

# **EU Product Standards and Export Diversification in Nigeria and South Africa**

## **Abstract**

The issue of export diversification has been receiving attention among scholars and policymakers. However, African countries face critical challenges in improving domestic capacity to meet production and quality standards required in the foreign markets. Premised on this, this study explores how standards affect agriculture and textile products exported to the EU market, by the two biggest economies in SSA between 1995 and 2004. Employing the Hirschman concentration index as a measure of diversification in the context of a modified poisson model of gravity trade theory, findings show that standards and harmonized standards are of no significant effect on South African agricultural export diversification while in Nigeria, standards have significant effect on agricultural export diversification but have no effect on textiles. Moreover, harmonized standards show positive effect on agricultural export concentration but have no effect on textile exports in South Africa. However, harmonized standards plays no role in the diversification of Nigerian agricultural and textile export varieties. The study therefore recommends that producers of agricultural products in South Africa should focus on single, country specific standards while producers of agricultural products in Nigeria should adopt harmonized standards to promote bilateral trade and develop quality products to improve competition in the EU markets.

**Keywords: product standards, export diversification, gravity model**

## **1. Introduction**

Trade has always proved to be a strong engine of economic growth and development. Not only does trade provide avenues to sell and earn foreign exchange, allows economic agents access product varieties which may not have been otherwise possible, it also improves product quality through competitiveness, increases efficient use of resources, creates jobs and hence generates employment (Olubiyi 2015). However, impediments to trade and supply response restraints have limited these benefits. Trade agreement between and among nations, both at the bilateral, regional and multilateral levels have actually addressed some of these impediments. Specifically, policy based barriers such as tariffs, outright ban, quotas, and some others have been reduced through trade negotiations (Kareem, 2014). But the other aspect of non-tariff measures (NTM), that is, technical standards and regulations is still notable and this tend to strangle the potency of some key export products where comparative advantage could benefit. In particular, some products for which developing countries have comparative export advantage tend to have been greatly negotiated away by the NTM (Kareem, 2010; Fugazza, 2013). Kee *et al.* (2009) claim that the NTM add not less than 70% to export restrictions imposed by tariffs.

Technical regulations and standards can have a potential effect on trade from the supply side. In this case, the cost of product adaptation that is incurred by the intending exporter of a particular product as required by the partner country will increase, and by implication, reduces the extent to which products can be diversified (Shepherd, 2015). This effect is more pronounced in lower-middle and low income countries where information asymmetry, weak governance and financial institutions, and lack of technological know-how exist. Meanwhile, product diversification can benefit from embracing harmonized standards of product provided the scale effect dominates the cost effect. The scale effect of harmonized product standards is that it allows exporting firms to gain access to many foreign markets with a single standard and pay just one cost. But it is also possible to adopt costly standards in at least one of the harmonized countries, thereby precipitating export diversification. This suggests that it is not in all cases that the regulation and standards aspect of NTM attenuates export diversification. Whether scale effect or cost effect prevail is an empirical issue and this is the basis for which this paper is developed.

This study focuses on selected African countries for at least three reasons. First, most African countries have limited national markets for local trade which can encourage faster growth rates for development. As a result, getting access to multiple markets for multiple export products at

the international front is very key to propelling economic growth and development. While there are many complementary actions that are needed to improve the investment climate so as to allow a higher growth rate to be achieved, addressing the effect of product standards both as barriers to trade and opportunities to expand market access is likely to be one of the areas where [investment](#) will have a high rate of return.

Second, Mosley (2018) points out that many African countries which achieved considerable foreign market penetration in the 1990s have lost their competitive edge, and by implication reverted back to domestic market, thereby getting entrapped in the vicious circle of increased costs and inability to diversify. Can this situation be attributed to the fact that the cost effect of standards and harmonized standards over weighs the scale effect? Third, although policy makers in some big countries in Africa, that is, South Africa and Nigeria, have made frantic efforts to diversify their export base, the result appears not to be commensurate. Available information from the IMF show that the diversification index for Nigeria rose from 3.74 in 1962 to 6.15 in 1985 but fell slightly to 6.14 in 20 years later and fell again to 5.54 in 2010 and rose slightly to 5.62 in 2014. In the case of South Africa, diversification index fell from 2.74 in 1962 to 2.24 in 1985 and then to 1.88 in 2005, rose to 2.30 in 2010 and 2.59 in 2014. However, this index lumped up the entire products and this could suppress the influence of product standards on the diversification of products for which comparative advantage exists.

Many authors have worked on export diversification in Africa but the issue of product standards is not addressed. The [most recent](#) is the study of Mosley (2018) where the issues surrounding weak export diversification in Africa were discussed and supported by empirical evidence. Surprisingly, the case of product standards was not addressed despite its importance in market access for exports and motivation for diversification. Studies on product standards that did not recognize the ability to diversify include Kareem (2014) and Kareem *et al* (2018), Kareem (2014) studies the effects of product standards on selected agricultural products at HS-4 digits for the whole African countries. Kareem *et al.*(2018) study the food safety standards of the EU for some products such as tomatoes, citrus fruits, using pesticides standards even though it focuses on some products for which comparative advantage prevail in Africa. Also for Africa as a whole, the study of Shepherd (2015) addresses the case of product standard in export

diversification model in some selected products such as textiles, footwear and clothing at the HS-6 digits.

The present study departs from these works by carrying out a country-specific analysis of product standards and export diversification. Except in Kareem *et al.*(2018), no other relevant studies control for country fixed effects and this could cast doubt on the reliability of third results. Second, the use of extensive margin of trade (number of new products developed in a sector or new markets for exports) is questionable in the gravity setting. While product standards can be accessed on bilateral basis, the extensive margin of trade data used by these authors are provided by the World Bank and these data are not available on bilateral basis. Hence, establishing how costly standards is employed from a given country may not be established if bilateral data on product standards are not employed and country effects are not accounted for.

Our study employs the standard approach of constructing export diversification of agricultural products and textiles on bilateral basis and extract bilateral product standards. Since the available product standards data is for the EU, the partner countries for exports from Nigeria and South Africa are the EU countries. We view this approach to provide better and comprehensive information about bilateral export diversification. We also view that selecting some products and studying their diversification will partially provide information about the extent of diversification in these sectors (Agriculture and Textiles). Our study computes diversification index of the entire agricultural and textile products at HS-6 digit. These two products have not benefitted from research activity on diversification at least at the Africa country-specific level, and specifically for the two biggest economies in the region and have been identified as the economic stronghold of sub-Saharan Africa. Further, Nigeria government is concerned about the situation of product diversification in the recent time and this makes policy of diversification in agricultural products to be of highest priority. Providing information on the influence of product standards on exports and export varieties of these agricultural products in the European countries is expected to be of help to the success of such policy.

## 2. Literature Review

Gravity model was used to analyze the broader effect on trade. It is a methodology mostly used in addressing the impact of regulation on trade due to its good performance and reasonable data requirements to perform the estimation (Melo *et al.*, 2012). Many studies that used this approach focused on estimating the impact of non-tariff barriers on trade. Some authors that used this method include: Moenius (2004), Melo *et al.* (2012), Asci *et al.* (2014), Shepherd and Wilson (2013), and Mangelsdorf *et al.* (2012). While many studies used gravity model to analyze the extensive and intensive margin of trade in the product standards literature, some other studies used other econometric models to study these margins of trade. Econometric models used by some of these studies include the two-step Heckman model used by Kareem (2014) to estimate the relationship between product standards and Africa's agricultural exports.

