

The effects of export-facilitating quality infrastructure on Africa's exports

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Abstract

Purpose – The continuous export challenges due to the inadequate quality infrastructure have brought to the fore the importance of export facilitation-quality infrastructure. Different infrastructure investments have been implemented to facilitate export; however, the outcomes were different across export facilitation infrastructures. This study investigates Africa's export effects of the implemented export-facilitating quality infrastructure.

Design/methodology/approach – An augmented gravity model is specified that is derived from the Helpman, Melitz and Rubenstein framework, which has two steps in the specification and estimation of the model. The extensive margin is the first step – the probability of export – while the second step is the intensive margin of export – the actual export values or volumes.

Findings – The main drivers of the decision to export are telecommunication infrastructure, internet usage and the logistic performance index. At the intensive margin of export, exporting time, the proliferation of telecommunication infrastructure and improvement in the logistics performance index significantly improve the intensity of export, while it is not the case for internet infrastructure usage. Thus, the soft-quality infrastructure has mixed outcomes at both export margins, while the hard-quality infrastructure is insufficient and ineffective for export facilitation, which invalidates the study's hypothesis that export-facilitating quality infrastructure stimulates exports.

Practical implications – The implemented export-facilitating quality infrastructure measures have achieved marginal improvement in exports. This is due to the inadequate development finance and investment towards enhancing export-facilitating quality infrastructure. Thus, extensive quality infrastructure is needed to facilitate and intensify exports for sustainable development in Africa.

Originality/value – This study departs from previous studies by investigating export facilitation from the lens of export-oriented quality infrastructure rather than the trade time and costs as dominated in the literature. Moreover, the determination of the extent to which quality infrastructure has influenced the probability of export is rarely investigated.

Keywords Export facilitation, Quality infrastructure, Sustainable development, Gravity model, Africa

Paper type Research paper

1. Introduction

Many African countries have been making concerted efforts to reduce exporting costs as well as overall transaction costs through engagement for ease of exporting and export supply chain enhancement, export documentation, customs and administrative procedures. These efforts tend

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to enhance the flow of goods and services as well as business transactions within a country and across borders (Kareem and Wieck, 2022), which impacts sustainable economic growth. Policy measures have been adopted to ease international movement of goods and services, and have been vigorously pursued by many African countries as the continuous ease of movement of goods and services has the propensity to propel exports. Export facilitation through exporting ease stimulates increased integration and inclusiveness of Africa, in particular, into the global trading system and thereby can stimulate sustainable development. Developing countries' inclusivity, particularly those in Africa, into the global market – especially through the global value chains (GVCs) – offers the opportunity and potential for rapid growth and reduction in poverty (Kareem, 2016; Shepherd, 2016; World Bank Group, 2020). The global market integration for Africa has not been more important than during the coronavirus pandemic (COVID-19) where there are disruptions in global trade supply chains, especially in the food value chains and medical supplies (Alraje *et al.*, 2020; Gustafson, 2021; Reardon *et al.*, 2020).

However, in practice, there are often challenges to the attainment of the full benefits of exporting. On one hand, there is the presence of trade policy measures – tariffs and non-tariff measures (NTMs, particularly the technical and non-technical measures) – which could be barriers to exporting. On the other hand, there are challenges relating to export procedures and export-oriented quality infrastructure that are associated with exporting. Quality Infrastructure (QI) is a system of resources – physical and non-physical – required for the implementation and achievement of expected development outcomes, particularly economic outcomes. Export-facilitated QI is the required tangible (e.g. automated ports, laboratories, telecommunication, accreditation and certification facilities and roads) and non-tangible (exporting procedure, inspectors, technical know-how, customs management, policy and regulations) resources that are essential and/or sufficient for export facilitation and export outcomes. UNIDO (2016) defines QI as a system that contributes to the policy objectives of the government in the areas of trade competitiveness, industrial development, food safety, health, efficient use of human and natural resources, the environment and climate change.

Generally, trade policy measures, export procedures and the extent of export-oriented QI provision could challenge and impact export facilitation, particularly in Africa. However, export procedures and export-oriented QI are associated, in practice, with export facilitation (Spence and Karingi, 2011). The issues in export facilitation manage the mechanism with which export could be carried out with no or fewer bottlenecks in the inspection, accreditation, logistics, regulations, institutions, governance and physical infrastructures. These pathways to export facilitation except the physical infrastructures are regarded as the soft mechanisms of export facilitation measures (soft, non-physical and QI) while the improvement in physical infrastructures – quality accreditation facilities, metrology, ports, digitalisation, communication, transportation, borders and laboratories – to enhance export is regarded as the hard measures of export facilitation – hard QI. Portugal-Perez and Wilson (2012) assert two dimensions of trade facilitation measures, tangible infrastructures such as highways, ports and telecommunication, as the hard dimension, while intangible infrastructures such as customs management, transparency, business environment and other institutional aspects are the soft dimension.

