Effect of Quality Standards on the Performance of Agricultural Exports in Cameroon

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Authors' contributions

This work was carried out in collaboration among all authors. Author EBFN wrote the first draft of the manuscript and performed the statistical analysis. Authors DMF and DTJ managed the literature searches. Author BGN contributed to the formulation of title, gave the main orientations. All authors read and approved the final manuscript.

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ABSTRACT

The aim of this paper is to assess the effects of quality standards imposed by developed countries on agricultural exports in Cameroon. Based on the quantification technique of Bora and et al. [1], we have constructed an indicator capturing the quality standards imposed by the developed country partners of Cameroon. The empirical analysis is done by applying the Poisson Pseudo-Maximum Likelihood (PPML) estimator to a gravity model on a panel made up of developed countries importing agricultural products from Cameroon. The results show that, over a study period of 2001-2018, compliance with the quality standards imposed by developed countries is restrictive and has a negative impact on agricultural exports in Cameroon. Thus, a 10% strengthening of quality standards results in a decrease of about 2.83% in the volume of agricultural exports to Cameroon. Given the very demanding nature of quality standards, their compliance can enable the Cameroonian agricultural export sector to become more competitive on the international market. We recommend training and support for producers in order to give them the opportunity to comply with the standards.

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1. INTRODUCTION

According to the theories of quality choice, the market for quality goods is far from perfect [2-7] (Baldwin, 1989; Lupton, 2005). The main cause of this imperfection is the lack of information on the quality of goods, which can hinder the trade of goods in the market. In order to remedy these shortcomings, there has been an increase in quality standards aimed at protecting the health and life of consumers from the risks of food-related diseases [8,9].

This issue of security of property remains a matter of some concern in international organizations and even in developed countries. Indeed, the World Health Organization (WHO) estimates that about 700,000 people die each year in the world due to the consumption of food products from Africa [10]. In addition, due to the consumption of fenugreek seeds from Egypt, between May and July 2011, there were about 4321 serious victims of E. coli food poisoning epidemics in Europe, 3469 of which were in Germany alone, of which 76 people died [11]. Statistics from the Centers for Disaster Control and Prevention (CDC, 2011)[1]show that the 50% drop in E. coli poisoning in the United States in 15 years (1996-2011) has not prevented a rise of about 3% in poisoning related to Salmonellosis, which is the most common cause of foodborne illness. These few examples of food crises and health incidents that have hit some Western countries demonstrate why food safety has been a major consumer concern and a common and growing public health problem worldwide for the past few decades.

Despite this growing concern for health in developed countries, it unfortunately does not seem to be given the same importance in developing countries, where it is often relegated to the background [12,13]. Yet non-compliance with standards can have adverse consequences for international trade performance. These consequences can be grouped into three categories. First, non-compliance with standards can impede trade by imposing a complete export ban or by prohibitively increasing production and marketing costs [14,10,15]. This results in

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[1] *CDC (Centers for Disease Control and Prevention) (2011), Vital Signs: Incidence and Trends of Infection with Pathogens Transmitted Commonly Through Food-Food borne Diseases Active Surveillance Network, 10 U.S. Sites, 1996-2010, MMWR Morbidity and Mortality Weekly Report 60 (22), 749-755.*

product rejections at the point of entry into the country of destination due to the detection of product safety problems. Hammoudi et al. [10] show that the total number of releases at the EU border for all countries of export was 1093 in 2008 and 7024 over the period 2003-2008, with a significant share of releases attributed to low income countries (89%). Secondly, the implementation of quality standards would be a means of protectionism. Indeed, Ferro et al [6] consider that the restrictive nature of standards in most developed countries often goes beyond simple health protection and aims at excluding certain types of products from their market. Under these conditions, the quality standards imposed by Western countries are obstacles to developing countries' access to international markets that can play an important role in the conduct of international trade [16,12,9]. Finally, compliance with quality standards acts as a catalytic stimulus to exports. Henson and Jaffee, [17] show, however, that the best performing countries and/or sectors are most often those that have used high quality standards to position themselves in competitive global markets. Previous work has focused on the influence of standards on international trade in the African context [16,18-21] (Legge et al., 2009). Legge et al. (2009) report that the share of smallholders in Kenyan fruit and vegetable production for export has declined by more than half, mainly due to pressures to comply with quality standards. Santeramo and Lamonaca [20,21] recently found that SPS compliance has sharply reduced (about 92%) the trade performance of the agribusiness sector in Africa.