Shepherd (2015) used theory of consistent measure of variety to estimate export diversification while using Ordinary Least Square method to analyze the relationship between product standards and export diversification. This method was also used by Shepherd (2008) to estimate the relationship between product standards, harmonization and trade. The Helpman, Melitz and Rudinstein (HMR) model was adopted by Ferro *et al.* (2013) and Munasib and Roy (2012). While Ferro *et al.* (2013) used the technique to estimate the effect of product standards on agricultural exports from developing countries, Munasib and Roy (2012) adopted the technique to estimate non-tariff measures as a barrier to trade. Probit estimation technique was adopted by Nicita and Rollo (2015) to analyze market access conditions and Sub-Saharan African's export diversification. The technique was also adopted by Maertens and Swinnen (2009) to estimate trade, standards and poverty in Senegal. Also, Hudson and Orviska (2013) used this technique to analyze firm's adoption of international standards.

Maskuset *al.* (2005) used transcendental logarithmic cost function to estimate the cost of compliance with product standards for firm in developing countries. Shepherd and Wilson (2013) used Poisson Pseudo Maximum Likelihood estimator (PPML) – which is an extension of gravity model- to estimate product standards and developing countries agricultural exports. Crivelli and Gröschl (2012) used Heckman selection model and maximum likelihood technique to estimate the impact of sanitary and phytosanitary measures on market entry and trade flows. Goedhuys and Sleuwaegen (2016) also used this technique to analyze institutional standards

certification, institutional voids and exports from developing country firms. Amurgo-Pacheco and Pierola (2007) analyzed the pattern of export diversification in developing countries using the Tobit estimation. Dennis and Shepherd (2009) analyzed trade facilitation and export diversification by using Poisson model.

The empirical literature of product standards and export diversification is small but increasing. However, studies on export diversification is voluminous hence, recent evidence on export diversification and some review of product standard effects on export diversification are presented.

Czubala *et al.* (2007) studied **how product standards affect African exports. The result indicate that standards dwarfs exports while harmonized standards enhances.** It was found in the analysis of the study that EU standards harmonized with international norms exert less negative impact on African export volume and propensity than standards which are not harmonized. Shepherd (2008) also carried out a study on product standards, harmonization and trade and he found that for an average low income country, the elasticity of export variety with respect to EU standards is -0.8 and the harmonization elasticity is 0.2, while for an average high income country, the corresponding figures are 0.4 and approximately zero. Standards and harmonization thus have the potential to exert an important impact on export variety growth in the developing world. The study also showed that harmonization is beneficial at the extensive margin provided that any increase in compliance costs are not too large.

Ferro *et al.* (2013) also **carried** out a study on the effects of product standards on the export of selected agricultural products. The product standards employed was food safety standards. The study **focused** on developing countries and the analysis of the study shows that on an average, product standards negatively affects exporter's decision to sell into a given destination market. It also shows that the marginal effects of BRICS (Brazil, Russia, India, China and South Africa) standards on the decision of firms to export is greater in absolute terms than that of non-BRICS countries. Furthermore, it appears that export from low income countries are more negatively affected by product standards than those from higher income countries.

A study on product standards and developing countries agricultural exports by Shepherd and Wilson (2013) showed that effects of standards, and in particular their characteristics as barriers



or catalysts, is highly sector specific. It is also found that in some cases – just like in previous works – internationally harmonized EU standards tend to have weak or even slightly positive trade impacts, whereas, non-harmonized EU standards, that is, those unique to the EU, tend to be trade-inhibiting. Reyes (2011) carried out a study on international harmonization of product standards and firms' heterogeneity in international trade. The analysis showed that US industries with relatively high harmonization exhibit relatively high export value to the EU; also, product standards harmonization increases the probability of higher productivity firms entering the EU market. However, this impact is more relevant for US firms that are already exporters serving developing countries than for firms entering the export activity. Maertens and Swinnen (2009) carried out a study on trade, standards and poverty in Senegal and found that exports have grown sharply despite increasing standards, resulting in important income gains and poverty reduction. The estimation indicated that poverty is 14% points lower due to vegetable exports. Therefore, tightening food standards induced a shift from small holder contract-based farming to large-scale integrated estate production, altering the mechanism through which poor households benefit: through labor markets instead of product markets. Hence, the impacts on poverty reduction are stronger as the poorest benefit relatively more from working on large-scale farms than from contract farming.

Mangelsdorf *et al.* (2012) carried out a study on food standards and exports in China and found that standards have a positive effect on China's export performance. It also showed that these positive effects are larger when standards are consistent with international norms. The estimation suggested that one additional international harmonized standard in China is associated with an increase in agricultural exports ranging between 0.38% and 0.64% and that the effect of mandatory standards is generally positive and statistically significant for both purely domestic and international harmonized standards. Weiet *al.* (2011) analyzed the impact of food safety standards on China's tea export and found that Maximum Residual Limit (MRL) of pesticides imposed by importing countries has significantly affected China's tea exports. A 1% increase in the regulatory stringency on pesticides (tighten restrictions on the pesticide) can lead to a 22% decrease of tea exports from China. Although, tariff on tea remain an important factor that affect China's tea exports, the MRLs of certain pesticides can significantly limit China's tea exports. Lei *et al.* (2013) also studied the impact of food safety standards on China's export of vegetables and fruits and discovered that although transportation distance between trading partners and tariff

rates on vegetables and fruits were still the important resistant factors for China's exports, vegetables and fruits export was sensitive to the number of regulated pesticides, the strictness and the level of food safety standards imposed by importing countries. The analysis showed significant trade flow effect implying that stricter food safety standards and increased number of regulated pesticides significantly inhibit China's export of vegetables and fruits.

A study carried out on product standards and Africa's agricultural exports by Kareem (2014) shows that at the extensive margin of trade, standards are trade-inhibiting in fish and coffee exports while they are trade-enhancing in vegetable export. At the intensive margin of trade on the other hand, standards are trade-inhibiting in vegetable and coffee exports while trade-enhancing in the export of fish. Hence, the study concludes that the impact of standards on trade is product-specific.

Shepherd (2015) studied the effect of product standards on textiles, clothing and footwear. The author extracted import data on the products from the European Union at the 8-digit level between 1995 and 2003. Relating EU standards to export varieties, the result shows that total number of standards in a particular sector is generally negatively associated with varieties of exports. The effect varies significantly with exporting country's income level. For small countries, it is negative but for big countries, it is positive. This suggests that ability to adapt to foreign products standards depend on the income level of exporting countries. For instance, low income inhibits investment and technological upgrade which consequently reduces ability to cope with product standards.

Kareem *et al.* (2018) argued that product standard appears to be a protectionism measure rather than enhancing trade. To establish this argument, they investigated the case of product standards (European Union Sanitary and Pythosanitary (EUSPS) and agricultural products, that is, tomatoes and citrus fruits. Their main focus was to see if the market condition of the EU constrains ability of African exports to the region. They obtained bilateral export data between 5 EU countries and 34 African countries between 2008-2013. Data on the three products are obtained at 6-digit of HS classification. They compare EU standards to the benchmark set by the World Health Organization and Food and Agricultural Organization. Their results indicate that product standards on tomatoes is more of import protectionism than health protection. The case of orange and lime are different because the products are under-protected.



Mosley (2018) explored into the binding constraints of export diversification in Africa. The author opines that traditional factors such as trade liberalization is not enough to promote diversification. The study therefore considered other drivers such as input subsidies, infrastructural development and human capital development. Clearly, this study assumed that the market condition of the partner countries is given, and so, there is no need for considering product standards. Incorporating these factors in the diversification model, the OLS and 2SLS result suggest that exchange rate was insignificant in influencing export diversification. However, when exchange rate was interacted with subsidies, the association was significant. This implies that element of protectionism, in form of input subsidies could reduce the influence of market imperfection constraining export diversification.

