Trade Openness and Competitiveness: BRICS and Sub-Saharan Africa Countries[1]

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Abstract

The aim of this study is to highlight the key competitiveness elements that promote trade flows between the BRICS countries of Brazil, Russia, India, China and South Africa and those in Sub-Saharan Africa. To do so, we employ the econometrics of panel data during the period of study from 1995 to 2018. We apply the Blundell and Bond GMM estimator [1998] and we utilize Sargan's [1958] over-identification test to confirm the validity of delayed variables in level and difference as instruments used in our estimations. The empirical findings of our study show that trade policy actions, high natural resource allocation and the evolution of gross domestic product (GDP) per capita of the participating countries promote this trade openness between BRICS and Sub-Saharan Africa economies. Additionally, African countries need to develop their industrial sector to export more high-value manufactured products.

Keywords: trade openness; competitiveness; BRICS countries; Sub-Saharan Africa countries

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Introduction

A state's competitiveness is defined by its ability to compete based on its own resources without suffering consequences. Price competitiveness refers to the ability to offer products at a lower price than competitors, and off-price or structural competitiveness refers to the ability to gain market share on criteria other than price. It includes product quality, after-sales service and product differentiation. The possession of one of these advantages by a state may justify its openness on the international stage.

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The notion of openness has been the subject of extensive literature in economics. The indicators now proposed for its measure are often very close and sometimes contradictory. Some authors have suggested indicators that deduce from distortions caused by trade barriers: the Relative Price Distortion Index [Dollar, 1992], the Trade Restriction Index [Anderson, Neary, 1994; Feenstra, 1995], the indicator based on effective tariffs [Pritchett, 1996], the commonly used opening ratio and finally the compound opening indicator defined by J. Squalli and K. Wilson [2011], which is built using the combination of the opening ratio and the foreign trade contribution of each country.

According to K. Tsegaye [2016], the examination of cultural and creative industries has a moderately extended history in African policymaking, going back to the 1980 Lagos Plan of Action. N. Cattaneo and J. Snowball [2019] found that South Africa suffers from trade imbalances in cultural goods sourced from the BRICS group, which is made up of Brazil, Russia, India and China in addition to South Africa, and these commodities belong mainly to the latter two countries.

Referring to food security, Y. Ren, Z. Li, Y. Wang and T. Zhang [2020] highlighted the importance of cooperation among the BRICS countries to manage fluctuations in the agricultural sector. Here, we mention scientific and technical cooperation, information exchange and trade policy coordination to increase commercial competitiveness. They found that, by applying agricultural science and technology, each BRICS country was able to leverage its resource benefits for continuous improvements in food production capacity, although more could be done.

From a trade point of view, BRICS countries have made an offensive toward African countries: trade rose from $17.06 billion in 1995 to $49 billion in 2004, reaching $164 billion in 2008 before slightly falling in 2010 to $142 billion [UNCTAD, 2010]. The share of trade with the European Union (EU) in sub-Saharan Africa's total trade fell from 31.61% in 1995 to 20.99% in 2013, while trade with BRICS increased from 10.83% in 1995 to 29.34% in 2013 [UNCTAD, 2010].

For BRICS countries, the African continent represents at the same time a supplier, a market and a potentially useful pool of votes in the event of reform of multilateral institutions. Given the very wide variety of situations specific to each African country and the specific relations that each of them separately maintains with BRICS countries, it is useful to qualify this observation by carrying out a detailed analysis at the bilateral level in order to identify strategies likely to maximize the benefits and minimize the risks involved in the rise of these new development partners for Africa. Despite the West's presence in Africa, the progress made by BRICS in sub-Saharan Africa is remarkable and deserves special attention. In this study, we highlight the competitiveness of these emerging countries in intensifying trade as the spillovers in sub-Saharan Africa depend on the opportunities provided by BRICS compared to other partners.

In this article, we examine empirically how competitiveness elements can promote trade flows between BRICS countries and those in sub-Saharan Africa. We use the econometrics of panel data as an empirical methodology during the period of study from 1995 to 2018. Using the Blundell and Bond GMM estimator [1998], the empirical results show that trade policy actions, high natural resource allocation and the evolution of gross domestic product (GDP) per capita of the participating countries promote trade openness. Also, we find that African countries need to develop their industrial sector in order to export more high-value manufactured products.

