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Abstract

The objective of this project is to analyze the effects of the implementation of trade facilitation indicators on bilateral trade flows. Thus, drawing on recent theoretical and empirical developments, we estimate a gravity model using the two-step model of Martinez Zarzoso and Chelala (2020) using the Poisson Pseudo Maximum Likelihood (PPML) estimator in robustness. The data comes from ESCAP (extension in reference), the World Bank, UNCTAD ¹and CEPII ²over the period 2006-2015. The main results obtained are as follows: (i) Total non-tariff trade costs have an overall negative and significant impact whether the country is an exporter or an importer, (ii) The time required to import a good has a negative and significant effect on exports (importers), (iii) The number of documents to export a commodity reduces exports significantly by 1%. We recommend reducing non-tariff trade costs, easing export and import documents, and dematerializing customs procedures to reduce the time needed to export a good.

Keywords: Trade facilitation, total non-tariff trade costs, bilateral trade flows, Gravity Model, PPML estimator.

¹United Nations Conference on Trade and Development

²Center for Prospective Studies and International Information

1. Introduction

Trade represents an indicator of competitiveness in the international market and reflects the policies of States to promote their exports. It is a catalytic instrument for all economic development and improves well-being (Dollar and Kraay, 2004; Baldwin et al., 2004; Winters et al., 2004). Consequently, the growth of trade is a strategic and essential tool in the different policies of countries. It thus depends on the capacity of a country to produce goods or services with a competitive quality-price ratio on external markets.

Indeed, according to Helpman and Razin (1978) in the strict sense, international trade concerns the purchase and sale of goods carried out between different economic territories. In the broad sense, it also includes international service transactions (transport, insurance, tourism, etc.). However, at the regional level, globalization often corresponds to a regionalization of trade. This can be explained both by the mechanisms described by the gravity method and by the accentuation of commercial regionalism in the 1990s (Beitone et al., 2019).

Indeed, according to the United Nations Conference on Trade and Development (UNCTAD, 2020), the level of trade with the rest of the world and that of intra-community trade remains low in Central Africa. The share of Central African exports in world exports remains limited compared to other regions of the continent. Very recently, UNCTAD (2022) released official statistics which reveal that bilateral trade is expected to reach 17.83% in 2023 (UNCTAD, 2022). According to the same source, there are quite a few disparities between the Regional Economic Communities in Africa (RECs). In 2020, the best performance is in SADC with intra-SADC (Southern Africa Development Community) trade at 20,010%, intra-EAC (East African Economic Community) trade at 18,558%, intra-CEN-SAD (Community of Sahelo-Saharan States) trade at 11,341%, intra-ECOWAS (Economic Community of West African States) trade at 11,278%, and intra-COMESA (Common Market of East and Southern Africa) trade at 9,401%. It is sad to note that intra-CEMAC (Economic and Monetary Community of Central Africa) trade is estimated at 3.059% in 2020 and 1.91% for intra-CEEAC (Economic Community of Central African States) trade.

Furthermore, several reasons are given to justify the low level of intra-African trade ranging from infrastructural deficiencies to the quality of institutions including the presence of tariff and non-tariff barriers (Mignamissi, 2020; Gandjon, 2017; Avom and Mignamissi, 2017; Bergstrand et al., 2015; UNCTAD, 2008).

According to the African Regional Integration Index (ARII), ECCAS is moderately integrated as it has an overall score of 0.442. It excels in macroeconomic integration, even though it performs poorly in terms of productive integration. The disparities between the Member States are considerable. However, the first observation is that eight of the eleven countries in this community have high scores, and two countries have satisfactory scores. If we excluded the last of the lot, namely Angola (score zero), the performance of ECCAS for this dimension would remain strong. It should be noted that no member country of this community is currently implementing any bilateral investment agreement, a sign of a stimulus for macroeconomic integration. For this reason, the macroeconomic integration of countries is only assessed based on the regional convertibility of their currencies and their inflation differential.

Therefore, to measure the degree of integration of each country and each region of Africa among its neighbors, the IIRA uses 16 indicators grouped into five dimensions (commercial integration ³, productive integration ⁴, integration macroeconomic ⁵, infrastructure integration ⁶ and free movement of people ⁷) (see graph 1).

Observation of Graph 1 brings out the following observations:

(i) The commercial integration of Africa shows that fast and efficient trade is good for business and consumers. Indeed, Africa has removed significant trade tariff barriers in recent years. Yet tariffs are only one aspect of trade barriers: non-tariff measures – sanitary and phytosanitary measures, variations in labeling laws, and rules of origin – can also undermine trade. ECCAS records an average score of 0.36 with Congo and Gabon occupying first (0.89) and second (0.50) places, respectively. The Democratic Republic of Congo ranks last with a score of 0.08. This is evidence of weak regional integration in ECCAS as a whole.

(ii) Regarding infrastructural integration, according to the 2018 edition of the AfDB Infrastructure Development Index, investments in infrastructure account for more than half of economic growth in recent years in Africa. This growth is mainly driven by improvements in information and communication

³The index also measures the state of regional integration on the continent as a whole.

⁴Producing products and services where countries have a comparative advantage allows nations to participate in regional and global value chains.

⁵The free movement and convertibility of capital stimulate investment and allow financing to be distributed where it will be most productive.

⁶Digital communications and land, air or sea connections directly affect the cost of transactions, prosperity and stability.

⁷The free movement of people across Africa promotes social ties and makes production more efficient.

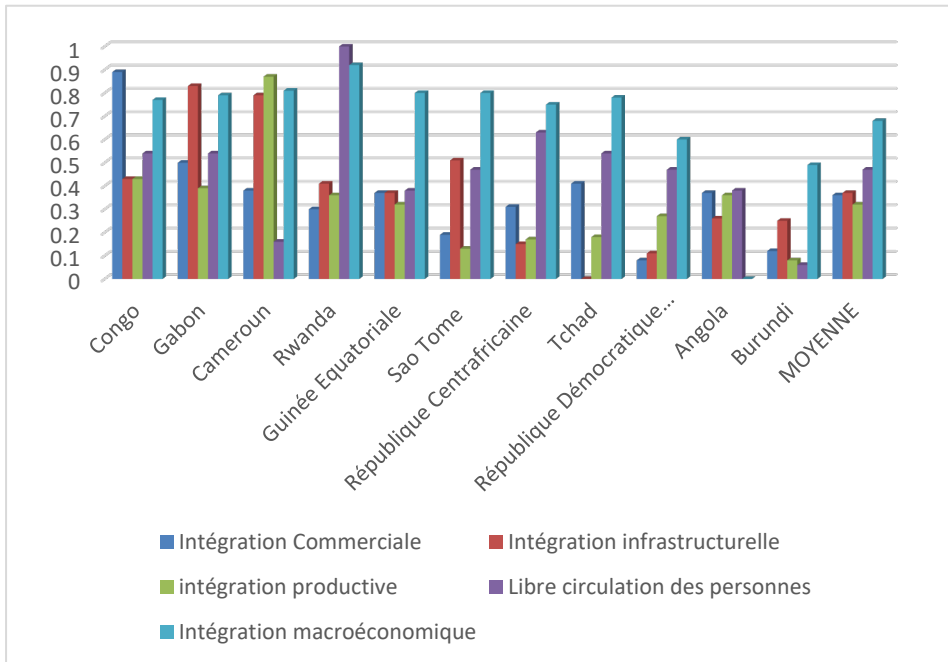
technologies. In this wake, to maintain optimal growth, it is necessary to develop infrastructure to facilitate not only internal connections but also intra-regional, even extra-regional ones. With an average score limited to 0.220; Africa is lagging in infrastructure integration. ECCAS comes with an average of 0.37 a little above the African average. We note the presence of Gabon and Cameroon in the first (0.83) and second (0.79) ranks. Chad for its part occupies the last place with 0 as an index.

