
	(0.04)	(0.04)	(0.04)	(0.04)
Tmic3-impIND	-0.29***	---	---	---
	(0.02)			
Tmic3-impNIND	0.09***	---	---	---
	(0.03)			
T-tmic2-impIND	---	-0.02	---	---
		(0.04)		
NT-tmic2impIND	---	-0.44***	---	---
		(0.03)		
T-tmic2-impNIND	---	0.12***	---	---
		(0.03)		
NT-tmic2-impNIND	---	-0.22***	---	---
		(0.05)		
Tmic3-impIND-expIND	---		-0.05	---
			(0.03)	
Tmic3-impIND-expNIND	---	---	-0.43***	---
			(0.03)	
Tmic3-impNIND-expIND	---	---	0.05	---
			(0.03)	
Tmic3-impNIND-expNIND	---	---	0.12***	---
			(0.03)	
T-tmic2-impIND-expIND	---	---	---	0.40***
				(0.05)
NT-tmic2-impIND-expIND	---	---	---	-0.44***
				(0.05)
T-tmic2-impIND-expNIND	---	---	---	-0.28***
				(0.04)
NT-tmic2-impIND-expNIND	---	---	---	-0.43***
				(0.03)
T-tmic2-impNIND-expIND	---	---	---	0.07**

				(0.03)
Table 28 continues				
NT-tmic2-impNIND-expIND	---	---	---	-0.13**
				(0.06)
T-tmic2-impNIND-expNIND	---	---	---	0.17***
				(0.03)
NT-tmic2-impNIND-expNIND	----	---	---	-0.30***
				(0.06)
Importer, Exporter, HS2	Yes	Yes	Yes	Yes
No. Of observations	166,775	166,775	166,775	166,775
R squared	0.1715	0.1723	0.1722	0.1737
Root MSE	2.4397	4.4385	2.4388	2.4366

Note: Note: All importers and Exports are considered. *, **, *** denote the significance at the ten, five and one percent level, respectively. The standard errors are importer and exporter clustered. See descriptions of variables[44].

[44] *Tmic3-impIND* is a dummy equal to one if j is an industrialized country and an NTM exists, zero otherwise. *Tmic3-impNIND* is a dummy equal to one if j is a non-industrialized country and an NTM exists, zero otherwise. *T-tmic2-impIND* is dummy equal to one if j is industrialized and a technical measure exists, zero otherwise. *NT-tmic2impIND* is a dummy equal to one if j is industrialized and non-technical measure exists, zero otherwise. *T-tmic2-impNIND* is a dummy equal to one if the j is non-industrialized and a technical measure exists, zero otherwise. *NT-tmic2-impNIND* is a dummy equal to one if the j is non-industrialized and a non-technical measure exists, zero otherwise. *Tmic3-impIND-expIND* is dummy equal to one if j is industrialized and i is industrialized and a non-tariff measure exists, zero otherwise. *Tmic3-impIND-expNIND* is a dummy equal to one if j is industrialized and i is non-industrialized nation i and a non-tariff measure exists. *Tmic3-impNIND-expIND* is dummy equal to one if j is non-industrialized and i is industrialized and non-tariff measures exists. *Tmic3-impNIND-expNIND* is a dummy equal to one if j and j are non-industrialized countries and a non-tariff measure exists, zero otherwise. *T-tmic2-impIND-expIND* is a dummy equal to one if j and i are industrialized countries j a technical measure exists, zero otherwise. *NT-tmic2-impIND-expIND* is a dummy equal to one if j and i are industrialized countries j and a non-technical measures exists, zero otherwise. *T-tmic2-impIND-expNIND* is a dummy equal to one if j is industrialized and i non-Industrialized and a technical measures exists, zero otherwise. *NT-tmic2-impIND-expNIND* is dummy equal to one if j is industrialized and i non-industrialized and a non-technical measures exists, zero otherwise. *T-tmic2-impNIND-expIND* is a dummy equal to one if j is non-industrialized and i industrialized and a technical measures exists, zero otherwise. *NT-tmic2-impNIND-expIND* is a dummy equal to one if j is non-industrialized i is industrialized nation and a non technical measure exists, zero otherwise. *T-tmic2-impNIND-expNIND* is dummy variable equal to one if j and i are non-industrialized and a technical measures exists, zero otherwise. *NT-tmic2-impNIND-expNIND* is a dummy variable equal to one if j and i are non-industrialized and a non-technical measures exists, zero otherwise.

The hypothesis tests confirm the asymmetry in the way the technical and non-technical measures are used in agricultural trade by the industrialized and non-industrialized countries. For example, hypothesis H_{3C}: $\mu_1=\mu_2$ states that the impact of technical measures on industrialized country imports does not vary by the level of development of the exporting country. Testing this hypothesis reveals that, there is a significant difference in the effect of the technical measures faced by the industrialized and non-industrialized countries exporting agricultural products to industrialized countries. The technical measures promote agricultural imports from industrialized country exporters to industrialized country importers by 49.2 percent while, imports from non-industrialized exporters to industrialized importers are reduced by 32.2 percent. The t-test statistic is significant at the one percent level (Prob > F = 0.000) thus providing the basis upon which the hypothesis that the impact of technical measures on industrialized country imports does not vary by the level of development of the exporting country is rejected.

Hypothesis H_{3D}: $\psi_1=\psi_2$ which states that the impact of technical measures on non-industrialized country imports does not vary by the level of development of the exporting country. The t- test results of this hypothesis reveal that there is a significant difference between the impact of technical measures on non-industrialized country imports from the industrialized and non-industrialized exporters. The technical measures promote imports of non-industrialized from industrialized exporters by 7.3 percent more while imports from non-industrialized exporters are increased by 18.3 percent more. The results are significantly different at the one percent level (Prob > F = 0.0005). Based on these t-test results, the hypothesis that the impact of technical measures on non-industrialized country imports does not vary by the level of development of the exporting country is rejected.

Hypothesis (H_{3E}: $\eta_1=\eta_2$) states that the impact of non-technical measures on industrialized country imports does not vary by the level of development of the exporting country. Based on the test results (Prob > F = 0.8706), we fail to reject this hypothesis which means that industrialized countries impose the same level of non-technical measures across all exporters. On the other hand, the impacts of non-technical measures imposed by non-industrialized importers pose different effects on their imports. The non-industrialized countries impose more restrictive non-technical measures on imports from fellow non-industrialized countries than those from industrialized countries. This difference is statistically significant at the five percent level of significance (Prob > F = 0.0165.

The asymmetry in the effect of NTMs in agricultural trade between the different groups of countries shown in table 28 can be explained as follows. Most of the standards are set by industrialized countries which mean that the non-industrialized nations are generally facing standards developed by industrialized nations. Since the standards of industrialized nations tend to be more similar to those of other industrialized nations, than those of the non-industrialized nations, the compliance cost of the industrialized exporting countries is expected to be lower compared to those of non-industrialized countries seeking to export to industrialized countries (Mayeda, 2004). Thus the fact that technical measures promote agricultural trade among industrialized nations and reduce imports from non-industrialized nations is not a surprise.

The difficulty with complying with the standards of the industrialized nations by the non-industrialized nations stems from the low level of capital, technical and institutional capacity in most of the non-industrialized nations.The FAO's (2005) Fact Sheet for the Sixth Conference of the WTO reports that compliance costs for non-tariff measures especially SPS related ones exceeds the total governmental development budgets for all expenditures in some least

developed countries. It is therefore not surprising that technical measures actually promote exports from fellow industrialized countries and reduce exports from non-industrialized nations. In addition, Mayeda (2004) also note that the industrialized nations have an upper hand in the setting of international standards since most of the non-industrialized nations do not normally participate in the process.

Some of these results reflect some of the privileges that the TBT agreement gives to the least developed countries. The Agreement offers least developed and developing countries special and differential treatment, which allows the non-industrialized countries to produce goods with standards lower than the products produced in the industrialized nations. This makes it difficult for the products from the non-industrialized nations to be accepted in the industrialized nations (Meyer, N. et., 2010). The trade among non-industrialized nations is promoted by technical measures probably because the non-industrialized nations probably produce items of similar quality.

7.5 Impact of Development Status and Geographical Location

Do the impacts of technical measures in agricultural trade differ by the geographical location of the exporter? To answer this question two hypotheses developed from hypothesis 4 are tested. The first hypothesis involves testing if there are differences in how geographical location of the exporters affects their ability to meet the technical requirements in the industrialized and non-industrialized countries. The estimation specification for this hypothesis is given in equation 28. The second hypothesis involves testing if there are differences in how the geographical location of the exporters affects their ability to meet the technical requirements of

their importers in the different geographical locations. The estimation equation for this hypothesis is given in equation 29.

There are five different geographical locations considered in this analysis according to the United Nations Database (as was discussed in the data section). The regions include: Americas, Africa, Asia, Europe, and Oceania. The results are displayed in table 29.

It appears that all countries in the five geographical locations have trouble exporting to industrialized nations with the exception of Oceania. NTMs promote imports of non-industrialized nations from Asian, European, and Ocean countries, while those from Africa and America are not affected significantly. When the NTMs are disaggregated into technical and non-technical measures, the results show that exports to industrialized countries from Africa are significantly affected by both technical and non-technical measures to trade. That is, a one percent increase in technical measures is predicted to reduce industrialized country imports from Africa by 85.9 percent ((=exp-0.62)-1)*100). Also, a one percent increase in the level of non-technical measures is predicted to reduce industrialized country imports from Africa by 63.2 percent ((=exp -0.49)-1)*100)). These results are statistically significant at the one percent level of significance.

The impacts of NTMs on Africa's exports to industrialized countries are compared to the impacts of NTMs on exports from other regions. The comparison is based on test results of the sub-hypotheses outlined in hypothesis 4. Industrialized country imports from Americas and Europe are significantly promoted by technical measures (by 12.7 percent and 15 percent more respectively). There is no significant impact on industrialized country imports from Asia and Oceania. The impact of technical measures on industrialized country imports from Africa is statistically different from the trade effect of technical measures faced by Americas, Asia,

Europe, and Oceania. These results are based on pair wise t-tests which are all significant at the one percent level (Prob > F = 0.0000). Therefore, the hypothesis that Geographical location of exporting countries has no effect on their ability to meet the technical requirements in industrialized import countries is rejected.

Agricultural imports of non-industrialized countries from Africa are not significantly affected by technical measures but are reduced by non-technical measures.

Non-industrialized country imports from Americas, Asia, Europe, and Oceania are significantly promoted by technical measures and reduced but non-technical measures in all the regions with the exception of Oceania.

However, the hypothesis test results reveal that there is no significant difference between the impact of technical measures on non-industrialized imports from Africa and America; Africa and Asia; and Africa and Europe. Based on these results, the sub-hypotheses that the effect of technical measures on non-industrialized country imports from Africa and America are equal (H_{4E}: $\vartheta_1=\vartheta_2$). The effects of technical measures on non-industrialized country imports from Africa and Asia are equal (H_{4F}: $\vartheta_1=\vartheta_3$). And that the effects of technical measures on non-industrialized country imports from Africa and Europe are equal (H_{4G}: $\vartheta_1=\vartheta_4$) cannot be rejected. This means that non-industrialized country impose the same level of measures across all exporters. The impact of technical measures on non-industrialized imports from Africa is significantly different from the impact of technical measures faced by exports from Oceania. In this case, the hypothesis that the effects of technical measures on non-industrialized country imports from Africa and Oceania are equal (H_{4H}: $\vartheta_1=\vartheta_5$) is rejected. It is also important to note that, overall, African exporters are the most affected by non-technical measures.