This article is organized as follows: first, we provide a literature review highlighting the role of price competitiveness on international trade on the one hand and the role of competitiveness-off-price on the other. We then outline the methodology and data used in this study, after which the main empirical findings are presented, followed by concluding observations.

Price Competitiveness as an Explanatory Factor in Trade Openness

Several authors have explained exchanges between states through price competitiveness. The common denominator is the comparative advantage that some countries have in which they can produce at low cost and sell at relatively low prices. The work of A. Wood [1994] highlights the strong endowment of some countries in human capital, which is based on technological evolution. Wood studied the components of the technological gap between countries as a determinant of international trade. The technological advantage of a country and an industry makes new production processes possible and thus creates a new comparative advantage for the innovating country. In addition, the approach to increasing yields introduces the concept of economies of scale.

The impact of trade openness on competitiveness is well studied in the literature, even if the relationship between these two indicators remains a subject of debate [Dollar, Kraay, 2003; Musila, Yiheyis, 2015; Tahir, Azid, 2015].

In the same context, several studies consider trade openness as one of the main determinants of competitiveness in a country [Bruneckiene, Paltanaviciene, 2012; Guerrieri, Meliciani, 2005; Mulatu, 2016; Snieska, Draksaite, 2007; Staskeviciute, Tamosiuniene, 2010]. Other studies have dealt with the links between competitiveness and productivity indicators, which have been analyzed in the context of trade liberalization while maintaining compatibility between competitiveness and social protection [Damijan, de Sousa, Lamotte, 2009; Kim, 2000; Liu, Nishijima, 2012; Miller, Upadhyay, 2000; Paul, Marks, 2009; Rath, Parida, 2014].

In the context of mark-ups, it is clear, as noted by R. Cherif et al. [2020, p. 12], that the difficulty of obtaining time series data at the firm level for most countries in sub-Saharan Africa complicates the analysis. For this, Cherif et al. [Ibid.] found that profit margins are increasing in sub-Saharan Africa, including in the two largest economies—Nigeria and South Africa. Indeed, they conclude that profit margins are very significant in sub-Saharan Africa and that the half-life of the margins are almost twice as long in the countries of the region than in other emerging economies and developing countries.

These trends are consistent with other studies [de Loecker, Eeckhout, 2018; Fedderke, Obikili, Viegi, 2018] that investigate the increase in profit margins of companies in these countries and in the world. With specific reference to sub-Saharan Africa and using data collected by the South African Revenue Service, J. Fedderke, N. Obikili and N. Viegi [2018] assessed the formation of the South African industrial market at the level of the company for the period 2010–12. They found that the variation in profit margins and the levels of market concentration based on this data are very different from and higher than estimates based on aggregate data. While they did not find a monotonous relationship between profit margins and market concentration, they did note that the interaction between these variables is shaped by the extent to which barriers to entry exist. They also concluded that firm-level data can provide important information on the relationships between profit margins, productivity and trade openness.

The Explanation of Trade Openness by Competitiveness-Above-Price

There are several approaches that explain trade through the elements of competitiveness-off-price. The first approach is the imperfect competition-based approach, which draws on the two major models of monopolistic market competition, E.H. Chamberlin [1937], which first introduced product differentiation. The first model of monopolistic market competition in the

first approach is developed by P. Krugman [1979] which considered the taste for variety which advanced the monopoly competition framework originally presented by Chamberlin [1937] by using the utility function proposed by A.K. Dixit and J.E. Stiglitz [1977]. The second model of monopolistic market competition in the first approach is developed by A. Shaked and J. Sutton [1982] which hypothesized a vertical product differentiation based on income differentials. In the same context of the second model of monopolistic market competition in the first approach, K.J. Lancaster [1979] considered that each product is defined by a set of characteristics requested by the consumer (for an automobile: speed, cabin volume, safety, fuel consumption, comfort). Every consumer has an ideal product. Each variety is produced by a single firm with increasing yields.

The second approach is based on models of oligopolistic competition in markets, mainly those of A. Cournot [1838/1960]. Representative of this approach is the work of J.A. Brander [1981] and J.A. Brander and P. Krugman [1983] which found that international trade is the consequence of the strategic behaviour of firms which creates a pro-competitive effect of trade.

The third approach considers the economic and geographic factors of states. The work of E.E. Leamer [1988], J.A. Frankel and D. Romer [1999] and S. Edwards [1998] concluded that the level of trade between states is linked to several economic and geographic variables—investment, macroeconomic stability policies, average income, population level, presence of mineral or oil resources, isolation and distance from trading partners.