Despite the relevance of previous studies and to our knowledge, no study has so far been devoted to the impact of quality standards on the performance of agricultural exports in Cameroon. Yet this study is justified in the Cameroonian context for at least two reasons: Firstly, we note that the agricultural sector plays a leading economic role in terms of accelerating economic growth, job creation and poverty reduction. Indeed, with an average GDP growth rate of 3.6% over the 2008-2014 period, the agricultural sector alone contributes to GDP formation by about 23% and accounts for more than 60% of the labor force (NIS, 2016). Fluctuations in Cameroon's main agricultural export products (Fig. 1, see Appendix) show that the agricultural sector is not able to keep the supply of agricultural products for export on a growth path. Indeed, this is justified, among other things, by

the fall in world prices of agricultural products and by international agricultural policies, particularly the strengthening of health security requirements by developed countries. According to the evolution of the distribution of market shares of Cameroon's main agricultural export products (Table 1, see Appendix), it can be seen that developed countries are the main destination of Cameroonian agricultural products. Failure to comply with the quality standards imposed by these partner countries can strongly influence Cameroon's export flows. Secondly, because the Cameroonian government is a signatory of the WTO agreements on Sanitary and Phytosanitary Measures (SPS) and Technical Barriers to Trade (TBT), compliance with these agreements could contribute to the development of its export channels and thus promote its agricultural sector on the international market.

The main aim of this study is to analyze the effects of quality standards on the performance of agricultural exports in Cameroon. Sections 2 and 3 presents the literature review and methodology while section 4 present the results and discussion, and section 5 concludes with policy recommendations.

2. QUALITY STANDARDS AND PERFORMANCE OF AGRICULTURAL EXPORTS: A REVIEW OF THE LITERATURE

The economic literature highlights two major controversies around the effects of standards imposed by developed countries on the performance of agricultural exports [14,16,22-24,6,7]. In the first category, some authors demonstrate that standards act as protectionist trade policies and their uses contribute to restricting foreign trade [16,18,25,6]. Standards in this line are concerned with restrictive non-tariff measures or non-tariff barriers used to protect the producer and domestic industries from international competition. Henson et al [14], in a study on the impact of sanitary and phytosanitary measures on developing countries' agricultural exports to the EU, show that significant trade losses are particularly linked to difficulties in monitoring sanitary and phytosanitary regulations. Otsuki et al. [16] have, using a gravity model, quantified the impact of aflatoxin standards imposed by the EU on exports of agri-food products from African countries over the period 1989-1998. Considering legal aflatoxin limits as one of the explanatory variables, the authors conclude that

