Evaluation of Non-Tariff Measures for African agricultural exports to the EU in a CGE framework

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Abstract

This paper evaluates the role of Non-Tariff Measures (NTMs) on agri-food trade between the EU and Africa. Given that the effects of NTMs cannot be generalised across products and regions the analysis considers several agricultural and horticultural products exported from Côte d'Ivoire, Kenya, Morocco, Uganda and South Africa. In these five countries 95 exporters were interviewed to obtain first hand information on five types of obstacle to exports: taxes and subsidies, customs and procedures, standards and regulations, specific limitations, and distribution chain and infrastructure. Indices corresponding to these five items were built and were integrated into an econometric analysis based on the approach presented by Fugazza (2008) to obtain estimates of the NTM effects on bilateral trade between the EU and the African countries. The values obtained from the econometric analysis were transformed into ad valorem tariffs equivalents (AVEs), and introduced into a computable general equilibrium (CGE) model to study the effects of their presence and removal.
The simulation results indicate the potential outcome of removing selected obstacles. From the econometric results, findings point to an overall positive effect resulting from standards and regulations, as well as from improvements in transportation, packaging, handling and preserving of African agricultural products. These findings provide empirical evidence on the effects of NTMs on African exports of agricultural products to the EU. They also support previous theoretical studies in which significant impacts are expected when standards and improvements are introduced into the agri-food export chain (Beghin, 2001).

Disclaimer: The views expressed are purely those of the authors and may not in any circumstances be regarded as stating an official position of the European Commission.

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Introduction

The European Union (EU) is the largest export market for most African countries regarding agricultural commodities. African products account for almost 9% of EU imports. Important instruments to lower the entry barriers for African products to the EU are included in the African, Caribbean and Pacific countries (ACP) regimes, the Everything but Arms (EBA) agreement, the Euro-Med Association Agreements[2], the Economic Partnership Agreements (EPA) and the Trade and Development Cooperation Agreement (TDCA) with South Africa. The EPA negotiations with ACP countries aim to conclude comprehensive trade and development agreements.

As a result of these agreements, both agricultural goods and food imports from most African countries face no or reduced import tariffs in the EU. Several studies have shown the important potential for agri-food products from developing countries, once free trade is established. However, trade flows have not reflected this favourable development, yet the overall trade share of Africa with the EU is declining over the years. For instance, EU imports from ACP countries remain at a level of about 10 billion € in recent years after a peak of 13 billion € in 2002[3]. Several reasons for this development can be identified, such as growing domestic demand, decreasing production or productivity, infrastructure, quality requirements etc. However, other limiting trade factors can be Non Tariff Measures (NTMs). The effects of NTMs on the different agents in the economy generate segregation between core and non-core NTMs. Core or border NTMs are those measures directly related to changes in trade figures such as prices and quantity controls, and therefore, affecting foreign producers. Non-core or internal NTMs are measures implemented in domestic economies with the intention of protecting local consumers, and therefore affecting local consumption. Examples of non-core NTMs are human health protection, animal health and life protection, plant health protection, environment protection, etc. (UNCTAD, 2007).

The aim of this paper is to assess the importance of the measures and factors other than tariffs which generate restrictions and diminish trade flows or NTMs for selected African products entering into the EU. Following the broad definition by Mahé (1997), this includes:

- Technical Barrier to Trade (TBT) as defined by the World Trade Organisation (WTO);
- Sanitary and Phytosanitary Measures (SPS) as defined by the WTO;
- Transport infrastructure and costs;
- Telecommunications, comprising telephone, fax and internet connections;
- Private product standards[4;]
- Technical handling and red tape.

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[2] In 2006, the IPTS organized a workshop titled "Euro-Med Association Agreements: Agricultural Trade – Regional Impacts in the EU." The aim of the workshop was to provide a platform for discussion on the methodological approaches and different results (http://www.jrc.es/publications/pub.cfm?id=1430).

[3] European Commission, Putting Trade Policy at the Service of Development, http://trade.ec.europa.eu/doclib/docs/2008/april/tradoc_138597.pdf , p. 24.

[4] Large private importing companies set internal standards for selling their products into their distribution channels.

The remainder of this paper is as follows. Section 1 presents a literature overview of existing NTM detection and measurement of their impacts. Section 2 describes the country and product selection for the exporter survey. Section 3 contains the description and presentation of the results collected from the exporter survey conducted in 2009. The methodology of our research is presented in Section 5. We start by detecting the presence of NTMs by an econometric regression taking as a dependent variable the answers from the survey performed amongst exporters (Sections 5.1 and 5.2). Then these results have been converted into a tariff equivalent (Section 5.3). An application of the tariff equivalents in a CGE model is designed and described in Section 5.4 to assess the effects of these NTMs on trade between African exports and the EU market. Section 5.5 contains the inclusion of tariff equivalent into a CGE to assess global trade changes. Finally, the main conclusions of our research are drawn in Section 6.

1. Literature Review on methodologies to evaluate NTMs

Given the vast variety of existing NTMs, there is no single analytical procedure or methodology capable of dealing completely with the entire spectrum of NTMs and their diverse manifestations on trade (Deardorff and Stern, 1998). Thus, there are different fashions for measuring or quantifying NTMs, these methods can be classified according to the nature of the identification. A first classification known as *frequency or coverage type* contains all those NTMs which have been identified. This classification consists of a listing of observed NTMs for specific countries and products or categories of trade at a disaggregated level. The second approach, *price wedge,* calculates NTM effects as those compared to a tariff equivalent. A similar classification examines a *quantity wedge* through an econometric model (Deardorff and Stern, 1998).

1.1 Incidence of Non-Tariff Measures

Several international institutions have invested resources over recent years to develop consistent and accurate databases detecting the presence of NTMs. The most extensive effort has been made by the UNCTAD to create the Trade Analysis and Information System (TRAINS) database, which is accessible online and contains indicators of Trade Control Measures (including Non Tariff Measures). The data is displayed at the Harmonised System 6-digit (HS-6) level for over 150 countries. A data in time series from the TRAINS has been extended in collaboration with the World Bank to create the World Integrated Trade Solution (WITS) software. Both databases are compounded by **trade coverage** and **frequency ratios**.