The fourth approach emphasizes state trade policy. M. Lambert-Racine [2009] pointed to the positive effect of tariff liberalization on trade, H.G. Johnson [1953] retained an optimal tariff to be implemented while K. Bagwell and R.W. Staiger [1999] proposed a framed exchange theory. Similarly, empirical studies by J.E. Anderson and Y.V. Yotov [2016], C. Couharde, I. Coulibaly, D. Guerreiro and V. Mignon [2013] and A. Hollander and C. Macdissi [2009] concluded that limiting tariff barriers and ratifying free trade agreements contribute to opening a country outward.

J.E. Anderson and Y.V. Yotov [2016] studied free trade agreements (FTAs) implemented between 1990–2002 and analyzed the terms of trade effects. They found that some members of FTAs achieved important manufacturing income gains of over 5%, while some non-members experienced a decrease of less than 0.3%. Also, they found that global efficiency increased by almost 1%.

V. Pilinkiene [2016, p. 187] noted that there is a connection between competitiveness and social welfare which makes possible a high standard of living within a country. She also suggested that most authors would view the ability to provide social welfare, which presupposes a competitive and productive economy, as more important than actual provision of welfare, and importantly, that trade openness is one of the main determinants of competitiveness.

S. Thazhugal Govindan Nair [2017] used the Markov Regime-Switching Model (MRSM) to investigate the possibilities of establishing a currency union between BRICS economies. He showed that the exchange market behaviour of the five countries converged with the formation of BRICS as a group, pointing to the importance of coordinated monetary policy. A more recent study by Thazhugal Govindan Nair [2020] examined the impact of continued coordinated economic integration of BRICS countries on their trade competitiveness and showed that competitiveness is key to their export growth.

The Methodology of the Study

We have three main concerns at this level: the presentation of the study model, the method of estimation used and the source of the data.

Gravity Model: Justification and Specification

In international trade, the **gravity equation** is a model that predicts the volume of bilateral trade by the economic weight of two countries (their GDP or GDP/capita in general) and by the distance between them. This model was first introduced to economics by W. Isard and M.J. Peck [1954]. The basic equation is written:

$$C_{ij} = G\frac{M_i M_j}{D_{ij}}. \quad (1)$$

Thus, the volume of trade C between two countries i and J depends on a constant G, the distance between the two countries D and the economic importance of each of these two countries M_i and M_j.

According to J. Tinbergen [1962] and P. Pöyhönen [1963], gravity models have become a popular instrument for empirical analysis of foreign trade. The idea is derived from Newtonian gravitational physics which states that two bodies attract each other proportionally to the product of their masses and inversely proportional to the square of the distance that separates them. Thus, Tinbergen and Pöyhönen established a positive link between trade flows and revenues of trading partners and a negative relationship between these flows and the reciprocal distances of partners. While J.E. Anderson [1979] first attempted a theoretical explanation, several authors, including I. Martinez-Zarzoso and F. Nowak-Lehmann [2003], also helped to strengthen the preliminary theoretical framework and proposed further extensions.

In general, the gravity equation applies in a monopolistic context that involves increasing scale returns and product differentiation. The framework of analysis is underpinned by three fundamental assumptions: (i) the maximization of profits by monopoly firms, (ii) the constrained maximization of utility by consumers, and (iii) the specialization of the supply of goods between countries [Anderson, 1979; Anderson, van Wincoop, 2001; Bergstrand, Egger, Larch, 2013, 2015; Helliwell, 1998].

The Specification of the Model

K. Head and T. Mayer [2014] identify three formulations of the gravity equation that we can summarize in two phases.

The First and Second Generation

The first so-called "general" formulation presents the gravity equation as a set of models producing expressed trade equations such as:

$$X_{ni} = GS_i M_n \varphi_{ni}. \quad (2)$$

The term S_i expresses the capabilities of the exporter i to all destinations. M_n captures all the characteristics of the n receiving markets. φ_{ni} $(0 \leqslant \varphi_{ni} \leqslant 1)$ is a coefficient that measures the bilateral accessibility of the country i to its partners n. It combines trade costs, which are combined with elasticities measuring their impact on trade flows. And G is the gravity variable, considered a constant in cross-section modelling. This formulation has two fundamental characteristics, namely its multipolarity and the capture of multilateral effects.