the imposition of a new aflatoxin standard in the EU has a negative impact on agricultural exports from Africa to Europe. A tightening of an EU aflatoxin standard helps reduce health risks by about 1.4 deaths per 1 billion, and at the same time causes a drop of almost 64% in African exports. Despite the influence and scope of this study, Xiong and Beghin [26] argue that the analysis of Otsuki et al. [16] has two main limitations: the first relates to the Maximum Residue Limit (MRL) variable, which has no time dimension. The second relates to the removal of all null entries, which constitutes a bias in the sample selection. Xiong and Beghin [26] examine the effect of the harmonization and tightening of EU maximum residue limits (MRLs) for aflatoxins in 2002 on peanut exports from Africa, taking into account sample selection bias, multilateral resistance and heterogeneity. They find that regardless of the estimation method used, the MRLs imposed by the EU do not have a significant impact on groundnut exports from Africa. Okello and Roy [27] adds an aspect regarding peanut products, arguing that peanut exports had even declined before EU harmonization. Using a gravity model, Chen et al [28] show that standards imposed by importing countries have a negative and statistically significant effect on agricultural exports from China. Ferro et al [6] constructed a restrictiveness index of standards to show that compliance with strict standards mainly increases the fixed costs of exports. Focusing on standards considered as barriers to trade, Fontagné et al. [29] show that, at the firm level, SPS measures constitute compliance costs that may hinder market entry. Thus, these trade costs remain high both in low-income countries and in small firms. Further evidence of the effects of reduced trade due to compliance with restrictive standards has also been provided by the work of Yue et al [30], Drogué and DeMaria [19], Melo et al. [31], and Ishaq et al. [32], Cadot et al [7]. Focusing on the effect of standards imposed by developed countries, shows in general that despite the objective of standards which is to reduce asymmetry of information in the market while ensuring the protection of consumer health against health risks, the harmonization of these standards at the international level is much less restrictive than their adoption by individual countries or by a sub-region (EU, United States).

In addition to their effects on reducing trade flows, standards can be seen as non-protectionist measures, so their evolution in some cases represents a potential opportunity to boost international trade in developing countries

[13,33] (Chiputwa et al., 2013). It is argued that the challenges posed by the evolution of standards can also act as a stimulus for improving food safety management capacities and provide the basis for a competitive position in high value-added markets. According to Henson and Jaffee [17], the best performing countries and/or sectors are most often those that have used high standards to position themselves in competitive global markets. In fact, quality standards provide a bridge between producers in DCs and consumer preferences in high-income markets and could be used as a catalyst for improving their competitive capacity. Disdier et al [22] show that the cost of complying with SPS measures and technical barriers to trade (TBT) can push domestic producers to improve their performance in the international market. However, the practices and requirements recommended by standards bodies have resulted in safer working conditions and increased business productivity. Moreover, the positive influence of SPS and TBT standards and the cost of compliance explains why developing countries (or exporting countries) are trying to comply with these standards. Disdier and Marette [34] have shown that strict regulations imposed by importing countries lead to an increase in welfare both nationally and internationally. Mangelsdorf et al [33] studied the effects of standards on food trade to the EU between 1992-2008. Their results suggest that standards have a positive impact on China's export performance. Their results show that the positive effect of standards in China is greater when they are harmonized with international measures. In other words, it is advantageous for China to base its national standards and regulations on international measures. Ishaq et al [32] build on their work in the same direction as above and show that standards imposed by importing countries have contributed to increased food exports from China. Compliance with strict standards thus plays a facilitating role for China's exports, as consumers will easily find safe products and importers will not have to pay search fees for a certain minimum expectation for a particular product.

Most studies thus show that the effect of health standards can have unpredictable consequences on the trade flows of a country or region. Despite its interest and to our knowledge, a study on the impact of sanitary regulations on exports has not yet been carried out in Cameroon. The relevance of our study concerns precisely its particularity to measure the effect of quality standards on the performance of bilateral trade between Cameroon and its trading partners.

3. RESEARCH METHODOLOGY

In order to highlight the effects of quality standards on the performance of agricultural exports in Cameroon, we will respectively present a critical approach of the different quantification methods, the econometric gravity model and the data.

3.1 Critical Analysis of Techniques for Quantifying Quality Standards

The economic literature distinguishes a diversity of methods for quantifying quality standards in international trade [35,8,36,24] (Deardorff and Stern, 1998). However, some standards can be quantified using trade data while others cannot [9]. For the purposes of this study, we distinguish four main methods of quantifying quality standards in international trade. The first is the price gap or quantity gap method. It is widely used in the work of Beghin and Bureau [8] and consists of evaluating the prices of goods traded before and after the introduction of a standard. This method of estimating the price gap has, however, been used in computable general equilibrium and gravity models, while focusing more on their welfare effects [8,37]. Despite its relevance, this approach has shortcomings. These include the difficulty of having sufficient data on different prices and on compliance with standards. This is, moreover, what justifies the fact that we do not use this method in our work.