### **3. Theoretical Framework and Methodology**

This study employs gravity model for explaining export diversification. Gravity model proposes that bilateral trade is determined by the income size and population of the trading partners and the distance between the pair economies. The extended gravity model includes some gravity variables such as common language, colony, and whether any of the countries or both countries in a pair are landlocked. However, the gravity model is being extended to include some variables deemed to affect export diversification. Mosley (2018) included preconditions to diversify and export. According to the author, such preconditions include provision of subsidies for the potential exporters, provision of physical infrastructure, human capital and institutional capacity. Provision of subsidies acts as a temporary protection policy and also aim at making exports to be more competitive. Provision of physical infrastructure such as electricity and water, reduces production bottleneck, and enriches ability to produce and diversify. Increase in human capital development ensures improved labour productivity, and provides adequate knowledge about the market. Thus, all these variables are expected to improve export diversification.

Our extended gravity model is similar to the work of Moenius (2004) who incorporated product standards in the gravity model. Shepherd (2015) extended the model by focusing on harmonized standards. The author argued that harmonized standards can be trade enhancing, provided the scale effect outweighs the cost effect, while country-specific standards is trade inhibiting. Thus, the variables that will enter our gravity model are the standard gravity variables, that is, income,

population, distance, common language, colony and landlocked. The next set of variables are the preconditions to diversify export products, that is, provision of subsidies, physical infrastructure, government spending and human capital (public spending on health as proxy). The third set is the trade facilitation (time to export), standards and harmonized standards. Given all these variables, the gravity model for export diversification is provided in equation 1:

$$ED_{i,j} = \frac{Y_i^{\alpha} Y_j^{\beta} V_{i,j}^{\gamma} S_{i,j}^{\delta} G_{i,j}^{\epsilon} I_{i,j}^{\zeta} T_{i,j}^{\eta} ST_{i,j}^{\theta} HST_{i,j}^{\iota}}{D_{i,j}^{\kappa}} \dots\dots\dots 1$$

Where  $ED_{i,j}$  is export diversification from country i (where i = Nigeria, South Africa) to country j (where j = each of the EU-21).  $Y_i$  and  $Y_j$  stand for income of country i and country j respectively.  $V, S, G, I, T, ST, HST$  represents other gravity variables, subsidies, government expenditure, physical infrastructure, time to export, product standards and harmonized standards respectively. In equation 1, export diversification is not observable, and so need to be computed. There are several approaches to computing diversification but this study employs the Hirschman index (Hirschman concentration index) as a measure of diversification. This index was developed by Alfred Hirschman in 1945 and stems originally from the field of industrial organization where it measures market concentration. The index was adopted to actually measure the concentration of export basket. The model obtains in its normalized form, value between 0 and 1, 0 implying a high degree of export diversification and 1 representing export concentration, i.e., the country rely on one or few product for export.

The Hirschman index takes the form specified in equation 2:

$$ED = \sqrt{\sum_{k=1}^N \left( \frac{X_{ikt}^v}{X_{kt}^v} \right)^2} \dots\dots\dots 2$$

Where  $X_{ikt}^v$  is the value of country i's exports of commodity k in sector v at time t and  $X_{kt}^v$  is the total export of sector v in the respective year while N is the maximum number of commodity

considered. Log-linearizing equation 1 and bearing in mind that ED is measured as given in equation 2, equation 3 is produced as follows:

$$ED_{i,j} = \beta_0 + \beta_1 \ln Y_{it} + \beta_2 \ln Y_{jt} + \beta_3 D_{i,j} + \beta_4 S_{it} + \beta_5 G_{it} + \beta_6 I_{it} + \beta_7 T_{it} + \beta_8 ST_{it} + \beta_9 HST_{it} + V' \gamma + v_t + e_i + e_j + e_{ij} + \mu_{it} \dots (3)$$

Where  $v_t, e_i, e_j, e_{ij}$  stands for time, export, importer and country pair fixed effects. Since the measure of ED as specified in equation 2 suggests that the closer the value to zero the more diversified the sector is it follows from equation 3 that  $\beta_1, \beta_2, \beta_4, \beta_5, \beta_6, \beta_9 < 0$  while  $\beta_3, \beta_7, \beta_8 > 0$  that is, increase in exporter and importer's income should reduce concentration and increase diversification. Also, the longer the distance, the more products are concentrated and the less they are diversified. Standards is expected to increase export concentration and hence, diversification inhibiting but harmonized standards are to reduce product concentration ratio and hence increase diversification. The various fixed effects included are meant to deal with unobserved country- or time-specific characteristics. Following Shepherd (2015) and Mosley (2018), real effective exchange rate is interacted with subsidies while GDP is interacted with standards and harmonized standards. It was argued that the extent to which subsidies enhance product diversification depends on the dynamics of exchange rate. During real depreciation, subsidies might increase competitiveness. Income size also determine whether standards or harmonized standards will affect export diversification or not. Increase in income size should engender export diversification through harmonized standards, provided scale effect prevails.

One major methodological challenge in our gravity model is that there are missing observations of some product varieties at the bilateral level. The missing observation could be as a result of no trade or that the data were not reported. Utilizing least square method to deal with this zero or unreported observation could cast doubt on our result. To address this issue, a modified Poisson model (negative binomial pseudo maximum likelihood-NBPML) was employed. This model captures the source of the zero counts by separating country pairs possessing strictly zero trade flows from those that have non-zero probability of having non-zero-valued trade flows. This estimation process is a two-step method which contains a logit or probit regression of the probability of no bilateral trade, and a Poisson regression of the probability of each zero count for the country pairs that have non- zero probability or interaction intensity other than zero. It is

better than the Heckman selection model because it is less restrictive and does not require an instrument for the second stage of the regression.

Bilateral export data were obtained online from the World Integrated Trade Solution (WITS) published by the COMTRADE and World Bank on Agriculture and textile products based on HS6-digit between 1995 to 2004. The bilateral exports of these products were obtained for Nigeria and South Africa against each of the EU-21, namely; Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, the Netherlands, Poland, Portugal, Romania, Spain, Sweden, and the United Kingdom.

#### 4. Results and Discussions

##### 4.1 Descriptive statistics of the variables

The table below summarizes the descriptive statistics showing the properties of the data. From table 1, ED\_AGR represent Agricultural export diversification index, ED\_TEX represents Textile export diversification index, EU represents Total number of EU standards, EU\_ISO represents the Proportion of EU standards harmonized with the ISO standards, GDP<sub>i</sub> represents the country's Gross Domestic Product, GDP<sub>j</sub> represents foreign country's Gross Domestic Product. Dist represents the distance between the home country and the foreign country, Lang (language) and colony are gravity variables implying whether or not the country has the same official language and falls under the same colony and TTE represent time to export measure.