Table 29: Development Status and Regional Exporters, 2004

Model	(1)		(2)
Dependent. Var = Log (imports)		Log (imports)	
Log Distance	-0.46***	Log Distance	-0.46***
	(0.01)		(0.01)
Common Border	0.46***	Common Border	0.46***
	(0.03)		(0.03)
Colonial links	0.29***	Colonial links	0.28***
	(0.03)		(0.03)
Common language official	0.18***	Common language official	0.18***
	(0.02)		(0.02)
RTA dummy (=1 if both are in and zero otherwise)	0.23***	RTA dummy (=1 if both are in and zero otherwise)	0.23***
	(0.03)		(0.03)
Bilateral tariff (simple average)	-0.65***	Bilateral tariff (simple average)	-0.66***
	(0.04)		(0.04)
Tmic3-impIND-expAFR	-0.59***	T-tmic2-impIND-expAFR	-0.62***
	(0.06)		(0.09)
		NT-tmic2-impIND-expAFR	-0.49***
			(0.07)
Tmic3-impIND-expAm	-0.20***	T-tmic2-impIND-expAm	0.12**
	(0.04)		(0.06)
		NT-tmic2-impIND-expAm	-0.37***
			(0.05)
Tmic3-impIND-expAsia	-0.30***	T-tmic2-impIND-expAsia	-0.04
	(0.04)		(0.05)
		NT-tmic2-impIND-expAsia	-0.44***
			(0.05)
Tmic3-impIND-expEur	-0.22***	T-tmic2-impIND-expEur	0.14***
	(0.04)		(0.05)
		NT-tmic2-imIND-expEur	-0.52***
			(0.05)
Tmic3-impIND-expOce	-0.06	T-tmic2-impIND-expOce	0.09***
	(0.08)		(0.11)
		Nt-tmic2-impIND-expOce	-0.07
			(0.10)
Tmic3-impNIND-expAFR	0.02	T-tmic2-impNIND-expAFR	0.07
	(0.05)		(0.06)
		NT-tmic2-impNIND-expAFR	-0.77***
			(0.18)
Tmic3-impNIND-expAm	0.06	T-tmic2-impNIND-expAm	0.11**
	(0.04)		(0.04)
		NT-tmic2-impNIND-expAm	-0.23***
			(0.07)

Table 29 continues

Tmic3-impNIND-expAsia	0.08**	T-tmic2-impNIND-expAsia	0.11***
	(0.04)		(0.04)
		NT-tmic2-impNIND-expAsia	-0.24***
			(0.08)
Tmic3-impNIND-expEur	0.09**	T-tmic2-impNIND-expEur	0.12***
	(0.03)		(0.03)
		NT-tmic2-impNIND-expEur	-0.24***
			(0.07)
Tmic3-impNIND-expOce	0.33***	T-tmic2-impNIND-expOce	0.34***
	(0.08)		(0.08)
		NT-tmic2-impNIND-expOce	0.32***
			(0.14)
Importer, Exporter,& HS2	Yes	Importer, Exporter,& HS2	Yes
No. Observations	166,775	No. Observations	166,775
R Squared	0.1729	R Squared	0.1729
Root MSE	2.4378	Root MSE	2.4378

Note: All importers and Exports are considered. *, **, *** denote the significance at the ten, five and one percent level, respectively. The standard errors are importer and exporter clustered. See description of the variable[45]

[45] *Tmic3-impIND-expAFR* is a dummy equal to one if *j* is industrialized and *i* is an African country and a non-tariff measure exists. *Tmic3-impIND-expAm* is a dummy equal to one if *j* is industrialized and *i* is an American country and a non-tariff measure exists. *Tmic3-impIND-expAsia* is a dummy variable equal to one if *j* is industrialized and *i* is an Asian country and a non-tariff measure exists. *Tmic3-impIND-expEur* is a dummy equal to one if *j* is industrialized and *i* is a European country and a non-tariff measure exists. *Tmic3-impIND-expOce* is a dummy equal to one if j is industrialized and i is an Ocean country and non-technical exists. Tmic3-impNIND-expAFR is a dummy equal one if j is a non-industrialized and i is an African country. *Tmic3-impNIND-expAm* is a dummy equal to one if *j* is a non- industrialized and *i* is an American country and a non-tariff measure exists. *Tmic3-impNIND-expAsia* is a dummy variable equal to one if *j* is a non-industrialized and *i* is an Asian country and a non-tariff measure exists. *Tmic3-impNIND-expEur* is a dummy equal to one if *j* is non-industrialized and *i* is a European country and a non-tariff measure exists. *Tmic3-impNIND-expOce* is a dummy equal to one if j is non-industrialized and i is an Ocean country and non-technical exists. The same definition apply to variables in column 2 only that the NTM dummy is disaggregated.

Table 30 shows the results for impact of NTMs on regional imports which answers the questions raised in the second stage of hypothesis 4. First, the results in column (1) show that, Africa, Asia, and Americas' imports are not significantly affected by NTMs. On the other hand, Europe's imports are reduced, while imports of Oceania increased by NTMs. For the same reason given in section 7.3.3, these results are not informative. In column (2) of table 30, the results show that, generally, African country imports are affected negatively by the non-technical measures but the technical measures have no significant impact.

The results for the impact of technical measures on African imports from the rest of the World are compared with the impacts of technical measures on imports of other regions. The answers obtained are used to answer questions for scenario one of stage 2 hypothesis 4. Details are as follows:

Imports of the American countries are promoted by the technical measures but are reduced by non-technical measures. Compared with the effect faced by African importers, the t-test results reveal that the impact of technical measures on African agricultural imports is significantly different from the impact of technical measures on agricultural imports by Americas. This result is significant at the one percent level (Prob > F = 0.0070). based on these results, the hypothesis that the impact of technical measures on African agricultural imports equals the impact of technical measures on America's agricultural imports (H_{4A}:$\mu_1=\mu_2$) is rejected.

Imports of Asian countries are not significantly affected by both technical and non-technical measures. In this case, the test results show that the effects of technical measures on Asia's and Africa's agricultural imports from the rest of the World are not statistically different from each other. This result is not significant even at the ten percent level. Therefore, based on

these findings, we fail to reject the hypothesis that the impact of technical measures on African agricultural imports equals the impact of technical measures on Asia's agricultural imports *(*H_{4C}:$\mu_1=\mu_{2)}$.

Europe's imports from the rest of the World are not significantly affected by technical measures but are reduced by non-technical measures[46]. The test result show that there is no significant difference in the way technical measures affect imports by Africa and Europe (Prob > F= 0.1738). Therefore, the hypothesis that the impact of technical measures on Africa's agricultural imports equals the impact of technical measures on Europe's agricultural imports *(*H_{4C}:$\mu_1=\mu_{2)}$ cannot be rejected based on these results.

Imports of Oceania are promoted by technical measures and not significantly affected by non-technical measures. The impact of technical measures on Ocean imports is statistically different from the impact of technical measures on Africa's agricultural imports. This difference is significant at the five percent level and thus provides the basis for rejecting the hypothesis that the impact of technical measures on Africa's agricultural imports equals the impact of technical measures on Europe's agricultural imports (H_{4D}:$\mu_1=\mu_5$).

[46] Europe as a geographical region should not be confused with the European Union.

Table 30: Influence of NTMS on Africa's Trade with other Regions in the World, 2004

Model	(1)		(2)
Log Distance	-0.46***	Log Distance	-0.47***
	(0.01)		(0.01)
Common Border	0.46***	Common Border	0.46***
	(0.03)		(0.03)
Colonial links	0.29***	Colonial links	0.29***
	(0.03)		(0.03)
Common language official	0.17***	Common language official	0.17***
	(0.02)		(0.02)
RTA dummy (=1 if both are in and zero otherwise)	0.23***	RTA dummy (=1 if both are in and zero otherwise)	0.23***
	(0.02)		(0.02)
Bilateral tariff (simple average)	-0.66***	Bilateral tariff (simple average)	-0.66***
	(0.04)		(0.04)
Tmic3-impAFR	0.03	T-tmic2-impAFR	0.05
	(0.06)		(0.06)
		NT-tmic2-impAFR	-0.42***
			(0.11)
Tmic3-impAm	0.01	T-tmic2-impAm	0.26***
	(0.04)		(0.05)
		NT-tmic2-impAm	-0.27***
			(0.05)
Tmic3-impAsia	-0.02	T-tmic2-impAsia	-0.01
	(0.04)		(0.04)
		NT-tmic2-impAsia	-0.12
			(0.08)
Tmic3-impEur	-0.30***	T-tmic2-impEur	-0.05
	(0.02)		(0.04)
		NT-tmic2-impEur	-0.44***
			(0.03)
Tmic3-impOce	0.18**	T-tmic2-impOce	0.30***
	(0.10)		(0.11)
		NT-tmic2-impOce	-0.07
			(0.12)
Importer, Exporter & HS2	Yes	Importer, Exporter & HS2	Yes
No. Of Observation	166,775	No. Of Observation	166,775
R-Squared	0.1714	R-Squared	0.1725
Root MSE	2.4399	Root MSE	2.4383

Note: All importers and Exports are considered. *, **, *** denote the significance at the ten, five and one percent level, respectively. The standard errors are importer and exporter clustered. See description of the variable[47]

[47] *Tmic3-impAFR* is a dummy equal to one if *j* is an African country and a non-tariff measure exists. *Tmic3-impAm* is a dummy equal to one if *j* is an American country and a non-tariff measure exists. *Tmic3-impAsia* is a dummy variable equal to one if *j* is an Asian country and a non-tariff measure exists. *Tmic3-impEur* is a dummy equal to one if *j* is a European country and a non-tariff measure exists. *Tmic3-impOce* is a dummy equal to one if j is an Ocean country and non-technical exists. *T-tmic2-impAFR* is a dummy equal one if *j* is an African country and a technical measure exists. *T-tmic2-impAFR* is a dummy equal to one if *j* is an African country and a non-technical measure exists. *NT-tmic2-impAm* is a dummy equal one if *j* is an American country and a technical measure exists. *T-tmic2-*

Table 31 reports the results for the impact of NTMs on Africa's agricultural imports. These results address the questions raised in scenario two of stage two in hypothesis 4. Column (1) displays results obtained using the overall NTM measure. Column (2) displays results with the NTM measures disaggregated into the technical and non-technical measure. The disaggregated results show that Africa's agricultural imports from other African country exporters are not affected by technical measures but are significantly affected by non-technical measures. That is, a one percent increase in the level of non-technical as measured by the dummy variable is predicted to reduce African country imports from other African countries by 249 percent -this result is significant at the one percent level. These results show that African importing countries impose the highest level of non-technical measures on fellow African countries compared to any other region in the world.

The results for the impact of technical measures on African country imports from other African countries are compared with the impact of technical measures on Africa's imports from other regions. This is done by testing the sub-hypotheses outlined in the second scenario of hypothesis 4. The technical measures promote African agricultural imports from Americas, Asia, and Oceania but no significant effects exist on agricultural imports from Europe. The positive impact of technical measures on African country imports from: Americas, Asia and Oceania is significantly different from the impact of technical measures on Africa's imports from other

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impAm is a dummy equal to one if *j* is an American country and a non-technical measure exists. *NT-tmic2-impAsia* is a dummy equal one if *j* is an Asian country and a technical measure exists. *T-tmic2-impAsia* is a dummy equal to one if *j* is an Asian country and a non-technical measure exists. *NT-tmic2-impEur* is a dummy equal one if *j* is European country and a technical measure exists. *NT-tmic2-impAm* is a dummy equal to one if *j* is a European country and a non-technical measure exists. *T-tmic2-impOce* is a dummy equal one if *j* is an Ocean country and a technical measure exists. *NT-tmic2-impOce* is a dummy equal to one if *j* is an Ocean country and a non-technical measure exists.

Table 31: Influence of NTMS on Africa's Imports from other Regions in the World, 2004

Model	**(1)**		**(2)**
Log Distance	-0.47***	Log Distance	-0.47***
	(0.01)		(0.01)
Common Border	0.45***	Common Border	0.45***
	(0.03)		(0.03)
Colonial links	0.29***	Colonial links	0.29***
	(0.03)		(0.03)
Common language official	0.17***	Common language official	0.17***
	(0.02)		(0.02)
RTA dummy (=1 if both are in and zero otherwise)	0.24***	RTA dummy (=1 if both are in and zero otherwise)	0.24***
	(0.02)		(0.02)
Bil. tariff (simple average)	-0.67***	Bil. tariff (simple average)	-0.67***
	(0.04)		(0.04)
Tmic3-impAFR-expAFR	-0.14*	T-tmic2-impAFR-expAFR	-0.09
	(0.08)		(0.08)
		NT-tmic3-impAFR-expAFR	-1.25***
			(0.24)
Tmic3-impAFR-expAm	0.32***	T-tmic2-impAFR-expAm	0.31***
	(0.09)		(0.10)
		NT-tmic2-impAFR-expAm	0.31
			(0.21)
Tmic3-impAFR-expAsia	0.20**	T-tmic2-impAFR-expAsia	0.21***
	(0.08)		(0.08)
		NT-tmic2-impAFR-expAsia	-0.19
			(0.18)
Tmic3-impAFR-expEur	-0.09	T-tmic2-impAFR-expEur	-0.05
	(0.07)		(0.07)
		NT-tmic2-impAFR-expEur	-0.59***
			(0.14)
Tmic3-impAFR-expOce	0.75***	T-tmic2-impAFR-expOce	0.73***
	(0.19)		(0.19)
		NT-tmic2-impAFR-expOce	0.71
			(0.43)
Import, Export, HS2	Yes	Import, Export, HS2	Yes
No. of Observations	166,775	No. of Observations	166,775
R-Squared	0.1711	R-Squared	0.1713
Root MSE	2.4404	Root MSE	2.4401

Note: Note: All importers and Exports are considered. *, **, *** denote the significance at the ten, five and one percent level, respectively. The standard errors are importer and exporter clustered. See description of variables[48]

[48] *Tmic3_impAFR-expAFR* is a dummy equal to one if *j* and *i* are African countries and a non-tariff measure exists. *Tmic3-impAFR-expAm* is a dummy equal to one if *j* is an African country and *i* is an American country and non-tariff measure exists. *Tmic3-impAFR-expAsia* is a dummy equal to one if *j* is an African country and *i* is an Asian country and a non-tariff measure exists. The rest of the variables carry the same description. Column (2) variables are for technical and non-technical measures.