The second method is to quantify standards through cost-benefit analysis [24]. This is a technique commonly used by policy and economic decision-makers to distinguish between a restrictive and a non-restrictive non-tariff barrier. It thus provides a rational basis for decision making by showing the winners and losers following a change in trade policy. The effectiveness of cost-benefit analysis depends on its ability to identify the optimal measure, i.e. the one that provides the best cost-benefit ratio. However, this method does not allow the estimated costs to take into account the price reactions in the market and even their impact on producers and consumers. Given the weakness of this approach, it will not be applied in this study.

In a third approach, the quantification of quality standards is done using a survey method. This purely qualitative technique, based on a survey and interviews with exporters and importers, makes it possible to identify standards that are likely to have a significant restrictive impact on export products [38,39]. Despite the relevance of this method, the economic literature tells us that the high cost of conducting surveys is the main drawback of this method [8]. Indeed, the implementation of this method requires a considerable amount of time and the results are not always reliable given the responses received, making the validity of the results obtained in the econometric estimates questionable.

Another approach to quantification is to use coverage measures of quality standards [1,22,40]. In contrast to survey-based techniques, this technique, based on the construction of a coverage ratio, consists of measuring the proportion of exports subject to quality standards for a given importing country. It reflects the extent of trade covered by the quality standards. The coverage ratio is calculated as follows:

$$CR_j = \frac{\sum_i D_i V_i}{\sum_i V_i} \times 100 \qquad (1)$$

Where i represents the product contained in product category j. Di is the dummy variable which corresponds to 1 if the SPS measure applies to product i and 0 otherwise. Vi is the value of product j exported by the country of origin to an importing country k.

Despite its relevance, this measure has a shortcoming, relating to the endogeneity of export value weights. Indeed, this measure takes into account the weight of exports in the quantification of standards. This implies that when the level of restrictiveness of standards for a product is high, this implies that it will prohibit all exports of the product. Thus, the use of such a measure may bias the regression. To overcome the shortcomings of the previous approach, we use the method of quantifying quality standards called frequency measures [1,22,40,41,20,21]. This method aims to assess the number of regulations or the proportion of products subject to standards in a given product classification. In contrast to the coverage measurement approach, frequency measurement covers the presence and/or absence of quality standards in a product without taking into account the value of exports covered.

Specifically, the Frequency Index (or "*FI*") of the *SPS* standards applied by the importing country, for product category *j* originating in the country of origin during a given period, represents the percentage of goods exported by the country of origin in product category *j* affected by the importing country's SPS measures *k* during that year. It is given by the following relationship :

$$FI_j = \frac{\sum_i D_i E_i}{\sum_i E_i} \times 100 \qquad (2)$$

Where *i* is an exported good contained in product category *j*. If the SPS measures are applied to product i, Di which is the dummy variable takes the value 1 and 0 otherwise. Ei is a dummy variable which is equal to 1 if there are exports for a particular product *i* and equal to 0 otherwise. Unlike the coverage ratio, the frequency index does not reflect the relative value of the affected products and therefore cannot give an indication of the relative importance of the SPS measure among all products in category *j*.

3.2 Econometric Model Specification

The econometric model used in this research is the gravity model, initiated to explain bilateral trade between countries in terms of their gross dometic product (GDP) and bilateral trade between them. The gravity model has been considered over the last two decades as a standard tool for modelling international trade [42]. This model aims to analyze the effects of trade liberalization, the consequences of the creation and diversification of trade associated with free trade areas, and the impact of distance on the volume of trade. This model is based on Newton's Law of Gravitation published in 1687, which states that: "the force of attraction between two bodies is equal to the product of the masses of the two bodies divided by the distance between them"[2]. Very quickly, this model found its very first applications in international trade from the 1960s onwards, notably with the pioneering work of Tinbergen [43] and Linnemann [44]. Based on these works, a transposition of Newton's law of gravity was applied to international trade, resulting in an economic expression of the Cobb-Douglas type as follows.