(iii) On the side of productive integration, according to the IIRA, it is the weakest link in Africa in terms of regional integration. The continent's average score for this dimension is only 0.201, and the fact is that 33 countries have lower scores. ECCAS has a score of 0.32 on average and only Cameroon has a score above 0.5, i.e. 0.87. It is followed by Congo with 0.43.

(iv) Regarding the movement of people, the countries' scores are very disparate. Several countries have scores below 0.1 which are far below the African average, which statistics show at 0.441. This result reflects the obstacles that African nationals face when traveling, making it more difficult to conduct business, visit tourism, and not promote integration in general. Adherence to the (Kigali) Protocol on the Free Movement of Persons and greater visa openness will improve scores in this area by reducing transaction costs, increasing trade, and increasing production efficiency. The CEEAC has an average of 0.47 driven by the Central African Republic (0.54) and three countries that have a score of 0.54 (Congo, Cameroon, Chad).

(v) Finally, the continent's average score is moderate. The countries are very heterogeneous, with gaps close to 0.8 between the most integrated countries and those that are least integrated. This result is mainly due to the excessive level of inflation in certain countries. The adoption of coordinated and rigorous fiscal and monetary policies is a priority if the continent aspires to economic stability. A healthy economic climate will encourage increased cross-border investment and strengthen macroeconomic integration. ECCAS has an average lower than that of Africa, i.e. 0.68. Rwanda comes first with 0.92 followed by Cameroon 0.81. The last country here is Angola with a zero score.

Figure 1: Performance of ECCAS countries according to the five dimensions of regional integration.



Source: Authors

Regarding Non-Tariff Barriers (NTBs), TRALAC (Trade Law Centre) estimated that these barriers to intra-AfCFTA (African Continental Free Trade Area) trade were equivalent to 283% tariff equivalent. Between 2015 and 2019, average intra-African non-tariff trade costs decreased slightly by 3% (CAGR). Thus, it seems judicious to postulate that the growth of bilateral trade could involve the implementation of trade facilitation measures (Sakya et al., 2018). Without, however, neglecting the production structure of the ECCAS countries which is based on cash crops (the majority being food crops), these countries have similar and extroverted eating habits.

However, trade barriers significantly increase trade costs for businesses, erode the competitiveness of the region's goods and services, hamper exports, and ultimately stifle prosperity. Thus, to achieve increased trade, it is necessary to put in place 4 types of improvements for trade growth: (i) *sustainable improvement in the efficiency and capacity of transport infrastructure*; (ii) *improvement of trade standards and reduction of non-tariff barriers*; (iii) *efficient*

*trade systems and procedures; (vi) improving the regulatory environment for trade*⁸.

In addition to tariff barriers, it is also important to identify non-tariff barriers (NTBs). These NTBs are reported by traders to be very high, representing a serious challenge for trade and regional integration. These are not easily detectable due to the rare use of surveys to assess the level of trade barriers in the region and the very limited adoption by traders of currently available mechanisms for identifying and reporting these obstacles.

One way to limit these obstacles to intra-African trade is trade facilitation. Trade facilitation affects trade through several non-exhaustive channels, but which can be summed up in the reduction of costs through prices. Reducing the complexity of exporting between African countries (Clarke, 2005), increasing customs duties, reducing long transport times (Freund and Rocha, 2011) and reducing customs fraud (UNCTAD, 2014). In short, there is a wide range of factors from geography to information frictions to policies that contribute more to trade costs than tariffs that influence trade costs (Anderson and Van Wincoop, 2004). Thus, according to the WTO, facilitating factors have an impact on the export performance of goods through the cost channel.

According to Portugal-Perez and Wilson (2012), in the strict sense, trade facilitation is associated with the reduction of border transaction costs other than tariff reductions, which essentially involves the simplification and standardization of customs formalities and administrative procedures related to international trade. Current WTO negotiations on trade facilitation are mainly linked to this dimension of border (or customs) facilitation. In a broader sense, trade facilitation includes not only issues at the border, but also issues beyond the border, such as the trading environment, quality of infrastructure, transparency and national regulations.

To do this, two different and complementary data sets are used to provide a complete picture of trade costs. Firstly, we have the trade across border indicators taken from Doing Business. Secondly, we have the bilateral estimates of trade costs established from the database on trade costs of the Economic and Social Commission for Africa and the Pacific (ESCAP) and the World Bank. ECCAS planned in 2016 to establish a regional common market in Central Africa, with the aim of strengthening capacities for the development of intra- and inter-regional trade. In addition, in the same vein, the ECCAS countries sign an institutional support project for the implementation of the WTO Trade Facilitation Agreement (PAI-AFE).

⁸ tralac.org

The overall objective of this project was to strengthen regional integration through actions aimed at stimulating trade and competitiveness in order to contribute to inclusive economic growth in ECCAS member countries. It also had the impact of increasing inter-regional trade within ECCAS, which should increase from 2% of total trade in 2016 to 3% in 2018. Indeed, whether at the individual level of states or at the global level, tariff and non-tariff trade costs have significant economic consequences. According to Jacquemot (2017), the complexity of border procedures, combined with administrative formalities and the existence of abnormal practices, increases transaction costs which are passed on to producers and consumers. Trade facilitation measures help to stimulate exports, thereby increasing the participation of companies in global value chains. Sixteen (16) trade facilitation indicators have been established by the WTO, including the availability of information in the field of trade, the simplification and harmonization of documents, and the rationalization and automation of procedures. The indicators assess the impact of measures specifically targeting trade barriers and certain border procedures in a majority of countries, while helping governments prioritize trade facilitation measures.

This article is particularly motivated by four reasons. First, we enrich the empirical literature dealing with structural issues of trade facilitation measures on trade. Next, we measure the effects of traditional trade facilitation indicators; Also, we consider total non-tariff trade costs, finally, we estimate a gravity model by the two-step model (Martinez Zarzoso and Chelala, 2020) and the Poisson Pseudo Maximum Likelihood (PPMV) estimator in robustness.

After having made this presentation of the ECCAS, and its economic and structural, geographical, infrastructural, and technological constraints, it is logical to see the objective of our research emerge: this study analyzes the effects of trade facilitation on intra-ECCAS trade flows for the period 2006 to 2015. Theoretically, the integration of bilateral non-tariff trade costs is crucial. These costs are estimated at (-356%) ad valorem equivalent for products manufactured in Chad and (-170%) in the DRC; at 487% in Sao Tome and Principe for agricultural products.

The rest of the paper is organized as follows. The following section provides a brief critical review of the theoretical and empirical literature on trade facilitation measures. The methodology used is explained and discussed, the data and the different sources, and the results in Section 3. In the fourth section, we present the conclusion.

2. Literature Review

This section provides a synthetic discussion on one hand on the theoretical level and the other hand on the empirical level of all the works that have paid attention to the impact of trade facilitation measures on the trade.

Review of theoretical literature between trade facilitation and trade

Theoretically, the analysis of international trade following the effects approach is done by both traditional and modern theories. The first considers that international trade is a source of well-being thanks to the existence of comparative advantages developed by Ricardo (1817) and thanks to the existence of factor endowments developed by Heckscher (1919), Ohlin (1933), and Samuelson (1947). The second extends the analysis of international trade by relying on the hypothesis of increasing returns to scale with the new geographical economics of Krugman (1979) and on the existence of intermediate goods and intra-industrial competitiveness with the “new” theory of international trade developed by Melitz (2003).