**Table 1: Descriptive statistics of study variable**

Variables	NIGERIA					SOUTH AFRICA				
	Obs.	Mean	Std. Dev.	Min	Max	Obs.	Mean	Std. Dev.	Min	Max
ed_agr	80	0.89	0.11	0.61	1.00	210	0.71	0.16	0.25	1.00
ed_tex	80	0.92	0.11	0.60	1.00	210	0.73	0.17	0.42	1.00

Lneu	80	10.72	0.78	9.16	11.87	210	10.72	0.78	9.16	11.87
lneu_iso	80	10.32	1.02	8.68	11.86	210	10.32	1.02	8.68	11.86
lngdp <sub>i</sub>	80	24.52	0.35	24.07	25.20	210	25.72	0.18	25.47	26.16
lngdp <sub>j</sub>	80	27.49	0.73	26.19	28.67	210	27.49	0.73	26.19	28.67
Indist	80	8.42	0.12	8.25	8.54	210	9.13	0.08	8.97	9.26
lang	81	0.12	0.33	0.00	1.00	210	0.10	0.29	0.00	1.00
colony	81	0.12	0.33	0.00	1.00	210	0.10	0.29	0.00	1.00
tte	81	46.73	2.72	43.3	51.1	210	44.7	2.49	40.8	48.6
lnsubs	210	3.10	0.16	2.78	3.41	147	3.29	0.13	3.15	3.57
lnreer <sub>i</sub>	210	4.73	0.54	4.25	5.61	210	4.55	0.14	4.24	4.72
lnreer <sub>j</sub>	209	4.51	0.15	3.83	4.77	209	4.51	0.15	3.83	4.77
lninfra	210	3.17	0.12	2.95	3.32	210	3.65	0.10	3.44	3.78
lngovt	210	2.16	0.31	1.64	2.64	210	2.41	0.05	2.34	2.48
lnhealth	210	1.16	0.17	0.89	1.46	210	2.12	0.03	2.07	2.15

Nigeria agricultural product and textiles are highly concentrated on few product varieties, but agriculture products are less concentrated. The minimum concentration ratio is 0.61 while the maximum is 1.00. The average concentration ratio of agricultural and textile products in South Africa is 0.71 and 0.73 respectively. Hence, South Africa agricultural and textile sectors are relatively more diversified than Nigeria. In fact, the minimum concentration ratio of agriculture and textile in South Africa are 0.25 and 0.42 respectively. The average number of product standards and harmonized product standards grew at 10.72 and 10.32 respectively. The mean growth of the EU was higher than Nigeria and South Africa. The implication of this is that insofar as Nigeria and South Africa agriculture and textile products are normal goods, there will be large market for these products in the EU countries. However, time to export in Nigeria was more than time to export in South Africa. The minimum time to export (number of days) in Nigeria was one month and 13 days while the minimum was one month and 10 days in South Africa. In some cases, it could take as much as almost two months for export to take place in Nigeria. The implication of this is that much as the African products could be normal goods, constraints to trade facilitation will reduce the potential to diversify. Meanwhile, trade facilitation in South Africa is relatively better than Nigeria and this could make diversification to be more pronounced in South Africa than Nigeria.

The government of South Africa supports the producers of export products more than Nigeria government. This is evident in the growth of subsidies that is more in South Africa than Nigeria. In the same vein, growth of physical infrastructure and government spending was higher in South Africa than Nigeria. The same situation exists in the case of the provision of human capital, that is public health expenditure. This implies that South African government is committed to motivate producers of export products and to make these products more competitive in the EU market. Such commitment could inform one of the reasons why diversification is more pronounced in the two sectors compared to Nigeria.

## 4.2 Result of the models

### 4.2.1 *South African agriculture and textile export diversification and EU product standards*

The interest of this research work is on the effect of product standards on agricultural and textile exports of South Africa and Nigeria to the European Union markets. The result of the gravity model showing the effect of product standards on the diversification of agriculture exports in South Africa is presented in Table 2. Columns 1 to 6 show the results of basic gravity, export competitiveness, government infrastructure and models that incorporate product standards. The last four columns control for year, exporter, importer and country pair fixed effects respectively. Starting from the basic gravity model, GDP of the importer countries, distance and time to export have significant effect on export diversification of agricultural products in South Africa. The positive effect of distance suggests that longer distance increases product concentration whereas shorter distance reduces product concentration, that is, **increases** diversification. Hence, the positive effect of distance on diversification is in line with the *a priori* expectation. If the time to export to the EU increases, product exports are less diversified. As can be verified, this effect cut across all the models. This suggests that reduction in time to export facilitates agricultural export diversification of South Africa. **This result confirms with the findings of Shepherd (2009).**

**TABLE 2: AGRIC EXPORT DIVERSIFICATION AND PRODUCT STANDARDS IN SOUTH AFRICA**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
HOME GDP	0.07 (0.05)	0.13 (0.22)	-0.24 (0.56)	0.06 (0.41)	0.06 (0.08)	0.05 (0.07)	0.00 (.)	0.08 (0.06)	0.00 (.)	0.00 (.)
PARTER GDP	-0.03*** (0.01)	- 0.04*** (0.01)	- 0.04*** (0.01)	-0.04*** (0.01)	-0.04*** (0.01)	-0.04*** (0.01)	-0.04*** (0.01)	-0.12 (0.10)	-0.12 (0.10)	-0.12 (0.10)
DISTANCE	0.24 (0.16)	0.20 (0.17)	0.20 (0.17)	0.20 (0.17)	0.20 (0.17)	0.20 (0.17)	0.20 (0.17)	0.00 (.)	0.00 (.)	0.00 (.)
LANGUAGE	-0.02 (0.03)	-0.02 (0.04)	-0.02 (0.04)	-0.02 (0.04)	-0.02 (0.04)	-0.02 (0.04)	-0.02 (0.04)	0.68 (0.49)	0.68 (0.49)	0.68 (0.49)
TIME TO EXPORT	0.01* (0.00)	0.01 (0.02)	-0.03 (0.05)	0.00 (0.03)	0.00 (0.01)	0.00 (0.01)	-0.00 (0.01)	-0.00 (0.01)	-0.01 (0.01)	-0.01 (0.01)
LOG OF SUBSIDIES		0.12 (0.39)	-0.25 (0.73)	-0.09 (0.66)	-0.10 (0.34)	-0.10 (0.34)	0.00 (.)	-0.04 (0.27)	0.00 (.)	0.00 (.)
LOG OF REERI		0.00 (.)	0.00 (.)	0.00 (.)	0.00 (.)	0.00 (.)	0.00 (.)	0.00 (.)	0.00 (.)	0.00 (.)
REER_X_SUBSIDIEE		-0.14 (0.37)	0.26 (0.78)	-0.01 (0.69)	0.00 (.)	0.00 (.)	0.00 (.)	0.00 (.)	0.00 (.)	0.00 (.)
LOG OF INFRASTRUCTURE			-0.60 (0.58)	0.00 (.)	0.00 (.)	0.00 (.)	0.00 (.)	0.00 (.)	0.00 (.)	0.00 (.)
LOG OF GOVERNMENT SPENDING				0.00 (.)	0.00 (.)	0.00 (.)	0.00 (.)	0.00 (.)	0.00 (.)	0.00 (.)
LOG OF HEALTH EXPENDITURE			-0.06 (1.31)	-0.41 (1.40)	-0.41 (1.18)	-0.41 (1.19)	0.00 (.)	-0.46 (0.87)	0.00 (.)	0.00 (.)
EU STANDARDS				0.03 (0.03)	0.03 (0.10)	0.00 (.)	0.00 (.)	0.01 (0.30)	0.02 (0.41)	0.02 (0.38)
EU HARMONIZED					0.00 (0.07)	0.00 (.)	0.00 (.)	0.001 (0.81)	0.001 (0.73)	0.001 (0.92)
STANDxGDP						-0.01 (0.16)	-0.01 (0.16)	-0.03** (0.04)	-0.02* (0.10)	-0.01** (0.02)
HARMONIZEDxGDP						0.02 (0.50)	0.02 (0.30)	0.02 (0.30)	0.01*** (0.04)	0.01*** (0.03)
Constant	-2.67** (0.02)	-3.37* (0.10)	8.38* (0.07)	-0.76** (0.03)	-0.65** (0.03)	-0.35** (0.5902)	-0.21** (0.04)	2.25*** (0.01)	3.56*** (0.01)	3.56*** (0.01)
TIME FIXED EFFECT	NO	NO	NO	NO	NO	NO	YES	NO	YES	YES
EXPORTER FIXED EFFECT	NO	NO	NO	NO	NO	NO	NO	YES	YES	NO
IMPORTER FIXED EFFECT	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES
COUNTRY-PAIR FIXED EFFECT	147	147	147	147	147	147	147	147	147	147
Observations										
Adjusted R <sup>2</sup>	0.087	0.130	0.124	0.124	0.124	0.124	0.124	0.554	0.554	0.554