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[2]$F_{ij} = G \times \frac{M_i . M_j}{D_{ij}}$ *With Fij the force of attraction between bodies i and j; M_i and Mj the masses of bodies i and j; G the gravitational constant and Dij is the distance between i and j.*

$$X_{ij} = K \frac{Y_i^{\alpha} Y_j^{\beta}}{D_{ij}^{\gamma}} \tag{3}$$

With *Xij the* bilateral trade flows between two countries *i* and *j*; *Yi* and *Yj the* respective GDPs of countries *i* and *j*; *Dij* the distance between the two countries and *K* a constant (under the assumption $\alpha + \beta + \gamma = 0$).

By analogy with Newton's gravitational law, the trade gravity model assumes that trade flows between two countries are proportional to the products of their GDP and inversely proportional to the distance between them.

In order to measure the effects of quality standards on the performance of agricultural exports in Cameroon, we formulate the linear form of the gravity model, inspired by the framework developed by Anderson and Wincoop [45]:

$$\text{Log}(\text{Exp}_{ijt}) = \beta_0 + \beta_1 \text{Log}(\text{GDP}_{it}) + \beta_2 \text{Log}(\text{GDP}_{jt}) + \beta_3 \text{Log}(\text{Dist}_{ij}) + \varepsilon_{ijt} \tag{4}$$

With *Expijt* which corresponds to the exports in value of agricultural products from Cameroon or the imports of the trading partner. *GDPi* and *GDPj* represent respectively the *GDP* of Cameroon and of the trading partner. *Distij* refers to the geographical distance between Cameroon and its trading partner.

From an economic point of view, the use of gravity models in the analysis of international trade is based on the principle that trade flows between two countries depend positively on their economic masses captured by *GDP*, and depend inversely on the distance between them. In order to improve the theoretical justification of gravity models, additional explanatory variables have been introduced [16,6]. While following recent approaches to empirically assess the impact of quality standards on the performance of agricultural exports, our model is written as follows:

$$\text{Log}(Exp_{ijt}) = \beta_0 + \beta_1 \text{Log}(GDP_{it}) + \beta_2 \text{Log}(GDP_{jt}) + \beta_3 \text{Log}(Dist_{ij}) + \beta_4 Col_{ij} + \beta_5 Lang_{ij} + \beta_6 IG_{jt} + \beta_9 SPSF_{ijt}^k + \varepsilon_{ijt} \tag{5}$$

In this specification, *i* is the exporting country *i.*e. Cameroon, *j* is the importing developed country[3] taken from a set of 21 importing countries consisting of Austria, Belgium, Canada, China, Czech Republic, France, Germany, Greece,

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[3] *The developed countries considered in our study refer to the classification made by the United Nations (UN).*

Ireland, Italy, Japan, Netherlands, Portugal, Russia, Singapore, Slovakia, Slovenia, Spain, Sweden, United Kingdom, United States; *k is* an agricultural product taken from the category of agricultural product exported by Cameroon to an importing country, and *t is* the year. ε_{ijt} is the error term whose values have a normal distribution, with a mean of zero. Exp_{ijt} represents the exports in value of the agricultural product *k* from Cameroon to the importing country *j*. GDP_{it} and GDP_{jt} are respectively the gross domestic product of Cameroon and of the importing country *j in* year *t*. $Dist_{ij}$ represents the bilateral distance in Km separating Cameroon from the importing country j. Col_{ij} and $Lang_{ij}$ are the dummy variables that respectively identify the existence of a collective primary language and colonial experience between the importing country and Cameroon IG_{jt} is the governance indicator that captures the quality of the institutions of the importing country. $SPSF_{ijt}^k$ is the frequency index of *SPS* measures applied by the importing country j for the category of product *k* from country i, in year *t*.

