Agricultural Export Patterns from Africa to the European Union: Exploring Non-Tariff Measures, Product Relatedness, and Market Size

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Summary

For many years, the European Union has been an important market for agricultural products from Africa. However, African agricultural exporters have often found the European market difficult to access because of a raft of NTMs that add to exporters' costs. The trouble with NTMs in the agricultural arena is that, while ostensibly used to uphold health and safety standards, they could have an underlying protectionist intent – which is very difficult to prove. This study explores how NTMs have affected the agricultural export patterns of four African countries (South Africa, Kenya, Cameroon and the Democratic Republic of the Congo) into the European Union market over the period 1992–2014. A four-stage analytical approach was used, which first determined the nature of export diversification during the period and then traced how the countries' export patterns might have been influenced by NTMs, product relatedness, and import-market size. In the study, products were classified at the Harmonized System six-digit level into six clusters, from primary agriculture and agro-processing (food and non-food) items, to product inputs and capital inputs. Together these clusters constitute the agro-complex. Among the main findings were that the European Union share of all four countries' agricultural exports have declined proportionally in the past two decades. Products in the primary agriculture and agro-processing (food) clusters have mainly been subject to SPS measures and technical barriers to trade. Products in the other clusters have been subject to a smaller number of NTMs, notably product quality/performance requirements. A definitive link between waning exports and the prevalence of NTMs could not be established, thus signalling the need for more in-depth research.

1 Introduction

With the growth of regional and pluri-lateral trade agreements in many parts of the world, tariffs are losing their lustre as a trade interventionist tool. Non-tariff measures (NTMs), in contrast, are on the rise (Nicita and Gourdon, 2013).

NTMs can be defined as all types of trade regulations, other than tariffs, that directly or indirectly affect international trade (Malouche et al., 2013; UNCTAD, 2012). For a long time NTMs were synonymous with quantitative restrictions like quotas, voluntary export restraints and non-automatic licensing, but this is no longer the case. NTMs have evolved to a point where such quantitative restrictions have largely been phased out and replaced by technical barriers to trade (TBT) and sanitary and phytosanitary (SPS) regulations (Cadot and Gourdon, 2016).

UNCTAD has developed a classification system that distinguishes between technical measures (TBTs) and non-technical measures on imports (SPS). The technical measures are concerned with the characteristics of goods and/or the production process underlying the goods. Non-technical measures, on the other hand, relate to standard commercial policy tools (UNCTAD, 2012).

While NTMs do restrict trade and offer no direct benefit to governments (as tariffs do), they have the potential to rectify the market's failure to produce certain market externalities in the product price (Calvin and Krissoff, 1998), which could be beneficial to consumers and producers. However, this effect is only possible if the aim of the NTMs is to correct market distortions, and not to protect local producers. If the sole purpose is the latter, producers will experience a welfare gain because they will face less competition from foreign producers that find it difficult to comply. Consumers, on the other hand, will face a cost to their welfare (Calvin and Krissoff, 1998). Not only will they be faced with higher prices but as the underlying motive is simply to restrict trade there will be no improvements in product quality or safety.

With a view to better understanding the political economy of NTMs, Disdier and Van Tongeren (2010) studied 777 agricultural and food products and their related NTMs. Complaints raised with the World Trade Organization (WTO) Committee on Sanitary and Phytosanitary Measures were used to determine frictions among countries because of NTMs. They concluded that just because a country is subject to large numbers of NTMs, it does not mean that it these measures are not meant to achieve a healthier and more environmentally responsible society.

In the agricultural arena, the intent behind a particular NTM is very difficult to prove – is it to address a genuine health concern or is it to support a protectionist agenda (Paarlberg and Lee, 1998)? Even if the health argument is successfully driven home, policy and regulatory changes are often implemented with scant regard paid to the impact that they will have on international trade. For example, a decision to completely bar all imports of a certain product could have dire consequences for down-the-line customers or providers in the service chain (Paarlberg and Lee, 1998).

To combat the use of NTMs for protectionist purposes, the Agreement on Technical Barriers to Trade of 1979 and the Agreement on Sanitary and Phytosanitary of 1994 (WTO, 1998) were introduced. These restrict WTO members' ability to use their own TBTs (Bureauet et al., 1998). That being said, a uniform standard is difficult to implement across all member countries because the costs of implementation differ. The aforementioned agreements allow countries to set their domestic standards at any level they deem necessary (Wilson and Otsuki, 2003).

The problem with countries choosing not to accept or implement these uniform NTM standards or "blanket policies" of the WTO is that it makes it difficult for compliant countries to export to other, non-compliant countries as the latter will have their own set of import requirements that may differ from those of the WTO members (Wilson and Otsuki, 2003; Winchesteret et al., 2012). This is especially detrimental to developing countries, which find NTMs more taxing than their developed competitors, mainly because they lack proper institutional support (Mayeda, 2013). As a result these blanket policies for NTMs also disproportionately affect developing countries as it is much more expensive for them than it is for developed countries to create the necessary infrastructure that allows adherence to the required standards (Henson and Loader, 2001; Gourdon, 2014). A study done by Hoekman (as cited in Henson and Loader, 2001) found that customs procedures alone equated to 2 per cent of the value of an imported product in developed countries. For developing countries, the cost would often be several times as much.

Convenient or otherwise, NTMs are playing an increasingly prominent role in the determination of agricultural trade flows, especially between developing and developed countries (Disdier and Van Tongeren, 2010). In Africa, the European Union (EU) has concluded various regional agreement, which make provision for African countries to enjoy full access for their agricultural products into the EU market, provided the products adhere to SPS requirements. Currently the attention of the EU is focused on the implementation of those EPAs that have been concluded.

The aim of this study is therefore to analyse the link between the diversity of NTMs in the EU and the shifts in the export patterns of Africa's broader agricultural sector the so-called agro-complex (see section 3.2). Four countries in Africa were selected as case studies. Section 2 below briefly introduces these countries and their specific circumstances. Section 3 provides a methodological framework for the analysis used in the study. The rest of the paper is devoted to examining historical export (diversification) patterns to the EU and the prevalence of NTMs, presenting a measure of product relatedness in export diversification as well as an approach for studying a country's "breadth" of exports, with some conclusions and policy recommendations provided in conclusion.

2 Overview of selected african countries used as case studies

The four countries chosen reflect an interesting cross-section of economic circumstances/strengths and varying levels of dependence on the EU market for their agricultural exports. Some key economic indicators are presented in table 1.

Table 1: Key economic indicators among four selected African countries (2015)

Country	Population (million)	GDP (UD$ billion)	GDP per capita (US$)	Growth rate	Inflation rate (GDP deflator)	Contribution of agriculture to GDP	% of total agricultural exports absorbed by EU (2014)	Global ranking for agricultural policy cost
South Africa	55	312	5 691	1.3%	3.7%	2.4%	28	73
Kenya	46	63	1 376	5.6%	9.1%	30.2%	41	59
Cameroon	23	29	1 250	6.2%	2.6%	23.9%	67	92
Democratic Republic of the Congo	77	35	456	6.9%	0.64%	21.2%	37	127

Sources: WEF, World Bank and own calculations based on data from UN Comtrade.

2.1. South Africa

The World Bank (2016) classifies South Africa as an upper middle-income country. As is evident from table 1, the country's gross domestic product (GDP) and GDP per capita are relatively high compared with those of the other three African countries. The economy of South Africa might be one of the largest and most complex in Africa, but it is not without its flaws and the country is currently facing very uncertain times. For example, growth has slowed considerably in recent years, while inflation has been above the target of 6 per cent since the start of 2016.

Agriculture in South Africa contributes a mere 3 per cent to the country's GDP. This, however, understates the importance of the industry. If the rest of the agricultural value chain were brought into the equation, the entire agro-complex would contribute approximately 12 per cent to GDP. Making it a larger contributor than the mining and construction sectors It is often contended that the true value of the agricultural sector lies in how labour-intensive it is. In this regard, South Africa's agricultural sector represents about 7 per cent of the formal employment of the country and this does not include subsistence farming or other employment in the informal sector (Department of Agriculture, Forestry and Fisheries, 2016).