African countries. Based on these results, the hypotheses that, the impact of technical measures on Africa's imports from other African countries is equal to the impact of technical measures on agricultural imports from other regions (Americas, Asia and Oceania) are rejected. One exception exists with imports from Europe for which the difference is not statistically significant.

The fact that technical measures promote Africa's agricultural imports from other African countries and imports from non-African exporters on one hand, and that African exports have limited access to non-African markets especially those in the industrialized nations means that, African nations favor low technical requirements in regards to their imports yet, they face high technical requirements for their exports especially in industrialized countriess. Products of sub-standard quality find their way into the market of the region, probably because the TBT infrastructure is underdeveloped (Meyer, N. et. al, 2010).

7.6 Impact of Technical Measures on Trade in Rice, Maize, Tomatoes and Plantain.

Do the impacts of technical measures on USM's imports of staple foods differ from those faced by other African countries and other countries in other geographical locations? This hypothesis allows for a comparison of the impacts of technical measures on African and non-African imports of staple foods and how these compare to those experienced by USM[49]. Equation (31) is the estimation used here and the results are reported in table 32.

Column (1) of table 32 displays the results for the overall impact of NTMs while column (2) shows the results with the NTMs disaggregated into technical and non-technical measures. The results in column (1) show that NTMs promote imports of food staples in USM and other

[49] USM denotes Uganda, Senegal and Mali.

African countries. The American, Asian, and European countries on the other hand, experience an overall negative impact of their own NTMs on their food staple imports**.**

The results in column (2) show that technical measures promote trade and that the non-technical measures have no significant impact on imports of food staples in USM. That is, a one percent increase in the level of technical measures as measured by the dummy variable is predicted to increase USM's food staple imports from the rest of the World by 72 percent. These results can be explained by the fact that importing from more food safety conscious countries signals quality and thus may promote trade. In comparison to other African importers of food staples, the results show that the technical measures promote trade. That is, a one percent increase in the level of technical measures leads to 49 percent more imports of food staples in other African countries. The non-technical measures are trade restricting and they reduce agricultural imports by 156 percent. Both coefficients (technical and non-technical) for the Other African countries are significant at the 1% level of significance.

However, the hypothesis test results show that, the impact of technical measure on USM's imports from the rest of the World is not statistically different from the impact of technical measures on food staple imports of other African countries from the rest of the World. With this result, we fail to reject the hypothesis that technical measures affect food staple imports of USMs and other African countries equally.

In comparison to other non-African regions, with the exception of Oceania and Europe, for which both technical and non-technical measures have no impact on food staple imports, Other regions i.e., America and Asia, have their food staple imports reduced by both the technical and non-technical measures and all their estimated coefficients are statistically different than zero.

Based on the test results, the impacts of technical measures on food staple imports of USM are statistically different from those experienced in Asia and Europe. This result provides the basis on which the hypothesis that the impacts of technical measures on USM imports of food staples are equal to other regions is rejected. This result is consistent with the result obtained in section 7.5. However, Asia and Europe have significantly different impacts of technical measures on their food staple imports from that experienced by USM. That is, a one percent increase in the level technical measures promotes Asia and Europe's food staple imports by 40.5 and 20.9 percent respectively.

The export side of the food staple trade cannot be analyzed with this sample data because there are very few observations for which there are measures notified in the importing countries. For example, there are only two observations for which Uganda's exports of food staples have a non-technical measure notified on them by the importing countries. In addition, there are no observations for Mali and Senegal. Specifically, there are 10 observations for which Ugandan exports of food staples meet a technical measure in the importing country; there are nine observations for Senegal; and no observations for Mali. This can be explained by the survey results described in chapter 5. Chapter 5 revealed that Uganda, Senegal, and Mali export maize, rice mainly to the neighboring countries which do not impose a lot of measures.

Table 32: A comparison of the Impact of Technical Measures between Uganda, Senegal and Mali and other African and non-African countries, 2004

Model	**(1)**		**(2)**
Log Distance	-0.46***	Log Distance	-0.46***
	(0.01)		(0.01)
Common Border	0.46***	Common Border	0.46***
	(0.03)		(0.03)
Colonial links	0.29***	Colonial links	0.29***
	(0.03)		(0.03)
Common language official	0.17***	Common language official	0.17***
	(0.02)		(0.02)
RTA dummy (=1 if both are in)	0.23***	RTA dummy (=1 if both are in)	0.23***
	(0.02)		(0.02)
Bilateral tariff (simple average)	-0.67***	Bilateral tariff (simple average)	-0.67***
	(0.04)		(0.04)
Tmic3_USMd	0.58**	T-tmic2-USMd	0.54*
	(0.29)		(0.29)
		NT-tmic3-USMd	3.36
			(2.44)
Tmic3-OtherAFRStp	0.27**	T-tmic2-OtherAFRStp	0.37***
	(0.11)		(0.11)
		NT-tmic2-OtherAFRStp	-0.94***
			(0.36)
Tmic3-Am_dStp	-0.34***	T-tmic2-Am-Stp	-0.14***
	(0.07)		(0.09)
		NT-tmic2-Am-stp	-0.81***
			(0.13)
Tmic3-Asia_dStp	-0.36***	T-tmic2-Asia-dStp	-0.34***
	(0.08)		(0.08)
		NT-tmic2-Asia-dStp	-1.03**
			(0.44)
Tmic3-Eur_dStp	-0.21*	T-tmic2-Eur-dStp	-0.19
	(0.11)		(0.13)
		NT-tmic2-Eur-dStp	-0.27
			(0.20)
Tmic3-Oce-dStp	0.07	T_tmic2_Oce_dStp	0.05
	(0.14)		(0.16)
		NT-tmic2-Oce-dStp	0.12
			(0.29)
Import, Export, HS2	Yes	Import, Export, HS2	
No. of Observation	166,775	No. of Observation	166,775
R-Squared	0.1710	R-Squared	0.1712
Root MSE	2.4404	Root MSE	2.4402

Note: Note: All importers and Exports are considered. *, **, *** denote the significance at the ten, five and one percent level, respectively. The standard errors are importer and exporter clustered. See description for the variables used in the table[50]

[50] *Tmic3_USMd* is a dummy equal to one if *j* is (Uganda, Senegal and Mali) and a non-tariff measure exists. *Tmic3-OtherAFRStp* is a dummy if *j* is other African countries and a non-tariff measure exists. *Tmic3-Am_dStp* is a dummy equal to one if *j* is an American country and a non-tariff measure exists. *Tmic3-Asia_dStp* is a dummy if j is an Asian country and a non-technical measure exists. *Tmic3-Eur_dStp* is a dummy equal to one if *j* is a European

Chapter 8: Summary and Conclusions

This thesis analyses the impact of non-tariff measures notified by the importing countries on bilateral agricultural trade flows. The non-tariff measures constitute the technical measures notified under the SPS and TBT agreements and the non-technical measures to trade. The econometric application focuses on imports and exports of groups of countries categorized using two criteria, development status and geographical location of the exporting and importing countries. The results obtained are used to draw possible food security implications for Africa in general and for the case countries (Uganda, Senegal and Mali) in particular.

It is difficult to assess the overall quantitative impact of non-tariff measures because different approaches that are commonly used to quantify non-tariff measures give different results. For example, the estimations with a dummy variable indicate that the NTMs generally have a negative impact of trade flows. Estimations with a coverage ratio indicate a positive impact on trade flows, while the frequency index indicates that non-tariff measures have no impact on trade flows. The AVEs of NTMs aggregated by both simple average and import weights indicate a positive impact. Thus, the overall impact of NTMs s is ambiguous.

This thesis also finds that the impact of technical measures (SPS and TBT) on bilateral agricultural trade flows is statistically different from the impacts imposed by the non-technical measures to trade. The technical measures generally promote trade while the non-technical

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country and a non-tariff measure exists. *Tmic3-Oce-dStp* is a dummy equal to one if *j* is an Ocean country and a non-tariff measure exists. The rest of the column two variables are defined in the same way but each of the column one variables is divided into two variables i.e., one for the technical measures and the other for the non-technical measures.

The measures are notified at the HS6 digit level by the importing countries. The imports considered for this table are those of the four food staples of focus in this study and they include: maize, rice, tomatoes and plantain and their products.

measures actually restrict trade. These results hold across the different approaches used to identify and quantify NTMs (dummy variable, coverage ratio, frequency index, and ad valorem equivalents) although there are some slight variations in the magnitudes of the estimated coefficients across the approaches. This finding suggests that the results obtained by Disdier, Mimouni and Fontagne (2008) are misleading. This is because, Disdier, Fontagne and Mimouni considered all the measures in the dataset to belong to the category of technical measures. As already discussed, measures are categorized according to the UNCTAD NTM codes as technical and non-technical measures. The technical measures have their NTM codes at the 8000 level while the non-technical measures have NTM codes below the 8000 level and the dataset developed by Disdier, Fontagne and Mimouni contains both categories. Also, since according to the findings of this thesis, technical measure promote trade and non-technical measures reduce trade, analyses attributing the overall impact of NTMs to just technical measures would be biased.

Several asymmetries exist across groups of countries in the way the technical and non-technical measures affect agricultural trade flows. First, the results indicate that overall, imports by industrialized nations from the rest of the World are generally negatively affected by non-tariff measures, while imports of non-industrialized nations are increased by non-tariff measures. The negative impact of non-tariff measures on the industrialized countries' imports from the rest of World arises from the non-technical measures since the technical measures have no significant impact on agricultural bilateral trade flows from the rest of the World. It also turns out that, technical measures promote trade among industrialized countries but reduce exports of non-industrialized countries to the industrialized countries. It is therefore important to note that

technical measures restrict non-industrialized countries from accessing the industrialized country markets.

In contrast, imports by non- industrialized countries from the rest of the World are promoted by technical measures while the non-technical measures reduce trade. Most interesting is that the technical measures that restrict non-industrialized countries from accessing industrialized country markets are promoting agricultural exports by industrialized countries to the non-industrialized countries. Even though the trade promotion effect of technical measures is larger for trade among non-industrialized countries than for exports by industrialized countries, it is still important to acknowledge the fact that the non-industrialized countries are almost limited to trade with fellow non-industrialized countries while the industrialized countries can access markets Worldwide.

Further, the non-technical measures the industrialized countries impose on their imports affect the industrialized and non-industrialized exporters in the same way and reduces agricultural trade by 55.3 percent. Conversely, the non-technical measures that non industrialized countries impose on their imports affect other non-industrialized countries' exports more than those of the industrialized (35 percent versus 13.9 percent). Overall, the non-industrialized countries have two big impediments to trade yet, agricultural exports contribute the largest portion of their trade.

The second set of asymmetry is seen with development status and geographical location. The technical measures imposed by industrialized and non-industrialized importers pose different effects on exports by the different regions (Africa, America, Asia, Europe and Oceania). The results indicate that, African countries face the biggest huddle with technical measures in exporting to industrialized countries. Other regions such as America, Europe and

Oceania have their exports to industrialized countries promoted by technical measures. Also, all the other regions' exports to non-industrialized countries are promoted by technical measures apart from those of Africa which have no significant effect. These results basically show that African exporters are most disadvantaged with regards to enjoying the benefits that other countries are deriving from the technical measures to trade.

The third asymmetry is vested in the geographical region imports. Agricultural imports by Africa, Asia and Europe are not significantly affected by technical measures while agricultural imports by America and Oceania are significantly increased. Further, the African agricultural imports from fellow African exporters are not significantly affected by technical measures while agricultural imports from America, Asia, and Oceania are promoted by technical measures.

By contrast, the impact of non-technical measures on African imports is similar to that of America and Europe but different for Oceania and Asia. The African, American and European imports are reduced more by non-technical measures than those of Asia and Oceania. Unfortunately, African imports from fellow African exporters are affects most by non-technical measures (estimated impact is 206%).

Lastly, the results show that the USM's imports of food staples (i.e., rice, maize, tomatoes and plantain) from the rest of the World are promoted by technical measures. This result is similar to the impact felt by other African countries.

In summary, the results obtained in this thesis indicate that Africa is enclosed in chains *of trade measures*" partly by itself through the non-technical measures and partly by other partners through technical measures.

8.1 Policy Implications

This thesis derives the following policy implications for food security in Africa in general. First, the possibility of Africa to reduce food security problems is limited by non-technical measures. Therefore, there is a need for African governments to develop a strategy to reduce the NTMs they are imposing on each other if they are really concerned with improving food security in the region. One possible way of addressing this problem is through forming a well formulated regional trading agreement for all the African countries.

Second, economic growth through agricultural exports to large economies where larger markets for agricultural products exists is problematic if African governments do not consider technical measures imposed by the developed /industrialized countries seriously. This has a number of implications. One of them is that, if African countries cannot export, they cannot earn foreign exchange and thus their current ability to import food is eroded. Therefore, African governments are required to re-think their investment strategies so as to upgrade their technologies for trade in agricultural goods.