Note: *p*-values in parentheses: \*, \*\*, \*\*\* = significant at 10%, 5% and 1% respectively

The second and third models consider the preconditions to diversify export products and government efforts to encourage diversification respectively. Subsidies do not have any significant effect on export diversification. However, when interacted with exchange rate, a positive and significant effect was observed. What this implies is that exchange rate dynamics plays important role in the effectiveness of subsidies on export diversification and it is the case



that during depreciation, although subsidies reduce cost of production, import input becomes more expensive and this dampens the competitiveness of these products in the EU markets. Hence, exchange rate negotiates away the potential of subsidies in encouraging diversification. Government spending on health and provision of physical infrastructure, such as water and electricity, have no significant effect on export diversification of agricultural products in this country. Column four and five present results of the effect of product standards on agricultural export diversification. The result suggests no significant effect of either the numbers of standards or numbers of harmonized standards on agriculture export diversification. However, when GDP was interacted with standards, the effect was negative and significant, although the magnitude of effect was mild. What can be deduced from the result is that the size of the economy is important for export varieties to the EU countries. Further, interacting harmonized standards with GDP produces positive, significant but mild effect on export varieties. The negative effect of the interaction of GDP with standards suggests that increase in GDP engenders standards to make agriculture exports less concentrated. Hence, access to EU market upon compliance with (a single) standards reduces agriculture product concentration, thereby favoring product varieties to be exported.

However, harmonized standards discourages product varieties as GDP increases, perhaps, due to lack of access to information regarding the demand and consumer preferences of some of the EU partner countries. The lack of access to this information could force the cost effect to outweigh the scale effect. The introduction of various fixed effects helps to improve on the results as it provides more detailed and reliable results.

The inclusion of the various fixed effects allows us to control for respective characteristics of time, exporter, importer and country pairs. As can be read off, the effects are important. Before the introduction of these effects, most of the variables were not significant. For instance, the interaction of subsidies with real effective exchange rate was now significant (column 6) and positive, suggesting that unobserved exporter specific characteristic influences the interaction of exchange rate with subsidies in reducing diversification of agricultural varieties to the EU.

The results of how South African textile varieties exported to the EU is affected by gravity variables, preconditions to diversify, government intervention and product standards is presented

**TABLE 3: TEXTILE EXPORT DIVERSIFICATION AND PRODUCT STANDARDS IN SOUTH AFRICA**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
EU GDP	0.10 <sup>*</sup> (0.07)	0.25 (0.21)	0.42 (0.44)	0.43 (0.34)	0.04 (0.17)	0.05 (0.17)	0.00 (0.19)	0.11 (0.16)	0.00 (0.16)	0.00 (0.16)
EU PER GDP	-0.06 <sup>***</sup> (0.01)	-0.07 <sup>***</sup> (0.01)	-0.07 <sup>***</sup> (0.01)	-0.07 <sup>***</sup> (0.01)	-0.07 <sup>***</sup> (0.01)	-0.07 <sup>***</sup> (0.01)	-0.07 <sup>***</sup> (0.01)	-0.20 <sup>**</sup> (0.10)	-0.20 <sup>*</sup> (0.10)	-0.20 <sup>**</sup> (0.10)
EU FINANCE	0.49 <sup>***</sup> (0.004)	0.58 <sup>***</sup> (0.001)	0.58 <sup>***</sup> (0.001)	0.58 <sup>***</sup> (0.001)	0.58 <sup>***</sup> (0.001)	0.58 <sup>***</sup> (0.001)	0.58 <sup>***</sup> (0.001)	0.01 <sup>***</sup> (0.001)	0.00 (.)	0.00 (.)
EU LANGUAGE	-0.11 <sup>***</sup> (0.03)	-0.11 <sup>***</sup> (0.03)	-0.11 <sup>***</sup> (0.03)	-0.11 <sup>***</sup> (0.03)	-0.11 <sup>***</sup> (0.03)	-0.11 <sup>***</sup> (0.03)	-0.11 <sup>***</sup> (0.03)	0.85 <sup>*</sup> (0.48)	0.85 <sup>*</sup> (0.48)	0.85 <sup>*</sup> (0.48)
EU TIME TO EXPORT	0.01 <sup>***</sup> (0.00)	0.03 (0.02)	0.03 (0.04)	0.03 (0.02)	0.02 (0.01)	0.02 (0.01)	-0.01 (0.01)	0.01 (0.01)	-0.02 <sup>*</sup> (0.01)	-0.02 <sup>*</sup> (0.01)
EU TYPE OF SUBSIDIES		0.36 (0.37)	0.60 (0.58)	0.61 (0.53)	0.32 (0.28)	0.32 (0.28)	0.00 (.)	0.41 <sup>*</sup> (0.23)	0.00 (.)	0.00 (.)
EU TYPE OF REERI		0.00 (.)	0.00 (.)	0.00 (.)	0.00 (.)	0.00 (.)	0.00 (.)	0.00 (.)	0.00 (.)	0.00 (.)
EU TYPE_X_SUBSIDIEE		-0.28 (0.35)	-0.56 (0.62)	-0.57 (0.56)	0.01 (0.55)	0.01 (0.45)	0.02 (0.46)	0.02 (0.98)	0.02 (0.43)	0.02 (0.56)
EU TYPE OF INFRASTRUCTURE			-0.03 (0.53)	0.01 (0.22)	0.05 (0.30)	0.05 (0.61)	0.05 (0.66)	0.05 (0.63)	0.03 (0.11)	0.00 (0.19)
EU TYPE OF GOVERNMENT SPENDING			0.00 (.)	0.00 (.)	0.00 (.)	0.00 (.)	0.00 (.)	0.00 (.)	0.00 (.)	0.00 (.)
EU TYPE OF HEALTH EXPENDITURE			0.76 (1.25)	0.74 (1.25)	0.52 (1.09)	0.52 (1.09)	0.00 (.)	0.45 (0.88)	0.00 (.)	0.00 (.)
EU TYPE OF STANDARDS				-0.02 <sup>**</sup> (0.03)	-0.07 <sup>*</sup> (0.08)	-0.07 <sup>**</sup> (0.02)	-0.04 <sup>**</sup> (0.03)	-0.03 <sup>**</sup> (0.04)	-0.03 <sup>**</sup> (0.03)	-0.02 <sup>**</sup> (0.03)
EU TYPE OF HARMONIZED					0.06 (0.16)	0.05 (0.16)	0.03 (0.16)	0.03 (0.13)	0.06 (0.21)	0.02 (0.11)
EU TYPE OF DISTxGDP						-0.01 (0.20)	0.01 (0.11)	-0.01 (0.30)	-0.02 (0.20)	-0.02 (0.20)
EU TYPE OF HARMONIZEDxGDP						0.03 (0.19)	0.01 (0.017)	0.02 (0.80)	0.03 <sup>**</sup> (0.03)	0.03 <sup>**</sup> (0.02)
Constant	-5.33 <sup>***</sup> (0.006)	-9.35 <sup>***</sup> (0.008)	-14.11 <sup>***</sup> (0.009)	-14.52 <sup>**</sup> (0.044)	-6.59 <sup>**</sup> (0.03)	-6.80 <sup>**</sup> (0.02)	-2.95 <sup>*</sup> (0.06)	-0.09 <sup>*</sup> (0.06)	5.68 <sup>**</sup> (0.03)	5.68 <sup>**</sup> (0.04)
FIXED EFFECT	NO	NO	NO	NO	NO	NO	YES	NO	YES	YES
SHORTER FIXED EFFECT	NO	NO	NO	NO	NO	NO	NO	YES	YES	NO
LONGER FIXED EFFECT	NO	NO	NO	NO	NO	NO	NO	YES	YES	NO
COUNTRY-PAIR FIXED EFFECT	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES
Observations	147	147	147	147	147	147	147	147	147	147
Adjusted R <sup>2</sup>	0.330	0.366	0.359	0.359	0.359	0.359	0.359	0.570	0.570	0.570