Specifically, the influence of trade facilitation measures on trade. It has been demonstrated in certain studies (Santos-Paulino, 2002; Wilson et al., 2003; Chris Milner et al 2005; Portugal-Perez and Wilson, 2009; Freund and Rocha, 2011; Seck, 2017). The complexity of exporting between African countries discussed by Clarke (2005) would not mean that trade facilitation should not increase trade flows between African countries due to similar comparative advantages or supply structures. However, as Afesorgbor (2017) pointed out based on the new trade theory developed by Krugman (1979), African countries can trade with each other in the form of intra-industrial trade including single manufactured products or varieties of agricultural products. The evaluation of non-tariff trade costs therefore appears justified in our study on both agricultural and manufacturing products which are incorporated into the total non-tariff trade costs. Trade facilitation is therefore essential (Iwanow and Kirkpatrick, 2007; Dennis and Shepherd, 2011; Portugal-Perez and Wilson, 2012).

Several factors are singled out to explain the ineffectiveness of trade facilitation and have become the main possible causes of Africa's inability to benefit from the trade opportunities presented by globalization. We can cite (i) unjustified customs delays, (ii) poor administration; (iii) an insufficient/inefficient transport and telecommunications system; (vi) excessive documentation and bureaucratic procedural activities; (v) inadequate coordination between government and agencies, and corruption

(Djankov et al., 2006; Buyonge and Kireeva, 2008; UNCTAD, 2008; Teravaninthorn and Raballand, 2009; Portugal-Perez and Wilson, 2012; UNECA, 2013; Berger, 2016; Sakyi et al., 2018). These factors are disproportionately high.

Review of empirical literature between trade facilitation and trade

On an empirical level, we identify here a few studies that have tried to quantify the effects of trade facilitation using a gravity model (Coulibaly and Fontagné, 2005; Tomaz Iwanow and Colin Kirk, 2007; Bouet et al., 2008; Freund and Rocha, 2011; OECD, 2012b; Portugal-Perez and Wilson, 2012; Hufbauer and Schott, 2013).

Several studies have attempted to use econometric methods to quantify the effects of trade facilitation on trade flows in Africa such as Njinkeu et al. (2008), Portugal-Perez and Wilson (2009), and Seck (2017). More specifically, Njinkeu et al. (2008) considered 25 African countries in their sample for the years 2003-2004 and concluded that improvements in port efficiency, service infrastructure, and regional trade agreements have positive effects on trade flows. Similarly, Portugal-Perez and Wilson (2009) used a dataset covering 104 importers and 115 exporters (including samples from 22 African countries) for the year 2006 and concluded that reducing trade costs has an effect more important on trade flows than the reduction of customs duties. Additionally, Seck (2017) used 2-year data for 2007 and 2012 for 41 sub-Saharan African countries and concluded that improving road infrastructure and international shipping and logistics skills are important trade facilitation measures that can generate export gains for the region.⁹

Indicatively, all those who work on international trade using gravitational models like Leamer and Levinsohn (1995) believe that they give robust results of the determinants of international trade. And even though gravity models are also used in the analysis of other phenomena (migration, space economy, FDI, etc.), the greatest concentration of work and publications is certainly in trade (Shepherd, 2021). Furthermore, most appropriate applications of the gravity model focus on observable variables which are determinants of bilateral trade costs because the observable unit is a pair of countries (exporter/importer) and therefore it is easy to distinguish three (3) groups of factors that can influence bilateral trade. It is first export-specific factors (push) such as the level of technology in production; Next import-specific factors (*pull*) such as

⁹Seck (2017) recognized the limitation of not capturing the heterogeneity associated with trade flows and trade facilitation measures using only two sample years.

market size and finally country pair-specific factors (drag) such as geographic distance.

Anderson and Van Wincoop (2004) provide an overview of the concept of trade costs consistent with the constraints on the growth of bilateral trade. Finally, to justify the use of the gravity model in our study, we will refer to the theory. The latter reflects the fact that this gravity model relates overall trade costs and bilateral trade. But it leaves great freedom in terms of research on all the observable variables that it wishes to use, and which empirically determine the costs of trade. Without, however, refuting the work of Timbergen (1962), Anderson and van Wincoop (2003), based on the work of Anderson et al., (2018); Allen et al., (2014); Head & Mayer (2014) and Eaton & Kortum (2002) to establish the general framework of our structural gravity modeling to analyze the effects of trade facilitation on the progress of bilateral trade in the ECCAS.

Indeed, as already mentioned above, the contribution of this study can also be summarized in three main points. Firstly, to our knowledge, studies on trade facilitation in the ECCAS are almost non-existent since all the studies are limited to researching the determinants of the weakness of trade in Central Africa. Secondly, we are in the era of the implementation of the African Continental Free Trade Area (AfCAF) agreement; a study on the role of considering intra-group facilitation measures is necessary because it shows that the conclusions are for East Africa are not for example for Central Africa whose colonial past and eating habits are not similar.

Alternatively, Coulibaly and Fontagné (2005) carried out a study on the WAEMU (West African Economic and Monetary Union) countries using a gravity model according to Armington. The study shows that there is untapped potential for South-South trade. If all interstate roads were paved, countries would see 2.87 times more trade than currently. Thus, there is great potential for road surfacing projects. The results show that transport distances constitute an additional obstacle to trade (resulting in additional trade costs of 6% of the total cost of trade), hence the importance of the geography of transit countries.

Iwanow and Kirk (2007) used the gravity model. The model estimation was done on a panel of 78 countries over 5 years from 2000 to 2004. They first estimated the probability that a pair of countries would trade. From their analysis, it emerges that: *(i)* Distance and remoteness from the rest of the world have a negative influence on trade flows ; *(ii)* Language and colonial heritage continue to play a significant and determining role in the bilateral partnership ; *(iii)* Trade facilitation (FE) is the determining cause of international trade, thus confirming the hypothesis that a better environment in terms of trade

facilitation significantly improves bilateral trade flows ; (iv) Improvements in the procedural and customs environment increase trade flows. An increase in the infrastructure index would increase bilateral exports by almost 8%, and similar trade improvements from facilitation would yield an increase in exports of around 5%.

Bouet et al. (2008) on a study in Africa (45 countries) during the period 1998-2004 using a semi-parametric gravity model. Based on Heckman's method, find that Africa exports low-value-added products and imports high-value-added products into the market. Transport and communication infrastructures tend to slow down trade in Africa. Regarding infrastructure, the results show that, for poor African countries like Congo, Mauritius, and Chad, an improvement in telephone density of 1% would lead to an increase in exports of more than 0.35%. The marginal impact of road density on trade in Sudan is 0.7. The low quality of trade-related infrastructure in Africa suggests that any improvement could have significant benefits.

Freund and Rocha (2011) show that across 44 SSA countries using the gravity model, transit delays reduce exports (economically and statistically). Reducing the travel time within the country to reach the port by one day would lead to an increase in exports of 7%. The 1% reduction in transit delays translates into an improvement in trade of around 1.5%.

According to an OECD analysis (2012b) carried out on 107 countries (including 37 African countries) using a gravity model, it was noted that trade facilitation has a positive impact on trade flows, the different measures having a quantitatively different effect. If all trade indicators, corresponding to the main strategic areas under negotiation at the WTO, are added to the same regression, their cost reduction potential is expected to reach almost 12% of trade costs for low-income countries.

The calculations of Hufbauer and Schott (2013) use the estimates of Portugal-Perez and Wilson (2012). Using a gravity model, Portugal-Perez and Wilson conclude that trade facilitation reforms improve the export performance of developing countries. However, they do not provide an estimate of the increase in trade resulting from these reforms. Instead, they calculate that liberalization of ad valorem tariffs would result in the same increase in trade as trade facilitation.