The percentage of trade subject to NTMs for an exporting country *j* at a desired level of product aggregation is given by the trade coverage ratio C:

$$C_{jt} = \left[\frac{\sum_{i=1}^{k}(D_{ijt} V_{ijt})}{(\sum_{i=1}^{k} V_{ijt})} \right] * 100 \qquad (1)$$

Where, by the existence of an NTM to a tariff line item *i*, from the importing country *j*, the dummy variable D_{ijt} (1=imports or 0=no imports), takes the value of one and zero if there is no NTM; V_{ijt} is the value of imports in item *i*, *t* is the year of the transaction.

The frequency index F accounts for the presence or absence of NTM. It can be also interpreted as the percentage of import transactions covered by a selected group of NTMs. It is calculated as:

$$F_{jt} = \left[\frac{\sum_{i=1}^{k}(D_{ijt}M_{ijt})}{\sum_{i=1}^{k}M_{ijt}} \right] * 100 \qquad (2)$$

Where D_{ijt} is a dummy variable(1=NTM or 0=non NTM), reflects the presence of an NTM on the tariff line item, M_i indicates whether there are imports from the exporting country j of good i (also a dummy variable: 1=imports or 0=no imports) and *t* is the year of measurement of the NTM. The frequency ratio, unlike the coverage ratio, does not reflect the relative value of the affected products and thus cannot give any indication of the overall importance of the NTMs to an exporter, or, relatively, among export items (Bora et al, 2002). The frequency ratio however provides a measurement of the percentage of imports subjected to NTMs.

The availability of coverage and frequency ratios is rather limited and not always continuous over the years. The last updated information is as of 2001. TRAINS-WITS data has information for 165 countries, however not all agricultural products and not all years are covered. This database can be used in econometric studies as explanatory variables when analysing factor trends in bilateral trade flows. The use of coverage and frequency ratios has also been applied in gravity models with promising results (Kee et al, (2008); Andriamananjara et al, (2004) etc).

1.2 Price comparison and quantity impact NTM measures

This approach, also known as the price or quantities wedge method, is based on the estimation of the difference caused by the NTM between import and domestic prices (quantities). From the difference the import tariff is deducted. The price (quantity) wedge between domestic and import is considered as the NTM. This method is quite easy to perform when both prices (quantities) for the same commodity are available. However, this method has several limitations. First, with this method one quantifies the effect of several NTMs affecting that product, but nothing can be said of the specific effect of each NTM or the identification of those NTMs acting on that product. Second, it is difficult to have domestic and import prices for the same product, therefore in most cases domestic produced and imported products are considered perfect substitutes. In order to overcome this caveat, some researchers such as Griliches (1970) apply hedonic prices either for domestic or for import prices (quantities). One of the important limitations of this approach is to be operational for large scale industries, as the data is too aggregated to identify specific differences (Deardorff, 1997).

1.3 Tariff equivalent

A tariff equivalent is estimated by calculating first the price wedge and then comparing the tariff that would have the same effect on prices or quantities flows as those caused by the NTMs. This method is applied to simulate the effects of NTMs in market models. It is also possible to apply an econometric method to determine the price wedge by analysing changes in prices (quantities) of produced and traded products over a period of time, a necessary requirement are supply and demand elasticities (Bora et al., 2002).

1.4 Survey-based Methods

A survey is conducted among exporters of certain products and regions. This method has several advantages, such as the identification of particular NTMs which through other methods would be difficult to identify, i.e. administrative entry procedures, pre-shipment inspections, customs classifications, etc.
Surveys allow for the possibility of prioritizing different types of mechanisms. Surveys also help to determine which specific NTMs are important to exporters (Mattson, et al., 2004). The main disadvantage is the high cost required to conduct export surveys. Additionally given the specificity of commodity trade across countries, it is difficult to reach a certain comparability level between surveys on different products (countries) (Carrère and de Melo, 2009). Depending on the survey structure, the further use of the results can vary depending on different econometric analyses (Kubar D., U., 2006).
The analysis of the survey data suggests that trade barriers vary considerably across countries, sectors, and trading partners. Many obstacles to trade are concentrated in specific sectors and are more prevalent in intraregional trade. Moreover, most of the goods affected are often under a preferential tariff treatment by the destination country. At the same time, obstacles to trade can be associated with a lack of infrastructure and efficient procedures in the country of origin as shown by the case of Uganda (Mimouni et al., 2009). Say here WHY you (apparently) adopted the survey method.

1.5 Econometric Methods

Gravity models are often used to relate the trade flows with country characteristics and coverage or frequency ratios. This approach includes in any case the distance between trading partners as a representation for transport costs. A basic gravity model representing trade flows is written as:

$$\log(\text{trade\_flow}_{ij}) = \alpha_0 + \sum \beta_n \log(C_i) + \sum \chi_n \log(C_j) + \text{dis}\tan\text{ce}_{ij} + \sum \delta_{ij} \log(\text{NTM}_{ij}) + \varepsilon_{ij}$$

Where: trade_flow_{ij} represents the absolute values of the trade flow between country i and j; C_i, C_j and NTM_{ij} are the characteristics considered in the study for country i, j, as well as the NTM faced in trade of commodities between i and j respectively; α_0 is the specific intercept; β_n, χ_n and

δ_{ij} are the parameters specific for characteristics of country i, j, and NTMs respectively; $distance_{ij}$ represents the distance between country i and j; finally ε_{ij} is the error term in the econometric regression. Gravity-based techniques address NTMs' impacts on trade rather than their welfare impact (CGE modelling approach), and may therefore neglect the current effect that regulations have on correcting market failures with restrictive trade flows (Beghin and Bureau, 2001).

2 Selection of countries

In order to select the countries to be included in our analysis, the trade relations have been analysed. The analysis focused on export volumes from different African regions to the EU, some very competitive and others with low trade flows with the EU. The short-listed African countries were Cameroon, Côte d'Ivoire, Ghana, Senegal, Ethiopia, Kenya, Malawi, Uganda and South Africa. After conducting a preliminary analysis, Côte d'Ivoire, Kenya, Uganda, South Africa and Morocco were selected as the target countries. From the preliminary list, five countries were then selected. Uganda, representing the smallest country in the sample, is also the only landlocked country and beneficiary of the EBA agreement. Morocco is the only North African country in this sample and is also included in the Neighbourhood policy of the EU. Côte d'Ivoire and Kenya are important regional players in respectively West and East Africa. South Africa has a specific bilateral trade agreement with the EU and is the most important single economy in Africa.