Note:: *p*-values in parentheses: \*, \*\*, \*\*\* = significant at 10%, 5% and 1% respectively

in Table 3. Starting from the basic gravity variables, South Africa GDP does not encourage diversification because increase in a GDP leads to more concentration of textile products exported to the EU. This result is surprising but it may be possible if they intend to produce good quality but sizable varieties to the region. However, EU countries' GDP encourages export diversification. Specifically, increase in the EU countries' GDP reduces the concentration of textile varieties and hence increases diversification of the products. This implies that textile varieties exported to the UE are normal products. The longer the distance or the longer the time to export, the less diversified textile products exported to the EU becomes. Consequently, distance and trade facilitation are crucial to

export diversification. Preconditions to diversify and ability to compete favorably in the foreign market are not significant.

Standards and harmonized standards also failed to significantly affect export diversification of textiles to the EU. But the interaction of standards and harmonized standards with GDP significantly affect textile product varieties exported to the EU. The result suggests that the size of South Africa economy influences standards to encourage diversification. This means that increase in income of South Africa engenders ability to enter the EU markets after complying with a country-specific standard. Adaptation of costlier standards, that is, harmonized standards is detrimental to textile export diversification. This could suggest that the cost effect outweighs the scale effect and so, increase in textile product varieties exported to the EU are encouraged by complying with single, country-specific standards. But this outcome is contingent on the performance of the economy. Period of low income in South Africa will be followed with more concentration while period of high income will welcome more textile product varieties to be exported to the EU. This result becomes stronger when various unobserved characteristics are considered. Hence the level of income alongside the consideration of specific unobserved characteristics should be considered in determining the extent to which standards affect export of textiles varieties of South Africa to the EU.

#### ***4.2.2 Nigerian agricultural and textile export diversification and EU product standards***

Result of agricultural export diversification of Nigeria to the EU is shown in Table 4. The first column, which is the model of basic gravity indicates that Nigeria GDP distance, language and time to export significantly affect exports of agricultural varieties to the EU. The effect of Nigeria GDP on the diversification of agricultural products to the EU was mild, almost negligible. The GDP of partner (importer) countries from the EU is negative but insignificant until unobserved characteristics are controlled for. This implies that some factors (not observed) in the EU tend to affect agricultural product diversification exported to the EU market. The negative effect as shown in columns 8-10 suggests that once these specific factors are considered, increase in the income of the EU tend to increase Agricultural export diversification of Nigeria to the region. Language and time to export are important variables that encourage export of agricultural varieties to the EU. The negative sign suggests that if there is an improvement in the communication of economic agents in any pair country, product concentration will reduce so that diversification will increase. This suggests that language of communication between countries enhances exports of agricultural product varieties. Reduction in time to export will also reduce product concentration, thereby increasing product diversification. Most agriculture products are not durable, and so, delay in the time to export could lead to spoilage. Hence less and less time to export will instill confidence in the producers of agricultural goods and this will encourage more varieties.

**TABLE 4: AGRICULTURE EXPORT DIVERSIFICATION AND PRODUCT STANDARDS IN NIGERIA:**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
HOME GDP	0.18 <sup>*</sup> (0.10)	0.16 (0.11)	-0.02 (0.14)	-0.03 (0.15)	0.47 (0.36)	0.48 (0.36)	0.03 (0.22)	0.49 (0.35)	0.09 (0.49)	0.13 (0.72)
PARTER GDP	-0.01** (0.02)	-0.03*** (0.01)	-0.11** (0.02)	-0.09** (0.02)	-0.06*** (0.01)	-0.03*** (0.01)	-0.03*** (0.01)	-0.24** (0.03)	-0.24** (0.03)	-0.24** (0.02)
DISTANCE	0.25** (0.02)	0.25** (0.02)	0.25** (0.03)	0.25** (0.03)	0.25** (0.03)	0.25** (0.02)	0.25** (0.03)	0.21** (0.03)	0.2** (0.04)	0.11** (0.04)
LANGUAGE	-0.06* (0.08)	-0.07* (0.08)	-0.07** (0.03)	-0.07** (0.03)	-0.07** (0.03)	-0.07** (0.03)	-0.07** (0.03)	-0.31** (0.02)	-0.31** (0.03)	-0.31** (0.02)
TIME TO EXPORT	0.03*** (0.01)	0.03** (0.02)	0.02** (0.02)	0.03** (0.02)	0.07** (0.03)	0.07** (0.03)	0.02* (0.01)	0.07** (0.03)	-0.03** (0.02)	-0.03** (0.02)
LOG OF SUBSIDIES		-0.11 (0.13)	-0.00 (0.22)	-0.01 (0.23)	-0.54 (0.47)	-0.54 (0.47)	0.00 (0.31)	-0.63 (0.39)	0.00 (0.11)	0.00 (0.24)
LOG OF REERI		0.00 (.)	0.00 (.)	0.00 (.)	0.00 (.)	0.00 (.)	0.00 (.)	0.00 (.)	0.00 (.)	0.00 (.)
REER_X_SUBSIDIEE		-0.03 (0.35)	-0.03 (0.27)	-0.02 (0.28)	-0.00 (0.19)	-0.00 (0.19)	-0.12*** (0.03)	-0.04* (0.07)	-0.13*** (0.03)	-0.13*** (0.03)
LOG OF INFRASTRUCTURE			-0.52* (0.09)	-0.53* (0.09)	0.37 (0.68)	0.37 (0.68)	0.00 (0.55)	0.25 (0.64)	0.00 (0.61)	0.00 (0.53)
LOG OF GOVERNMENT SPENDING			-0.07 (0.19)	-0.08 (0.12)	0.23 (0.24)	0.23 (0.24)	0.00 (0.32)	0.18 (0.22)	0.00 (0.24)	0.00 (0.51)
LOG OF HEALTH EXPENDITURE			-0.12 (0.16)	-0.13 (0.17)	0.22 (0.30)	0.22 (0.30)	0.00 (0.30)	0.33 (0.27)	0.00 (0.25)	0.00 (0.26)
EU STANDARDS				-0.01 (0.13)	-0.13 (0.19)	-0.11 (0.38)	-0.11 (0.16)	-0.10* (0.07)	-0.09* (0.06)	-0.08* (0.08)
EU HARMONIZED					-0.16 (0.11)	0.02 (0.20)	0.02 (0.19)	0.01 (0.21)	0.02 (0.31)	0.02 (0.19)
STANDxGDP						0.01 (0.20)	0.00 (0.50)	0.02 (0.30)	-0.01 (0.19)	-0.01 (0.40)
HARMONIZEDxGDP						-0.01 (0.11)	-0.01 (0.14)	-0.01*** (0.00)	-0.02*** (0.00)	- (0.00)
Constant	-6.73** (0.09)	-5.75* (0.09)	0.85* (0.08)	1.11** (0.04)	-15.74** (0.02)	-15.94* (0.09)	-1.17* (0.07)	-7.49* (0.06)	7.81** (0.02)	7.81** (0.06)
TIME FIXED EFFECT	NO	NO	NO	NO	NO	NO	YES	NO	YES	YES
EXPORTER FIXED EFFECT	NO	NO	NO	NO	NO	NO	NO	YES	YES	NO
IMPORTER FIXED EFFECT	NO	NO	NO	NO	NO	NO	NO	YES	YES	NO
COUNTRY-PAIR FIXED EFFECT	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES
Observations	80	80	80	80	80	80	80	80	80	80
Adjusted R <sup>2</sup>	0.081	0.138	0.148	0.136	0.158	0.158	0.158	0.277	0.277	0.277