8.2 Areas for Future Research

The trade data used in this data did not consider trade flows with zero flows. The results obtained are therefore conditioned on trade occurring. According to Santo Silva and Tenreyro (2006), the omission of zero trade flows can cause biased estimates. Therefore, the results obtained in this study may be improved by considering the zero trade flows. Also, the trade data used in this analysis is cross sectional and this has a number of implications. First, it only captures a snap shot impact of trade measures and thus it misses the time varying impacts of trade measures. Second, even when measures do not change much over time, there is a

possibility that some countries may drop or add measures over time; the cross section data misses out on all these details.

This study has also not considered the effect trade harmonization has on the impact of NTMs on agricultural trade. It would be relevant for policy development purposes if the actual impact of such efforts is known since it could provide one of the avenues for dealing with NTMs especially the non-technical ones which have been found to be trade restrictive. It could also be the case that the impact of NTMs is over estimated.

One finding of this thesis is that trade among African countries is limited by non-technical measures and that with other partners is limited by technical measures. However, the study does not pin down which non-technical measures, are posing the biggest impact. For well informed policy recommendations, this area needs to be explored so that African governments can know where to target their policy change.

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Appendix A1: Classification of Barriers by UNCTAD

Category	Description	Code
Finance measures	Refundable deposit for sensitive product to protect environment	4174
Surveillance	Prior surveillance to protect human health	5271
	Prior surveillance to protect environment	5274
Authorization	Authorization to protect human health	6171
	Authorization to protect animal health	6172
	Authorization to protect plant health	6173
	Authorization to protect environment	6174
	Authorization to protect Wildlife	6175
	Authorization to ensure human safety	6177
Quotas for sensitive product	Quota to protect human health	6271
	Quota to protect environment (Montreal protocol)	6274
Prohibition	Prohibition to protect human health	6371
	Prohibition to protect animal health and life	6372
	Prohibition to protect plant health	6373
	Prohibition to protect Environment	6374
	Prohibition to protect wildlife	6375
	Prohibition to ensure human safety	6377
Monopolistic Measures	Single channel for imports to protect human health	7171
Technical Measures (related to product characteristics requirement)		
	Product characteristics requirements to protect human health	8111
	Product characteristics requirements to protect animal health and life	8112
	Product characteristics requirements to protect plant health	8113
	Product characteristics requirements to protect environment	8114
	Product characteristics requirements to protect wildlife	8115
	Product characteristics requirement to ensure human safety	8117

Appendix A1 continued		
Technical measures (related to marketing requirements)		
	Marketing requirements to protect human health	8121
	Marketing requirements to protect plant health	8123
	Marketing requirements to protect environment	8124
	Marketing requirements to ensure human safety	8127
Technical measures (related to labeling requirements)		
	Labeling requirements to protect human health	8131
	Labeling requirements to protect animal health and life	8132
	Labeling requirements to protect plant health	8133
	Labeling requirements to protect environment	8134
	Labeling requirements to protect wildlife	8135
	Labeling requirements to ensure human safety	8137
Technical measures (related to packaging requirements)		
	Packaging requirements to protect human health	8141
	Packaging requirements to protect animal health and life	8142
	Packaging requirements to ensure human safety	8147
Technical measures (related to testing, inspection or quarantine requirements)		
	Testing, inspection or quarantine requirements to protect human health	8151
	Testing, inspection or quarantine requirements to protect animal health and life	8152
	Testing, inspection or quarantine requirements to protect plant health	8153
	Testing, inspection or quarantine requirements to protect environment	8154
	Testing, inspection or quarantine requirements to protect wild life	8155
	Testing, inspection or quarantine requirements to ensure human safety	8157

Source: Trains data and Disdier and Fontagnè (2007).

Appendix A2: List of Importing Countries in the Database by Geographical Region (Continent)

ISO country Code/ Country		
Africa (68,970)		
AGO. (Angola)	GMB. (Gambia)	RWA. (Rwanda)
BDI. (Burundi)	GNQ. (Equatorial Guinea)	SDN. (Sudan)
BEN. (Benin)	KEN. (Kenya)	SEN. (Senegal)
BFA. (Burkina Faso)	MAR. (Morocco)	SLE. (Sierra Leone)
CAF. (Central African Republic)	MDG. (Madagascar)	TCD. (Chad)
CIV. (Cote d lvoire)	MLI. (Mali)	TGO. (Togo)
CMR. (Comoros)	MOZ. (Mozambique)	TUN. (Tunisia)
COG. (Peoples' Republic of Congo	MRT. (Mauritania)	TZA. (Tanzania)
DJI.(Djibouti)	MUS. (Mauritius)	UGA. (Uganda)
DZA. (Algeria, PDR)	MWI. (Malawi)	ZAF. (South Africa)
EGY. (Egypt)	NER. (Niger)	ZMB. (Zambia)
GAB. (Gabon	GIN. (Guinea)	ZWE. (Zimbabwe)
GHA. (Ghana)	NGA. (Nigeria)	
Americas (105,315)		
ANT. (Netherland Antilles)	DMA. (Dominica)	NIC. (Nicaragua)
ARG. (Argentina)	DOM. (Dominican Republic)	PAN. (Panama)
ATG. (Antigua &Barbuda)	ECU. (Ecuador)	PER. (Peru)
BLZ. (Belize)	GRD. (Grenada)	PRY. (Paraguay)
BOL. (Bolivia)	GTM. (Guatemala)	SLV. (El Salvador)
BRA. (Brazil)	GUY. (Guyana)	SUR. (Suriname)
BRB. (Barbados)	HND. (Honduras)	TTO. (Trinidad and Tobago)
CAN. (Canada)	HTI. (HTI)	URY. (Uruguay)
CHL. (Chile)	JAM. (Jamaica)	USA. (United States)
COL. (Colombia)	KNA. (Saint Kitts and Nevis)	VCT. (St. Vincent and the Grenadines)
CRI. (Costa Rica)	LCA. (Saint Lucia)	VEN. (Venezuela)
CUB. (Cuba)	MEX. (Mexico)	
	Table continues to next page	
ASIA (148,233)		

Appendix A2: Continued		
ARE. (United Arab Emirates)	JOR. (Jordan)	MYS. (Malaysia)
ARM. (Armenia)	JPN. (Japan)	NPL. (Nepal)
BGD. (Bangladeshi)	KAZ. (Kazakhstan)	OMN. (Oman)
BHR. (Bahrain)	KGZ. (Kyrgyz Republic)	PAK. (Pakistan)
BRN. (Brunei)	KHM. (Cambodia)	PHL. (Philippines)
BTN. (Bhutan)	KWT. (Kuwait)	QAT. (Qatar)
CHN. (China)	LAO. (Lao People's Republic)	SAU. (Saudi Arabia)
CYP. (Cyprus)	LBN. (Lebanon)	SGP. (Singapore)
GEO. (Georgia)	LKA. (Sri Lanka)	THA. (Thailand)
HKG. (Hong Kong)	MAC. (Macao Special Administrative Region)	TUR. (Turkey)
IND. (India)	MDV. (Maldives)	TWN. (Taiwan)
IDN. (Indonesia)	MMR. (Myanmar)	VNM. (Viet Nam)
ISR. (Israel)	MNG. ((Mongolia)	
OCEANIA (16,499)		
AUS. (Australia)	NZL. (New Zealand)	SLB. (Solomon Islands)
FJI. (Fiji)	PNG. (Papua New	
EUROPE		
ALB. (Albania)	FRA. (France)	MLT. (Malta)
AUT. (Austria)	GBR. (United Kingdom)	NLD. (Netherland)
BEL. (Belgium)	GRC. (Greece)	NOR. (Norway)
BGR. (Bulgaria)	HRV. (Croatia)	POL. (Poland)
BLR. (Belarus)	HUN. (Hungary)	PRT. (Portugal)
CHE. (Switzerland)	IRL. (Ireland)	ROM. (Romania)
CZE. (Czech Republic)	ISL. (Israel)	RUS. (Russia)
DEU.(Germany)	ITA. (Italy)	SVK. (Slovakia)
DNK. (Denmark)	LTU. (Lithuania)	SVN. (Slovenia)
ESP. (Spain)	LVA. (Latvia)	SWE. (Sweden)
EST. (Estonia)	MDA. (Moldova)	UKR. (Ukraine)
FIN. (Finland)	MKD. (Macedonia)	

Note; List of all countries in the data base by Geographical Region. The classification is based on the United Nations Statistical Database (2010)

Appendix A3: List of Notifying Countries (UNCTAD, 2004)

ISO Code(Country Name)	ISO Code (Country Name)	ISO code (Country Name)	ISO Code (Country Name)
1. ALB (Albania)	24. DEU (Germany)	47. LBN (Lebanon)	70. POL (Poland)
2. ARG (Argentina)	25. DNK (Denmark)	48. LKA (Sri Lanka)	71. PRT (Portugal)
3. AUS (Australia)	26. DZA (Algeria)	49. LTU (Lithuania)	72. PRY (Paraguay)
4. AUT (Austria)	27. ECU (Ecuador)	50. LVA (Latvia)	73. ROM (Romania)
5. BEL (Belgium)	28. EGY (Egypt)	51. MAR (Morocco)	74. RUS (Russia)
6. BFA (Burkina Faso)	29. ESP (Spain)	52. MDV (Maldives)	75. SAU (Saudi Arabia)
7. BGD (Bangladeshi)	30. FIN (Finland)	53. MEX (Mexico)	76. SDN (Sudan)
8. BHR (Bahrain)	31. FRA (France)	54. MLI (Mali)	77. SEN (Senegal)
9. BLR (Belarus)	32. GBR (Great Britain)	55. MOZ (Mozambique)	78. SGP (Singapore)
10. BOL (Bolivia)	33. GHA (Ghana)	56. MUS (Mauritius)	79. SVK (Slovakia)
11. BRA (Brazil)	34. GNQ (Equatorial Guinea)	57. MWI (Malawi)	80. SWE (Sweden)
12. BRN (Bahrain)	35. GRC (Greece)	58. MYS (Malaysia)	81. THA (Thailand)
13. BTN (Bhutan)	36. GTM (Guatemala)	59. NGA (Nigeria)	82. TUN (Tunisia)
14. CAN (Canada)	37. HUN (Hungary)	60. NIC (Nicaragua)	83. TWN (Taiwan)
15. CHE (Switzerland)	38. IDN (Indonesia)	61. NLD (Netherland)	84. TZA (Tanzania)
16. CHL (Chile)	39. IND (India)	62. NOR (Norway)	85. UGA (Uganda)
17. CHN (China)	40. IRL (Ireland)	63. NPL (Nepal)	86. UKR (Ukraine)
18. CIV (Cote d' l voire)	41. ISL (	64. NZL (New Zealand)	87. URY (Uruguay)
19. CMR (Cameron)	42. ITA (Italy)	65. OMN (Oman)	88. USA (United States)
20. COL (Colombia)	43. JOR (Jordan)	66. PAK (Pakistan)	89. VEN (Venezuela)
21. CRI (Costa Rica)	44. JPN (Japan)	67. PER (Peru)	90. VNM (Viet Nam)
22. CUB (Cuba)	45. KAZ (Kazakhstan)	68. PHL (Philippines)	91. ZMB (Zambia)
23. CZE (Czech Republic)	46. LAO (Lao)	69. PNG (Papua New Guinea)	92. ZWE (Zimbabwe)

Note: Extracted from dataset constructed by Disdier, Fontagné and Mimouni (2010).

Appendix A4: Product Categories per Crop

Crop	HS4 code	Product description	HS6 Code	Products considered
Rice	1006(4)		100610	Rice in the Husk
			100620	Husked (brown) rice
			100630	Semi-milled or wholly milled rice
			100640	Broken rice
	1102 (4)	Cereal flours other than of wheat or meslin	110220	Rice flour
Maize	1005 (2)	Maize (Corn)	100510	Maize seed
			100590	Maize except, seed
	1102 (4)	Cereal flours other than of wheat or meslin.	110220	Maize (corn) flour
	1104 (8)	Cereal grains otherwise worked (for example, hulled, rolled, flaked, pearled, sliced or kibbled), except rice of heading No. 10.06; germ of cereals, whole, rolled, flaked or ground.	110423	Worked maize grain
Tomatoes	0702 (1)	Tomatoes, fresh or chilled.	070200	Tomato; Fresh or Chilled
	2002 (2)	Tomatoes prepared or preserved otherwise than by vinegar or acetic acid.	200210	Tomatoes not prepared by vinegar. Whole or in pieces
			200290	Tomato paste not prepared or preserved by vinegar
	2103 (4)	Sauces and preparations thereof; mixed condiments and mixed seasonings; mustard flour and meal and prepared mustard	210320	Tomato ketchup and other sauces
Bananas	0803 (1)	Bananas, including plantains, fresh or dried.	080300	Bananas, including plantains, fresh or dried

Note: Data obtained from the United Nations Commodity Database through: http://comtrade.un.org/db/mr/rfCommoditiesList.aspx Data base Retrieved: 3/26/2011. The values in parentheses indicate number of product lines per HS4 tariff product line.