The selected countries' diverse geographies, stages of economic development and institutional, political and economic relations with the EU permit a reasonable degree of variation within the African continent. Regarding the export of agricultural and food products they are diverse, some are concentrated on a few main products; others supply a wide range of products to the EU. Table 1 presents a brief summary of the Agreements that apply to each of the selected countries. Generally, these countries are the most important African exporters of agricultural and food products, with the exception of Uganda.

Table 1: Trade Agreements between the EU and the selected countries

Type of Agreement	Agreement Name	Côte d'Ivoire	Morocco	Kenya	South Africa	Uganda
Bilateral	EU – Morocco Association		✓			
	The Trade, Development and Cooperation Agreement (TDCA)				✓	
	Economic Partnership Agreement *	✓				
Multilateral non-reciprocal	Generalised System of Preferences	✓	✓	✓	✓	✓
	Everything but Arms Initiative					✓
	Lomé Convention (Cotonou Agreement)	✓		✓	✓	✓

Multilateral reciprocal	WTO Agreement (MFN)	✓	✓	✓	✓	✓

Source: Own design

* Not enforced during the time period analysed in the study.

In all five countries selected for this study, the main agri-food commodities produced are: staple grains like wheat, barley and maize, animal origin products like milk, and products that have been an integral part of local diets such as yams, cassava and bananas.

Regarding trade, each of the selected countries is assessed depending on their main exported commodities and trade agreements with the EU.

2.1 Morocco

Morocco's main exports to the EU are tomatoes, oranges, beans, mandarins, and prepared or preserved olives. All these products can enter the EU through favourable tariff conditions under the EU-Morocco Association Agreement. These five commodities result in an average export revenue of 430 million € per year.

In general, export tendencies for tomatoes and beans have been increasing, whereas for oranges and mandarins they are decreasing. Export levels of olives have remained steady, with a slight growth trend appearing as of 2005.

European destinations continue to provide the most significant outlet for vegetable and fruit exports in particular. The markets for citrus fruits and fruit in general are more diverse. Morocco is one of the most important Mediterranean trading partners and this is reflected in the trade preferences granted bilaterally.

On 17 December 2009, an agreement on trade in agri-food products and fisheries relations was concluded between the EU and Morocco. The agreement immediately liberalised 55% of agri-food imports from Morocco. For the more sensitive products from the vegetable and fruit sector for which trade will not be fully liberalised, such as tomatoes, strawberries, courgettes, cucumbers, garlic and clementines, Morocco has improved their conditions of access to its market in the form of import schedules and tariff rate quotas (TRQs). These TRQs will still see expanded access for Moroccan exports (e.g. increasing from a TRQ of 233 000 tonnes to 285 000 tonnes for tomatoes over four years).

2.2 South Africa

South Africa's top agri-food exports to the EU are products in which some level of preference has been granted by the TDCA (Table 1). Wine, grapes, oranges, apples and pears are the main commodities exported to the EU. Globally, South Africa's main exported commodities generate revenue in excess of 977 million € per year.

The export levels of South Africa's main agri-food commodities have in general risen. Increasing trends are apparent in the cases of oranges, pears, bulk wine and apples. All tariffs applicable to South Africa's main agri-food exports to the EU decreased from 1998 to 2007, whether they were preferential, non-preferential or third country tariffs. However, while the EU shares of South African

grape exports have remained steady, around 80%, oranges are being diverted from the EU to other markets. Apples also show a decreasing trend in EU shares even though they are allowed duty-free into the EU at specific times of the year. The EU shares of pear exports have also decreased despite tariffs maintaining stability. Wine has been diverted to alternative markets in recent years (as of 2005/2006). The EU does not grant any preferential treatment to South African wines. Therefore alternative markets are most likely being exploited by South African exporters.

With the exception of grapes, which show a decreasing trend in the analysed time period, the remaining commodities exported from South Africa to the EU have maintained producer price stability within a limited range of values. Regarding export prices, there is price stability with oranges, apples, pears and grapes. The export prices of wine showed a general decrease between 1999 and 2007.

2.3 Uganda

Representing 83.5% and 66.9% of the country's agri-food exports in volume and value respectively, coffee has been a major driving-force behind the Ugandan economy and is the country's most important agri-food export to the EU. Tobacco is Uganda's second most important export to the EU, overall between 1999 and 2007 representing 10.6% of the country's total agri-food export revenue during that period. Fresh cut flowers, a non-typical crop, occupy the third spot in Uganda's main agri-food exports to the EU, with a combined 126.04 million € worth of revenue between 1999 and 2007, the equivalent of 7.4% of the total agri-food commodity export value.

Even though coffee export levels decreased from the second half of the nineties until recently, they have still remained above those of any other commodity in Uganda by a considerable margin. As for tobacco, export levels have suffered less severe changes from 1999 to 2007, but are at a much lower level compared to coffee. Export revenue from fresh cut flowers has been increasing steadily since 1999, and in 2004 they surpassed tobacco as Uganda's second most important agri-food export.

2.4 Côte d'Ivoire

Regarding Côte d'Ivoire's top exported products, all main Ivoirian commodities exported to the EU are subject to duty free imports and/or preferential GSP tariffs. Cocoa beans, cocoa paste, cocoa butter, bananas and pineapples are responsible for an annual revenue of approximately 1 274 million €. Three of the main commodities are cocoa related products resulting from Côte d'Ivoire's dominant position in world cocoa production and trade.

Cocoa beans are the main driving force behind export revenue generation in Côte d'Ivoire. From 1999 to 2007 they generated annual earnings between 600 and 1 200 million €. The remaining commodities have not, in the analysed time period, generated revenue above 200 million €.

Côte d'Ivoire's main agri-food exports to the EU enter the market duty-free if exported under the Lomé Convention. All duty reduction schemes, with the exception of that applied to bananas, are straightforward: a zero tariff is imposed on Ivoirian commodities if they are exported under the Lomé Convention provisions, or a reduced quota is imposed if the same commodities are exported under the GSP. In either case, the tariff is less than the third country tariff.