The underplaying of the importance of the agricultural sector in South Africa is largely due to the dual nature of the sector. On the one hand, there is a developed commercial sector, while on the other hand, there is communal farming (World Wide Fund for Nature, 2012). Because of the burden that the South African government places on the agricultural sector via its policies, South Africa occupied 73rd position in the world for agricultural policy cost in 2015 (World Economic Forum, 2015).

In terms of its agricultural trading relationship with the EU, South Africa exported 34 per cent of its total agricultural exports to the EU in 2000. By 2015, this share had decreased to 28 per cent. However, the EU remains an important export market for South Africa's agricultural products.

2.2. Kenya

Kenya is classified as a lower middle-income country by the World Bank (2016). Despite the country struggling with high levels of poverty and inequality, Kenya has had more than a decade of sustained economic growth.

The country's growth rate is expected to rise to a fairly impressive 6.1 per cent in 2017, largely owing to various investments in infrastructure (World Bank, 2016).

The agricultural sector plays a very significant role in the economy of Kenya and is one of the leading economic sectors in the country. It also makes the most significant contribution of all sectors, outside of government, to wage employment. Agriculture's gross value added amounted to 6.2 per cent in 2015, which was assisted by excellent weather conditions during the year (KNBS, 2016b). The sector's vulnerability to weather patterns could, though, result in slower growth in the years after 2015, but growth is expected nonetheless (KNBS, 2016b).

Advances in electricity provision and lower international fuel prices are expected to assist the agricultural sector's development in the years ahead. Furthermore, the manufacturing sector's improved capacity in terms of food production should be a further growth stimulant. However, the government's agricultural policy landscape is not particularly appealing and therefore, despite the importance of the sector to Kenya's economy, the country occupied 59th place in the world for agricultural policy cost in 2015 (World Economic Forum, 2015).

Kenya's agricultural trading relationship with the EU is strong. The country exported 68 per cent of its agricultural exports to the EU in 2000 but by 2015, this share had decreased to 41 per cent, which is still very significant.

2.3. Cameroon

Cameroon is classified as a lower middle-income country (World Bank, 2016). The country has seen a sustained growth trend since 2000, yet there has been little improvement in the low levels of per capita income.

Agriculture is a very important part of Cameroon's economy. In this regard, active attempts by the government, in collaboration with the World Bank, to improve the country's agricultural infrastructure and competitiveness have seen the sector's stature rise and its output grow (World Bank, 2013). However, Cameroon still occupies the 92nd position in the world for agricultural policy cost in 2015 because of the excessive policy burden that the Cameroonian government places on the country's agricultural sector (World Economic Forum, 2015). This is a considerable improvement from 112th in the previous year (World Economic Forum, 2014).

The agricultural trading relationship between Cameroon and the EU is the strongest of all four countries featured in this study. The country exported 71 per cent of its agricultural exports to the EU in 2000. By 2015, this share had decreased slightly to 67 per cent.

2.4. Democratic Republic of the Congo

The Democratic Republic of the Congo is the only low-income country among those featuring in this study. There are various factors contributing to its low-income status, but the chief one is that the country has only recently begun to recover from a series of conflicts that ended in the 1990s. Despite this handicap, the Democratic Republic of the Congo has been showing very solid growth, partly due to buoyant extractive industries and increased foreign investment (World Bank, 2016).

Agriculture's contribution to GDP showed a decline since 2010 (Banque Centrale du Congo, 2014). This decline is attributable not to a decrease in agricultural production, but rather to a diversification of production in the country, which has taken the spotlight off agriculture. In order to ensure food security, the Government of the Democratic Republic of the Congo has launched campaigns to promote growth in agriculture in several of the provinces (Banque Centrale du Congo, 2014). As a result, the value added of this sector grew by 4.2 per cent in 2014, which contributed to the country's overall growth rate of 0.8 per cent that year.

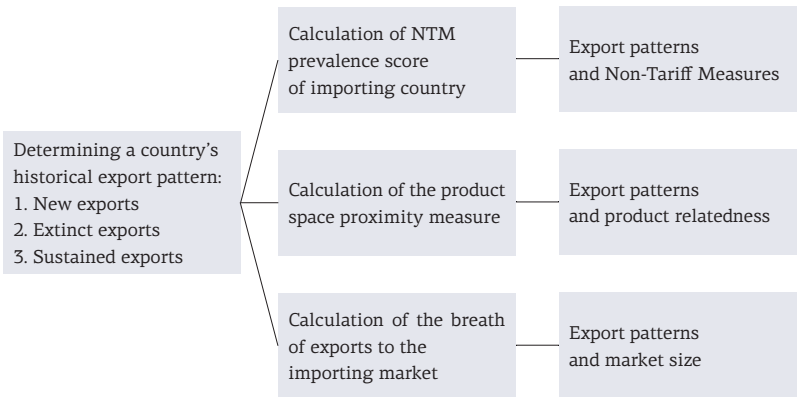
The Democratic Republic of the Congo's agricultural trade relationship with the EU has changed dramatically over the years. While the country exported 81 per cent of its agricultural exports to the EU in 2000, by 2015 the proportion had dropped to only 37 per cent. This significant drop is substituted by increased exports to for example China, India. Malaysia and Singapore.

3 Methodological approach used

3.1. Introduction

Historically the EU has been, and to this day remains, an important market for African agricultural producers. Yet the EU has earned a reputation for being, at times, a difficult market to access because of a plethora of NTMs that add to exporters' costs. Quite how these NTMs have affected African countries' agricultural export performance deserves investigation. In this section, we examine the link between export patterns to the EU within the agro-complex of the four selected case study countries. A four-fold approach is used. Initially, the historical export patterns to the EU are determined. Based on this, the prevalence of NTMs is then analysed. Thirdly, a measure for determining the product relatedness in export diversification is presented, and finally, an approach for studying a country's breadth of exports is discussed. A schematic depiction of these steps (which together form an analytical framework) is shown in figure 1.

Figure 1: Schematic overview of the methodological approach



Sources: UN COMTRADE, UNCTAD TRAINS (WITS)

This analytical framework is progressively unpacked in subsequent sections.

3.1. Determining historical export patterns to the European Union

For the purposes of this study, products have been classified at the six-digit level of the Harmonized System (HS) (2012 version) into six clusters, namely:

i. Primary agriculture, e.g. maize, avocados (235 products);
ii. Agro-processing: food, e.g. palm oil, canned fruit (406 products);
iii. Agro-processing: non-food, e.g. wool, essential oils (273 products);
iv. Production inputs: primary agriculture, e.g. insecticides, fertilizers (53 products);
v. Capital inputs: primary agriculture, e.g. ploughs, combines (24 products);
vi. Capital inputs: secondary agriculture, e.g. bakery machinery, machinery for preparing animal feed (24 products).

These 1,015 products, categorized in six clusters, comprise the agro-complex and are used later in the analyses underpinning this study.[1]

The export diversification patterns of the four selected countries into the EU market were analysed by adopting the revealed comparative advantage (RCA) index, which was developed by Balassa (1965). As this study was concerned with how export patterns within the country's agro-complex have shifted over time to the EU market alone, the index used here determined a country's RCA in the EU market at product level.

$$RCA_{EUcp} = \frac{x_{cp}EU}{X_{cEU}} \Big/ \frac{i_{pEU}}{I_{EU}} \quad (1)$$

Where:
$x_{cp}EU$ is exports of product p to the EU by country c,
X_{cEU} is total exports,
i_{pEU} is imports of product p by the EU, and
I_{EU} is total imports.

An RCA_{EU} index of greater than 1 implies that country c has a revealed comparative advantage in the EU market with regard to the exports of product p. In order to make the index more time-robust and resistant to annual shocks, a single RCA_{EU} index was calculated for a three-year period. As

[1] A complete product list is available from the authors upon request.

this study was interested in historical export patterns, the index was calculated for South Africa, Kenya, Cameroon and the Democratic Republic of the Congo for the periods 1992–1994 and 2012–2014, using data from the UN Comtrade (United Nations Commodity Trade Statistics) database. The products were classified according to the 2012 version of the HS nomenclature and mirror statistics[2] were used for the exports of these four countries in order to achieve a more consistent and reliable data set. Since the RCA_{EU} indices for the period 1992–1994 were calculated using the 1998–1992 version of the HS nomenclature, these indices were later linked to the 2012 HS version using correspondence tables to ensure comparability.