The second formulation of the gravity model is called "structural." It includes a subset of general gravity models in which bilateral trade is expressed by:

$$X_{ni} = \frac{Y_i X_n}{\delta_i \phi_n}\ \phi_{ni}, \quad (3)$$

where, $Y_i = \sum_n X_{ni}$ is the production, $X_n = \sum_i X_{ni}$ is the overall expenditure of the importer and δ_i and Φ_n are the terms of multilateral resistance defined as follows:

$$\theta_n = \sum_i \frac{\phi_{nl} Y_l}{\delta_l}, \tag{4}$$

$$\delta_i = \sum_i \frac{\phi_{li} Y_l}{\theta_l}. \tag{5}$$

This formulation can be validated against other alternatives due to the correct estimation of fixed effects in relation to their theoretical values. Thus, the structural gravity equation can be estimated at the aggregate level or at the level of a company. At the aggregate level, Y_i is approximated as the gross production (not the added value) of traded goods (assuming that X_{ni} is the trade in goods) and X_n as the consumption of goods. But in practice, GDP is often used as a proxy for Y_i or X_n.

The Third Formulation Is of "Naïve" Gravity Equations

These express bilateral trade as follows:

$$X_{ni} = G Y_i^a Y_n^b \phi_{ni}. \tag{6}$$

This very general and more restrictive formulation expresses bilateral trade in proportion to the product of the sizes of the countries. However, several theoretical approaches postulate the hypothesis of unit elasticities. The studies of A.K. Rose [2000] and D. Gbetnkom and D. Avom [2005] show that the theoretical justifications for this formulation impose a very rigid restriction that φ_{ni} is a constant.

Empirically, the original econometric transposition of the Tinbergen-inspired gravity model [1962] generally takes the following form:

$$Com_{ij} = \beta_0 \frac{Y_i^{\beta_1} Y_j^{\beta_2}}{D_{ij}^{\beta_3}} Exp(\varepsilon_{ij}), \tag{7}$$

where, Com_{ij} represents total bilateral trade between the countries i and j, Y_i and Y_j represent the respective GDPs of the countries, and D_{ij} represents the distance between them. β_i are parameters to estimate and ε_{ij} is an error term. Considering the evolution of the gravity model, we adopt in this article the following enhanced log-linear form:

$$\ln CTS_{ijt} = \beta_0 + \beta_1 \ln Y_{it} + \beta_2 \ln Y_{jt} + \beta_3 \ln N_{it} + \beta_4 \ln N_{jt} + \beta_5 \ln D_{ijt} + \beta_6 \ln dY / hbt_{ijt} +$$

$$+\beta_7 \ln RN_{it} + \beta_8 \ln TCR_{ij}t + \beta_9 OuvMer_i + \beta_{10} Accom_{ij} + \beta_{11} EU + \beta_{12} USA + \mu_{ijt}, \tag{8}$$

where, CTS[2] is the Composite Trade Share that measures the degree of openness of a country, following the work of Squalli and Wilson [2011]. $Y_{i(j)t}$ represents the level of GDP of the country *i(d)* in the initial period in constant value ($) and measures the purchasing power of populations. This variable is used to measure the impact of African and BRICS revenues on BRICS trade in goods. In reference to E. Helpman [1987], more openness is expected in the face of an increase in GDP. $N_{i(j)t}$ represents the size of the country *i(d)* which is measured by the population level

[2] $CTS_i = \frac{(X+M)_i}{\frac{1}{n}\sum_{j=1}^{n}(X+M)_j} \frac{(X+M)_i}{GDP_i}$.