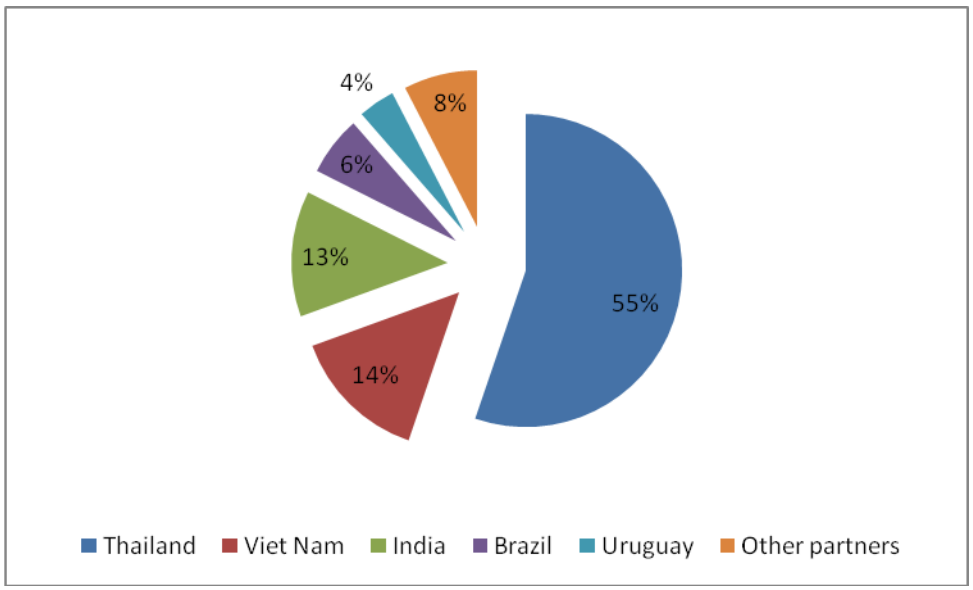
Appendix A5: Regional Trade Agreements considered, 2004

Region	Regional Trade Agreement (RTA)	Type of RTA	Notification	Date of entry into force
	Customs Union			
Africa	East African Community (EAC)	CU	Enabling Clause	07-Jul-2000
Africa	Economic and Monetary Community of Central Africa (CEMAC)	CU	Enabling Clause	21-Jul-1999
Africa	Economic Community of West African States (ECOWAS)	CU	Enabling Clause	24-Jul-1993
Africa	West African Economic and Monetary Union (WAEMU)	CU	Enabling Clause	01-Jan-2000
Africa	Southern African Customs Union (SACU)	CU	GATT Art. XXIV	15-Jul-2004
Caribbean; Central America; South America	Community and Common Market (CARICOM)	CU	GATT Art. XXIV & GATS V	01-Aug-1973
Central America	Central American Common Market (CACM)	CU & EIA	GATT Art. XXIV	24-Feb-1961
South America	Andean Community (CAN)		Enabling Clause	01-Oct-1990
South America	Southern Common Market (MERCOSUR)	CU & EIA	GATT Art. XXIV & GATS V	17-Feb-1991
Europe	EC-Turkey	CU	GATT Art. XXIV	01-Jan-1996
Europe	European Union -EC (25) Enlargement)	CU&EIA	GATT Art. XXIV & GATS V	01-May-2004
Europe	EC-Treaty	CU & EIA	GATT Art. XXIV & GATS V	24-April-1957
Middle East	Gulf Cooperation council (GCC).	CU	GATT Art. XXIV& Enabling Clause	01-Jan-2003
Common wealth of Independent States (CIS)	Eurasian Economic Community (EAEC)	CU	GATT Art. XXIV	21-Apr-1999

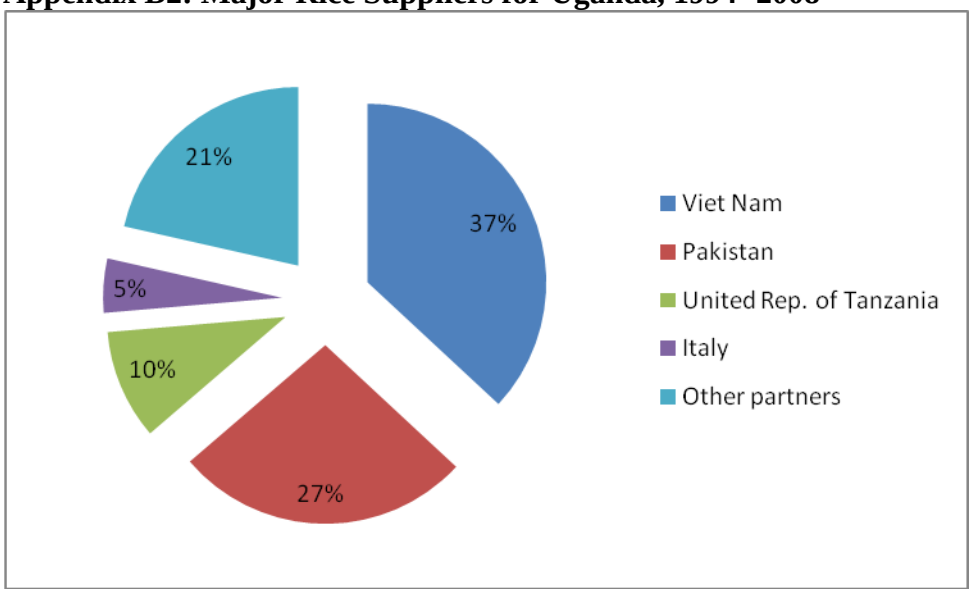
Appendix A5 continued				
Region	Free Trade Agreements (FTAs)	Type of RTA	Notification	Date of entry into force
Africa	Common Market for Eastern and Southern Africa (COMESA)	FTA	Enabling Clause	08-Dec-1994
Africa	Southern African Development Community (SADC)	FTA	GATT Art. XXIV	01-Sep-2000
Europe; Africa	EC-Egypt	FTA	GATT Art. XXIV	01-Jun-2004
Europe; Africa	EC-Morocco	FTA	GATT Art. XXIV	01-Mar-2000
Caribbean; European; Africa; South America; Oceania; North America	EC-Overseas Countries and Territories (OCT)	FTA	GATT Art. XXIV	01-Jan-1971
Europe; Africa	EC-South Africa	FTA	GATT Art. XXIV	01-Jan-2000
Europe; Africa	EC-Tunisia	FTA	GATT Art. XXIV	01-Mar-1998
Europe; Africa	EFTA-Morocco	FTA	GATT Art. XXIV	01-Dec 1999
Africa; Middle East	Pan Arab Free Trade Area (PAFTA)	FTA	GATT Art. XXIV	01-Jan-1998
East Asia	ASEAN Free Trade Area (AFTA)		Enabling Clause	28-Jan-1992
Europe; Middle East	EC-Israel	FTA	GATT Art. XXIV	01-Jan- 2000
North America	North American Free Trade Agreement (NAFTA)	FTA & EIA	GATT Art. XXIV & GATS V	01-Jan -1992
Europe; North America	EC-Mexico	FTA & EIA	GATT Art. XXIV & GATS V	01-Jul-2000
Europe	European Free Trade Association (EFTA)	FTA & EIA	GATT Art. XXIV & GATS V	03-May-1960
South America; Europe	EFTA-Chile	FTA & EIA	GATT Art. XXIV & GATS V	01-Dec-2004
South America; North America	Chile- Mexico	FTA & EIA	GATT Art. XXIV & GATS V	01-Aug-1999
Europe; Middle East	EFTA-Jordan	FTA	GATT Art. XXIV	01-Jan-2002
Middle East; North America	US-Israel	FTA	GATT Art. XXIV	19-Aug-1985
Middle East; North America	US-Jordon	FTA & EIA	GATT Art. XXIV & GATS V	17-Dec-2001
Europe; Middle East	EFTA-Israel	FTA	GATT Art. XXIV	01-Jan-1993
Europe; Middle East	EFTA-Jordan	FTA	GATT Art. XXIV	01-Jan-2002

Appendix A5: continued				
Region	**Free Trade Agreements (FTAs)**	**Type of RTA**	**Notification**	**Date of entry into force**
Europe; East Asia	EFTA- Singapore	FTA & EIA	GATT Art. XXIV & GATS V	01-Jan-2003
Europe; North America	EFTA-Mexico	FTA & EIA	GATT Art. XXIV & GATS V	01-Jul-2001
South America; North America	US-Chile	EFTA & EIA	GATT Art. XXIV & GATS V	01-Jan-2004
Middle East; Europe	Turkey-Israel	FTA	GATT Art. XXIV	01-May-1997
Middle East; North America	Israel-Mexico	FTA	GATT Art. XXIV	01-Jul-2000
Oceania	Australia New Zealand (ANZCERTA)	FTA & EIA	GATT Art. XXIV & GATS V	01-Jan-1983
North America; South America	Canada-Chile	FTA & EIA	GATT Art. XXIV & GATS V	05-Jul -1997
	Canada-United States		GATT Art. XXIV & GATS V	
South America; North America	Colombia -Mexico	FTA & EIA	GATT Art. XXIV & GATS V	01-Jan-1995
Africa; South America; West Asia; Caribbean; Europe; East Asia; Middle East; North America; Central America	Global System of Trade Preferences among Developing Countries (GSTP)	PSA	Enabling Clause	19-April-1989
West Asia; South America; Africa; Middle East; East Asia, North America, Europe	Protocol on Trade Negotiations (PTN)	PSA	Enabling Clause	11-Feb -1973
West Asia; East Asia	Asia Pacific Agreement (APTA)	PSA	Enabling Clause	17-Jun-1976
South America; Caribbean; North America	Latin America Integration Association (LAIA	PSA		
West Asia; Commonwealth of Independent States (CIS); Middle East; Europe	Economic Cooperation Organization (ECO)	PSA	Enabling Clause	17-Feb-1992
Oceania	South Pacific Regional Trade and Economic cooperation Agreement (SPARTECA)	PSA	Enabling Clause	01-Jan-1981

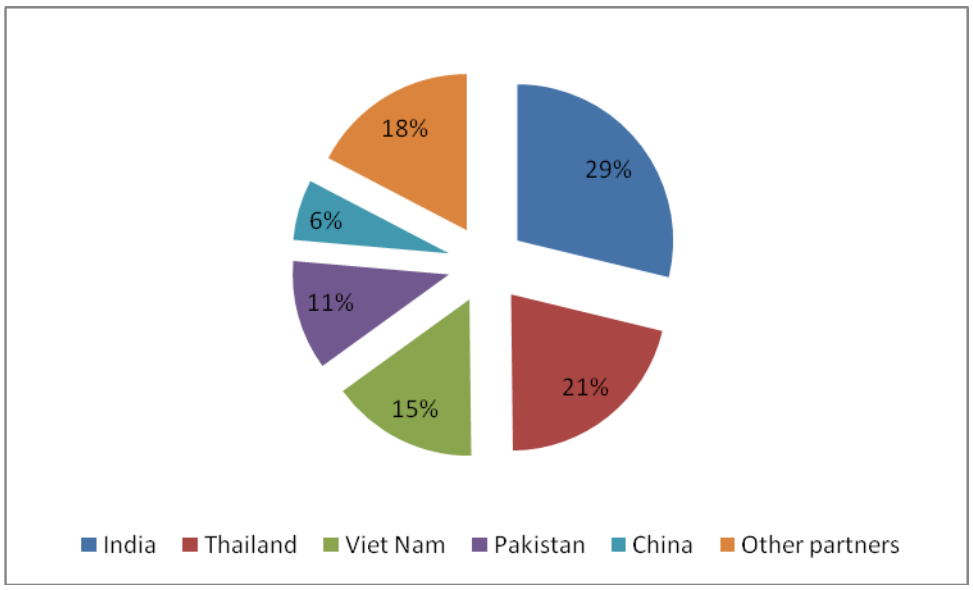
Appendix B1: Major Rice Suppliers for Senegal, 1996- 2009



Appendix B2: Major Rice Suppliers for Uganda, 1994- 2008



Appendix B3: Major Rice Suppliers to Mali, 1996-2009



Appendix C1

Questionnaire for Imports

Background Information:

This project is an African Food Security initiative intended to identify trade bottlenecks in West Africa and East Africa. Similar Studies will be conducted in Uganda, Senegal and Mali and the study is targeting exporters and importers of major food staples in the three countries. The products considered in this study include maize, rice, tomatoes and plantain, and the study specifically focuses on Sanitary and Phytosanitary issues from a trade stand point.