Comparing the RCA_{EU} indices of the two time periods (1992–1994 and 2012–2014) revealed shifts in the export patterns within the agro-complex to the EU among the four selected countries. There were three options in this regard:

i. Export products to the EU in which a country was able to sustain its comparative advantage over a set period of time (sustained);
ii. Export products to the EU in which a country was able to develop new comparative advantages over a set period time (diversification);
iii. Export products to the EU in which a country was not able to sustain its comparative advantages over a set period of time and which export flows thus ceased (extinction).

This pattern of sustained, diversified and ceased exports could then be linked to the prevalence of NTMs, the relatedness between products and the breadth of exports. These aspects are discussed in the sections that follow.

3.3 Analysing non-tariff measures on imports into the European Union

To determine whether export diversification patterns of the four selected countries have been affected by NTMs in the EU, this section discusses an approach for quantifying these measures. This approach was then applied in the subsequent analyses. To encourage a better understanding of the use of NTMs in the EU, this section also provides some stylized facts.

[2] Trade data as reported by the importer; the EU countries in this case.

Empirical Approach

Various approaches exist to determine the importance of NTMs and their impact on trade. These include estimating ad valorem equivalents (see Kee et al., 2009), estimating price gaps and inventory measures. In terms of the inventory measure, three indices prevail: the frequency index, the coverage ratio and the prevalence score (Gourdon, 2014). This study applied an NTM diversity score which captures the number of different types of NTMs applicable to a specific product at the six-digit (product) level of the HS. It is argued here that different types of NTM imply additional costs of compliance compared with NTMs within the same category. Simply counting the number of NTMs—which could, as in the prevalence score, fall under the same category—does not capture this dynamic. Furthermore, the frequency index and the coverage ratio do not account for NTMs applied at product level.

The different types of NTM are classified by UNCTAD in different levels structured in a hierarchical tree/branch structure. The categorisation is based on the scope of the measure. At the highest level, NTMs are categorised in sixteen chapters, and then further in 122 sub-groups, which split even further up to four levels. The latest classification (M3) which was developed in 2012 has 333 NTMs classified at the third level and a further 120 NTM at the fourth level.

The NTM diversity score (Dj) in this study was calculated as follows:

$$D_j = \left[\frac{T_{ij} - T_{i,min}}{T_{i,max} - T_{i,min}} \right] \quad (2)$$

Where:
T is the number of different types of NTM
j is a product classified at the six-digit level of the HS, and
i is an importing country (or economic region).

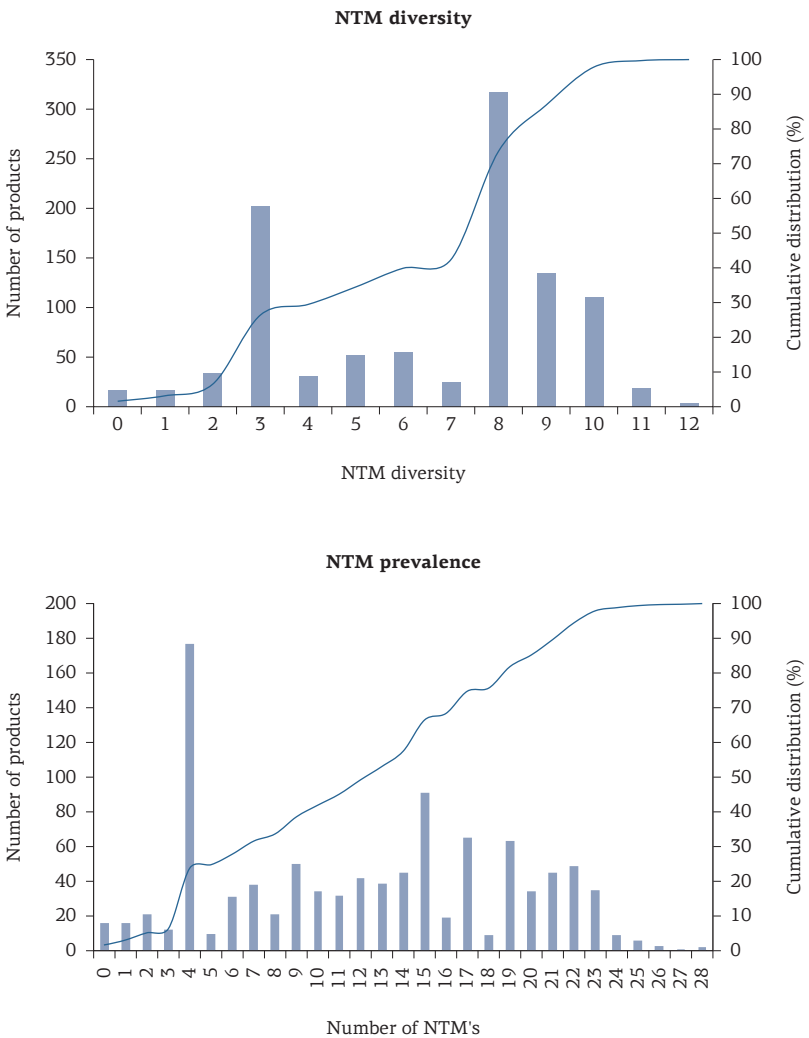
The score calculated using equation 3 thus assigns a normalized value to each product based on the number of different types of NTM applicable to that specific product (T_{ij}), the maximum number of NTMs applicable to any product ($T_{i,max}$) and the minimum number of NTMs applicable to any product ($T_{i,min}$) in country i (see also OECD, 2008). A score of close to zero implies less diversity in the NTMs imposed to a product and a score close to one implies a high diversity in the types of NTMs imposed on a product.

In this study, the NTM prevalence and diversity scores were calculated for the EU. The data used were extracted from the UNCTAD TRAINS database. The NTMs were classified according to the M3 nomenclature and 2014 data were used. Although the NTMS levels in 2014 are used a benchmark, it is assumed that the set of NTMs have accumulated over the time and have impact export patters between 1992 and 2014. Furthermore, the products were classified at the six-digit level of the 2012 version of the HS. This classification comprised 5,205 products in total.

An overview of the NTM data set is provided in figure 2. The figure shows the prevalence (frequency) and the diversity of NTMs in the EU among the 1,015 HS six-digit products of the agro-complex. In both panes, the x-axis depicts the number of products and the secondary y-axis indicates the cumulative percentage. It is evident from the upper pane that only a small share (1.6 per cent / 16) of the products within the agro-complex were not subject to any NTMs when imported into the EU. The average number of NTMs in the agro-complex was 12, which is relatively high compared with the average of seven NTMs in respect of all products which was also calculated a comparison. Furthermore, the figure reveals that the maximum number of NTMs applicable was 28. However, the figure shows that the distribution of NTMs was relatively uneven, with 85 per cent of the products being subject to 20 or fewer NTMs. In order to avoid disturbance by these outliers, the NTM prevalence score used 20 NTMs as the maximum.

The lower pane in figure 2 shows the NTM diversity. Recall that it is assumed that different types of NTM imply additional costs of compliance compared with NTMs within the same category which is not captured by the prevalence score. Most products (317) within the agro-complex were subject to eight different NTM categories when imported into the EU. About 70 per cent of the products were subject to more than four NTM categories. The average number of different NTMs per product in the agro-complex was seven, which is also relatively high compared with the average of four different NTMs when taking into account all products. Hence, NTMs in the agro-complex were relatively more frequent and diverse.