at the period *t*. The expected sign of the coefficient of this variable will be negative or positive depending on the realization of the absorption or economy of scale effect.[3] D_{ij} is the distance between the country *i* and *j*; for the purpose of this analysis, we limit the distance to bird's eye or even orthodromic distance due to the availability of data. The capitals of countries are taken as commercial poles and the arc distance between these poles using geographical coordinates (longitude and latitude) is calculated. This distance measurement yields robust results only under the condition of ceteris paribus [Avom, Mignamissi, 2013]. dY/hbt_{ijt} represents the per capita income differential between the two partner countries. In reference to the work of D. Avom and D. Mignamissi [2013], this variable will be measured by the square of the difference in per capita incomes of the two partner countries. TCR_{ijt} is the bilateral real exchange rate between countries *i* and *j* at the time *t*. This variable reflects the price competitiveness between the sub-Saharan African countries (SSA) and the BRICS group for export and import functions. This variable is obtained by the ratio of the price indices of the two partners multiplied by their nominal bilateral exchange rate. RN_{it} represents the share of natural resources in the country's total exports *i*. PM_{it} represents the share of manufactured goods in the country's total imports from the country *j*. $OuvMer_{i}$ represents the geographical location of the country *i* in relation to the sea. It is equal to 1 if the country *i* has access to the sea and 0 otherwise. $Accom_{ij}$ is also a silent variable indicative of the existence of trade agreements between a sub-Saharan African country and a BRICS country. This variable takes the value 1 in case of agreements and 0 if there are none. EU and US are variables representing the existence of trade agreements between the sub-Saharan African countries and one of the European Union (EU) countries or the United States (US). These variables take value 1 if there is an agreement and 0 if not. Finally, μ_{ijt} represents the term error.

Except for dummy variables, all other variables will be expressed in natural logarithm. As a result, the estimated coefficients of these variables will be directly interpreted as elasticities. However, the elasticities of qualitative variables are given as the exponential of estimated coefficients.

The Method of Estimating and Sources of Data

Next, we present the estimation method and identify the source of the data.

The Estimation Method

Recent literature has identified three biases that the gravity model can exhibit: a bias related to the logarithmic transformation of variables, a bias due to the presence of zeros in the dependent variable, and a bias related to heteroscedasticity of the residuals [Avom, Mignamissi, 2013]. J. Santos Silva and S. Tenreyro [2006, 2010, 2011] demonstrated that the problem of estimating trade in the gravity model is not necessarily the endogeneity of the variables, but the optimal treatment of these different biases. They proposed a strategy to overcome the inconsistency of log-linear approaches in the presence of heteroscedasticity and zero flows of trade. In addition, they recommend the use of the estimator of the Poisson Maximum Probability Pseudo (PPMV) which, according to Santos Silva and Tenreyro [2011], has the same robustness as the Gamma PML estimator due to the similarity of their first-rate conditions [Head, Mayer, 2014].[4]

[3] Absorption effect: a highly populated country exports less than a less populated country. Economy of scale effect: a highly populated country exports more than a less populous country.

[4] Starting from a simple model, where $X_{ij} = Exp(Z'_{ij}\beta)\varepsilon_{ij}$ the term multiplicative error is a term, the first-rate conditions for maximum for Poisson, MCO and Gamma are given by: $\sum Z_{ij}X_{ij} - \hat{X}_{ij} = 0$, $\sum Z_{ij} \ln X_{ij} - \ln \hat{X}_{ij} = 0$

Several contributions focused on the relative performance of the various non-linear estimators followed. The econometric literature on counting data, applied to whole non-negative values, proposes different alternatives. L. de Benedictis and D. Taglioni [2011] point out that when the prevalence rate of zero is high in trade flows, the PPMV is no longer appropriate. They propose to use the Zero-Inflated Poisson Model or Zero-Inflated Negative Binominal Model. On the other hand, Head and Mayer [2014] discourage the use of the negative binomial law (NEGBIN), even in the case of a fairly large dispersion[5] of the dependent variable, because of the high sensitivity of this estimator to the unit of measurement of the dependent variable.

In this article, we use the PPMV as the main estimation technique, following Santos-Silva and Tenreyro [2006; 2010; 2011] and Avom and Mignamissi [2014]. Other estimation techniques will allow us to test the sensitivity of our results.

Different Sources of Data

The data used in analysis cover the period from 1995 to 2018; data for the described variables are extracted from the United Nations Conference on Trade and Development database (UNCTADSTAT). The traditional variables such as GDP and populations come from the World Bank database (WDI). The distance data were extracted from the files of the Centre for Forward-Looking Studies and International Information (CEPII). The period of study was chosen based on the existence of data and on the historical relationship between BRICS and the sub-Saharan African countries.

The silent variables of control and integration were compiled by the authors. The income differential variable was built from per capita income from the World Bank (WDI) database. The price competitiveness variable was obtained by the product of the price indices of the two partners as well as their nominal bilateral exchange rate extracted from the World Trade Organization (WTO) and International Monetary Fund (IMF) databases. The natural resource and manufactured variables were calculated using data from UNCTADSTAT.