Consent Note:

Participation in this study is free and any participant has full rights to accept or refuse to be part of this study. If you choose to participate in this study, you are assured that the information that is provided will only be used for the purposes of this study. The personal identification of respondents will be kept confidential. Participating in this study may take about an hour of your time. If you agree to participate in this study please confirm by signing in the space below**.**

…….

……/……/……..

Sign **date: mm/dd/yr**

SECTION1: EXPORTER INFORMATION

1) Name of importer or company
2) When the business started (for how long has the exporter been in business)
3) Trade partners (partner organizations providing support to promote agricultural trade)

Government Institution	Private Institutions
_____	_____
_____	_____
_____	_____

4) Major Countries imported from:

_____ _____ _____ _____

5) Any changes in the countries where you source your produce from?

_____

6) Why the change?

_____

7) Are there any restrictions that impact on how much you can import in a particular period of time?

Regulatory restrictions Yes ___ No ___
Private restrictions Yes ___ No ___

a) If yes for Regulatory restrictions ….

- Did you receive any import permit from your authorities that indicates the maximum amounts you are supposed to import? Yes ____ No ____
    - If yes, what is the maximum amount per period (tons per month or year, …)

      _____
- What is the maximum amount your company can import per period (tons per month or year, …) _____

In case the maximum amount the company can potentially import is greater than the amount permitted by the regulatory restrictions, ask the following question

- Is there any national policy which does not allow your company to import up to a certain limit just to ensure food security in their country? Yes ____ No ____
- If yes, please list them

i) _____

ii) _____

iii) _____

- Please indicate any effect these restrictions had or still have on your import capacity (Check all that applies)
    - Adjust my imports accordingly _____
    - The excess imports are traded domestically ____
    - Other _____ (Please be explicit)

b) If yes for Private restrictions….

- Do you have any private restrictions such as financial constraints that prevent you from bringing in the maximum amount your company can import? Yes__ No__

- If yes, indicate the effect of such restrictions on your import capacity (Check all that applies)
    - No effect ____
        - Still purchasing (part in cash and part in credit) the required amount by the importing country from farmers ____
        - Receive credit support from financial institutions _____
    - Reduction of the quantity demanded from farmers _____

SECTION 2: PRODUCT INFROMATION

1) Which crop do you import and in which form do you import your product**? (Please check all that applies)**

Table 1: Product categories exported for tomatoes, rice, maize, and plantain.

Product	**Product lines/Categories**	**Tick where applicable cross otherwise.**
Tomatoes	Canned Tomatoes	
	Tomato Juice	
	Tomato concentrate (Tomato paste and puree)	
	Highly seasoned (sauce and Ketchup)	
Maize	Maize grain	
	Maize flour	
Rice	Rice grains	
	Rice flour	
Plantain	Plantain chips	
	Fresh fingers	
	Plantain flour	

SECTION 3A: FOOD SAFETY STANDARDS

(Food safety standards include ways in which food is handled, prepared and stored to avoid food borne illnesses).

1) Have you heard of food safety standards? Yes ____ No ____
2) What category of suppliers do you pick your products?
    a) A group of farmers
    b) Wholesalers (processing companies)
    c) Local traders

3) What do you do with your products once they are here?
    a) They are re-exported
    b) They are distributed for local consumption
    c) Both

4) What food safety requirements/Standards do you have to fulfill before importing your products? Refer to table 2 below.

Note: The private standards are those imposed privately by a specific company i.e. labeling of products could be done according to the Chain -retailer standard (e.g. Walmart)

Table 2: Shows a list of private, international and public standards (contact the appropriate person in the company about technical questions and lab questions)

Private standards (Check all that applies)	**International Standards (Check all that applies)**	**Public Standards for where you export (Check all that applies)**
	Food Safety	
___ Pesticide residue limits	___ Codex Pesticide residue limits	___ Pesticide residue limits
___ Microbial standards	___ Codex microbial Standard	___ Microbial standards
___ Traceability requirements *(Documentation of names and address of supplier* *Nature of product* *Date of delivery* *Volume and quantity of product* *Batch number* *Product description)*	___ ISO 9000- (quality management. It is concerned about the processes through which an organization manages its work and not directly the end product)	___ EU general Food Law –Traceability requirement (2005) *(Documentation of names and address of supplier* *Nature of product* *Date of delivery* *Volume and quantity of product* *Batch number* *Product description)*
___ Hygiene requirements		___ Hygiene requirements
___ Mycotoxin levels	___ Codex Mycotoxin standard	___ Mycotoxin levels
	Animal plant health	
___ Plant material quarantine	___ ISO 22000- food safety management standard (ISO standard)	___ Plant material quarantine
___ Pest risk analysis	___ HACCP (codex)- food safety meta-system	___ Pest risk analysis
___ Fumigation analysis	___ GMP (codex)	___ Fumigation analysis
___ Phyto sanitary certificate	___ BS OHSAS 18001 Occupational Health and Safety standard (ISO standard)	___ Phyto sanitary certificate
	Quality and technical attributes	
___ Quality grades		
___ labeling requirements	___ Codex labeling requirements	___ General labeling requirements
___ Packaging standards	**___ Other codex standards**	___ Packaging standards
	Environmental	
___ Pesticide use restriction	___ Standard for processed tomato concentrate	___ Pesticide use restriction
___ Water or soil contamination requirement	___ Processed cereal based foods for infants and young children	
___ Codes of Organic practices	___ Standard for maize corn-1995	
___ Bio-safety /GMO regulations	___ Standard for whole maize meal-1995	
___ *Accountability 8000*		
___ The *Ethical Trading Initiative*		

___ The *Marine Stewardship Initiative*		
Social		
___ Monitoring of Child Labor	___ For de-germed maize (corn) meal and maize grits 1995	
___ Occupational health Standards	___ Standard for Rice	
Others		
___ Global Good Agricultural Practices (GAP)	___ Standard for Bananas 2005	
UK supermarkets		
___ British retail consortium (BRC) (deals with main pack-house operations, including high care and minimal processing facilities).	___ Standard for tomatoes	
___ Ethical Trading Initiative (ETI)	___ Standard for preserved tomatoes -2007	
___Tesco Nature's Choice standards (it's a pre-farm standards developed by Tesco supermarket)		
___ Save Quality Food Program		
___ Farm Folk standards (developed by Marks and Spenser-considers packing as well as production)		
French supermarkets (have also developed quality assurance schemes for their own brands		
___ *Terre et Saveur* of Casino		
___ *Filiere Agruculture Raisonnee* of Auchan		
___ *Filiere Qualite* of Carrefour.		
___ Other (Specify)		

NOTE: Please ask for copies for all standards that apply.

5) According to your experience which SPS measures gives you a hard time to comply with? (Check all that applies)
   a) ___ Private standards
   b) ___ Public/technical/ developed by government
   c) ___ International standards
6) Why do you think the choice in (1) is more difficult for you to comply?

   _____
   _____
   _____
7) Generally how do you rate the level of food safety standards in terms of stringency in your country?
   a) ___Very strict
   b) ___ Strict
   c) ___ Fairy strict
   d) ___ Not strict

8) How do you rate food safety standards in terms of ease of compliance?
   a) ___ Very difficult to comply with
   b) ___ Difficult to comply with
   c) ___ Slightly difficult to comply with
   d) ___ Not difficult to comply with

9) Are your suppliers required (by your country) to have tested their products before you import them? Yes ___ No ___
10) How many inspection points are currently in operation? How many agricultural (Phytosanitary) inspectors are currently employed in your country?

11) If Question (5) is (YES) what are they required to test*? (Note: ask for documents especially the Phytosanitary certificate, actual copies of standards; and contact the institutions in the country responsible for issuing the certificates)*

	Standard	Product	Recommended level *(Attach a sample of the certificate or actual test report).*
Microbiological standards	Aflatoxin levels.		
	Staphylococcus (cfu/g)		
	Total coli forms (MPN/g)		
	Escherichia Coli		
	Total plate count- (cfu/g)		
	Yeast and moulds—(cfu/g)		
	Pesticide residue levels.		
Composition& quality	pH (Total Acidity-Acetic acid) for tomato sauce		
Any other?			
Limits for mineral impurities	Lead (Pb)		
Any Other?	…….....		

12) Where do you take your products for testing? (Organizations responsible for enforcing food safety)
   a) ___ Government laboratory
   b) ___ Private laboratory

13) Please mention the private laboratories in your country you know of?
   a) _____
   b) _____
   c) _____

14) Which SPS measures must your products meet before you import them?
   Mention crucial certification I. e.
   a) ___ Organic certificate
   b) ___ Certificate of Analysis
   c) ___ Export certificate
   d) ___ HACCP certificate

   e) ___ GLOBAL GAP certificate
   f) ___ Other (Please specify) _____

CATEGORIES OF FOOD SAFETY STANDARDS

Food safety standards are categorized into three broad categories, the international standards, the public or technical standards and the private standards. In this questionnaire every detail is about the importing country unless when the local standard is considered equivalent.

SECTION 3B: International food Safety standards:

15) Have you heard of international Food safety Standards? Yes ___ / No ___

16) Check all that applies to your import products

Standards	Country	What does it involve?	Any difficulties for compliance?
ISO 22000- food safety management standard (ISO standard)			
HACCP (developed by codex)			
GMP (developed by codex)			
BS OHSAS 18001 Occupational Health and Safety standard (ISO standard)			
Codex labeling requirements			
Codex Pesticide residue limits			
Codex microbial Standard			
ISO 9000- (quality management. It is concerned about the processes through which an organization manages its work and not directly the end product)			
Standard for whole maize meal-1995			
Codex labeling requirements			
Codex Standard for processed tomato concentrate			
COD-Processed cereal based foods for infants and young children			
COD-Standard for maize corn-1995			
Standard for whole maize meal-1995			
COD-For de-germed maize (corn) meal and maize grits 1995			
COD- Standard for Rice			
COD-Standard for Bananas 2005			
COD-Standard for tomatoes			
COD-Standard for preserved tomatoes -2007			

[51]More on International Standards:

International standards are developed and disseminated by international governmental and non-governmental standards development organizations, such as International Standardization Organization, International Electro technical-Commission, the International Telecommunication Union or Codex Alimentarius. These international standards are voluntary standards. At the international, regional or sub-regional level, harmonization of standards is done through regional standards bodies or sub-regional standards organizations.

[51] Examples of International Standards

- ~ ISO standards
- ~ Codex standards
- ~ IPPC standards
- ~ IEC

SECTION 3C: Private Food safety Standards

Private standards include regulations or restrictions or conditions that are put in place by private buyers. These conditions are aimed at promoting legal safety. This is because in developed countries such as EU, there are EU standards but these are relatively easy to comply with yet the private retailers have strict rules imposed on them by the EU government so for the private companies to be safe they develop private standards that enable them to work within the confines the EU government imposes on them. i.e Tesco natures choice developed by Tesco supermarket.

17) Are you familiar with any private standards? Yes ____ No____

18) What private standards have been developed over time in your product field? _____

MORE ON PRIVATE STANDARDS:

Illustrative Standards and Technical Requirements: Product group-FF&V (E.g. Tomatoes and plantain) and Cereals (e.g. maize and Rice)

Standards, Regulations or Private Protocols Related to food safety			
	Indicate country considered in each case	YES/ NO (Indicate product considered)	Compliance problems /difficulties
Pesticide residue limits	Does your country require your suppliers to test their products for pesticide levels before you import them?		
	What levels are acceptable or required? (attach a copy of one of the analysis report)		
Microbial standards	Are there any requirements for microbial standards in your country for the product you import?		
	What are the required levels (attach a copy of the requirements)?		
Traceability requirement	Does your country require you to know where your produce was produced and the way it was handled?		
	If Yes, How do you trace your suppliers? (Provide descriptive details)		Descriptive details i.e. for traceability req'ts Mark here 1. Documentation of names and address of supplier 2. Nature of product 3. Date of delivery 4. Volume and quantity of product 5. Batch number 6. Product descriptions for each shipment

			7. Data base of your suppliers 8. Codes for plots and farmers
Hygiene requirement	Any hygiene or cleanliness requirements?		
	What are those requirements (provide details)		
Mycotoxin levels (for cereals and nuts only)	Have you had any problems with aflatoxins in the maize (cereals) you import?		
	What are the acceptable levels of Aflatoxins in the cerals you import? (Please attach a sample of test results if any and the requirements you have to meet).		**Any Problems with Complying**

Animal and Plant health protection			
		YES/ NO	**Problems with Complying**
Plant material quarantine	Are there any products you were refused from importing due to quarantine requirements? (Maize, rice, tomatoes & plantain).		
	Why the quarantine? (What is the target pest or disease being prevented from spreading?		
	For how long has/did the quarantine stayed/stay?		
	What do you need to do to have the quarantine removed from your product?		
Pest risk analysis	Does your country carry out a pest risk analysis on the products you import?		
	What conditions does your country normally indicate on your import permits (the document you send to your suppliers		
	Are they normally easy to comply with?		Give some details of the requirements normally indicated on the import permit.
Fumigation analysis	Are you required to have your produce fumigated before they cross the boarders? (Are there any fumigation requirements?)		
	What chemicals are required to be used during fumigation?		
	Describe the inspection procedure, What is considered to be very important for which failure to comply leads to rejection?		
	Have your produce ever been rejected by your country? Why was the produce rejected?		
Phytosanitary certificate	Do you need a Phytosanitary certificate to import your produce? (get a copy of the certificate)		

Quality or technical attributes			
		YES or NO	Details
Quality grades	Are the products you import categorized into quality levels?		
	What quality levels are your products graded?		
General labeling requirement	Any requirements for labeling your produce?.		How should the labeling be done? (please provide the labeling standards for your country)
	Is the labeling done according to your country standards or your company (importing company)?	a) According to the importing country standards. b) According to importing company. c) According to exporting country standards. d) According to exporter standards.	
	Provide details in either way of how the labeling standards are fulfilled?		
Packaging standards	Do you have a specific way of packaging you need to follow?		
	Who determines the packaging style?		
GMO labeling	Do you import GMOs in your country?		
	Does your country know about it?		
	Are you required to have your products labeled as GMOs?		
	Do you import Animal feeds?		
Restriction on animal feed ingredients	Which ingredients are not allowed in your country?		
	Are you required to indicate the nutrient content of the food stuffs you import?		
Nutritional labels	Does your country require your imports to bear nutritional labels on their packages? (Is it a requirement by your country?)		
	How do you label, is it according to national standards, company standards, or exporting country standards?		