Figure 2: Overview of non-tariff measures in the European Union on products within the agro-complex (2014)



Source: Authors' own calculations based on data from UNCTAD-TRAINS

Stylized facts about non-tariff measures in the European Union on products within the agro-complex

As this study explores NTMs and export diversification in the agro-complex specifically, this section briefly presents four stylized facts in this regard. Looking at the broader picture, the prevalence in the EU of NTMs on products within the agro-complex was relatively high. Of all the NTMs prevalent in the EU, 23 per cent were aimed at these specific products. This is not all that surprising given that these products could pose a direct risk to human, plant and animal health within the EU. Hence, the regulatory environment for these products was deemed relatively stringent compared with that for other product categories.

Considering all products and the broad types of NTMs prevalent in the EU, it was found that most (22 per cent) of the measures were classified as "conformity assessment related to Technical Barriers to Trade (TBT)". A further 16 per cent of measures were classified as "labelling, marking and packaging requirements". Sanitary and Phyto-sanitary (SPS) measures, which are of specific relevance to agricultural and food products, constituted 10 per cent of all NTMs prevalent in the EU.

A summary of the NTMs specifically applicable to each of the clusters in the agro-complex is provided in table 2. The table shows that the numbers of NTMs were obviously the highest in those clusters with more products. However, the proportion of products subject to NTMs did not differ significantly between the clusters (see column 6).

Column 4 shows that the prevalence of NTMs per product was the highest in the primary agriculture and agro-processing of food clusters. This is possibly attributable to the fact that the products in these specific clusters were destined for human consumption and were subsequently transformed, which entailed a number of possible risk-bearing activities (e.g. crushing, milling, cutting, cooling, cooking, preserving, mixing, packaging, transporting, etc.). These two clusters also showed the highest diversity in NTMs per product (see column 5).

Table 2: Summary of the European Union's non-tariff measures applied to the agro-complex (2014)

Cluster	Total number of NTMs	Max number of NTMs	Average number of NTMs per product	Average diversity of NTMs per product	% of products subject to NTMs
(1)	(2)	(3)	(4)	(5)	(6)
Primary agriculture	3 916	27	17	8	98.3
Agro-processing: food	6 330	28	16	8	99.8
Agro-processing: non-food	1 328	26	5	4	96.3
Production inputs	513	22	10	6	100.0
Capital inputs – primary	193	10	8	5	100.0
Capital inputs – secondary	143	12	6	3	100.0

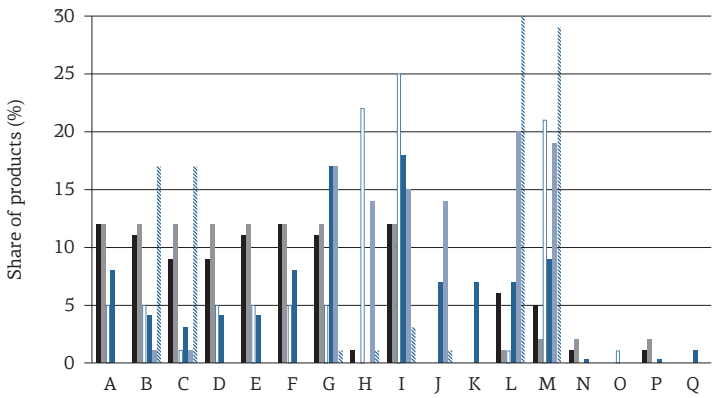
Source: Authors' own calculations based on data from UNCTAD-TRAINS.

As mentioned earlier, some specific NTM categories are more prevalent in the agro-complex. Of the total of 61 broad NTM categories classified under the UNCTAD M3 nomenclature, only 17 apply to products of the agro-complex imported into the EU.

Figure 3 shows the prevalence of these 17 categories within each of the six clusters. Note that one product can be subject to measures falling under different NTM categories. Furthermore, the "A" categories entail SPS measures, the "B" categories are TBT, the "E" categories are all non-automatic licensing, quotas and prohibitions other than for SPS and TBT reasons, the "G" category entail finance measures and the "P" categories include export related measures.

Confirming what was evident in table 1, figure 3 shows that most products within the primary agriculture and agro-processing (food) clusters were subject to a range of NTM categories. These mainly consisted of SPS and TBT measures. The products in the other clusters were generally subject to a much smaller range of NTM categories. For instance, most imported capital inputs only had to adhere to product quality/performance requirements and/or conformity assessment related to TBT.

Figure 3: Prevalence of non-tariff measure categories applied to European Union imports within the agro-complex (2014)

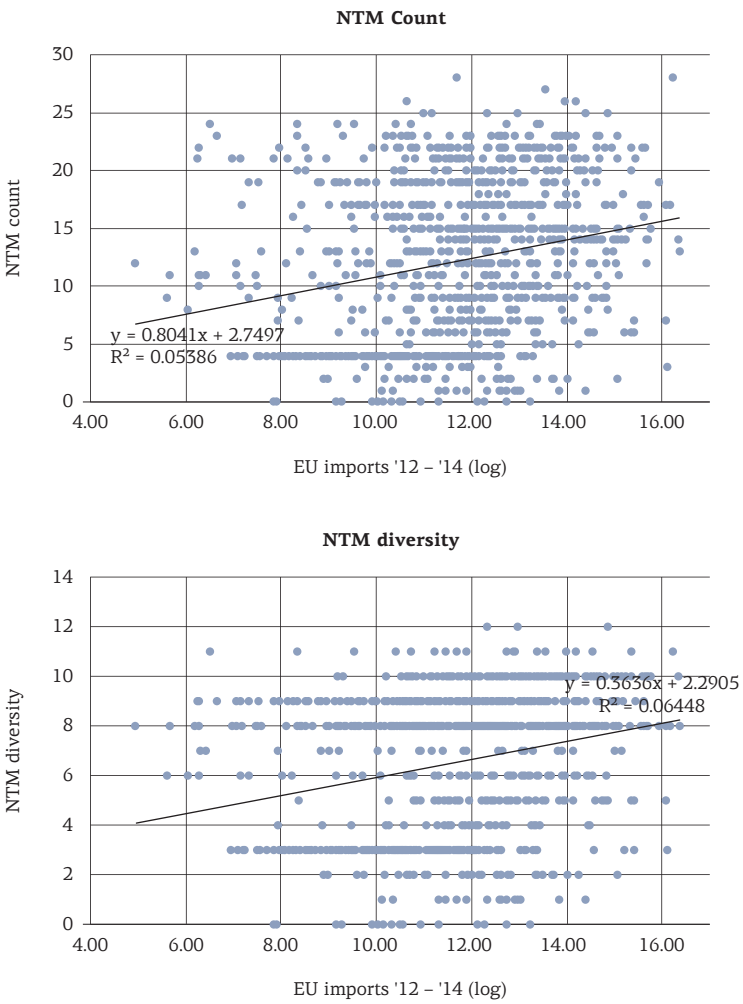


A Prohibitions/restrictions of imports for SPS reasons
B Tolerance limits for residues and restricted use of substances
C Labelling, Marking and Packaging requirements
D Hygienic requirements
E Other requirements on production or post-production processes
F Conformity assessment related to SPS
G Prohibitions/restrictions of imports for objectives set out in the TBT agreement
H Tolerance limits for residues and restricted use of substances
I Labelling, Marking and Packaging requirements
J Production or Post-Production requirements
K Product identity requirement
L Product quality or performance requirement
M Conformity assessment related to TBT
N Non-automatic import licensing procedures other than authorizations for SPS or TBT reasons
O Prohibitions other than for SPS and TBT reasons
P Advance payment requirement
Q Export technical measures

Primary agriculture | Agro-processing: food | Agro-processing: non-food
Production inputs | Capital inputs – primary | Capital inputs – secondary

Source: Authors' own calculations based on data from UNCTAD-TRAINS

Figure 4: European Union imports and the count and diversity of non-tariff measures in the agro-complex (2014)



Source: Authors' own calculations based on data from UNCTAD-TRAINS.

The relationship between EU imports and the prevalence and diversity of NTMs is explored in figure 4. This is done so as to verify the extent to which agro-complex exports to the EU have been subject to these measures. This relationship can also shed some light on the trade restrictiveness of NTMs in the EU market.