The model is estimated from a sample comprising almost all countries in sub-Saharan Africa (excluding South Africa), BRICS countries, the U.S. and the EU. Consideration of these regions makes it possible to identify the specific effects in terms of destruction or creation of exchanges with BRICS in relation to the latter.

Presentation of Robustness Results and Tests

Table 1 presents the results of the estimates with the GMM system of the opening of countries from sub-Saharan Africa to BRICS.

Model 1 is the basic model where aperture is explained by traditional variables; the GDP and populations of the two partner countries, the distance between these partners and the dummy variable representing ratified trade agreements.

In Model 2 interest variables are taken into account: price competitiveness is measured by the real exchange rate and the per capita income differential; competitiveness-off-price is measured by the share of natural resources in the exports of sub-Saharan African countries, the

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and $\sum Z_{ij} \frac{X_{ij}}{\hat{X}_{ij}} - 1 = 0$. Poisson and Gamma both provide consistent estimators, regardless of the distribution of ε [Head, Mayer, 2014].

[5] The Poisson estimator is theoretically based on the proportionality between conditional variance and conditional average [Wooldridge, 2000]. However, when the variance is above average ("over-dispersal"), negative binomial law can be used.

population of these countries, and the diplomatic actions taken by them. Both specifications are generally significant.

Fisher's [1955] null hypothesis of overall significance tests is rejected (p-value is equal to 0.000). In addition, J.D. Sargan's [1958] over-identification test confirms the validity of delayed variables in level and difference as instruments used in all our specifications. M. Arellano and S.R. Bond's second-order self-correction test [1991] does not reject the hypothesis of no second-order self-correction of our specifications.

Table 1. Results of Estimates With the GMM System for Opening to BRICS

Variables	Model 1	Model 2
Opening (CTS)	**Coefficients**	**Coefficients**
lnCTS | L1.	0.455 (15.37***)	0.398 (12.62***)
$lnGDP_i$	0.297 (3.33***)	0.842 (7. 06***)
$lnGDP_j$	1. 634 (13.73***)	1.110 (5.51***)
lnN_i	0.072 (0.02)	−0.116 (−1.16)
lnN_i	0.171 (2.46**)	0.332 (1.92*)
lnD_{ij}	−0.412 (−2.36**)	−0. 531 (−2.12**)
LndY/hbt_		0.238 (2.95**)
$lnTCR_{ij}$		−0.285 (3.88***)
lnRNi		0.726 (3. 34***)
ACCOM	0.512 (2.46**)	0.590 (3.26***)
EU		−0.133 (−2.20**)
USA		−0.063 (−1.73)
Constant	17.441 (3.17***)	7.253 (2.28**)
Number of observations	5430	5139
Number of bilateral relations	230	230
F-statistic (p-value) Prob > F	0.000	0.000
Sargan test Prob>chi2 =	0.354	0.312
Arellano-bond test autocor.1	Pr > z = 0.052	Pr > z = 0.044
Arellano-bond test autocor.2	Pr > z = 0.830	Pr > z = 0.743

Note: (***), (**) and (*) are a Significant value at a threshold of 1%, 5% and 10%, respectively. GMM indicates the generalized method of moments, BRICS indicates the countries; Brazil, Russia, India, China and South Africa, CTS indicates the Composite Trade Share, GDP indicates the Gross Domestic Product, N indicates the size of the country, D indicates the distance between the country i and j, Y/hbt indicates the per capita income, TCR indicates the bilateral real exchange rate between countries i and j, RN indicates the share of natural resources in the country's, ACCOM indicates silent variable indicative of the existence of trade agreements between a sub-Saharan African country and that of the BRICS group, EU indicates the European Union, and USA indicates the United States of America.

Source: Calculated by the authors.

In general, it is apparent from the results presented in Table 1 that the traditional variables of the gravity model have, for the most part, the expected signs with variable statistical significance.

Indeed, the significance of the delayed dependent variable coefficient (lnCTSL1) reveals that the opening level of the previous period has a significant positive effect on the current level. The coefficient estimated in Model 2 indicates that a 10% increase in the opening of the previous year results in a current increase of 3.9% considering the influence of the other variables. This confirms that bilateral trade is part of a dynamic process.