Environmental Concerns:			
		YES or NO	**Problems with complying**
Pesticide use restrictions	Is there a restriction on the kind of pesticides the farmer uses during production or the traders must use to fumigate during storage?		
	Which chemicals are recommended for fumigation in your country?		
	Is there a conflict with what your export/ suppliers require?		
	If yes, what are the recommended chemicals for fumigation? Why the choice?		
	Please mention the chemicals that are banned by the importing country?		Provide a list if possible.
	Please mention the chemicals that are banned in your country?		
Water soil contamination requirement	Are there any protections imposed by your country to protect water or soil resources against contamination? *(it could be soil a condition imposed by your country to the exporting country in order to encourage environmental protection in the exporting country)*		
Codes for Organic practices /Certificate	Are you dealing with organic products?		
Biosafety /GMO regulations	Do you have bio-safety regulation?		
	Please attach a copy of the regulation or policy is existent		
Codes for organic practices and certification	Do you import your product as Organic?		

	What practices do you have to ensure before you import?		
	Which certificates are required by your country?		
Social			
Monitoring of child Labor	Any requirements of the age of the people used to produce the on the farms or companies from which you pick your imports?		
	Give details of the requirements of child labor incase it has to be used?		
Occupational Health Standards	Are your suppliers required by your country to provide specific working environment for their employees?		
	Provide details of what is required?		
Others			
Global Good Agricultural Practices (GAP)	Are your suppliers required to have Global Gap certification before they access the market in your country?		
UK supermarkets			
British retail consortium (BRC) (deals with main pack-house operations, including high care and minimal processing Facilities).	Does your country follow the BRC? Or Has your country adopted BRC standards requirements/does your country require its suppliers to have adopted the BRC?		
	Do you know any of the private standards below? Does any of them apply to your country?/ has any of them been adopted as standard upon which the quality of imports is judged? Check where its applicable		
Ethical Trading Initiative (ETI)	Yes ___ No ____		
Tesco Nature's Choice standards (it's a pre-farm standards developed by Tesco	Yes ___ No ____		

supermarket)			
Save Quality Food Program	Yes ___ No ____		
Farm Folk standards (developed by Marks and Spenser-considers packing as well as production)	Yes ___ No ____		
French supermarkets (quality assurance schemes for own brands)			
Terre et Saveur of Casino			
Filiere Agruculture Raisonnee of Auchan			
Filiere Qualite of Carrefour.			
Please mention any other private standard applied to imports in your country			

NOTE: For companies exporting to more than one country, find out information per importing country. This is because each country has a right to develop their own standards so even neighboring countries could have different standards.

SECTION 4: Maximum Residue Limits (MRLs) (HARMONISATION OF SPS REGULATIONS)

1) Is there an official list of approved MRLs in your Country?

2) Does the same list exist for the countries where you import from?
3) List the countries with approved MRLs?

1.	2.
3.	4.

4) How are MRLs set in your Country? (Provide the details/copy of the MRLs for your country).
   a) According to Codex standards**……**
   b) According to consumer protection needs…….
5) Any other basis?
6) How does your Country monitor MRLs in foods?

Country	**Ways of monitoring**	**Indicate other monitoring strategies here.**
	Pick food samples routinely at the point of entry for testing.	
	Require the importers to have lab reports (tests done from the exporting country)	
	No monitoring	
	Pick food samples routinely at the point of entry for testing.	
	Require the exporters to have lab reports	
	No monitoring	
	Pick food samples routinely at the point of entry for testing.	
	Require the exporters to have lab reports	
	No monitoring	

7) Does your country have pesticide laboratories that can analyze residues in foods? Yes ___ No __

8) Which MRLs does your country base on to accept your import your products? (Chemicals of interest to the importing country and indicate the acceptable levels)
   _____ _____
   _____

9) Has your country formally participated in regional or international efforts to harmonize pesticide registration and MRLs? (Consider private sector participation – mention organizations) Yes _No_

10) Briefly explain efforts that have been or are currently undertaken

_____

11) If yes, (the country has taken efforts to harmonize MRLS) briefly describe outcomes that have been achieved and the challenges that have been encountered

_____

12) List the chemical residues tested in the product you import , if there is testing done in your country (insert the chemical residues here for each crop)

_____ _____

_____

13) Which of the residues is considered to be most important when accepting imports into your country?

_____

_____

14) What are the acceptable levels of the chemical residues for your products in your country?

SECTION 5: GENERAL QUESTIONS

19) What are your major concerns/ challenges regarding the requirements for food safety in Agricultural trade?

_____

_____

_____

What do the inspectors consider to pass / or accept your import products into your country?

a) Physical analysis
b) Consistence of documentation
c) Tests performed by themselves
d) Any other?

Please get copies of documents listed below

		National Standards	
I.	*The plant protection Act*	*I.*	*General requirements for nutrition labeling*
II.	*The produce protection Act*	*II.*	*Tomato standards (if they are standards specified for the products mentioned in section 2 please attach them)*
III.	*The produce marketing Act*	*III.*	*Specific standards for Maize, rice, plantain (Musa SSP) and their products*
IV.	*Acts related to animal health*	*IV.*	*Hygiene standards*
V.	*National industrial policy or Act*	*V.*	*Standards for the existing trade arrangements I.e ECOWAS or WAEMU*
VI.	*National trade policy*		
VII.	*The seeds and plant Act*		

Appendix C2

Questionnaire for Exports

Background Information:

This project is an African Food Security initiative intended to identify trade bottlenecks in West Africa and East Africa. Similar Studies will be conducted in **Uganda, Senegal and Mali** and the study is targeting exporters and importers of major food staples in the three countries. The products considered in this study include maize, rice, tomatoes and plantain, and the study specifically focuses on Sanitary and Phytosanitary issues from a trade stand point.

Consent Note:

Participation in this study is free and any participant has full rights to accept or refuse to be part of this study. If you choose to participate in this study, you are assured that the information that is provided will only be used for the purposes of this study. The personal identification of respondents will be kept confidential. Participating in this study may take about an hour of your time. If you agree to participate in this study please confirm by signing in the space below**.**

…… .. ……/……/……

Sign **date: mm/dd/yr**

SECTION1: EXPORTER INFORMATION

8) Name of exporter or company
9) When the business started (for how long has the exporter been in business)
10) Trade partners (partner organizations providing support to promote agricultural trade)

Government Institution	Private Institutions
_____	_____
_____	_____
_____	_____

11) Major Countries exported to:

_____ _____ _____ _____

12) Any changes in the destination countries overtime?

_____

13) Why the change?

_____

14) Are there any restrictions that impact on how much you can export in a particular period of time?

Regulatory restrictions Yes ___ No ___
Private restrictions Yes ___ No ___

c) If yes for Regulatory restrictions ….

- Did you receive any import permit from the importer which indicates the maximum amounts you are supposed to export? Yes ____ No ____
    - If yes, what is the maximum amount per period (tons per month or year, …)

      _____
- What is the maximum amount your company can export per period (tons per month or year, …) _____

In case the maximum amount the company can potentially export is greater than the amount permitted by the regulatory restrictions, ask the following question

- Is there any national policy which does not allow your company to export up to a certain limit just to ensure food security within the country? Yes ____ No ____
- If yes, please list them

iv) _____

v) _____

vi) _____

- Please indicate any effect these restrictions had or still have on your production capacity (Check all that applies)
    - Adjust my production accordingly _____
    - The excess production is traded domestically ____
    - Other _____ (Please be explicit)

d) If yes for Private restrictions….

- Do you have any private restrictions such as financial constraints that prevent you from sending the maximum potential amount your company can export? Yes__ No__

- If yes, indicate the effect of such restrictions on your production capacity (Check all that applies)
    - No effect ____
        - Still purchasing (part in cash and part in credit) the required amount by the importing country from farmers ____
        - Receive credit support from financial institutions _____
    - Reduction of the quantity demanded from farmers _____

SECTION 2: PRODUCT INFROMATION

2) Which crop do you export and in which form do you export your product**? (Please check all that applies)**

Table 1: Product categories exported for tomatoes, rice, maize, and plantain.

Product	**Product lines/Categories**	**Tick where applicable cross otherwise.**
Tomatoes	Canned Tomatoes	
	Tomato Juice	
	Tomato concentrate (Tomato paste and puree)	
	Highly seasoned (sauce and Ketchup)	
Maize	Maize grain	
	Maize flour	
Rice	Rice grains	
	Rice flour	
Plantain	Plantain chips	
	Fresh fingers	
	Plantain flour	

SECTION 3A: FOOD SAFETY STANDARDS

(Food safety standards include ways in which food is handled, prepared and stored to avoid food borne illnesses).

20) Have you heard of food safety standards? Yes ____ No ____

21) What category of customers do you supply or sell to your products?

d) Chain retailers (supermarkets) (these require private Standards)
e) Wholesalers (processing companies)
f) General markets (these satisfy public standards)

22) What food safety requirements/Standards do you have to fulfill before exporting your products? Refer to table 2 below.

Note: The private standards are those imposed privately by a specific company i.e. labeling of products could be done according to the Chain -retailer standard (e.g. Walmart)

Table 2: Shows a list of private, international and public standards (contact the appropriate person in the company about technical questions and lab questions)

Private standards (Check all that applies)	**International Standards (Check all that applies)**	**Public Standards for where you export (Check all that applies)**
	Food Safety	
___ Pesticide residue limits	___ Codex Pesticide residue limits	___ Pesticide residue limits
___ Microbial standards	___ Codex microbial Standard	___ Microbial standards
___ Traceability requirements *(Documentation of names and address of supplier* *Nature of product* *Date of delivery* *Volume and quantity of product* *Batch number* *Product description)*	___ ISO 9000- (quality management. It is concerned about the processes through which an organization manages its work and not directly the end product)	___ EU general Food Law –Traceability requirement (2005) *(Documentation of names and address of supplier* *Nature of product* *Date of delivery* *Volume and quantity of product* *Batch number* *Product description)*
___ Hygiene requirements		___ Hygiene requirements
___ Mycotoxin levels	___ Codex Mycotoxin standard	___ Mycotoxin levels
	Animal plant health	
___ Plant material quarantine	___ ISO 22000- food safety management standard (ISO standard)	___ Plant material quarantine
___ Pest risk analysis	___ HACCP (codex)- food safety meta-system	___ Pest risk analysis
___ Fumigation analysis	___ GMP (codex)	___ Fumigation analysis
___ Phyto sanitary certificate	___ BS OHSAS 18001 Occupational Health and Safety standard (ISO standard)	___ Phyto sanitary certificate
	Quality and technical attributes	
___ Quality grades		
___ labeling requirements	___ Codex labeling requirements	___ General labeling requirements
___ Packaging standards	___ **Other codex standards**	___ Packaging standards
	Environmental	
___ Pesticide use restriction	___ Standard for processed tomato concentrate	___ Pesticide use restriction
___ Water or soil contamination requirement	___ Processed cereal based foods for infants and young children	
___ Codes of Organic practices	___ Standard for maize corn-1995	
___ Bio-safety /GMO regulations	___ Standard for whole maize meal-1995	
___ *Accountability 8000*		
___ The *Ethical Trading Initiative*		

___ The *Marine Stewardship Initiative*		
Social		
___ Monitoring of Child Labor	___ For de-germed maize (corn) meal and maize grits 1995	
___ Occupational health Standards	___ Standard for Rice	
Others		
___ Global Good Agricultural Practices (GAP)	___ Standard for Bananas 2005	
UK supermarkets		
___ British retail consortium (BRC) (deals with main pack-house operations, including high care and minimal processing facilities).	___ Standard for tomatoes	
___ Ethical Trading Initiative (ETI)	___ Standard for preserved tomatoes -2007	
___Tesco Nature's Choice standards (it's a pre-farm standards developed by Tesco supermarket)		
___ Save Quality Food Program		
___ Farm Folk standards (developed by Marks and Spenser-considers packing as well as production)		
French supermarkets (have also developed quality assurance schemes for their own brands		
___ *Terre et Saveur* of Casino		
___ *Filiere Agruculture Raisonnee* of Auchan		
___ *Filiere Qualite* of Carrefour.		
___ Other (Specify)		

NOTE: Please ask for copies for all standards that apply.