Bananas are entitled to enter the EU duty-free under a pre-established quota, being that after the quota is exhausted a preferential tariff is applied.

Given this scenario, it is contradictory that the EU shares of three of Côte d'Ivoire's main exports have decreased in the analysed time period (cocoa beans, bananas and pineapples), another has remained constant within a specific range of values (cocoa butter) and only the EU share of cocoa paste exported from Côte d'Ivoire has increased. One is then led to believe that decreasing shares are not due to tariff factors as these have become increasingly favourable.

2.5 Kenya

All of Kenya's main agri-food exports to the EU are cash-crops with a special emphasis on fresh cut flowers, a non-typical crop with a high value-weight ratio. Tea and coffee, which have been privileged African exports to the EU due to the high market value and lack of associated duties, follow fresh cut flowers in Kenya's list of top exported products. These three commodities together with beans and prepared or preserved pineapples generate export revenue in excess of 537 million € per year.

Fresh cut flowers show the most remarkable growth in exports to the EU. The only other commodity that also presents a noticeable growth, even if much more moderate, is beans. On the other hand, coffee and tea, two typical cash crops leveraged by African countries to tap into the EU market, have suffered decreasing exports from 1999 to 2007. Exports of prepared or preserved pineapples have remained stable throughout the analysed period.

Since EU export shares could only be determined for tea and coffee, these are the only commodities for which it is possible to establish a correlation between those shares and the tariffs imposed by the EU. Tea and coffee are not subject to tariffs when entering the EU. Therefore, the decreasing trend in the EU share, especially in the case of tea, cannot be explained based on tariff schemes applied to Kenya. This is also the case for an inconsistent EU share of Kenyan coffee exports, as no duty on coffee exists in the EU for any country since 2001. However, competing countries have also enjoyed eliminated or reduced tariffs when exporting coffee and tea to the EU, which may be hampering Kenya's competitiveness with regard to those two commodities.

Out of the three commodities for which there are producer prices available for Kenya, only beans have maintained a stable price during the time period analysed. Both tea and coffee have experienced general price decreases until 2005, only to recover significantly in 2006. These trends are matched by the export prices. The export prices of the remaining three commodities experienced decreasing trends as of 2001, being that those trends are more pronounced in the cases of beans and cut flowers and less in the case of prepared or preserved pineapples.

3 Exporter survey

3.1 Sampling

The survey of selected exporters in 2009 resulted in 95 questionnaire replies, 20 from each of the following countries – Uganda, South Africa, Morocco and Kenya – and 15 from Côte d'Ivoire. The original intention was to collect answers from at least 100 individuals, evenly distributed among the five participating countries, but this proved unviable due to the lack of answers provided by Côte

d'Ivoire where only 15 answers were obtained. The exporters were carefully selected by the team's local experts taking into account two conditions: (i) the questionnaires had be completed by the respondent, in due time, and with enough detail to allow for a quality analysis; and (ii) the group of exporters selected had to represent the largest possible array of main commodities exported by the respective country. Thus, the outcome is not representative but provides an insight into the opinion and perceptions of agricultural commodity and food exporters.

Many of the selected respondents currently export a wide variety of agri-food products to the EU, but were selected due to their importance as an exporter of one or two particular products, which represents a main export of a given country (e.g. coffee in Kenya and Uganda, citrus fruits in Morocco and South Africa).

3.2 Evaluation of Non-Tariff Measures by exporters

In the questionnaire five groups of NTMs have been addressed, as described in Table 2.

Table 2: NTM categories used in the survey

Category	Description
Taxes and Subsidies	European and African Government Participation in Trade and Restrictive Practices (subsidies, tax benefits, and government monopoly practices)
Customs Procedures	Customs and Administrative Entry Procedures (sampling, import licensing, pre-shipment inspection, customs classification, and anti-dumping duties)
Standards and Regulations	Technical Barriers to Trade (specific labelling requirements related to non safety issues, packaging requirements, and quality requirements for fresh food)
	Sanitary and Phytosanitary Measures (chemical residue limits, testing, certification of food safety, labelling requirements related to food safety)
Specific Limits	Specific Limits (embargoes, tariff quotas, export taxes, trade agreements, export restraints, and export/import quantity restrictions)
Distribution Chain and Infrastructure	Others

Source: Own design

All the sub-sections in the questionnaire followed the same structure. The respondent was first asked to grade the influence that a list of NTMs, under each specific category, had on his/her trade volume. The grading included a positive impact (graded as 1 or 2) and a negative impact (graded as -1 or -2). In the following sub-sections, cross-country trends are presented for each of the five categories. In the following descriptive sections the focus is on the overall answers and not on the country or product-specific ones. The questions are presented in the same way as in the questionnaire.

3.2.1 Summary of grading results

Taking the combined results of the respondents from the five countries regarding taxes and subsidies, some general statements can be made regarding the findings on exports. First, in almost all cases,

respondents condiered that the application of taxes and surcharges, countervailing duties, EU procurement policies and insurance costs had a negative impact on their ability to export.

Second, regarding customs and procedures, respondents were especially sensitive to rules of origin, customs formalities and pre-shipment procedures. Although opinion was mixed as to whether their impact on exports is negative or positive, the balance was predominantly negative.

Third, concerning standards and regulations, respondents were very opinionated and results showed that they perceive related obstacles and supports as having an overall positive effect on their activity, even if by a somewhat marginal difference. The main conclusions drawn from the responses are that labelling and packaging requirements are viewed in a very positive light, whereas EU and private SPS standards are not.

Fourth, the respondents were mainly indifferent to the range of specific limitations that have the potential to affect African exports to the EU including quotas, embargoes and discrimination from bilateral agreements.

Fifth, distribution chain and infrastructure constraints have often been seen as key barriers to export performance. Replies shed light on two key areas: transportation and communication. Ttransportation costs from the production site to the port of export (which involve overland transportation), from export port of EU entry export (typically, sea or airfreight) and transport infrastructure, and transportation, were seen as problematic. On the other hand, results showed that communications were acceptable for the majority of the respondents.