The empirical analysis of our results is done by applying the Poisson Pseudo-Maximum Likelihood (PPML) estimator to a gravity model on a panel of developed countries importing agricultural products from Cameroon.

3.3 Data

The information used in our research comes from four main sources: for the main developed countries importing Cameroon's agricultural products, we have annual data covering the period 2001-2018. The data used come from four main databases: the Trade Statistics for International Busness Development (Trade Map), the Integrated Trade Intelligence Portal (I-TIP) of the World Trade Organization, the World Development Indicators (WDI) and the Centre d'Etude Prospectives et d'Informations Internationales (CEPII).

4. RESULTS AND DISCUSSION

The descriptive statistics and the correlation matrix of the model variables are respectively presented in Tables 3.1 and 3.2 (see Appendix). Table 3 confirms the absence of significant correlation between the dependent and independent variables, which, combined with the characteristics of the sample in the dataset, validates the absence of multicollinearity to bias the results.

In order to confirm the validity of our results, the econometric model used in this paper was estimated under five specifications. The first specification is based on the basic model in the sense of Tinbergen [43], including the original variables of the gravity model, namely GDP, distance and the governance indicator. The second specification slightly modifies the basic model by incorporating the variable of interest, the quality standards frequency index. The third and fourth specifications integrate respectively in the previous model the bilateral control variables, namely the sharing of a common language and the colonial link with the importing countries, and the governance indicator variable. The last specification takes into account the original model, the variable of interest and the other variables in order to explain the performance of agricultural exports in Cameroon. The results from this specification are recorded in the following table.

We find that the results are broadly consistent with theoretical predictions for the traditional variables, namely GDP and geographic distance. Indeed, the GDPs of *j* (partner) countries positively explain bilateral trade in agricultural products. A 10% increase in the GDP of the partner country is accompanied by an increase of about 0.043% in exports of agricultural products. Indeed, the increase in the income of country *j* increases the purchasing power of country j, which may increase a preference for products exported by country *i*. It should also be noted that the GDP of country *i* (Cameroon) positively and significantly explains bilateral exports of

agricultural products. A 10% increase in the GDP of country i (Cameroon) translates into an increase of about 3.25% in bilateral exports of agricultural products. Thus, even if the level of income in country *i* is essential to boost consumption and therefore production, that of country *j is a* determining factor. Consistently, when there is an increase in income in country *j*, the latter has additional purchasing power likely to increase its domestic and foreign demand.

The distance coefficient, which is a proxy for transport costs, has a negative and significant sign. This negative impact could be explained by the fact that the greater the distance between two partners, the more bilateral trade between them decreases. In other words, this implies that the greater the distance between two countries, the higher the transport cost, the lower the possibility for trade to be profitable because of the existence of the gap between the import price and the export price, and consequently the less bilateral trade develops. All other things being equal, estimates show us that a 10% increase in distance is accompanied by a 2.44% decrease in bilateral exports of agricultural products. The significance of this result at 1% is justified by the fact that the distance between two partners is an important element capable of explaining the bilateral trade of agricultural export products. In addition, we note that the coefficient of the governance indicator shows a positive and significant sign at 1%. This indicates that the quality of institutions in the partner country is a stimulant for bilateral exports.

Table 1. Results of the severity model estimated by the PPML method

Variables	(1) Ln export	(2) Ln export	(3) Ln export	(4) Ln export	(5) Ln export
lnDist	-0.256***	-0.214***	-0.263***	-0.227***	-0.244***
	(0.0443)	(0.0474)	(0.0472)	(0.0463)	(0.0467)
lnGDPi	0.276***	0.315***	0.304***	0.335***	0.325***
	(0.0896)	(0.0898)	(0.0841)	(0.0862)	(0.0825)
lnGDPj	0.00117	-0.00677	0.0101	-0.00679	0.00426
	(0.00890)	(0.00960)	(0.0102)	(0.00933)	(0.00979)
SPSF		-0.254***	-0.297***	-0.244***	-0.283***
		(0.0733)	(0.0674)	(0.0696)	(0.0660)
Lang			0.141***		0.0781*
			(0.0373)		(0.0400)
Col			0.266***		0.297***
			(0.0334)		(0.0344)
GI				0.0219***	0.0173***
				(0.00399)	(0.00426)
Constant	0.603	-0.0318	0.320	-0.333	-0.158
	(1.217)	(1.224)	(1.162)	(1.189)	(1.160)
Observations	378	378	378	378	378
R-squared	0.106	0.135	0.253	0.194	0.281

*Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1; Source: Authors*

The coefficient of the common language variable is positive and significant at 10%, indicating that sharing a common language with these trading partners is a facilitator of bilateral trade and complicity between the two partners. Thus, partners with a common language will have a trade intensity 0.78% higher than the others. The colony variable also has a positive and significant sign at 1%. This result means that the fact of having been a colony of the metropolis may in some cases be a factor in the intensification of bilateral trade. Indeed, to preserve its political pre-square, the colonizing countries were tempted to impose in their colony, the currency and even some political and economic treaties.

The variable capturing quality standards explains negatively and significantly (at the 1% threshold) the exports of agricultural products. This suggests that the quality standards imposed by developed countries between 2001 and 2018 have been restrictive factors for Cameroonian agricultural exports. Indeed, a 10% strengthening of quality standards translates into a decrease of about 2.83% in the volume of agricultural exports to Cameroon. The quality standards imposed by developed countries thus play a negative and significant role on the performance of agricultural exports and therefore restrict bilateral trade in Cameroon. Indeed, the standards imposed by developed countries act as protectionist trade policies and their use contributes to restrict agricultural exports in Cameroon. Cameroonian agricultural products thus suffer from restrictive standards or barriers disguised under the banner of protecting human health and biodiversity. These findings broadly corroborate those previously obtained by Otsuki et al. [16], Wilson et al. [18], Disdier et al. [22], Yue et al. [30], Ferro et al. [6], Ishaq et al. [32] and Gibson and Wang (2018). The quality standards adopted by Western countries thus remain very restrictive and have a negative impact on the performance of agricultural exports in Cameroon.

The results of the robustness analysis (see table) show that the variable of interest (quality standard) and the distance coefficient maintain their negative and significant impact on the performance of agricultural exports in Cameroon. Thus, due to compliance with the standards imposed by the developed countries and transport costs, the performance of agricultural exports would decrease in the different models of our analysis.

5. CONCLUSION

The aim of this paper is to study the impact of quality standards imposed by developed countries on the performance of agricultural exports in Cameroon. After having carried out a critical review of the different methods of quantification of quality standards, we selected the most relevant one (the one based on the frequency index of quality standards). From the latter, we constructed a variable likely to capture the quality standards imposed by developed countries in the context of Cameroon. Following an empirical approach, we applied the Poisson estimator of the Poisson Pseudo-Maximum Likelihood (PPML) to a gravity model on a panel of developed countries importing agricultural products from Cameroon.