23) According to your experience which SPS measures gives you a hard time to comply with? (Check all that applies)
   d) ___ Private standards
   e) ___ Public/technical/ developed by government
   f) ___ International standards
24) Why do you think the choice in (1) is more difficult for you comply with?
   _____
   _____
   _____
25) Generally how do you rate the level of food safety standards in terms of stringency
   e) ___Very strict
   f) ___ Strict
   g) ___ Fairy strict
   h) ___ Not strict

26) How do you rate food safety standards in terms of ease of compliance
   e) ___ Very difficult to comply with
   f) ___ Difficult to comply with
   g) ___ Slightly difficult to comply with
   h) ___ Not difficult to comply with

27) Do you test your product before export? Yes ___ No ___

28) If Question (5) is (YES) what do you test for*? (Note: ask for documents especially the phytosanitary certificate, actual copies of standards; and contact the institutions in the country responsible to deliver the certificate)*

	Standard	Product	Recommended level *(Attach a sample of the certificate or actual test report).*
Microbiological standards	Aflatoxin levels.		
	Staphylococcus (cfu/g)		
	Total coli forms (MPN/g)		
	Escherichia Coli		
	Total plate count- (cfu/g)		
	Yeast and moulds—(cfu/g)		
	Pesticide residue levels.		
Composition& quality	pH (Total Acidity-Acetic acid) for tomato sauce		
Any other?			
Limits for mineral impurities	Lead (Pb)		
Other	……..**.....**		
	……..		
	……..		

29) Where do you take your products for testing? (Organizations responsible for enforcing food safety)
   c) ___ Government laboratory
   d) ___ Private laboratory

30) Please mention the private laboratories in your country you know of?
   a) _____
   b) _____
   c) _____

31) Which SPS standard methods must your products met before exporting them?
   Mention crucial certification I. e.
      g) ___ Organic certificate
      h) ___ Export certificate
      i) ___ HACCP certificate
      j) ___ GLOBAL GAP certificate
      k) ___ Other (Please specify) _____

International standards are developed and disseminated by international governmental and non-governmental standards development organizations, such as International Standardization Organization, International Electro technical-Commission, the International Telecommunication Union or Codex Alimentarius. These international standards are voluntary standards. At the international, regional or sub-regional level, harmonization of standards is done through regional standards bodies or sub-regional standards organizations.

CATEGORIES OF FOOD SAFETY STANDARDS

Food safety standards are categorized into three broad categories, the international standards, the public or technical standards and the private standards. In this questionnaire every detail is about the importing country unless when the local standard is considered equivalent.

SECTION 3B: International food Safety standards:

32) Have you heard of international Food safety Standards? Yes ___ / No ___

33) Check all that applies to your export products

Standards	Country	What does it involve?	Any difficulties for compliance?
ISO 22000- food safety management standard (ISO standard)			
HACCP (developed by codex)			
GMP (developed by codex)			
BS OHSAS 18001 Occupational Health and Safety standard (ISO standard)			
Codex labeling requirements			
Codex Pesticide residue limits			
Codex microbial Standard			
ISO 9000- (quality management. It is concerned about the processes through which an organization manages its work and not directly the end product)			
Standard for whole maize meal-1995			
Codex labeling requirements			
Codex Standard for processed tomato concentrate			
COD-Processed cereal based foods for infants and young children			
COD-Standard for maize corn-1995			
Standard for whole maize meal-1995			
COD-For de-germed maize (corn) meal and maize grits 1995			
COD- Standard for Rice			
COD-Standard for Bananas 2005			
COD-Standard for tomatoes			
COD-Standard for preserved tomatoes -2007			

SECTION 3C: Details for Private Food safety Standards

Private standards include regulations or restrictions or conditions that are put in place by private buyers. These conditions are aimed at promoting legal safety. This is because in developed countries such as EU, there are EU standards but these are relatively easy to comply with yet the private retailers have strict rules imposed on them by the EU government so for the private companies to be safe they develop private standards that enable them to work within the confines the EU governments impose on them.

34) Are you familiar with any private standards? Yes ____ No____

35) What private standards have been developed over time in your product field? _____

MORE ON PRIVATE STANDARDS:

Illustrative Standards and Technical Requirements: Product group-FF&V (E.g. Tomatoes and plantain) and Cereals (e.g. maize and Rice)

Standards, Regulations or Private Protocols Related to food safety			
	Indicate country considered in each case	YES/ NO (Indicate product considered)	Compliance problems /difficulties
Pesticide residue limits	Do your importers require you to test your products for pesticide levels before you export?		
	What levels are acceptable or required? (attach a copy of one of the analysis report)		
Microbial standards	Are there any requirements for microbial standards in your export country for the product you export?		
	What are the required levels (attach a copy of the requirements)?		
Traceability requirement	Do your customers require you to know where your produce is produced from and the way it is handled?		
	If Yes, How do you trace your suppliers? (Provide descriptive details)		Descriptive details i.e. for traceability req'ts Mark here 9. Documentation of names and address of supplier 10. Nature of product 11. Date of delivery 12. Volume and quantity of product 13. Batch number

			14. Product descriptions for each shipment 15. Data base of your suppliers 16. Codes for plots and farmers
Hygiene requirement	Any hygiene or cleanliness requirements?		
	What are those requirements (provide details)		
Mycotoxin levels	Have had any problems with aflatoxins in the maize (cereals) you export?		
	What are the acceptable levels of Aflatoxins in the food you export? (Please attach a sample of test results if any and the requirements you have to meet).		**Any Problems with Complying**

Animal and Plant health protection			
		YES/ NO	**Problems with Complying**
Plant material quarantine	Are there any products you were refused from exporting due to quarantine requirements? (Maize, rice & plantain).		
	Why the quarantine? (what is the target pest or disease being prevented from spreading?		
	For how long has the quarantine stayed?		
	What do you need to do to have the quarantine removed from your product?		
Pest risk analysis	Does your export country carry out a pest risk analysis on the products you export?		
	What conditions do you normally get on the import permits sent from the buyer		
	Are they normally easy to comply with?		Give some details of the requirements normally indicated on the import permit.
Fumigation analysis	Do you have to fumigate your products before they cross the boarders? Are there any fumigation requirements?		
	What chemicals are required to be used during fumigation?		
	Describe the inspection procedure, What is considered to be very important for which failure to comply leads to rejection?		
	Have your produce ever been rejected? Why was		

	the produce rejected?		
Phytosanitary certificate	Do you need a phytosanitary certificate to export your produce? (get a copy of the certificate)		

Quality or technical attributes			
		YES or NO	Details
Quality grades	Do you categorize your produce into quality levels?		
	What quality levels do you grade for your export products?		
General labeling requirement	Any requirements for labeling your produce.		
	Do you follow the importer rules or you label according to your country standards?	e) According to the importing country rules. f) According to importing company. g) According to exporting country rules. h) According to exporter rules.	
	Provide details in either way of how the labeling standards are fulfilled		
	Do you have a specific way of packaging you need to follow?		
Packaging standards	Who determines the packaging style?		
	Do you produce GMOs in your country?		
	Are they part of what you export?		
	Do your import countries know about it?		
GMO labeling	Do they require you to label your products as being GMOs?		
	Do you export Animal feeds?		
Restriction on animal feed ingredients	Which ingredients are not allowed in your destination countries?		
Nutritional labels	Do you indicate the nutrient content of the food stuffs you export on their labels?		
	Is it a requirement by your buying country?		
	How do you label, is it according to national standards, company standards, or importing country		

	standards?		

Environmental Concerns:			
		YES or NO	**Problems with complying**
Pesticide use restrictions	Is there a restriction on the kind of pesticides the farmer uses during production or the traders must use to fumigate during storage?		
	Which chemicals are recommended for fumigation?		
	Please mention the chemicals that are banned by the importing country?		Provide a list if possible.
	Please mention the chemicals that are banned in your country?		
Water soil contamination requirement	Are there any protections imposed by the importing country to protect water or soil resources against contamination?		
Codes for Organic practices /Certificate	Are you dealing with organic products?		
Biosafety /GMO regulations	Do you have bio-safety regulation?		
	Please attach a copy of the regulation or policy is existent		
Codes for organic practices and certification	Do you export your product as Organic?		
	What practices do you have to ensure before you export?		
Accountability 8000			Provide details of its requirements and descried the difficulties involved in meeting the requirements.

The *Ethical Trading Initiative*			
The *Marine Stewardship Initiative*			
	Which certificates are required by your importers?		
Social			
Monitoring of child Labor	Any requirements of the age of the people used to produce the on the farms from which you pick your exports?		
	Give details of the requirements of child labor incase it has to be used?		
Occupational Health Standards	Are you required to provide specific working environment for your employees?		
	Provide details of what is required?		
Others			
Global Good Agricultural Practices (GAP)			
UK supermarkets			
British retail consortium (BRC) (deals with main pack-house operations, including high care and minimal processing facilities).			
Ethical Trading Initiative (ETI)			
Tesco Nature's Choice standards (it's a pre-farm standards developed by Tesco supermarket)			

Save Quality Food Program			
Farm Folk standards (developed by Marks and Spenser-considers packing as well as production)			
French supermarkets (quality assurance schemes for own brands			
Terre et Saveur of Casino			
Filiere Agruculture Raisonnee of Auchan			
Filiere Qualite of Carrefour.			
Other			

NOTE: For companies exporting to more than one country, find out information per importing country. This is because each country has a right to develop their own standards so even neighboring countries could have different standards.

SECTION 4: Maximum Residue Limits (MRLs) (HARMONISATION OF SPS REGULATIONS)

15) Is there an official list of approved MRLs in the Countries you export your products?

16) List the countries with approved MRLs?

5.	6.	7.
8.	9.	10.

17) Does the same list exist for your country?

18) How are MRLs set in the Country you export your products? (provide the details/copy of the MRLs for the individual countries were they exist)
   c) According to Codex standards.**1, 2……..**
   d) According to consumer protection needs…….
   e) Any other basis……..

(N.B. Indicate country code from the table above against the option that applies. Like in the example above)

19) How does your export Countries monitor MRLs in foods?

Country	**Ways of monitoring**	**Indicate other monitoring strategies here.**
	Pick food samples routinely at the point of entry for testing.	
	Require the exporters to have lab reports	
	No monitoring	
	Pick food samples routinely at the point of entry for testing.	
	Require the exporters to have lab reports	
	No monitoring	
	Pick food samples routinely at the point of entry for testing.	
	Require the exporters to have lab reports	
	No monitoring	

19) Does the country have pesticide laboratories that can analyze residues in foods? Yes ___ No ___

20) Which MRLs do you base on to export your products? (Chemicals of interest to the importing country and indicate the acceptable levels)

_____ _____

_____

21) Has the country formally participated in regional or international efforts to harmonize pesticide registration and MRLs? (Consider private sector participation – mention organizations) Yes _No_

22) Briefly explain efforts that have been or are currently undertaken

_____

23) If yes, (the country has taken efforts to harmonize MRLS) briefly describe outcomes that have been achieved and the challenges that have been encountered

_____

24) List the chemical residues tested in the product you export (insert the chemical residues here for each crop)

_____ _____

_____

25) Which of the residues is considered to be most important when exporting your product?

_____

_____

26) What are the acceptable levels of the chemical residues for your destination country?

SECTION 5: GENERAL QUESTIONS

36) What are your major concerns/ challenges regarding the requirements for food safety in Agricultural trade?

_____

_____

_____

Please get copies of documents listed below

		National Standards	
VIII.	*The plant protection Act*	*VI.*	*General requirements for nutrition labeling*
IX.	*The produce protection Act*	*VII.*	*Tomato standards (if they are standards specified for the products mentioned in section 2 please attach them)*
X.	*The produce marketing Act*	*VIII.*	*Specific standards for Maize, rice, plantain (Musa SSP) and their products*
XI.	*Acts related to animal health*	*IX.*	*Hygiene standards*
XII.	*National industrial policy or Act*	*X.*	*Standards for the existing trade arrangements I.e ECOWAS or WAEMU*
XIII.	*National trade policy*		
XIV.	*The seeds and plant Act*		