In the following sub-sections, an inside on the general trends is presented according to the answers collected for the three groups included in the further analysis in this paper

3.2.2 Taxes and Subsidies

Monetary restrictions other than tariffs are regarded in this study as NTMs, i.e. other applied taxes and subsidies. These taxes can take many forms such as port taxes or surcharges, as specified in Table 3.

Table 3: Grading NTMs related to Taxes and Subsidies (as % of 95 answers)

Impact	-2	-1	0	1	2
1) African Government assistance to African exporters/producers, including subsidies and tax benefits	12	6	53	12	17
2) Countervailing duties (additional import duty imposed to offset Government subsidies in the exporting country, when the subsidized imports cause material injury to domestic industry in the importing country)	16	4	70	8	2
3) European Union procurement (policies that favour domestic suppliers when imported goods are price-competitive and are of comparable quality)	31	15	48	1	5
4) African State trading, government monopoly practices, etc.	14	7	77	1	1
5) European Union surcharges, port taxes, etc.	28	25	45	1	1
6) African Government surcharges, port taxes, export taxes, etc.	22	27	44	3	3
7) Insurance charges/premiums	4	34	53	3	6

Note: -2 = major negative impact; -1 = minor negative impact; 0 = no impact; 1 = minor positive impact; 2 = major positive impact

3.2.3 Sanitary and Phytosanitary regulations

Sanitary and Phytosanitary regulations deal with food safety issues and technical standards. The regulations addressed in this category are presented in Table 4. They represent the common, albeit diminishing, notion of what NTMs are and are consistently indicated as one of the main causes behind the difficulties of African agri-food exporters exporting to the EU.

Table 4: Grading NTMs related to Sanitary and Phytosanitary regulations (in % of answers)

Impact	-2	-1	0	1	2
1) Critical mass of exportable quality product at producer place	6	11	51	19	13
2) EU SPS measures (chemical residue limits, disease free product, requirements for specific product treatments)	19	19	29	12	21
3) Private SPS measures (e.g. Global GAP, British Retail Consortium, International Food Standards, etc)	14	23	40	7	16
4) Other private measures (related to inorganic farming, fair trade, animal welfare, environmental protection, etc)	8	21	44	14	13
5) Testing and certification arrangements (methods to verify the exported goods meet the prescribed product standards)	11	20	36	15	18

Note: -2 = major negative impact; -1 = minor negative impact; 0 = no impact; 1 = minor positive impact; 2 = major positive impact

3.2.4 Transport infrastructure

In the transport and communications category, some of the most important and often overlooked factors impairing African agri-food exporters' performance were considered especially trade-damaging. These NTMs include all limitations related to transportation infrastructure, transportation costs and transportation over land. The categeories considered are describes in Table 5.

Table 5: Grading NTMs related to Distribution Chain and Infrastructure (in % of answers)

Impact	-2	-1	0	1	2
1) Transportation costs from production location to port, airports and other shipping places	29	25	36	6	4
2) Transportation from ports of export to EU ports of entry	49	14	27	2	8
3) Infrastructures access for transportation from the production place to ports of export (road, railways, etc)	27	9	52	4	8
4) Transportation over land	25	39	28	4	4

Note: -2 = major negative impact; -1 = minor negative impact; 0 = no impact; 1 = minor positive impact; 2 = major positive impact

4 Methodology to estimate the effects of NTMs

4.1. Deriving indices from questionnaires

Single measures have been graded in the questionnaire -2 and -1 when respondents indicated a negative impact of the measure, and +1 and +2 in case of a positive effect. Several single NTMs have been grouped and adjusted to a range between -1 and 1. The resulting index NTM_x is calculated according to formula (1).

$$NTM_x = \frac{\sum answers}{\sum questions\_addre\sin g\_each\_NTM * 2}$$

(1)

4.2 Econometric estimation of impacts of NTMs

Import flows are addressed in an extension of the econometric specification proposed by Kee *et al.* (2008). We point at import flows, because NTMs detected through the exporter surveys affect imports into the EU from the chosen African countries. This econometric estimation assumes that import flows are dependent on country characteristics, domestic support, import tariffs and NTMs. In our case studies, import tariffs for African products have been set to zero in most cases. Therefore, we have modified the approach to include other explanatory variables in the econometric estimations. With our approach we suppose an impact on import flows of three types of product: a) highly perishable such as fresh flowers, fresh vegetables and fresh fruits, b) moderately perishable such as cashew nuts and other nuts; and c) storable such as coffee, cocoa, tea. A sociologic characteristic has been included: official language, either English or French. To estimate the effect of NTMs on import flows we consider a modified approach from Leamer (1988) and Kee *et al.*, (2008).

$$\ln x_{ir} = \alpha_{ir} + \sum_k \alpha_{irk} C_{rk} + \sum_k \beta_{irk} NTM_{rk} + \sum_k \varphi_{rk} PROD_{rk} + \mu_{rk}$$

(2)

Where x_{ir} is the reported import value of commodity i entering the EU market from country r at world market prices; α_{ir} is the commodity intercept; and C_{rk} are country characteristics such as agricultural GDP, total GDP, and total exports, country dummies, language spoken (English, French). NTM_{rk} represents the indices calculated from the exporter survey (Section 4.1); $PROD_{rk}$ represents commodity specific variables; α_{irk}, β_{irk} and φ_{rk} are the coefficients estimated through the econometric analysis for the country characteristics, for the NTMs and the commodity characteristics, respectively. While gravity models aim to assess the impact of NTMs on trade from the presence of imperfect substitutability between goods (Anderson, 1979), this approach explains the impact of NTMs on trade based on comparative advantages and economic country and commodity characteristics (Kee *et al.*, 2008). Finally, μ_{rk} is the error term.

4.3. Estimating Ad Valorem Equivalents

The calculation of ad-valorem tariff equivalents (AVEs) is broadly used to calculate the effect of NTMs on prices of imports. The usefulness of AVEs relies on the assumption that NTMs effects can be reproduce in the model as the effects of equivalent tariff. Nonetheless, the interpretation of welfare changes has to be different between the effects of tariffs and NTMs (Beghin and Bureau, 2001).