The upper pane in figure 4 shows the count of NTMs per product in relation to its total import value into the EU for the period 2012–2014. The lower pane shows the relationship between the numbers of different NTMs per product (diversity) and its imported value into the EU for that same period. Although the dotted trend line revealed a positive relationship in both panes, the correlation between these two variables was not very significant. Hence, the count and diversity of NTMs of agro-complex products imported into the EU market were not necessarily linked to the size of import flows.

3.4. Analysing export diversification patterns in the agro-complex

Hausmann and Klinger (2006) found that countries tend to diversify towards related products which to a large extent use a similar set of productive capabilities. This section sets out a framework for analysing this relatedness in diversification within the agro-complex of the four selected countries, using some concepts developed by Hausmann and Klinger (2006) and Hidalgo et et al. (2007).

Hausmann and Klinger (2007) argue that the ability of a country to diversify into the production of new goods depends on its current set of available capabilities. Thus, a country that has built up a competence (i.e. comparative advantage) in producing a certain good can use its corresponding set of capabilities in the production of new and related products that are close to its current productive structure. This process of diversification into "nearby" (related) products also requires the development or acquisition of new capabilities. A drawback of the product relatedness theory, though, is that it does not explain how these new capabilities are acquired; it assumes that the necessary explanation can be derived from institutional economics and endogenous growth models (i.e. learning-by-doing). Hausmann and Klinger (2007) argue that foreign direct investment could also play an important role in this matter.

This resource-based approach to diversification and growth, which is based on related resources and capabilities, has been further conceptualized by Hidalgo et al. (2007). They developed a measure for the proximity between products and used this concept to map the relatedness of products in a network visualization (i.e. the product space). In this network,

products are depicted by nodes and their relatedness by edges. The position of a country in the network, whether in the sparser or denser parts, can predict the ease with which the country will be able to transform itself economically. Such structural transformation is not an endogenous process; it is driven by market and policy incentives. In terms of capabilities, products are not necessarily developed in sequence. For example, the fact that a country is capable of effectively producing soybeans does not imply automatically that it is an efficient producer of soybean oil. Hence, vertical linkages are as important as horizontal linkages.

As mentioned earlier, the relatedness of products in the product space is based on the concept that similar products require a similar set of requisite capabilities. This relatedness is measured by proximity, reflecting the likelihood that countries have a comparative advantage in both goods. If two products require almost the same set of capabilities for their production and marketing, this would be reflected in a higher probability of the country having a comparative advantage in both products.

The proximity measure used in the product space is the conditional probability that a given country produces product A, given that it also produces product B (e.g. P{A|B}). The conditional probability is not a symmetric measure; hence, P{A|B} is not the same as P{B|A}. As the number of exporters of product A decreases, the conditional probability of exporting another good moves closer to 1. This then reflects the particularity of the country and not the similarity between products. In this context for example, if South Africa is the only global producer of litchis, then all other goods exported by South Africa (such as wool) with a revealed competitive advantage would be closely related, when in fact they are quite different. To counter this, the minimum pair-wise conditional probability is used as an inverse measure of distance in both directions, thereby making it symmetric and more stringent (see equation 3).

(3) $$\text{Min } [P\{A|B\}, P\{B|A\}]$$

The proximity measure is traditionally based on the RCA index of Balassa (1965) (see section 3.2). This study has deviated from this practice for the simple reason that the RCA relates to exports only and fails to take imports into account. Since the product space aims to analyse the productive structure, the use of an alternative measure that captures the domestic production capabilities was considered to be a better option. Hence, this study used the index for revealed trade advantage (RTA), as developed by

Vollrath (1991). This index simultaneously accounts for exports and imports at product level and is seen to more accurately reflect the comparative advantage of local production. The RTA index is expressed as follows:

$$RTA_{cp} = RCA_{cp} - RMA_{cp} \tag{4}$$

Where: c is a country and p is a product. The conventional RCA index by Balassa (1965) is calculated as follows (equation 1 was a deviation of this formula):

$$RCA_{cp} = \frac{X_{cp}}{\sum_c X_{cp}} \Big/ \frac{\sum_p X_{cp}}{\sum_{c,p} X_{cp}} \tag{5}$$

Where: X_{cp} represents the exports of country c in product p. The RMA_{cp} is the revealed comparative import advantage, the counterpart of the RCA, and is expressed as follows:

$$RMA_{cp} = \frac{I_{cp}}{\sum_c I_{cp}} \Big/ \frac{\sum_p I_{cp}}{\sum_{c,p} I_{cp}} \tag{6}$$

An RTA > 1 implies that a country has built a core competency in producing the product in question. The index is then used to build a matrix that associates each country with the product in which it has an RTA. To counter annual variations in agricultural production, the RTA is calculated using compound trade data for a time-period three years (2012-2014) and set at 1, if a country has an RTA > 1. Hence, the matrix M_{cp} can be defined as follows (Hausmannet et al., 2011):

$$M_{cp} = \left\{ \begin{array}{c} 1 \text{ if } RTA_{cp} \geq 1 \text{ in } 3 \text{ yrs;} \\ 0 \text{ otherwise} \end{array} \right\} \tag{7}$$

This matrix summarizes which country makes what, proxied by an RTA > 1. In order to mute short-term fluctuations in agricultural trade patterns, the proximity matrix is made time-consistent by using data in the period 2012–2014 as a basis. By expanding this to the calculation of the proximity between products, which is based on the likelihood of having a revealed trade advantage in good p and good p', one arrives at the following (Hausmann et al., 2011):

(8) $$\emptyset_{pp'} = \frac{\sum_c M_{cp} M_{cp'}}{max(\sum_c M_{cp} | \sum_c M_{cp'})}$$

Equation 8 implies that if, for instance, 25 countries are good in producing export oranges (proxied by an RTA > 1), 18 countries are good in producing export orange juice (proxied by an RTA > 1) and 15 countries are good in producing both products (proxied by an RTA > 1)), the proximity value between oranges and orange juice is 15/25 = 0.6. Hence, the probability that a given country produces oranges, given that it also produces orange juice, and vice versa, is 0.6. This value thus implies that 60 per cent of the countries that produce oranges also produce orange juice. Such strong vertical (input–output) linkages as in this example are relatively rare in the product space since the two products require a relatively different set of productive capabilities (e.g. capital, knowledge, skills, etc.). More typical is vertical product relatedness, such as wheat and maize. The set of productive capabilities embedded in these products is relatively similar and more easily transferable.

A proximity value of 0 indicates no product relatedness, whereas a value of 1 indicates the highest level of product relatedness. A proximity value of 0.51 is generally assumed to be a minimum and meaningful measure of the strength of relatedness between products (see Hidalgo et al., 2007; Bayudan-Dacuycuy, 2012). The revealed proximity value between every pair of products is used to construct a proximity matrix. This matrix can then be used for the visual network representation to study the structure and dynamics of the product space.

The proximity matrix used in this study was based on 2012–2014 trade data from UN Comtrade (extracted via WITS (World Integrated Trade Solution)).[3] The matrix was built using Excel and R. The proximity matrix at the six-digit level of the 2012 version of HS is available as a comma separated values file from the authors on request. The product space network (see also section 4.1) was graphed by using the NodeXL[4] plugin for Excel.

The probability of a country producing a particular "new" product in the future depends on that product's proximity to its current productive structure (i.e. core competencies) in the product space. A country-product level indicator to measure this is *distance*, which reflects how "far" each product is located from a country's current exports (see Hausmann et al., 2011). The measurement of *distance* reflects the sum of the proximities connecting a

[3] Available at https://wits.worldbank.org.
[4] Available at https://nodexl.codeplex.com/.

new product *p'* to all the products that country *c* is currently *not producing*. This indicator is then normalized by dividing it by the sum of the proximities of all the products connected to product *p'*. If a country produces most of the products (proxied by an RTA > 1) connected to the "new" product, the value will be close to 0; otherwise, the value will be close to 1. For example, *Country A* is not producing canned peaches and this product is related to six other products in the product space. Of those six products, the country does not produce four products. The *distance* of this diversification opportunity to the country's existing productive structure (i.e. core competencies) would then be four divided by six, which equals 0.66. *Country B* also does not produce canned peaches and does not produce two of the related products. Hence, the opportunity to diversify production into canned peaches in *Country B* is more favourable as it only has a *distance* of 0.33 to its existing production (i.e. core competencies).