3. Empirical Analysis

Data and sources

Bilateral export data comes from UNCTAD from 2006-2015. Data on the variable total non-tariff trade costs is taken from the World Bank's 2020 ESCAP trade costs database. Trade facilitation indicators such as the time taken to export a good (deadline) and the many export documents are taken from the World Bank's Doing Business (2020). In addition to the classic variables of the augmented gravity model downloaded in the WDI (real GDP, population), in the CEPII database (distance, border, language, colonization). Dichotomous variables were also introduced which take the value of 1 if the exporting (importing) country is a member of the same monetary union or the Great Lakes Community.

Appendix Table A1 summarizes the variables used in the empirical analysis, including names, definitions, and sources. Table 1 contains a summary of the main statistics for the variables used in the empirical study.

Table 1: Descriptive statistics

Variables _	Variable names	Obs	Mean	Std. Dev.	Min	Max
Ln_Exp _{ij}	Logarithm of bilateral exports	900	4.3	4,368	0	13,275
Lpib_exp _i	Logarithm of GDP of the exporting country	900	3.503	.544	2,745	4,589
Lpib_imp _j	Logarithm of GDP of the importing country	900	3.503	.544	2,745	4,589
Lpop_exp _i	Logarithm of the population of the exporting country	900	3,727	.717	2.209	4,882
Lpop_imp _j	Logarithm of the population of the importing country	900	3,727	.717	2.209	4,882
Ldist _{ij}	Logarithm of bilateral distance	900	6,954	.862	2,349	7,842
Lang _{ij}	Common language between countries i and j	900	.267	.442	0	1
Front _{ij}	Common border between countries i and j	900	.489	.5	0	1
Comcol _{ij}	Common colonizer between countries i and j	900	.256	.436	0	1
Comcur _{ij}	Common currency between countries i and j	900	.467	.499	0	1
Larea_exp _i	Logarithm of the area of the exporting country	900	12,159	2,272	6,867	14,634
Larea_imp _j	Logarithm of the area of the importing country	900	12,159	2,272	6,867	14,634
Landlocked_exp _i	Landlockedness of the exporting country	900	.7	.459	0	1
Landlocked_imp _j	Landlockedness of the importing country	900	.7	.459	0	1
CEPGL_exp _i	Exporter member of the Economic Community of the Great Lakes Countries	900	.2	.4	0	1
CEPGL_imp _j	Importer member of the Economic Community of the Great Lakes Countries	900	.2	.4	0	1
CCNTT _{ij}	Commercial Costs Non-Tariff Total	900	122.86	166,763	0	752,644
Del_exp _i	Deadlines for exporting goods	900	35,257	23,456	0	78

Del_imp _j	Deadlines for importing goods	900	43.86	17.97	19	78
Doc_exp _i	Number of documents for exporting goods.	900	7.13	3,877	0	11
Doc_imp _j	Number of documents for importing goods.	900	7.13	3,877	0	11

Source: Authors: Variable definitions can be found in Table A1.

Empirical model and methodology

The gravity model has been widely used to predict bilateral trade flows between countries over the past decades and is the gold standard model for international trade analysis (Feenstra, 2004). It is a structural model with solid theoretical foundations (Allen, Arkolakis, & Takahashi, 2014; Anderson, Larch & Yotov, 2018; Anderson & Van Wincoop, 2003; Eaton & Kortum, 2002; Head & Mayer, 2014; Martinez- Zarzoso & Chelala, 2020). It is particularly suitable for estimating the effects of trade policies and the magnitude of trade costs that are associated with distance and trade facilitation. Two of the most valued properties of the gravity model are its structure, which can flexibly adapt to factors that affect trade, and its predictive power for overall trade flows. Therefore, we used it in this study to estimate the effects of total non-tariff trade costs and trade facilitation measures on bilateral trade flows.

When applied to trade, the gravity model predicts that bilateral exports between two countries are directly proportional to the product of their economic 'mass' and inversely proportional to the costs of trade (distance) between them. In its original form, the gravity model is as follows:

$$X_{ijt} = \frac{Y_{it}Y_{jt}}{Y_t^W} \left(\frac{t_{ijt}}{P_{it}P_{jt}} \right)^{1-\sigma} \quad (1)$$

X_{ijt} are the exports of country i to country j in period t in current US dollars and Y_{it} (Y_{jt}) is the GDP of the exporter (importer) in period t and Y_t^W denotes world GDP. T_{ijt} is the cost of trade between i and j in period t and P_{it} are P_{jt} price indices that reflect the multilateral trade resistance of the exporter and importer, respectively. Using natural logarithms, the model is given by:

$$\ln X_{ijkt} = \ln Y_{it} + \ln Y_{jt} - \ln Y_t^W + (1 - \sigma) \ln t_{ijt} - (1 - \sigma) \ln P_{it} - (1 - \sigma) \ln P_{jt} \quad (2)$$

In model (2), we assume that trade costs are a linear function of the distance between trading countries and a series of factors that facilitate trade such as speaking a common language (Langij), sharing a border (frontij), having colonial ties (Comcolij), and members of monetary unions (Comcurij) or the economic community of Great Lakes countries (CEPGL). The linear model to estimate is:

$$\begin{aligned} \ln(X_{ijkt}) = & \beta_0 + \beta_1 \ln Y_{it} + \beta_2 \ln Y_{jt} + \beta_3 \ln dist_{ij} + \beta_4 Landl_i + \\ & \beta_5 Landl_j + \beta_6 \ln Area_i + \beta_7 \ln Area_j + \beta_8 Front_{ij} + \beta_9 Lang_{ij} + \\ & \beta_{10} Comcol_{ij} + \beta_{11} CEPGL_{ij} + \beta_{12} Comcur_{ijt} + \beta_{13} CCNTT_{it} + \\ & \beta_{14} CCNTT_{jt} + \beta_{15} Delai_{it} + \beta_{16} Delai_{jt} + \beta_{17} Doc_{it} + \beta_{18} Doc_{jt} + \\ & u_{jt} \end{aligned} \quad (3)$$

Where, in addition to the variables described above, *Landl* indicates the country does not have access to the sea, *Area* designates the surface area of the country *i(j)* in square kilometers, and *CCNTT_{i(j)t}* indicates *i* or *ja* costs in period *t*, *Delay it* and *Delay jt* (in days), and *Document it* and *Document jt* (number) for all countries in period *t*.

The rapid and continued development of new model estimation techniques, based on theoretical advances, has resulted in a series of practical recommendations well documented in Head and Mayer (2014) and more recently in Larch et al. (2016) and Piermartini and Yotov (2016). More precisely, the factors that represent bilateral costs can be replaced by bilateral fixed effects (*ij*). Fixed effects that vary with exporter time (*it*) and importer time (*jt*) are included as a proxy for multilateral resistance so that variables such as GDP, variables facilitation, and non-tariff trade costs cannot be directly identified.¹⁰ Furthermore, to identify the effects of variables that vary by country and over time, such as total non-tariff trade costs, the time needed to export goods, and the number of export documents, two steps are estimated. In the first step, country-time effects are estimated from the following gravitational model:

$$\ln X_{ijt} = \delta_{ij} + \tau_{it} + \varphi_{jt} + \beta_1 TP_{ijt} + \varepsilon_{ijt} \quad (4)$$

Where fixed (bilateral) effects associated with trade δ_{ij} , represent the time-invariant characteristics of the trade relationship between *i* and *j* and are included to avoid biases due to unobservable, time-invariant bilateral factors that affect trade. Since the influence of bilateral and time-invariant variables, such as geographic distance, a common language, or a common border, is absorbed by bilateral fixed effects, it is impossible to directly estimate the coefficients of these factors. TP_{ijt} represents time-varying bilateral factors, such as being a member of a monetary union or the Community of Great Lakes Countries (CEPGL)¹¹. Finally, ε_{ijt} is the error term and is assumed to be identically and independently distributed.