In our approach we estimate AVEs in order to further integrate them into a CGE model. As the information obtained from the sample was collected at HS-6 level, specific AVEs can be estimated for the considered traded products between the selected African countries and the EU. The effect of an NTM can be translated in terms of AVE by the equation (Kee *et al.,* 2008):

$$AVE_{irk} = \frac{e^{\hat{\beta}_{irk}} - 1}{\varepsilon_{irk}}$$

(3)

ε_{irk} is the import elasticity for the specific product, $\hat{\beta}_{irk}$ are the coefficients estimated by Eq(2) for NTMs. Import elasticities are taken from previous research by Kee et al (2008). However, given the high degree of specificity, not all elasticities have been estimated. In our study new NTMs have been identified and included. Thus, some commodity elasticities do not exist for those products which were not included in the study of Kee et al (2008). Some Elasticities were not reported in the abovementioned studyl These non-existent elasticities have been set to -1. The average value $\hat{\beta}_{irk}$ is estimated taking into consideration the importance of the commodity in question for the country r in the exports to the EU in terms of the values reported in the GTAP database by aggregated sector.

4.4 Modelling NTMs in a General Equilibrium Framework

Each category of NTMs affects trade flows in a different way.

The various different impacts are represented in an aggregate way in CGE modelling, as already reported by Andriamananjara *et al* (2004); Ferrantino (2006); and Fugazza and Maur (2008), by implementing price wedges. The modelling approach of our paper applies the GTAP model to simulate the effects of the NTMs found through the exporter interviews and transformed into AVEs in Section 5.2. For the simulation, we used the standard version of the GTAP model using the database version 7 and applying the weighted AVEs in the aggregated commodities from the CGE database. The database has been aggregated to 57 commodities (the originals from the GTAP database) and 7 regions (Côte d'Ivoire, Kenya, Morocco, South Africa, Uganda, the EU and the rest of the world).

5 Empirical Results

5.1 Impacts of NTM in trade flows

Eq (2) represents EU imports from the selected African countries as a function of own country and commodity characteristics, as well as NTM affecting trade flows. In the global approach reported by Kee *et al.* (2008), NTM effects also depend on tariffs levied on the particular goods. As for the

commodities included in our research, all have trade preferences when entering the EU, import tariffs as explanatory variables have not been included. Furthermore, in our sample we assume that most of the variations in import flows are dominated by a specific commodity and country marginal effect, country characteristics, and the NTMs imposed on products. The results obtained from the econometric estimation are given in Table 6.

Table 6: Estimated parameters for impacts of detected NTM and country characteristics in import flows from Africa into the EU

Explanatory variables	Coefficient (standard error)
ln Constant	-13.63 (10.10)
Sanitary and Phytosanitary regulations	-0.79** (0.34)
Taxes	0.28 (0.66)
Transport infrastructure	0.58** (0.30)
Imperishable commodities (coffee, tea and tobacco)	1.22*** (0.37)
French speaking former colony	-0.56** (0.33)
ln Agricultural GDP	1.19*** (0.37)
error	1.24

The asterisks ***, ** and * denote rejection of the null hypothesis at the 1%, 5%, 10% significance levels.

The R^2 for the estimated model is 0.23. The Wald test for joint significance of the variables (against a two-sided alternative) yields a Chi square statistic equal to 26.69. And the probability of explanatory variables being equal to zero is $p >= 0.0001$. The explanatory variables of Sanitary and Phytosanitary regulations, agricultural GDP and language variable are significant and their signs are consistent with the former studies evaluating these effects (Aloka et al, Kee et al, 2008 and Fedderke et al, 2010). The significant explanatory country and product specific variables found are: imperishable commodities (includes the production of coffee, tea and tobacco), francophone countries, and agricultural GDP. The significant NTMs identified are Sanitary and Phytosanitary (SPS) measures and transport infrastructure. Surprisingly, the variable of taxes and subsidies, contrary to the theoretical expectations, is not found to be significant in this exercise. Most probably, effects related to this category of NTM are associated with specific products and thus covered by the variable describing type of commodity (either perishable, medium perishable or imperishable).

In Table 6, the constant of -13.63 represents the average value without influence from any explanatory variable. Therefore, the exponential value represents the mean export value for the sample: exp (-13.63) = 1.2 Mio USD. The analysis of specific NTMs shows that specific SPS measures decrease export flows to the EU. SPS have according to our findings the highest negative impact on export

flows. SPS impacts are linked to reduction of export flows up to 0.49 Mio. USD (= exp (-0.79)). These negative effects are barriers that products face when trying to enter the EU market, such as EU SPS measures regarding chemical residue limits, disease free product, requirements for specific product treatments, as well as other private SPS measures (e.g. Global GAP, British Retail Consortium, International Food Standards, etc).

The results in Table 6 also suggest that former French colonies tend to have lower trade flows than former British colonies, other things being equal. For former French colonies, exports to the EU can fall by up to 0.57 Mio. USD (= exp (-0.56)). The same trends have been observed for time series of trade performance by Fedderke, et al, (2010) who associate these trends with the legacy of British colonisation in trade openness and human capital. Results also point to higher export flows for imperishable products such as coffee, tea or cocoa, up to 3.3 Mio. USD (=exp(1.22)), in comparison to other perishable commodities such as fresh vegetables, flowers and fruits. Imperishable commodities can be stored longer, and thus do not need to be specially processed to be kept fresh. The explanatory variable related to a country's agricultural GDP accounts for the size of countries. As agricultural GDP increases, countries' export flows increase as well.

Positive impacts are associated with an increase in export flows by 0.56 Mio. USD as transportation means improve. This category includes transportation costs from production location to port, airports and other shipping places; transportation from ports of export to EU ports of entry and other infrastructure access for transportation from the production place to ports of export (road, railways, etc).

5.2. Estimation of AVEs

The average AVEs estimated for products and countries are presented in Table 7. While the sample is small (95 exporters from five countries), several patterns suggest variation across countries and products. Beyond the expected results suggesting technical measures as the most important form of NTM (a result also evident from the earlier data — see section 5.1 above —), it is also apparent that imports from South Africa and Morocco face the highest NTMs according to the classifications considered, while imports from Kenya face the lowest NTMs when entering the EU.