This study applied a slightly modified version of the *distance* measure in that it measured the distance to existing exports of the four selected countries to the EU specifically. Distance (or D_{cp}) is defined here as:

$$D_{cp'} = \frac{\sum_{p'} (1 - M_{cp'}) \emptyset_{pp'}}{\sum_{p'} \emptyset_{pp'}} \quad (9)$$

Hausmann and Klinger (2006) show that this measure is an extremely significant predictor of shifts in a country's productive structure within the product space. This study explored whether this also held for the export patterns within the agro-complex of the four African countries selected. This was done by testing for the statistical difference in the *distance* measure between the following groups of export products in each country (see also section 3.2): "new" exports to the EU (export diversification), ceased exports to the EU (export extinction) and the set of unexplored diversification opportunities in the product space. This difference between these groups of products was analysed using the Kruskal-Wallis test.[5] The results of this analyses are presented in section 4.2.

3.5 Analysing the breadth of export patterns

Apart from market access (i.e. NTMs) and product relatedness, shifts in a country's export patterns can be incentivized by the size of the market to which it exports. This determines whether it is lucrative to export

[5] The non-parametric Kruskal-Wallis test was used here as the data set represented more than two independent and not normally distributed samples.

to a specific market or to diversify into new exports, or whether it is best to cease exports altogether. In order to determine how important a country's export portfolio is to a specific market (the EU in our case) this study slightly adapted the measure developed by Hummels and Klenow (2005). Their index for the extensive margin calculates the breadth of a country's total exports, that is, how much of a share these products represent in total global imports. In this study we specifically look at the EU's total imports within the agro-complex instead. In other words, how important is what a country exports to that market? This measure of market representation was calculated in this study as follows:

$$EM_{c,EU} = \frac{\sum_{c,p} i_{p,EU}}{\sum_{w} I_{EU}} \quad (10)$$

Where: *EM* is the extensive margin of country *c* with respect to its exports to the *EU*, the numerator is the sum of imports (*i*) by the *EU* of all products (*p*) that country *c* exports to the *EU*, and the denominator is the sum of total imports (*I*) by the *EU* from the world (*w*). The "breadth" of exports will be calculated for the export pattern of each country. Hence, the group of products in which a country diversified, in which it cased exports and for which it sustained exports (see section 3.2).

In this study, total imports of only those products within the agro-complex were considered. For example, if the *EM* for South Africa is 14, it implies that South Africa's portfolio of export products represents (or "symbolizes") 14 per cent of the EU's total imports within the agro-complex. The higher the *EM*, the more potential market capability a country has. It is important to note that the *EM* thus does not reflect an exporting country's market share in imports; which would be lower.

4 Export diversification patterns: product relatedness, market size and non-tariff measures

The previous two sections presented the methodological approach to analysing the export diversification patterns to the EU within the agro-complex for the four selected African countries (South Africa, Kenya, the Democratic Republic of the Congo and Cameroon). This section discusses the outcomes of the analyses in terms of whether these shifts in export patterns (presented in section 4.1) have been impacted by product relatedness, the NTMs imposed and/or market size (see also figure 1).

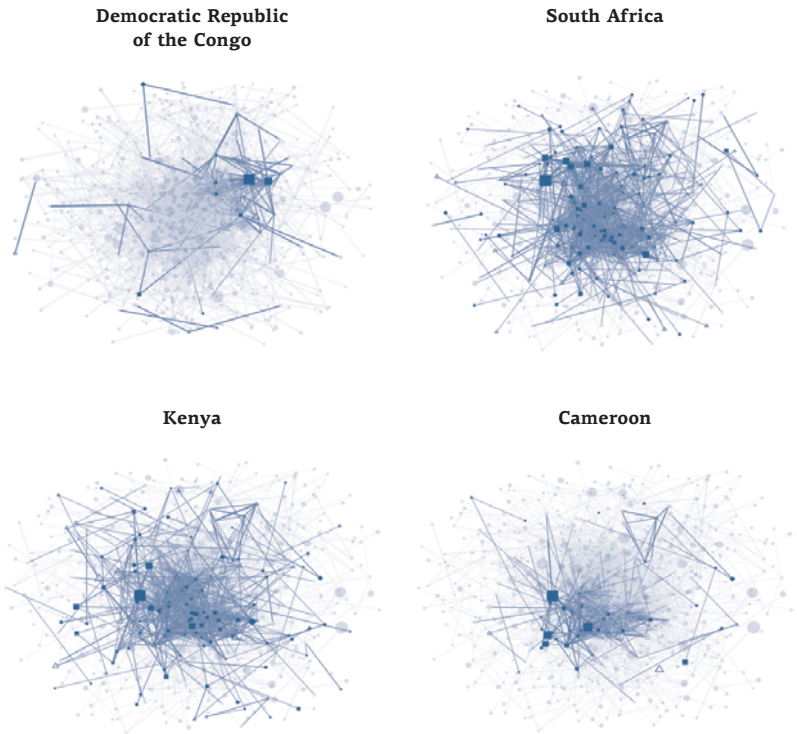
4.1 Export patterns in the agro-complex

The *RCA_EU* index was used to determine the structure of exports to the EU from the four selected countries in the periods 1992–1994 and 2012–2014, and the shifts that occurred during these periods. The position and shifts of each country's export structure to the EU were visually depicted in the agro-complex product space, as shown in figure 5. Each node in the network represents a product within the agro-complex and the edges depict the linkages between these products (measured by proximity). The width of the edges represents the degree of relatedness, while the sizes of the nodes are proportional to the value imported by the EU in the period 2012–2014. The black nodes in each sub-image reflect the country's pattern in revealed comparative advantage of exports to the EU. The solid-square shaped nodes corresponds with whether the RCA was sustained in the periods 1992–1994 and 2012–2014, became extinct (triangles) or was developed (solid diamonds). The grey "disc" shaped nodes are thus products in which the respective country has never had a revealed comparative advantage in exports to the EU.

The agro-complex product space calculated here contains 769 products (nodes) of the agro-complex and 4,620 edges. Hence, a significant number of products within the agro-complex were "dropped" as their degree of relatedness with other products was below the threshold level (i.e. a proximity of < 0.51, see section 3.4). This illustrates the relatively low level of product linkages within the agro-complex and the challenges this poses for a country's economic diversification endeavours.

The overall conclusion from figure 5 is that the four countries had a relatively narrow position in EU imports during the periods in question. Only Kenya and South Africa showed somewhat more diversified and stronger export positions (see the number of black triangular nodes). The figure reveals further that the countries were not able to sustain some of their exports to the EU (see the red solid triangles) over the period under investigation. However, all of the countries were able to diversify their exports to some extent (reflected by the green triangles). The "churning" in export patterns was the largest for South Africa and Kenya, which is not surprising since they have the largest export base within the agro-complex. Figure 5 already reveals some preliminary trends in terms of EU market size and relatedness, which will be discussed further in subsequent sections.

Figure 5: Position of the Democratic Republic of the Congo, South Africa, Kenya and Cameroon in the agro-complex product space in the periods from 1992–1994 to 2012–2014



Source: Authors' own calculations based on data from UN Comtrade, created with NodeXL.

Tables A1–A4 in annex I provide a more detailed overview of the historical patterns of exports to the EU from the four countries. The first four columns show the trend in Revealed Comparative Advantage (RCA) for each cluster in the agro-complex. The count reflects the number of products with an RCA > 1 in each cluster and the share reflects the contribution of each cluster to the country's total set of products with a RCA > 1. As was evident from figure 5, the tables show that South Africa and Kenya have developed by far the largest set of RCAs in terms of exports to the EU. The tables also reveal that in all four countries most RCAs are located within the primary agriculture and agro-processing (food) clusters. Furthermore, none of the countries has developed any significant RCAs in terms of production and capital inputs.