Note: p-values in parentheses; \*, \*\*, \*\*\* = significant at 10%, 5% and 1% respectively

The precondition to export agricultural varieties to the EU is not important as the results in column 2 indicates. Provision of physical infrastructure significantly minimizes concentration ratio and increases diversification of agricultural varieties exported to the EU. However, government final expenditure and public expenditure on health are not important for agricultural export varieties. This is not impossible because most Nigerian graduates don't fancy employment in the agriculture sector. This is even the case when we controlled for various fixed effects.

Product standard could not significantly influence agriculture varieties until some fixed effects were accounted for. However, harmonized standards fail to impact significantly on the export diversification of agricultural products in Nigeria. When interacted with GDP, standards was still not significant but harmonized standards was significant, and this exists after controlling for various fixed effects. The direction of effect is negative for harmonized standards. This implies that as more standards are harmonized, concentration ratio falls. Hence, harmonized product standard enhances agricultural product varieties. It must therefore be the case that the cost of harmonizing is outweighed by the scale effect for agricultural exports to be diversified. This result therefore suggests that specific but unobserved characteristics play important role in how harmonized standards influences agriculture product varieties exported to the EU. Such unobserved characteristics could include weather and rainfall conditions.

Another lesson from this result is that improvement in the economic activity is important for reducing cost of harmonizing standards in affecting the diversification of agricultural products exported to the EU market. This implies that the compliance to harmonize standards increases confidence in Nigeria agricultural varieties and this encourages exports of the varieties. Also, information about the demand and consumer preferences in the partner countries can be accessed. This can be made possible by communication technology and of course information by the Nigeria immigrants.

Nigeria textile export varieties to the EU indicates that only in the basic gravity model did Nigeria's GDP significantly affect exports varieties of textile products to the EU (Table 5). When other factors are in play, GDP ceases to be an important driver of textile export diversification. However, income of the EU countries plays a crucial role in the diversification of textile exports to the region. In the same vein, language significantly affects textile export diversification. Specifically, increase in the income of the EU countries reduces concentration of textile products, thereby encouraging the diversification of the products. This implies that textile product varieties exported to the EU can be considered as normal goods. More improvement in communication between Nigeria textile producers and EU consumers provides necessary and relevant information about the type and pattern of textile product required and this enables producers to increase textile product varieties.

The effects of both income and language are consistent with the expectation of gravity model. The provision of infrastructural facilities and ability to encourage competitiveness of textile exports to the EU markets are not important drivers of diversification of the products. Furthermore, human capital development is not significant in influencing textile export diversification. The prediction of the effect of distance on export diversification is also established in our result. As can be observed, increase in distance encourages exports of a few numbers of textile varieties. Thus, the longer the distance, the less varieties of textile products exported.

**TABLE 5: TEXTILE EXPORT DIVERSIFICATION AND PRODUCT STANDARDS IN NIGERIA**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
HOME GDP	0.06* (0.09)	0.01 (0.10)	-0.18 (0.13)	-0.17 (0.14)	-0.22 (0.33)	-0.23 (0.33)	0.00 (0.21)	-0.21 (0.28)	0.00 (0.41)	0.00 (.)
PARTER GDP	-0.03*** (0.01)	-0.03*** (0.01)	-0.03*** (0.01)	-0.03*** (0.01)	-0.03*** (0.01)	-0.03*** (0.01)	-0.03*** (0.01)	-0.46*** (0.01)	-0.46*** (0.01)	-0.46*** (0.14)
DISTANCE	0.39*** (0.008)	0.39*** (0.009)	0.39*** (0.008)	0.39*** (0.008)	0.39*** (0.008)	0.39*** (0.008)	0.39*** (0.008)	0.23*** (0.001)	0.27*** (0.003)	0.00 (.)
LANGUAGE	-0.19** (0.04)	-0.19*** (0.04)	-0.19** (0.04)	-0.19** (0.04)	-0.19** (0.04)	-0.19** (0.04)	-0.19** (0.04)	0.60** (0.026)	0.60** (0.026)	0.60** (0.26)
TIME TO EXPORT	0.01 (0.11)	-0.00 (0.27)	-0.01 (0.27)	-0.02 (0.27)	-0.02 (0.31)	-0.02 (0.32)	-0.00 (0.17)	-0.02 (0.17)	-0.04*** (0.017)	-0.04*** (0.01)
LOG OF SUBSIDIES		-0.14 (0.12)	-0.27 (0.17)	-0.25 (0.18)	-0.19 (0.35)	-0.19 (0.35)	0.00 (.)	-0.33 (0.24)	0.00 (.)	0.00 (.)
LOG OF REERI		0.00 (.)	0.00 (.)	0.00 (.)	0.00 (.)	0.00 (.)	0.00 (.)	0.00 (.)	0.00 (.)	0.00 (.)
REER_X_SUBSIDIEE		0.03 (0.15)	0.04 (0.15)	0.02 (0.17)	0.02 (0.17)	0.02 (0.17)	-0.03 (0.24)	0.08 (0.26)	-0.04 (0.23)	-0.04 (0.03)
LOG OF INFRASTRUCTURE			-0.37 (0.26)	-0.35 (0.27)	-0.45 (0.58)	-0.45 (0.58)	0.00 (.)	-0.68 (0.45)	0.00 (.)	0.00 (.)
LOG OF GOVERNMENT SPENDING			0.03 (0.17)	0.06 (0.19)	0.02 (0.20)	0.03 (0.20)	0.00 (.)	-0.08 (0.18)	0.00 (.)	0.00 (.)
LOG OF HEALTH EXPENDITURE			0.15 (0.13)	0.17 (0.14)	0.13 (0.24)	0.14 (0.24)	0.00 (.)	0.33 (0.20)	0.00 (.)	0.00 (.)
EU STANDARDS				0.01 (0.12)	-0.00 (0.18)	0.00 (0.21)	0.00 (0.33)	0.00 (0.41)	0.00 (0.50)	0.00 (.)
EU HARMONIZED					0.02 (0.91)	0.00 (0.81)	0.00 (0.21)	0.00 (0.44)	0.00 (0.32)	0.00 (.)
STANDxGDP						-0.00 (0.11)	-0.01*** (0.00)	-0.01*** (0.00)	-0.02* (0.08)	-0.00* (0.00)
HARMONIZEDxGDP						0.00 (0.00)	0.03* (0.07)	0.02* (0.06)	0.01*** (0.00)	0.01*** (0.00)
Constant	3.27 <sup>A</sup> (0.07)	1.39** (0.04)	5.18** (0.02)	4.68* (0.07)	6.56** (0.03)	6.69** (0.02)	1.47* (0.06)	21.74** (0.03)	14.12*** (4.02)	14.12*** (4.06)
TIME FIXED EFFECT	NO	NO	NO	NO	NO	NO	YES	NO	YES	YES
EXPORTER FIXED EFFECT	NO	NO	NO	NO	NO	NO	NO	YES	YES	NO
IMPORTER FIXED EFFECT	NO	NO	NO	NO	NO	NO	NO	YES	YES	NO
COUNTRY-PAIR FIXED EFFECT	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES
OBSERVATIONS	80	80	80	80	80	80	80	80	80	80
ADJUSTED R <sup>2</sup>	0.381	0.377	0.430	0.424	0.416	0.416	0.416	0.599	0.599	0.599

Note: p-values in parenthesis. \*, \*\*, \*\*\* implies significant at 10%, 5% and 1%.