Ad valorem tariffs estimated for transport and SPS cost measures are between 0.05% and 3.9%. By comparing averages of AVEs for transport and SPS costs, higher AVE values are observed for SPS and specifically for vegetables, fruits and fresh flowers. These higher SPS costs for perishable goods may arise because exporters and producers must change their production processes in order to comply with private and governmental standards. SPS impacts might also modify production quantities, to ensure the compliance with the import standards, and thus decrease foregone revenues from economies of scale.

The AVE values estimated across different tariff lines have a large variation. The average level of AVEs in coffee (Kenya), 0.24% in comparison to 3.2% (South Africa) for apples, provides an example of the lower NTM on imperishable products. The highest AVE of NTMs is estimated for apples from South Africa, as the transport chain and the transportation costs, as well as the conservation of the

apples from South Africa to the EU appear to increase prices by almost 3.2%. The lowest average AVE of NTMs is estimated for beans from Morocco at 0.07%.

Table 7: Estimation of Ad valorem Equivalents (AVE) of NTM on African exports in the EU

Exporting Country	Commodity	GTAP Sector	AVE		Average per country	
			Transport	SPS	Transport	SPS
Kenya	Beans	Vegetables and fruits	-0.53	-0.81	-0.32	-0.58
Kenya	Flower		-0.23	-0.35		
Kenya	Coffee	Other crops	-0.21	-0.32	-0.40	-0.62
Kenya	Tea		-0.60	-0.92		
Côte d'Ivoire	Coconuts	Vegetables and fruits	-0.79	-1.20	-0.79	-1.20
Côte d'Ivoire	cashew nut		-0.79	-1.20		
Côte d'Ivoire	Mango		-0.79	-1.20		
Côte d'Ivoire	Coffee	Other crops	-0.18	-0.27	-0.48	-0.73
Côte d'Ivoire	Cocoa		-0.79	-1.20		
Morocco	Tomatoes	Vegetables and fruits	-0.79	-1.20	-0.60	-0.92
Morocco	Beans		-0.05	-0.08		
Morocco	Olives		-0.79	-1.20		
Morocco	Oranges		-0.79	-1.20		
South Africa	Oranges	Vegetables and fruits	-0.25	-0.39	-1. 09	-1.67
South Africa	Apples		-2.55	-3.89		
South Africa	Pears		-0.79	-1.20		
South Africa	Plums		-0.79	-1.20		
Uganda	Tobacco	Other crops	-0.54	-0.83	-0.51	-0.75
Uganda	Flower		-0.79	-1.20		
Uganda	Coffee		-0.22	-0.24		

Source: Own calculations

Our estimated AVEs are considerably lower than those of Kee et al., (2008), whose values were between 39.8% and 22.7%. The main reasons for these differences are: a) in our study we analyse on a bilateral trade basis between the EU and the referred countries, b) the trade agreements with these countries have reduced nearly all import tariffs to zero; c) we work with NTMs estimated from a primary source with a scale grasping positive and negative impact instead of core NTMs.

5.3 CGE modeling approach.

5.3.1. Standard GTAP Model

The approach used in this study to estimate the effects of trade liberalization on household welfare relies on the comparative-static multi-regional GTAP model. The model possesses a structure able to simulate links among national economies; private, intermediate and government consumption; trade, and services. Further features of the model are perfect competition in all markets, as well as a profit and utility maximizing behaviour of producers and consumers. All policy interventions are represented by price wedges (Hertel, 1997). Further features and full documentation of the model are published in Hertel (1997) and constantly updated on the homepage of the Centre for Global Trade Analysis Project (www.gtap.org).

5.3.2. Database

The data set used is the GTAP database release 7.0. The database consists of bilateral trade, transport, and protection matrices linking 117 country / regional economic databases, where 14 out of the 117 countries are composite regions, e.g. Rest of Southeast Asia (XSA) or Sub-Saharan Africa (XSS). Moreover, 57 sectors are covered including a very detailed agricultural sector with 12 agricultural primary sectors and 8 food processing sectors. The remaining sectoral part comprises services, manufacturers and other primaries. Finally, besides those country and sector matrices, the database also contains five factors: natural resources, land, capital, unskilled and skilled labour (Hertel, 1997).

5.3.3. Regional and Sectoral Aggregation

In order to keep calculations as simple as possible, the database is aggregated in seven regions and 57 sectors (see Table 8). The sectors follow the same aggregation as in the GTAP database. This aggregation facilitates a convenient overview of export flows from the relevant African countries to the EU.

Table 8: Regional and Sectoral aggregation of the GTAP-Database Version 7.0

Regional Aggregation	
Code	**Countries included**
Cote d'Ivoire	Cote d'Ivoire
Kenya	Kenya
Morocco	Morocco
South Africa	South Africa
Uganda	Uganda
EU27	Belgium, Luxembourg, Denmark, Germany, Greece, Spain, France, Ireland, Italy, The Netherlands, Austria, Portugal, Finland, Sweden, United Kingdom, Cyprus, Malta, Czech, Republic, Hungary, Poland, Slovenia, Slovakia, Bulgaria, and Romania
ROW	Rest of the World
Sectoral Aggregation	
The same as in the GTAP database Version 7.0 containing 57 markets.	

Source: Own design

5.3.4. Scenarios description and results

We evaluate the effects of NTMs on trade by simulating two different scenarios. In the first scenario (AVE scenario), tariff equivalents are handled as import tariffs, thus this scenario simulates a change in import tariffs proportional to the magnitude of the estimated AVE. In the second scenario (called scenario TECH) we evaluate the NTM as a measure that generates efficiency losses but does not generate governmental gains (Andriamananjara *et al.,* 2004). The NTM effect in the scenario TECH is simulated via changes in production technology. The design of the simulation scenarios as well as the interpretation of our welfare results have to be carefully considered. The welfare effects obtained from the GTAP model are subjected to certain restrictions, such as the fact that these NTMs have been determined for specific products (at HS-6 level). However in the GTAP simulations the same shocks

are applied to all aggregated products in one category. Another effect caused by SPS might be on production quantities. Shifts in production will also have an impact on welfare reallocation and have not been included in our simulations due to the lack of information about the quantitative linkages.