In the light of the results obtained, we note that, over the period 2001-2018, the quality standards imposed by developed countries are restrictive and have a negative and significant impact on the performance of agricultural exports in Cameroon. Thus, a 10% strengthening of quality standards results in a decrease of about 2.83% in the performance of agricultural exports in Cameroon. The standards imposed by developed countries act as protectionist trade policies and their use contributes to restricting agricultural exports in Cameroon. Despite the very demanding nature of the quality standards imposed by developed countries, their compliance can enable Cameroon's agricultural export sector to become more competitive on the international market. Thus, we recommend training and support for producers to enable them to comply with the standards. We also suggest that special support be put in place to help producers obtain quality products that comply with the requirements imposed by developed countries.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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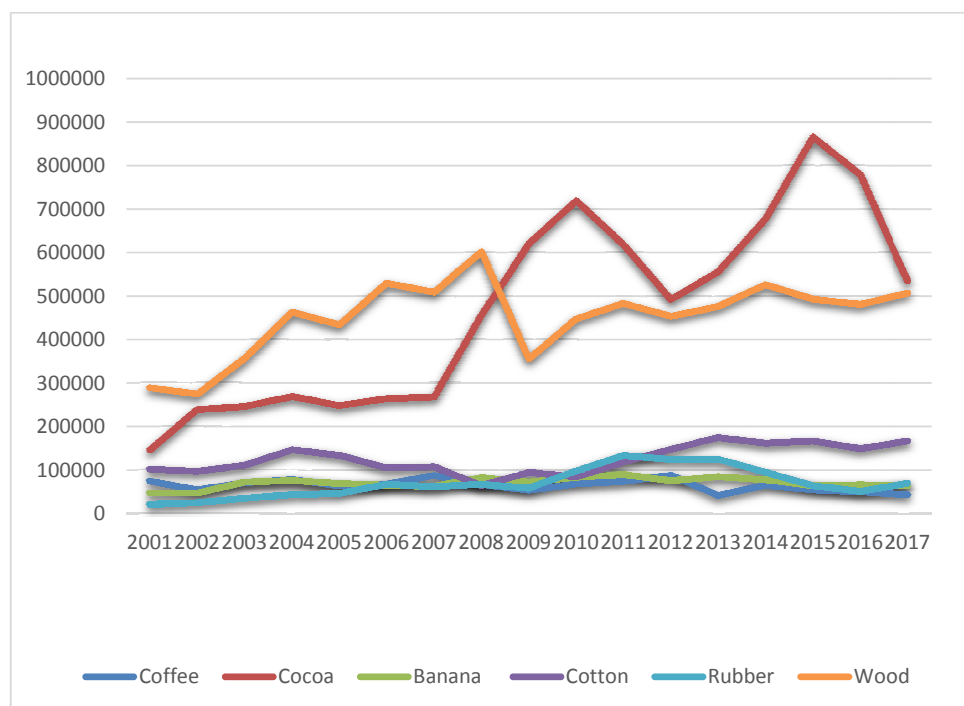
APPENDIX

Appendix 1

Fig. 1. Evolution of exports of main agricultural products in Cameroon (2001-2017)
Source: authors from Trade Map

Appendix 2

Table 2.1. Distribution of market shares (%) of Cameroon's main agricultural products in the world

Produits Importateurs	Cocoa	Wood	Cotton	Rubber	Banana	Coffee
Monde	100	100	100	100	100	100
Europe	83,3	66,3	11,6	72,4	99,1	85,3
Amérique	5,1	3	-	3,6	-	3,8
Asie	7,5	26,2	82,51	17	-	-

Source: Authors from Trade Map

Appendix 3

Table 3.1. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
LnEXPORT	378	8.023055	2.587828	1.386294	13.20787
LnDist	378	8.717935	.395879	7.934357	9.479072
LnGDPi	378	13.36353	.1838279	13.07586	13.65124
LnGDPj	378	10.84352	1.384978	8.760733	15.28296
SPSF	378	.6357641	.1993134	0	1
Lang	378	.3333333	.4720293	0	1
Col	378	.047619	.2132411	0	1
GI	378	6.301038	3.90336	-5.135226	11.45287

Source : authors

Table 3.2. Correlation matrix

	LnEXPORT	LnDist	lnGDPi	lnGDPj	IG	Col	Lang	SPSF
LnEXPORT	1.0000							
LnDist	-0.3462	1.0000						
LnPIBi	0.1496	0.0000	1.0000					
LnPIBj	-0.1224	0.5085	0.0255	1.0000				
IG	0.2253	-0.0232	-0.0433	0.0393	1.0000			
Colonie	0.3134	-0.1234	-0.0000	-0.0628	0.0502	1.0000		
Langue	0.1618	0.1645	-0.0000	-0.1890	0.3922	0.3162	1.0000	
SPSF	-0.2014	0.3415	0.1180	-0.1952	0.0042	0.0269	0.1804	1.0000

Source: authors

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