The exporter (τ_{it}) and importer (φ_{jt}) time fixed effects all represent trade barriers that are country-specific and vary over time. Multilateral outward and inward resistance must be mastered, that is to say the obstacles to trade of third countries which affect trade costs.

¹⁰The direct effect on exports that changes across countries and over time is subsumed into the exporter-time and importer-time fixed effects.

¹¹The list of countries is listed in Appendix Table A3.

The time-exporter and time-importer fixed effects were extracted from model (4)¹² and are used as dependent variables in the second step. The following model was estimated for the export time fixed effects in the second stage:

$$\ln\widehat{\tau}_{ij} = \gamma_i + \alpha_1 \ln Y_{it} + \alpha_2 \ln Pop_{it} + \alpha_3 CEPL_i + \alpha_4 CCNTT_{ijt} + \alpha_5 Del_{it} + \alpha_6 Doc_{it} + \alpha_7 Landl_i + \alpha_8 \ln Area_i + \alpha_9 \sum_j w D_{ij} + n_{it} \quad (5)$$

A similar model was estimated for importing countries (j) for time-importer fixed effects (φ_{it}). If we consider factors such as institutions or cultural factors that vary slowly, the estimation includes unobservable country effects (fixed or random effects). Y_{it} indicates the GDP of the exporter. Pop refers to population, and *CEPL* is a dummy variable that takes the value 1 if the exporting country is a member of *CEPL* and 0 otherwise. Total non-tariff trade costs (CCNTT) and time taken to export (*del_exp*) and number of export documents (*doc_exp*).

Other variables that do not vary over time were introduced into the model estimated using random effects, such as the fact that the country does not have access to the sea (*Landl*), the natural logarithm of the surface area in square kilometers (Area), the weighted average of the distance between it and all these partners (included in D_{ij}) and measures of cultural similarities (D_{ij}): with how many partners does it share a linguistic, border or colonial relationship.

Main results

The gravity model for exports among the 10¹³ ECCAS countries was estimated with annual data for 2006 - 2015.

Table 2: Gravity model estimation result

VARIABLES	(1)	(2)	(3)	(4)
	lnX_EFT	lnX_EFCT	lnX_EFBET	lnX_EFBCET
CCNTT _{ijt}	-0.00073*** (0.000134)	-0.00065*** (0.000143)	-0.00085*** (0.000131)	
lnDel_exp _{it}	-0.0696 (0.0753)	-0.0294 (0.0554)	-0.0351 (0.0573)	

¹²Model (4) was also estimated using the Poisson pseudo-maximum likelihood (PPML) method, with different levels of exports, where zeros are included in the dependent variable and the method is robust to heteroskedasticity in the residuals. The model specification is as follows:

$$X_{ijt} = EXP[\delta_{ij} + \tau_{it} + \varphi_{jt} + \beta_1 TP_{ijt}] \varepsilon_{ijt}$$

¹³ The sample countries are listed in Appendix Table A2 and A4.

lnDel_exp _{jt}	-0.0894 (0.0784)	-0.262*** (0.0689)	-0.197*** (0.0723)	
lnDoc_exp _{it}	-0.0958 (0.0944)	-0.00318 (0.0798)	0.0313 (0.0847)	
lnDoc_exp _{jt}	0.151 (0.0932)	0.106** (0.0430)	0.0573 (0.0477)	
Comcur _{ijt}	0.0793 (0.0610)	0.0165 (0.0472)	0.185*** (0.0468)	0.371*** (0.0438)
CEPGL_exp _{it}	-0.197** (0.0768)	-0.102 (0.0648)	-0.0769 (0.0593)	-0.0260 (0.0457)
CEPGL_imp _{jt}	-0.0102 (0.0912)	-0.0672 (0.0514)	-0.0613 (0.0533)	-0.174*** (0.0560)
lnPIB _{it}	0.0391 (0.0557)	0.240*** (0.0437)	0.172*** (0.0377)	
lnPIB _{jt}	0.184*** (0.0634)	0.413*** (0.0547)	0.377*** (0.0528)	
lnPOP _{it}	0.0403 (0.0613)	0.143*** (0.0364)	0.114*** (0.0407)	
lnPOP _{jt}	0.290*** (0.0581)	0.332*** (0.0442)	0.356*** (0.0466)	
lnDIST _{ij}	-0.00376 (0.0125)	-0.0727*** (0.0141)		
Front _{ij}	0.180*** (0.0412)	0.102** (0.0500)		
Lang _{ij}	0.656*** (0.127)	0.852*** (0.0956)		
Comcolij	-0.400*** (0.142)	-0.666*** (0.0941)		
IAREA _i	0.136*** (0.0521)			
IAREA _j	-0.0296			

	(0.0417)			
Landlocked _i	0.341***			
	(0.0600)			
Landlocked _j	0.379***			
	(0.0694)			
Constant	-0.919	-0.474	-0.740	1,779***
	(0.668)	(0.564)	(0.568)	(0.0427)
Time fixed effects (LEF)	Yes	Yes	Yes	
Observations	532	532	532	532
R ² adjusted	0.705	0.628	0.545	0.205
Number of countries	10	10	10	10

Source: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. EFT=time fixed effects; EFCT= temporal export fixed effects; EFBCECT denotes bilateral, time-exporting fixed effects. A description of the variables is given in Table A2.

First, Table 2 presents the results obtained for the traditional gravity model estimated with the dependent variable in logarithm, to compare it with the two-stage model which is the preferred option. Column (1) includes the country variables (income and population of the exporting country), and the bilateral variables (common language, common border, colonial ties etc.) which are introduced as control variables each having a role depending on trade bilateral according to specification (3).

Indeed, the first column shows that the first variable of interest which brings together total non-tariff commercial costs has a negative and statistically significant coefficient of 1%. These costs incorporate both agricultural and manufacturing non-tariff trade costs. The low coefficient of this variable is because these countries trade very little with each other. These costs reduce exports by 0.07%. Trade facilitation indicators such as the time needed to export or import a good (deadline) and the number of documents to export or import a good are overall negative and significant at 1%, thus reducing the speed of trade flows. Time is an important factor in trade costs. It is important to reduce these costs to obtain results in the sense of Njinkeu et al. (2008). They concluded that improvements in port efficiency, service infrastructure and regional trade agreements have positive effects on trade flows.

Subsequently, in relation to delivery times, these results show that the time which elapses between the placing of an order and the delivery of the ordered

goods is an obstacle to the development of trade in the ECCAS. It should also be noted that the delivery time depends on the nature and number of products. On this subject, Avom and Mignamissi (2017) postulate that the low level of trade integration in ECCAS can also be perceived by the number of products traded between member countries. Finally, ECCAS must have a good policy for forecasting and supply chain management, logistics services, and, of course, distance from customers and suppliers. However, ECCAS countries should establish mutual recognition of norms and standards from one country to another. Since it has the advantage of being a much lighter means than the harmonization of regulations at the international level. There, mutual recognition is undoubtedly the only way to remove obstacles and regulations to trade within a reasonable time (Gozlan and Marette, 2000; Mazé *et al.*, 1996). The coefficient that was estimated for geographic distance is negative and significant around 1, indicating that a 1% increase in distance reduces exports by approximately 0.05%. This result is similar to that of Coulibaly and Fontagné (2005) for whom transport distances constitute an additional obstacle to trade (resulting in additional trade costs), hence the importance of the geography of transit countries. The dummy variables of sharing a common border and language facilitate exchanges, which is consistent with the conclusions of the studies of Anderson and Van Wincoop (2004), Brenton *et al.* (2010), Shah *et al.*, (2023) which show that these variables have a positive effect on bilateral trade.