The last four columns in tables A1–A4 decompose the shifts in RCAs for the periods 1992–1994 and 2012–2014. The "Diversification" column indicates the number of products in which the country developed an RCA in the EU market during the period under investigation (the green triangles in the product space). The "Extinct" column reflects the number of products in which the country was not able to sustain its RCA over time (the red triangles). The "Sustained" column depicts the number of export products with an RCA in both time periods. The last column indicates the level of transformation within each cluster by subtracting the extinct products from the number of products in which the country has diversified. A positive level of export transformation means that the country was at least able to diversify into more products than those in which it failed to sustain export flows to the EU. In this regard the tables reveal that South Africa and the Democratic Republic of the Congo have lost some ground in the EU market as their levels of export transformation were negative. How these shifts in exports patterns are linked to product relatedness, market size and NTMs is further explored in the sections below.

4.2 Export patterns and product relatedness

Figure 5 showed the interrelatedness among products within the agro-complex. Products located in the denser parts of the product space network were better connected as the products located in the sparser parts had fewer product connections. Hence, the opportunities for export diversification were greater in the denser parts. The figure showed that all countries had RCAs located in both the denser and the sparser parts of the agricultural product space. However, the figure further revealed that none of the countries had developed any significant clustering of related products in the agro-complex.

As mentioned in section 3.4 countries tend to diversify their exports to nearby products. This section briefly explores whether this has also been the case for the exports of the four selected countries. Intuition would then also suggest that products in which a country has ceased to export are less related to their comparative advantages.

The distance measure (see equation 9) analyses how "close" (or related) any given product is to a country's current Revealed Comparative Advantage (RCA) in the product space. With respect to this study, it measured for each country how related any product was to the products in which it had a sustained RCA in the EU market. This concept of distance was applied to specifically those products within the agro-complex in which the country managed to specialize (diversification) and those products in which it failed to sustain its exports (extinction).

Table 3 provides a summary of this analysis. The six columns indicate the number of products within the agro-complex that the country diversified into, ceased to export, or could diversify into (see also tables A1-A4), as well as the average distance of these products to the country's existing RCAs to the EU. Recall that a value of close to 0 implies relatively close relatedness to existing exports, whereas a value of close to 1 implies little relatedness. Given the relatively high average distances, the products in which diversified took place and the products that became "extinct" of all four countries were relatively far removed from their existing comparative advantages in exports. However, the unexplored diversification opportunities (last column) are relatively close to the country's existing RCAs within the agro-complex. This implies unexploited potential in terms of export diversification.

Table 4 provides the results of statistically testing[6] the differences in average distance to a country's RCAs between export diversification and export extinction, as well as between export diversification and unexploited diversification opportunities. This test showed that apart from South Africa, products in which a country diversified were not necessarily closer to existing RCAs than extinct exports. The set of diversification opportunities within the agro-complex in all of the four countries, on the other hand, were significantly closer to existing comparative advantages in exports. However, these opportunities have not been pursued, possibly owing to market failure or institutional constraints limiting the development and transfer of productive capabilities. Hence, all four countries have mainly diversified into unrelated products within their agro-complex, which is in contrast to the findings of Hausmann and Klinger (2006).

Table 3: Historical export patterns and distance to existing comparative advantages

Country	Diversification		Extinction		Diversification opportunities	
	#	Average distance	#	Average distance	#	Average distance
Kenya	48	0.88	37	0.84	306	0.28
Democratic Republic of the Congo	7	0.93	11	0.95	46	0.59
Cameroon	24	0.81	12	0.90	115	0.24
South Africa	44	0.82	52	0.90	480	0.27

Source: Authors' own calculations based on data from UN Comtrade.

[6] The non-parametric Kruskal-Wallis test was used here as the data set represented independent and not normally distributed samples.

Table 4: Statistical differences in the distance to existing comparative advantages

	Diversification – Extinction	Diversification – Opportunities
Kenya	No	Yes
Democratic Republic of the Congo	No	Yes
Cameroon	No	Yes
South Africa	Yes	Yes

Source: Authors' own calculations based on data from UN Comtrade.

4.3 Export patterns and market size

An important driver of export diversification to the EU might be its relative market size. The single market is the world's largest importer of agro-food products; responsible for ten percent of global imports in 2014 (own calculations based on UN Comtrade data)[7]. Using the extensive margin measure, as discussed in section 3.5 (see equation 10), this section offers some brief findings on the breadth of the revealed export patterns to the EU for the four countries. The results of the analysis are shown in table 5. The total export breadth in the last row symbolizes the country's export portfolio in total imports within the agro-complex by the EU (summing diversification and sustained exports).

Table 5: The breadth of exports to the European Union within the agro-complex

	Democratic Republic of the Congo	South Africa	Kenya	Cameroon
Diversification	0.7%	3.6%	3.0%	1.4%
Extinction	1.0%	4.3%	3.6%	1.4%
Sustained	2.7%	8.6%	6.2%	4.6%
Total export breadth	**3.5%**	**12.2%**	**9.2%**	**6.0%**

Source: Authors' own calculations based on data from UN Comtrade.

[7] From a regional perspective, of total global agro-food trade 16 percent is imported by East-Asia and 12 percent by North-America (calculations based on data of UN Comtrade.

Table 5 reveals that the export diversification of these countries represented a smaller import market in EU than that of extinct exports. Ideally, a country should diversify into those export products with favourable market prospects and cease the exports of those products with a less favourable import market size. Hence, a country should export what is important to the importer, in this case the EU. Overall it seems that the four countries have not structured their export diversification efforts within the agro-complex around the size of the import market but rather around other factors, possibly market niches or seasonality, for example – but these factors fall outside the scope of this study. The export portfolios of South Africa and Kenya, however, showed that they still embodied a fair proportion of EU total imports within the agro-complex.

4.4 Export patterns and non-tariff measures

Section 3.3 revealed that the frequency and diversity of NTMs in the agro-complex is relatively high compared with other sectors. Whereas the EU's market size might be a driver of exports, its relatively high level and diversity of NTMs might present a barrier for developing countries in particular, as the high cost of compliance can be a burden (see also section 1). Hence, this section briefly explores the relationship between the identified export patterns of the four countries to the EU and the diversity of NTMs in the agro-complex.

Section 3.3 also introduced the *NTM diversity score* which reflects the diversity of different types of NTMs imposed at product level; with a score close to zero implying low diversity and a score close to one a high diversity of NTMs. It is assumed that different types of NTM imply additional costs of compliance compared with NTMs within the same category. Hence, the more diverse the set of imposed NTMs the more stringent they are to the exports of the respective product. Table 6 provides a summary of the analyses of the NTM diversity imposed by the EU in relation to the export patterns of the four selected countries. The table shows the average *NTM diversity score* for each category of export flow and it is evident that there exists a relatively high level of average diversity of NTMs across all three categories. All average scores were well-above the average *NTM diversity score* of 0.35 calculated over all products within the agro-complex. Thus, the four countries sustained and diversified their exports within the agro-complex despite facing a relatively high level of different NTMs in the EU market.

Table 6: Non-tariff measure diversity and export patterns

	South Africa	Democratic Republic of the Congo	Kenya	Cameroon
Diversification	0.56	0.71	0.54	0.67
Extinction	0.51	0.37	0.63	0.51
Sustained	0.61	0.47	0.54	0.56
Diversification opportunities	**0.42**	**0.63**	**0.48**	**0.51**

Source: Authors' own calculations based on data from UNCTAD-TRAINS.

The Kruskal-Wallis test was applied to test whether the NTM prevalence was statistically different among the three categories of exports. The outcome of the test results is shown in table 7, and for ease of interpretation the statistically significant differences between the categories are marked with an "x."

Table 7: Statistical analysis of differences in *NTM diversity score* between export patterns categories

	South Africa	Democratic Republic of the Congo	Kenya	Cameroon
Diversification – Extinction				
Diversification – Sustained				
Diversification – Opportunity	x			
Sustained – Opportunity	x			
Sustained – Extinction			x	
Extinction – Opportunity				

Source: Authors' own calculations.