Table 9 displays percent changes in export quantities of vegetables and fruits across the countries or regions. In all scenarios, it is observed that the abolition of NTMs will increase export quantities from the African countries concerned. Other regions appear not to have significant changes in export quantities of fruits and vegetables. In both scenarios, changes are observed for those export countries with comparative production advantages towards EU market supply (Morocco, South Africa and Kenya).

Table 9: Percent changes in export quantities by regions or countries (vegetables and fruits)

Scenario Country	AVE	TECH
Côte d'Ivoire	0.000	0.000
Kenya	0.001	0.001
Morocco	0.002	0.002
South Africa	0.004	0.003
Uganda	0.000	0.000
EU27	0.000	0.000
Rest of the World	0.000	0.000

Source: Own calculations

These results suggest that the current transport conditions in Africa and sanitary and phytosanitary standards restrain exports to the EU. Nevertheless, the achievement of standard requirements causes an accentuation in terms of the trust in the healthiness and quality of these products. Furthermore, demand might increase after the successful implementation of production processes to comply with the standards requirements. On the other side, transport improvements will facilitate the transportation of agricultural commodities to export ports and export destinations. Faster commodity transportation might promote trade and increase export flows. Thus, those regions whose means of transport are improved would be able to export higher volumes of agricultural commodities in a shorter period of time. This can be a critical issue, especially in the case of commercialization of perishable products from tropical regions.

The abolition of these NTMs is not only accompanied by changes in exports, imports and outputs produced, but it will also change welfare in the countries and regions involved. The changes in welfare in the GTAP model are measured by the equivalent variation (EV). The EV is an indicator that compares the level of the total income in the baseline taking the pre-existing tariffs and export subsidies into consideration with the new levels of tariffs and export subsidies after the simulation in one region or country. It represents the money required to reach the total utility in the baseline after the simulation. The EV is the sum of allocative effects (AE), the terms of trade (TOT) and the investment saving (I-S) effects (Huff and Hertel, 2000). I-S effects originate from the changes in the relative prices of savings and investments, which in the standard version are nearly zero. The AE come from changes in one region or country between imports and domestic production. Finally, the

TOT represents the cash value of the changes in relative prices of imports and exports in one region or country. In Table 10, changes in welfare in the form of EV for the three different simulations are presented.

Table 10: Equivalent variation in thousands of USD

Scenario / Country	AVE	TECH
Côte d'Ivoire	-0.2	-0.8
Kenya	19.0	16.0
Morocco	8.0	5.0
South Africa	22.0	16.0
Uganda	-0.2	-0.2
EU27	-26.0	52.0
Rest of the World	-10.0	-53.0

Source: Own calculations

From an analysis across the two scenarios in Table 10, it is observed that the countries suffering welfare losses are Côte d'Ivoire and Uganda. In these two cases, the abolition of costs related to the implementation of certain standards and transport improvement do not benefit exports to the EU. Thus, the reduction in costs of implementing standards and the improvement of means of transportation might restrict the entrance of these products into the EU as well as the output produced by these countries.

These results are not conclusive yet. Kuiper and van Tongeren (2006) warned about the likely underestimation of trade facilitation for SPS in the welfare results from the GTAP model. Specific examples of this are the positive effect of successful implementation of compliance processes as well as products representing small trade shares, such as those from Uganda. Another shortcoming is the difficulty to interpret the reallocation of tariff rents from government budget to other agents in the economy as depicted by the GTAP model. Therefore, it underlines the need for further research into the effects of NTMs in markets and the externalities caused by NTMs. Nevertheless, the model might provide trends when compliance processes have not yet been implemented.

For Kenya, Morocco and South Africa, trade facilitation will cause substantial welfare gains simulated across the three different scenarios. This suggests that the positive allocative efficiency impact of NTM removal will outweigh the likely adverse terms of trade impact. South Africa and Kenya are the countries with the highest improvement in welfare, as much as 22 000 USD and 16 000 USD in scenario TECH and AVE respectively. This indicates the high potential for agri-food products from these countries in the EU market. It is important to bear in mind that many of the products exported to the EU from Kenya, Morocco and South Africa are fresh, which according to our study are subject to more NTMs.

6   Conclusions

This paper introduces preliminary findings presented for five countries exporting fifteen agricultural products to the EU. Our results show different trends across countries and commodities. First, the econometric estimations show differences for countries with different languages (English, French), for

different types of export products (perishables, medium perishables and imperishables) and finally for the different types of NTM addressed.

We illustrate the application of different techniques to identify, quantify and analyse the effects of NTMs on international trade. These findings add empirical evidence to the current almost non-existent information on the effects of NTMs on bilateral trade flows of African agri-products into the EU. However, the approach still has a number of caveats to overcome. The results from our study have to be regarded carefully and several limitations taken into account.

While the survey comprises a modest number of countries and commodities, one major contribution of this paper is the information provided on these specific products and countries. We have characterised specific NTMs which had not been identified before due to the high costs associated with conducting field surveys. Nevertheless further field research is needed to grasp as the maximum possible number of NTMs restricting trade between the EU and African trade partners. Regarding the general equilibrium approach, extensions in the model have to be tailored to model non-constant returns to scale, which bias the magnitude of effects caused by the implementation of standards and regulations.

From the econometric results, our empirical findings point to higher possibilities of agricultural products from English-speaking countries entering the EU market. Also an overall decrease in export flows to Europe is detected as a direct effect of SPS. The improvement of means of transport used to transfer African agricultural products to European ports might enhance export flows to the EU. Furthermore, the implementation of standards would yield positive changes in welfare for competitive African regions, especially for Kenya, Morocco and South Africa. These three countries supply the EU mostly with fresh agricultural products which are found to face more restraints.

Furthermore, we stress the need for a comprehensive revision of the source of costs paid for the implementation of SPS and the destination of the profits once the processes have been implemented. This will provide a better understanding of the actual agents involved in welfare changes.

The export industry and world demand for agricultural products are facing increasing consumer concerns regarding the health benefits and quality standards of the agri-food products available on the market. Quality standards include diverse processes such as packaging, labelling and compliance with international and private technical standards of products. This study provides preliminary evidence for specific case studies of the effects caused in trade flows by these measures and the effects that technical standards have on trade between selected African countries and the EU.

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