The second column shows the results that were obtained after including exporter and importer fixed effects in the model to control for multilateral resistance which does not vary over time. We can observe that the effect of total non-tariff trade costs is negative and significant and remains at its level of 1%, thereby reducing trade flows. The number of documents and export deadlines are obstacles to trade in ECCAS. Because the coefficient of the time required to export is negative and significant at 1%, the coefficient of the number of export documents is also negative and significant at 1%. This result confirms the conclusions of Iwanow and Kirk (2007).

Indeed, improvements in the customs procedure environment have a positive impact on trade flows. The results obtained in column (3), which was estimated with bilateral fixed effects, present a negative significance first of the variable total non-tariff commercial costs (CCNTTij) at 1%, then, of the coefficient of the delay variable at the export of 1%. Finally, column (4) shows the results when both fixed effects are included simultaneously, as specified in equation 4: origin time, destination time, and two-sided fixed effects. The first two groups of fixed effects were extracted from this model and are used in the second step of the estimation of model (5) in the next section.

Table 3 shows the results obtained from the estimation of Model (5) for exporters with random effects in the first column and with country-fixed effects in the second. In this table, “first log log” is the estimate after recording the RML by the OLS method with HDFE, i.e. reghdfe (high-dimensional fixed effects).

Table 3: Multilateral resistance and export: Results of the second stage (first Log. Log)

	(1)	(2)	(3)	(4)
Var. Dep: RML from the first step	Exporter	Exporter	Importer	Importer
	FE2_2RE	FE1_2FE	FE2_2RE	FE1_2FE
Var. Independent				
CCNTT _{ijt}	-0.022*** (0.002)	-0.015*** (0.002)	-0.108*** (0.010)	-0.084*** (0.008)
lnDel_exp _{it}	-0.342*** (0.022)	-0.196*** (0.032)		
lnDel_imp _{jt}			-0.314*** (0.076)	-0.049** (0.022)
lnDoc_exp _{it}	-5.838 (4.378)	-3.275*** (0.892)		
lnDoc_imp _{jt}			-0.381*** (0.030)	-0.007 (0.065)
lnPIB _{it}	1,372 (1,058)	-1.169 (2.254)		
lnPIB _{jt}			-0.003 (0.148)	0.083 (0.062)
lnPOP _{it}	-8.921 (7,644)	10,724 (7,657)		
lnPOP _{jt}			-0.077 (0.149)	-0.089** (0.037)
IAREA _i	-			

IAREA _j			0.140	
			(0.142)	
Landlocked _i	-		0.012	
			(0.093)	
CEPGL _{exp it}	-		-0.135	
			(0.154)	
lnDIST _{ij}	-0.008		-0.027*	
	(0.011)		(0.014)	
Front _{ij}	0.045		0.134	
	(0.025)		(0.086)	
Lang _{ij}	0.004		-0.114*	
	(0.060)		(0.059)	
Comcol _{ij}	-0.047		0.009	
	(0.064)		(0.113)	
Time fixed effects (LEF)	Yes	Yes	Yes	
Observations	429	429	429	429
Number of IDs	10	10	10	10
R ² within		0.153		0.076

Source: Authors

Robust standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Note: FE1_2RE and FE2_2RE respectively designate the first and second random effect; FE1_2FE and FE2_2FE designate the first and second fixed effect respectively.

Columns (1) and (2) give us the results for exporting countries. The first variable of interest which constitutes total non-tariff trade costs is overall negative and significant at 1%, whether the country is an exporter (a drop of 0.01%) or an importer (a drop of 0.08%), which corroborates the conclusion of Sakyi et al. (2018) according to whom the average costs of intra-African non-tariff trade have slightly decreased by 3% (CAGR). The time required to export a commodity is negative and significant on exports at 1% (a decrease of 0.19%) and on the importer side at 5% (a decrease of 0.04%). The number of

documents for exporting a commodity is negative and significant at 1% for exporting countries and a negative and insignificant sign on the importer side. Indeed, whether it is the number of documents for exporting or importing a commodity or the delays in importing or exporting a commodity, they remain negative and significant at 1% in exporting countries. They thus hinder the development of trade in the ECCAS. Thus, the documents variable assumes that the contract between the two parties is signed and counts the number of documents to be completed from this step. This includes customs declarations, documents to be completed at the port of arrival, and import licenses (Pamina Koenig, 2010). As we have just recalled, all these elements have a negative impact on bilateral trade in the ECCAS. Subsequently, we present Table 4 estimated with the PPML.

Table 4: Multilateral resistance and export: Results of the second stage (first PPML)

	(1)	(2)	(3)	(4)
Var. Dep: RML from the first step	Exporter	Exporter	Importer	Importer
	FE1_2FE	FE1_2RE	FE2_2FE	FE2_2RE
Var. Dep				
CCNTT _{ijt}	-0.0009** (0.000)	-0.0008** (0.000)	-0.0004** (0.000)	-0.0003** (0.000)
lnDel _{exp it}	-0.174 (0.170)	-0.174 (0.171)		
lnDel _{imp it}			-0.078*** (0.021)	-0.140*** (0.041)
lnDoc _{exp it}	-0.841** (0.313)	-0.840** (0.313)		
lnDoc _{imp it}			-0.010 (0.014)	-0.025 (0.032)
lnPIB _{it}	-0.174 (0.163)	-0.174 (0.164)		
lnPIB _{jt}			0.070*** (0.020)	0.030 (0.018)

lnPOP_it	1.403 (1.322)	1,395 (1,320)		
lnPOP_jt			0.026* (0.012)	0.042 (0.031)
IAREA_i		-		-0.022 (0.022)
landlockedi		-		0.033** (0.014)
lnDISTij		-0.000 (0.001)		-0.002 (0.007)
Frontij		0.003 (0.004)		-0.007 (0.018)
Langij		0.001 (0.002)		-0.050* (0.025)
comcolij		-0.005 (0.003)		0.035 (0.020)
Constant	-6.489 (4,879)	-6.471 (4,878)	-1.091*** (0.287)	-1.085*** (0.269)
Time fixed effects (LEF)				
Observations	429	429	429	429
R ² within		0.292		0.173
Number of IDs	10	10	10	10

Robust standard errors in parentheses

***p<0.01, **p<0.05, *p<0.1

Robustness check

As robustness checks, we estimated different versions of the gravity model using the PPMV technique, as proposed in the related literature (Head & Mayer, 2014; Larch et al., 2016; Martinez-Zarzoso & Chelala, 2020). Overall, the first stage estimates were presented in the appendix (Table A6). The results for our variables of interest indicate that the coefficients of variables such as total non-tariff trade costs, the time needed to export goods, and the number of

export documents are negative and statistically significant in the first column of Table A5 when only time-fixed effects are considered.

However, the introduction of exporter and importer fixed effects or even fixed effects makes the coefficients not statistically significant for the documents and deadlines variable (column 2). Thus, when the model is estimated in two stages, the results obtained for the second stage, reported in Table 4, also suggest that total non-tariff trade costs, time required to export, and the number of export documents reduce exports. The result obtained is consistent with the work of the authors (Nordas, 2006; Freud and Rocha, 2010) who showed that the increase in the delay in trade negatively influences the supply of countries. The effect of introducing total non-tariff trade costs indicates that exports decrease by 0.3%; time reduces exports by 4% and imports by 7.4%. This corroborates the results found by Hummels and Schauer (2013). Finally, as before, the number of documents remains a barrier to exports in the ECCAS.