Product standards and harmonized standards did not, on their own, have significant effect on textile exports. However, when each of these standards was interacted with GDP and unobserved specific characteristics were controlled, the variables impacted significantly on textile export. Unlike the case of South Africa, country pair unobserved characteristics need to be considered when investigating textile export varieties to the EU. The result also shows that product standards reduces concentration of textile export varieties while harmonized standards encourages it. This suggests that adoption of harmonized standards is detrimental to varieties of textile products exported to the EU. Adoption of standards (partner country specific) appears to be less costly and enhances varieties of textile product exported to the EU markets.

## Conclusion

This study explores the effects of standards on export diversification of selected products in Nigeria and South Africa. These countries are the two biggest economies in sub Saharan Africa and it is important to investigate how product standards influence the diversification of some products for which the countries enjoy comparative advantage. The study of product standards has been generating tremendous interest among the policy makers and researchers. This is not unconnected with the less than expected export earnings after the reduction of tariff and quota based restriction. These countries are keen about diversifying their export base and also seeks to encourage more varieties of some products, particularly agricultural and textile products.

We extended previous studies by including both preconditions to diversify and considering government intervention in making exports to be more competitive. Further, we considered various fixed effects that are identified to influence export of these products. Data were collected on agricultural and textile products exported to each of the 21 EU countries for which data on product standards are available. The data were extracted on 6-digit HS product classification between 1995 and 2004. In order to account for missing or unreported observation, negative poisson maximum likelihood (NMPL) method was utilized.

Our result indicates that some variables affect export varieties of both agriculture and textile products in both countries. For instance, the EU income significantly encourage export diversification of both agricultural and textile products in both countries. This suggests that the two products from both countries are gaining competitiveness in the EU markets. Another variable that plays a significant role in the exports of the two products in both countries to EU is the official language. Increase in the language of communication between the two pairs of countries tends to facilitate varieties of both agricultural and textile products exported to the EU markets. The improvement in language can be informed by the state of the art technology in telecommunication and of course, the African immigrants in the EU countries. Information provided by these immigrants, aided by language of communication tend to raise the level of product varieties. In the same vein, time to export significantly affect the varieties of these products. It has been argued that trade facilitation is a binding constraint to exports and time to



export is one particular indicator of this (Shepherd, 2009). Our study confirms the authenticity of trade facilitation in improving export varieties of agricultural and textile products in the two countries.

Meanwhile, variables such as exporter income, distance, standards and harmonized standards have mix effect across products and across countries. In particular distance has no significant effect on South Africa's agricultural export diversification but the effect is significantly manifested in the export of textile varieties. Again, South African exports of textile varieties respond significantly to income.

Standards and harmonized standards do not have any significant effect on South African agricultural export diversification. But in the case of textile exports varieties, standards plays significant role. Specifically, compliance with standards increases export varieties of textile products of the South Africans. However, harmonized standards has no seeming effect on the textile export diversification. When standards and harmonized standards are interacted with income, it is clear that income level plays important role in the effectiveness of standards on export varieties of agricultural products and textiles. In this regard, harmonized standards is contingent on income level. Increase in the size of the economy raises the ability to pay a single sunk cost and, upon compliance, have access to the EU markets. The positive effects, in the case of agricultural products and textiles for South Africa indicate that the scale effect outweighs the cost effect and the overall effect is more when the standards are harmonized standards. Also, distance constrains Nigeria's export diversification of both agricultural and textile products.

Nigeria income does not affect its agricultural and textile export diversification. In Nigeria, standards significant reduce agriculture export concentration after controlling for country-pair and importer fixed effects while no effect was observed in the case of textile products when some fixed effects are controlled for. This indicates unobserved importer effects have important influence on how product standards affects agriculture export diversification of Nigeria. The negative effect suggests that Nigerian producers of agricultural products comply with the standards in each of the EU under study and this builds the confidence of the producers to increase varieties of agricultural products. It could also be that Nigerian producers have access to information regarding the demand and preferences of consumers in these countries (EU) and this

helps them to produce and export varieties of agricultural products based on the information concerning the consumption behaviour. The access to information concerning the consumption preferences is possible due to sizable and increasing numbers of Nigerian immigrants in the EU countries. However, there is no seeming significant effect of standards on textile product varieties.

In Nigeria, increase in income level makes standards insignificant in affecting agricultural export varieties but the income level engenders harmonized standards to improve diversification of agricultural exports. This suggests that as Nigeria income increases, it makes sense for firms to engage in harmonized standards since it is now possible to cover the single cost of harmonization and of course, the scale effect prevails. This result is in contrast with the findings of Shepherd (2015) where it was discovered that increase in income level forces harmonized standards to be export inhibiting. Perhaps a good reason for this point of departure is the control for unobserved specific effects, which was absent in the Shepherd (2015) study. However, our result is consistent with Shepherd (2015) in the case of textile export diversification. Our result indicates that varieties of textiles exported to the EU reduces as income increases. It means that cost effect of harmonized standards is higher than scale effect and this reduces ability to increase varieties. This result is not surprising because textile products are secondary products and ability to compete with such manufactured products in the EU may be costly. Furthermore, the standards for textiles could be more of protecting domestic products than encouraging quantity. The study of Kareem *et al.* (2018) alluded to the fact that most EU standards are designed to protect indigenous products.

Several policy implications can be drawn from our study. First, improvement in the EU income is good for diversification of agricultural and textile products in South Africa and Nigeria. Hence, exporters of these products are at advantage during economic boom and at a disadvantage during economic burst. Since plant size is irreversible, it is important to study the EU economy by reading the economic prospect of the region and also pay keen attention to government policies before embarking on diversification.

Producers of agricultural and textile products in the two countries can take advantage of favorable communication to improve on product varieties. Also, the two countries should work on reducing some factors inhibiting trade facilitation such as time to export. In Nigeria, subsidies, when interacted with real effective exchange rate, serve as a drag to export diversification. What this suggests is that production of agricultural and textile varieties is costly during real depreciation. Hence, Nigerian government will encourage export diversification during stable exchange rate or by creating a window for special exchange rate for potential and existing agricultural and textile producers to make them competitive.

Not all standards are trade inhibiting in Nigeria and South Africa. Since harmonized standards dampens agricultural and textile varieties as income rises in South Africa while standards increase varieties, it is suggestive that producers of agricultural products in South Africa should concentrate on single, country-specific standards rather than harmonizing. In Nigeria, harmonized standards is agricultural export enhancing but textile product inhibiting. Hence, producers of textile products should focus more on country-specific standards while producers of agricultural products should enter into harmonized standards.

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