In the second model, we find that the values of variable coefficients are consistent with the theory; the foreign partner's GDP ratio is positive and significant at 1%. This means that the opening of sub-Saharan African countries to BRICS countries is explained by the increase in incomes in those countries. Similarly, the GDP ratio of African countries is positive and significant at 1%. More concretely, the 10% increase in the GDP of foreign partners (BRICS countries) leads to an increase in openness of 11%, while an increase in the GDP of African countries by 10% leads to an increase in the opening of almost 10.4%.

The coefficients of the population variables of the partner countries have signs to the contrary. The positive and significant 5% sign reflects the economies of scale effect that is being achieved, that is, the greater the population in the BRICS group, the more the quantity produced increases and exports increase. The positive sign for African countries also reflects the economy of scale effect. The negative relationship between distance and openness is also consistent with economic intuition.

The variable representing trade agreements between partners has a positive signal coefficient; this means that the intensification of trade between sub-Saharan Africa and BRICS is explained by the facilitation measures adopted by the partners. These results are in line with economic intuition and confirm the work of A. Hollander and C. Macdissi [2009].

The coefficient of the variable "GDP differential per head" has a positive and significant sign at 5%. This means that the intensification of trade between sub-Saharan Africa and the BRICS countries is explained by the proximity of the level of development of these two partners to the countries of the South.

The sign of the coefficient of the variable "price competitiveness measured by the real exchange rate" is negative and significant at 1%. These results are consistent with the theories of Krugman [1979] and Dixit and Stiglitz [1977]. Sales of a country's goods increase when the products on offer are cheaper. This is one of the main explanations for the intensification of these exchanges—the varieties of products offered by BRICS countries to Africans are price competitive with the products offered by western countries.

The variable "natural resource" has a positive and significant coefficient of 1%, which means that this opening between the two groups of countries is mainly explained by the presence of these resources. For a 10% increase in natural resources, the opening to BRICS is increasing to the tune of about 7.3%. These results are consistent with the study of P. Guillaumont [1994].

Conclusion

Our objective in this article is to highlight the main elements that could explain trade openness between the countries of sub-Saharan Africa and those of BRICS. To do so, we used the augmented gravity model in reference to J. E. Anderson and E. Wincoop [2001] and Martinez-Zarzoso and Nowak-Lehmann [2003] favouring the dynamic approach of the panel model, and we selected the Arellano and Bond estimator [1991] as a potential methodology to examine the importance of trade openness and competitiveness between BRICS and sub-Saharan African countries during the period of study from 1995 to 2018.

Our empirical results show that trade openness between sub-Saharan Africa and BRICS has elements of both economic and trade policy justification. This type of trade openness is closely linked to the evolution of GDP per capita of the participating countries, the low differ-

ential in their income and especially to the endowment of African countries in natural resources and to the low price of products from these partners. Similarly, trade policy actions such as diplomatic relations and organized forums, from which many trade agreements are ratified, play a significant role.

The trends analyzed in this article indicate that, overall, sub-Saharan Africa and BRICS countries are jointly developing a model of South-South relations that can benefit both. For BRICS, the interest of developing economic relations with the sub-Saharan African countries is obvious. It gives BRICS access to raw materials, broadens outlets for its exports and allows it to make investments that could ultimately bring significant benefits, as well as strengthen its political and diplomatic prestige. Beyond common interests, BRICS countries each have specific reasons for being interested in sub-Saharan Africa.

Finally, the strategic objective which should guide any form of cooperation with BRICS countries is to ensure that the revenues from rising commodity prices translate into benefits in sustainable development, poverty reduction and structural change. Sub-Saharan African countries must formulate their own development policies. The sub-Saharan African authorities must ensure that they obtain for their country a fair distribution of the mutual economic benefits arising from these new partnerships, that these are shared equitably across society, and that the competition between partners (traditional and emerging) in favour of the new "rush for Africa" plays in favour of sub-Saharan African countries.

Both the outlook and the challenges ahead underscore the need for sub-Saharan countries to adopt appropriate policies in order to make the most of their reorientation toward emerging partners such as the BRICS countries. As large sections of the world's population experience exceptionally high economic growth rates, sub-Saharan Africa has an opportunity to strengthen its ties with emerging countries to make faster progress toward economic prosperity and the eradication of endemic poverty. Sub-Saharan African governments are key players in economic development and must rise to the task. The perspectives and challenges described above should encourage them in particular to: improve the management of natural resources, set guidelines without favouring any particular sectors, increase the flexibility of the economy and strengthen protection systems, promote regional integration, make greater use of special economic zones, and negotiate better access to markets, especially for products with high added value.

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