4. Conclusion

The objective of this project is to analyze the effects of the implementation of trade facilitation indicators on bilateral flows. Based on the idea that the implementation of facilitation measures has a positive effect on bilateral trade; thus, we estimated a gravity model by the two-step model following Martinez Zarzoso and Chelala (2020) and the Poisson Pseudo Maximum Likelihood (PPML) estimator in robustness. The results reveal that the time required to export or import a commodity is negative and significant. The latter reduces the frequency of flows in CEEAC. The number of documents for exporting or importing a commodity is negative and significant at 1% for exporting (importing) countries. Total non-tariff trade costs (CCNTTij) have a negative and significant sign. These variables are obstacles to the development of trade in ECCAS which already suffers from the lack of transport and communication infrastructure which are essential for the proper functioning of trade. However, our results are consistent with other similar studies in the literature, as they go in-depth into the nature of trade facilitation measures by emphasizing total non-tariff trade costs. Thus, trade facilitation is essential (Iwanow and Kirkpatrick, 2007; Dennis and Shepherd, 2011; Portugal-Perez and Wilson, 2012).

Given that ECCAS countries are rentier countries, as an economic policy implication, the following measures could be considered to increase intra-ECCAS trade. (i) reduce total non-tariff trade costs to encourage agricultural production and its processing as a substitute for imports in these two sectors,

which could increase the consumption of local products and stimulate exports from the sub-region. (ii) develop transport and communication infrastructure to enable fluidity of trade. (iii) dematerialization of customs procedures to reduce the time needed to export a good.

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Appendices

Table A1: Description of variables

Variables	Definitions	Data sources
<i>Lexp</i>	Log bilateral exports in current US dollars	UNCTAD
<i>lpib_exp</i>	Logarithm of the exporting country's GDP in current US dollars.	WDI, World Bank
<i>lpib_imp</i>	Logarithm of GDP of the importing country in current US dollars.	WDI, World Bank
<i>lpop_exp</i>	Logarithm of the population of the exporting country in number of inhabitants.	WDI, World Bank
<i>lpop_imp</i>	Logarithm of the population of the importing country in number of inhabitants.	WDI, World Bank
<i>larea_exp</i>	Logarithm of the area of the exporting country in square kilometers.	world Bank
<i>larea_imp</i>	Logarithm of the area of the importing country in square kilometers.	Monial bank
<i>landl_exp</i>	Is the dummy variable which takes 1 if the exporting country is landlocked and 0 otherwise.	Martinez-Zarzoso_Chelala (2020) and the authors
<i>landl_imp</i>	Is the dummy variable which takes 1 if the exporting country is landlocked and 0 otherwise.	Martinez-Zarzoso_Chelala (2020) and the authors
<i>Ldist</i>	Sum of distances between the main cities of each country weighted by their relative size	CEPII
<i>Lang</i>	Dummy variable indicating the sharing of a common language between countries i and j.	CEPII
<i>Comcol</i>	Dummy variable which indicates whether countries i and j have a common colonizer.	CEPII
<i>Border</i>	Dummy variable that indicates whether countries i and j share a common border.	CEPII

<i>CC_No_Tariff _Total</i>	The bilateral measure of trade costs presented in this database is truly comprehensive in the sense that it includes all costs involved in international trade in goods with another partner (i.e. - bilaterally) compared to those involved in domestic (i.e. intranational) trade in goods. It captures trade costs in their broadest sense, including not only international transportation costs and tariffs, but also other components of trade costs discussed in Anderson and van Wincoop (2004), such as direct costs and indirect costs associated with differences in languages, currencies as well as cumbersome import or export procedures.	ESCAP_World_Ban k_International_Tr ade_Costs
<i>doc_exp</i>	All documents required by shipment to export goods are recorded. It is assumed that the contract has already been accepted and signed by both parties. Documents required for customs clearance by ministries, customs authorities, port and container terminal authorities, sanitary and technical control agencies and banks are considered. Since payment is made by letter of credit, all documents required by banks for issuing or guaranteeing a letter of credit are also considered. Documents that are renewed annually and that do not require renewal by shipment (for example, an annual fee clearance certificate) are not included.	Doing Business
<i>doc_imp</i>	Number of documents for importing goods.	Doing Business
<i>del_exp</i>	Time is recorded in calendar days. The calculation of the time of a procedure starts from the moment it is started and runs until it is completed. If a proceeding can be expedited for an additional cost, the quickest legal proceeding is chosen. It is understood that neither the exporter nor the importer wastes time, and each undertakes to complete each remaining procedure without delay. Procedures that can be performed in parallel are measured as simultaneous. Waiting time between procedures - for example, when unloading cargo - is included in the measurement.	Doing Business
<i>del_imp</i>	Number of days to import a commodity.	Doing Business

<i>Comcur</i>	Is a dummy variable that has the value 1 when the exporting and importing country shares a common currency and 0 otherwise.	De Sousa (2012), Martinez-Zarzoso_Chelala (2020) and the authors
<i>CEPGL_exp</i> (Economic Community of the Great Lakes Countries)	Is a dummy variable which takes the value 1 if the exporting country is a member of the CEPGL and 0 otherwise.	Authors
<i>CEPGL_imp</i> (Economic Community of the Great Lakes Countries)	Is a dummy variable which takes the value 1 if the importing country is a member of the CEPGL and 0 otherwise.	Authors

Source: Authors

Table A2: List of ECCAS countries

Angola (ENG)	Central African Republic (CAF)	Gabon (GAB)	Republic of Congo (COG)	Sao Tome and Principe (STP)
Burundi (BUR)	Cameroon (CMR)	Equatorial Guinea (GNQ)	Democratic Republic of Congo (DRC)	Chad (TCD)

Table A3: List of CEPGL countries (economic community of great lakes countries)

Burundi	Uganda	Democratic Republic of Congo	Rwanda	Tanzania
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Table A4: List of EAC countries excluding South Sudan

Burundi	DRC	Uganda
Kenya	Rwanda	Tanzania

Table A5: presentation of exports from certain countries that do not trade with each other (column 4 represents bilateral trade data from UNCTAD 2020).

Column 1	Column 2	Column 3	Column 4	Column 1	Column 2	Column 3	Column 4
AGO	BDI	2006	0	BDI	AGO	2006	0
AGO	BDI	2007	55,425	BDI	AGO	2007	0
AGO	BDI	2008	35,465	BDI	AGO	2008	0
AGO	BDI	2009	51,634	BDI	AGO	2009	0
AGO	BDI	2010	0	BDI	AGO	2010	0
AGO	BDI	2011	0	BDI	AGO	2011	0
AGO	BDI	2012	0	BDI	AGO	2012	0
AGO	BDI	2013	0	BDI	AGO	2013	0
AGO	BDI	2014	0	BDI	AGO	2014	0
AGO	BDI	2015	5,619	BDI	AGO	2015	0
AGO	CIF	2006	56,169	BDI	CIF	2006	0
AGO	CIF	2007	77.46	BDI	CIF	2007	0
AGO	CIF	2008	93,875	BDI	CIF	2008	0
AGO	CIF	2009	113,565	BDI	CIF	2009	0
AGO	CIF	2010	11,101	BDI	CIF	2010	0
AGO	CIF	2011	4,874	BDI	CIF	2011	0
AGO	CIF	2012	2.44	BDI	CIF	2012	310,897
AGO	CIF	2013	0	BDI	CIF	2013	27,166
AGO	CIF	2014	0	BDI	CIF	2014	2,559
AGO	CIF	2015	0	BDI	CIF	2015	93,206
AGO	CMR	2006	2250.55	BDI	CMR	2006	49,759
AGO	CMR	2007	9656.76	BDI	CMR	2007	0
AGO	CMR	2008	11030,851	BDI	CMR	2008	1,106