It is evident from the table above that none of the countries diversified into products that face a significantly lower or higher *NTM diversity score* than that which they were used to from their sustained (and extinct) exports to the EU. In three instances the diversity of NTMs faced by specific diversification opportunities was statistically lower than that for the other product groups. Overall, the results show no conclusive evidence of a pattern of NTM diversity between new, sustained, and ceased export flows within the agro-complex and "unexploited" export opportunities to the EU.

5 Conclusion and policy recommendations

This study explored the export patterns within the broader agricultural sector, the so-called agro-complex, of four heterogeneous African countries (South Africa, Kenya, the Democratic Republic of the Congo and Cameroon) to the EU specifically for the period 1992 to 2014. The rationale behind the study was, firstly, to establish whether much-needed diversification has taken place over the last couple of decades and, secondly, to explore how these export patterns might have been influenced by NTMs as well as by product relatedness and size of the import market.

The main conclusions with regard to shifts in export patterns (see also section 4.1) can be summed up as follows:

- The Democratic Republic of the Congo and Cameroon have a very narrow export base to the EU within the agro-complex, which is dominated by primary agricultural products. Kenya and South Africa have a much broader export base, yet this is also dominated by primary agricultural products.
- Over the past two decades, Cameroon has shown no significant changes in the export pattern of its agro-complex to the EU; the only major shifts have been seen in the exports of primary agriculture.
- Similarly, the Democratic Republic of the Congo has not shown signs of a positive shift in its agro-complex exports to the EU; rather, it has experienced a relatively high rate of export extinctions.
- Kenya has experienced some churning in its agro-complex export basket to the EU over the past two decades, with some export extinctions within its agro-processing of food cluster and some export diversification within primary agriculture.
- Exports from South Africa within the agro-complex have shown some undesirable patterns in that the level of export extinction to the EU in agro-processing is relatively high and has contributed to a decrease in the number of products exported to the EU with an RCA.

When applying the *distance* measure, which was used to determine the degree to which changes in the countries' export patterns were related to their comparative advantages at product level (see also section 4.2) , the following aspects were observed:

- The export diversification to the EU within the agro-complex of all four countries has largely been to relatively unrelated products. This is in contrast to earlier findings by Hausmann and Klinger (2006), who concluded that countries tend to diversify to nearby products;

- Most products within the agro-complex that ceased being exported to the EU after 1992 (i.e. export extinction) by the have been much "further removed" from existing comparative advantages;
- In all four countries the unexploited diversification opportunities have been significantly more closely related to sustained exports than to the realized export diversification over the last two decades.

The EU is a significant global importer of agro-food products. Whether the EU market size for a product determines whether exports are sustained, diversified or ceased was analysed by looking at the breadth of exports (see also section 4.3). The findings for the four countries can be summed up as follows:

- In all four countries the sustained exports represented the largest proportion of the EU import market;
- In all four countries the export extinctions represented a larger proportion of the EU import market than the export diversification. This is undesirable and requires further investigation.

Lastly, the export patterns within the agro-complex of the four countries were investigated with regard to the stringency of NTMs in the EU (see also section 4.4). The following conclusions can be drawn:

- The diversity of NTMs applicable to sustained exports, diversified exports and extinct exports was relatively high for all four countries;
- Only in a very few cases was there a significant difference in the diversity of applied NTMs between the different groups of products;
- The hypothesis that countries would diversify their exports to the EU into products with less stringent NTMs and cease exports in products with more stringent NTM regimes seems not to hold. Hence, compliance with NTMs does not seem to present a barrier for agro-complex exports to the EU. However, further research whether this conclusion holds for products outside the agro-complex is recommended.

These results have important policy implications:

- The relative importance of EU as a destination of agro-complex exports of the four selected countries have declined over the past two decades, but is however, still important. The trade relationship within the agro-complex can be further characterised by relatively high levels of extinction of export flows. Thus, in the absence of a definitive link between the prevalence of NTMs, it is important to determine why some exports to the EU ceased—particularly in the case of South Africa,

which has a stronger economy and more resources than the other three countries featured in the study. Export extinction is not a healthy sign when the destination is a sizeable market like the EU with which the four countries have long-standing trading relationships;
- Policymakers should probe the causes of the anomalous diversification patterns displayed by the four countries in the study, since most countries tend to diversify into nearby or related products. It would appear that diversification follows a loose and circuitous path. Rather, it should be part of a streamlined process that attaches priority to particular sectors with resources being allocated accordingly;
- The agricultural policy environment is clearly not sufficiently conducive to building either capacity or a more value-added orientation in the agro-complex in the four countries, judging from their disappointing agricultural policy cost rankings in 2015.

Sectoral exports to a certain target region can flourish only when there is a strong policy environment that is clearly informed by the views of all relevant stakeholders. This study has laid an important foundation for further, more detailed investigations into exports from Africa's agro-complex with Europe and what it will take to turn African countries' comparative advantages into sustainable competitive advantages.

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Annex

Table A1: Historical export pattern of Cameroon's agro-complex into the European Union market

	RCA count		RCA share		RCA pattern			
	1992–94	2012–14	1992–94	2012–14	Diversifi-cation	Extinct	Sustained	Trans-formation
Primary agriculture	13	24	39%	53%	16	5	8	11
Agro-processing: food	12	12	37%	27%	5	5	7	0
Agro-processing: non-food	8	9	24%	20%	3	2	6	1
Production inputs	0	0	0%	0%	0	0	0	0
Capital inputs – primary	0	0	0%	0%	0	0	0	0
Capital inputs – secondary	0	0	0%	0%	0	0	0	0
Total	**33**	**45**	**100%**	**100%**	**24**	**12**	**21**	**12**

Source: Authors' own calculations based on data from UN Comtrade (2016).

Table A2: Historical export pattern of the Democratic Republic of the Congo's agro-complex into the European Union market

	RCA count		RCA share		RCA pattern			
	1992–94	2012–14	1992–94	2012–14	Diversifi-cation	Extinct	Sustained	Trans-formation
Primary agriculture	7	5	41%	38%	2	4	3	-2
Agroprocessing: food	5	7	30%	54%	5	3	2	2
Agroprocessing: non-food	5	1	29%	8%	0	4	1	-4
Production inputs	0	0	0%	0%	0	0	0	0
Capital inputs – primary	0	0	0%	0%	0	0	0	0
Capital inputs – secondary	0	0	0%	0%	0	0	0	0
Total	**17**	**13**	**100%**	**100%**	**7**	**11**	**6**	**-4**

Source: Authors' own calculations based on data from UN Comtrade.

Table A3: Historical export pattern of Kenya's agro-complex into the European Union market

	RCA count		RCA share		RCA pattern			
	1992–94	2012–14	1992–94	2012–14	Diversifi-cation	Extinct	Sustained	Trans-formation
Primary agriculture	43	53	43%	48%	21	11	32	10
Agroprocessing: food	34	26	34%	23%	11	19	15	-8
Agroprocessing: non-food	22	28	22%	25%	13	7	15	6
Production inputs	1	3	1%	3%	2	0	1	2
Capital inputs – primary	0	0	0%	0%	0	0	0	0
Capital inputs – secondary	0	1	0%	1%	1	0	0	1
Total	**100**	**111**	**100%**	**100%**	**48**	**37**	**63**	**11**

Source: Authors' own calculations based on data from UN Comtrade (2016).

Table A4: Historical export pattern of South Africa's agro-complex into the European Union market

	RCA count		RCA share		RCA pattern			
	1992–94	2012–14	1992–94	2012–14	Diversifi-cation	Extinct	Sustained	Trans-formation
Primary agriculture	51	54	39%	44%	16	13	38	3
Agroprocessing: food	37	34	28%	27%	14	17	20	-3
Agroprocessing: non-food	40	30	30%	24%	10	20	20	-10
Production inputs	4	5	3%	4%	3	2	2	1
Capital inputs – primary	0	0	0%	0%	0	0	0	0
Capital inputs – secondary	0	1	0%	1%	1	0	0	1
Total	**132**	**124**	**100%**	**100%**	**44**	**52**	**80**	**-8**

Source: Authors' own calculations based on data from UN Comtrade.