AGO	CMR	2009	2729.078	BDI	CMR	2009	20,353
AGO	CMR	2010	2319,756	BDI	CMR	2010	28.5
AGO	CMR	2011	1722.06	BDI	CMR	2011	0.55
AGO	CMR	2012	5707,669	BDI	CMR	2012	17,665
AGO	CMR	2013	4606,535	BDI	CMR	2013	16,949
AGO	CMR	2014	5191.28	BDI	CMR	2014	39,692
AGO	CMR	2015	893,271	BDI	CMR	2015	21,401
AGO	COG	2006	101510,5 31	BDI	COG	2006	1055,68 5
AGO	COG	2007	136418.7 1	BDI	COG	2007	36,212
AGO	COG	2008	110548,6 78	BDI	COG	2008	1271,77 7
AGO	COG	2009	411880.1 86	BDI	COG	2009	0
AGO	COG	2010	500319.7 55	BDI	COG	2010	0
AGO	COG	2011	582256,3 98	BDI	COG	2011	0
AGO	COG	2012	211073.3 6	BDI	COG	2012	0
AGO	COG	2013	366057,6 71	BDI	COG	2013	28,665
AGO	COG	2014	143092.2 69	BDI	COG	2014	6,875
AGO	COG	2015	203375.4 66	BDI	COG	2015	0
AGO	ATM	2006	3118,759	BDI	ATM	2006	0.344
AGO	ATM	2007	3907,583	BDI	ATM	2007	0.327
AGO	ATM	2008	7777,327	BDI	ATM	2008	0

			11997.31				
AGO	ATM	2009	6	BDI	ATM	2009	4,707
AGO	ATM	2010	4313,831	BDI	ATM	2010	0.94
AGO	ATM	2011	8959,167	BDI	ATM	2011	0
AGO	ATM	2012	4682,543	BDI	ATM	2012	1.065
AGO	ATM	2013	6046,247	BDI	ATM	2013	0
AGO	ATM	2014	5194.832	BDI	ATM	2014	1,291
AGO	ATM	2015	3218.037	BDI	ATM	2015	0
AGO	GNQ	2006	0	BDI	GNQ	2006	0
AGO	GNQ	2007	5144,472	BDI	GNQ	2007	0
AGO	GNQ	2008	0	BDI	GNQ	2008	0
			83057,33				
AGO	GNQ	2009	9	BDI	GNQ	2009	0
			12577.42				
AGO	GNQ	2010	5	BDI	GNQ	2010	0
AGO	GNQ	2011	7063.28	BDI	GNQ	2011	0
AGO	GNQ	2012	1589,406	BDI	GNQ	2012	0
AGO	GNQ	2013	46,009	BDI	GNQ	2013	0
AGO	GNQ	2014	9176,727	BDI	GNQ	2014	0
AGO	GNQ	2015	43,223	BDI	GNQ	2015	0
							1114,53
AGO	DRC	2006	0	BDI	DRC	2006	7
AGO	DRC	2007	5875.042	BDI	DRC	2007	671,459
AGO	DRC	2008	0	BDI	DRC	2008	284,684
AGO	DRC	2009	4108.665	BDI	DRC	2009	586,076
AGO	DRC	2010	4949.095	BDI	DRC	2010	508,818
							3384,42
AGO	DRC	2011	5811,409	BDI	DRC	2011	3

AGO	DRC	2012	4622.094	BDI	DRC	2012	3317,998
AGO	DRC	2013	6547.91	BDI	DRC	2013	2643,802
AGO	DRC	2014	13906,906	BDI	DRC	2014	2950,355
AGO	DRC	2015	8547,253	BDI	DRC	2015	2743.104
AGO	PLEASE	2006	39,446	BDI	PLEASE	2006	0
AGO	PLEASE	2007	770,817	BDI	PLEASE	2007	0
AGO	PLEASE	2008	3219.957	BDI	PLEASE	2008	0
AGO	PLEASE	2009	581,028	BDI	PLEASE	2009	0
AGO	PLEASE	2010	78,048	BDI	PLEASE	2010	0
AGO	PLEASE	2011	301,158	BDI	PLEASE	2011	0
AGO	PLEASE	2012	46.93	BDI	PLEASE	2012	0
AGO	PLEASE	2013	369,244	BDI	PLEASE	2013	0
AGO	PLEASE	2014	1013,125	BDI	PLEASE	2014	0
AGO	PLEASE	2015	188,664	BDI	PLEASE	2015	0
AGO	TCD	2006	119,655	BDI	TCD	2006	0
AGO	TCD	2007	181.28	BDI	TCD	2007	0
AGO	TCD	2008	0	BDI	TCD	2008	0
AGO	TCD	2009	0	BDI	TCD	2009	0
AGO	TCD	2010	25,002	BDI	TCD	2010	0
AGO	TCD	2011	60,006	BDI	TCD	2011	0
AGO	TCD	2012	119,752	BDI	TCD	2012	0
AGO	TCD	2013	0	BDI	TCD	2013	0
AGO	TCD	2014	5,048	BDI	TCD	2014	0
AGO	TCD	2015	0	BDI	TCD	2015	0

Table A6: PPML estimates

	(1)	(2)	(3)	(4)
Dept. Var	lnX_TFE	lnX_TCFE	lnX_BFE	lnX_BCTFE
Ind. Var				
CCNTTij	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	
del_exp	-0.005* (0.003)	-0.004 (0.003)	-0.004** (0.002)	
doc_exp	-0.016 (0.023)	-0.015 (0.020)	-0.017 (0.014)	
CEPGL_exp	0.058 (0.211)	0.032 (0.200)	-0.043 (0.125)	-0.051 (0.184)
Comcur	0.207** (0.082)	0.198** (0.081)	0.328*** (0.063)	0.723*** (0.064)
lnpib_exp	0.179 (0.135)	0.156 (0.121)	0.153* (0.079)	
lnpib_imp	0.532*** (0.049)	0.536*** (0.049)	0.474*** (0.048)	
lnpop_exp	0.061 (0.148)	0.065 (0.132)	0.117 (0.087)	
lnpop_imp	0.413*** (0.039)	0.417*** (0.039)	0.396*** (0.039)	
Lndistij	-0.061*** (0.021)	-0.062*** (0.020)		
Lang	0.527*** (0.155)	0.521*** (0.155)		
Border	0.152*** (0.056)	0.152*** (0.056)		

Comcol	-0.292*	-0.284*		
	(0.162)	(0.161)		
Constant	-2,250***	-2.153***	-2.262***	1,554***
	(0.821)	(0.741)	(0.557)	(0.089)
Observations	532	532	532	532
R ² -adjusted	0.50	0.51		0.25
Number of code	10	10	10	10

Standard errors in parentheses

***p<0.01, **p<0.05, *p<0.1

Table A7: Multilateral resistance and export: Results of the second stage (first OLS)

	(1)	(2)
Dept. Var: MRT from first step PPML	Exporter	Importer
	FE1_2FE	FE2_2FE
IND. Var		
LPIB	-0.806	-0.418
	(1.128)	(1.107)
Lpop	2,190	3,723
	(0.2744)	(2,666)
CCNTTij_CEEAC	-0.000	-0.000
	(0.000)	(0.000)
Del_exp_CEEAC	-0.081***	-0.001
	(0.008)	(0.001)
Doc_exp_CEEAC	-0.377	-0.003
	(0.041)	(0.003)
CCNTTij_CAE	-0.000	-0.000

	(0.000)	(0.000)
Del_exp_CAE	-0.004**	-0.004***
	(0.002)	(0.001)
Doc_exp_CAE	-0.044**	-0.028***
	(0.004)	(0.004)
Observations	900	900
Number of countries	10	10
R ² adjusted	0.213	0.403

Robust standard errors in parentheses

***p<0.01, **p<0.05, *p<0.1

Source: Authors



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