There is a gamut of problems associated with African export facilitation. On one hand, the available QI is inadequate, obsolete and inappropriate to expand export to different export markets. The deficiency in export-facilitating QI often has consequences on the export quality and export market access, which thereby impacts the overall development aspirations of the continent, particularly the attainment of sustainable development goals. On the other hand, the exporting procedures are characterised by official and unofficial obstacles which impact the ease of exporting and the intensity of export flows (Kareem and Wieck, 2022). The official obstacles are the governance, institution and transparency challenges that characterised export documentation, customs and administrative procedures, logistics, border operations and other domestic regulations. The unofficial obstacles deal with the activities of formal and informal economic agents, such as gratification and harassment, that obstruct exporting. The

preponderance of these obstacles impacts the implementation of export facilitation and the corresponding opportunities therein.

Moreover, the implementation of export facilitation for developing countries, particularly in Africa, involves huge quality infrastructure financing and investments, which are significant challenges (Shepherd and Wilson, 2008; Sakyi *et al.*, 2018) and often beyond available resources of many African countries and, as such, there is a need for governments to prioritise the provision of these QIs based on their domestic economic development aspirations. However, in some countries where these QIs were available, corruption activities adversely affected the quality and quantity of implemented export facilitation, which in turn hampered export propensity and intensity. Policymakers have now redirected their focus to overcome these export facilitation obstacles, particularly the administration, regulations and logistics, which affect export flows and/or the cross-border movement of exported goods. UNCTAD (2016) asserted the promotion of export facilitation as a tool to enhance and smooth trade between countries.

Furthermore, two distinguishable export facilitation measures have been identified as soft and hard measures. The soft trade facilitation policy measures have been defined by Hoekman and Shepherd (2015) as measures to reduce the overall costs of the international movement of goods and/or the lowering of trade-related operating costs, while Safaeimanesh and Jenkins (2021), OECD (2005), Sakyi and Afesorgbor (2019) and Seck (2016) consider it the reduction in transaction costs associated with the enforcement, regulation and administration of trade policies. The hard trade facilitation measures are the trade-related quality infrastructure to support and enhance exporting. In addition, trade facilitation policy has been investigated by Sithole (2021), Portugal-Perez and Wilson (2009) and Francois and Manchin (2007) using the lens of both soft and hard trade facilitation measures. Thus, the extent to which the implemented export facilitation has impacted export flows is still an issue for empirical investigation. To this end, this study asks: To what extent has the export-facilitating quality infrastructure in Africa impacted export? Are there significant impacts of hard export-facilitating QI on exports? It is on this basis that this study investigates the impact of export-facilitation measures, particularly QI, on Africa's exports.

Thus the current issue of export facilitation in international trade is due to its impact on export flows, export and transaction costs and thereby the competitiveness of the exported goods and the achievement of sustainable development. In addition, the COVID-19 pandemic brought to the fore the relevance of promoting export facilitation across all products, particularly food and medical value chains, and countries. To this end, the facilitation of export is germane to Africa's quest for sustainable economic development, particularly through the reduction of export transaction costs with trade partners. Moreover, it has been hypothesised that Africa and the least developed countries would witness export growth, estimated at 3.5% annually, with export base diversification and an increase in annual national output of 0.9% with export facilitation (WTO, 2022). Thus, it is worthwhile to ascertain this assertion by investigating the effects of export facilitation through the improvement in export-related quality infrastructure on Africa's exports.

The knowledge of this area within the African context is extended with this investigation which departs from previous studies by focussing on the specific export-oriented and facilitated quality infrastructure that impacts both the extent and intensity of Africa's exports (Sakyi and Afesorgbor, 2019; Hoekman and Shepherd, 2015). The determination of the trade effects of trade facilitation has mostly been investigated at the intensive margin (Safaeimanesh and Jenkins, 2021; Debashi and Sacchidananda, 2016; Spence and Karingi, 2011) while few studies focused on the extensive margin (Portugal-Perez and Wilson, 2009; Seck, 2016; Persson, 2013), however, the literature shows studies on export facilitation or promotion have not extended the analysis to the probability to export (extensive margin). Moreover, this study includes hard infrastructure variables seldom used in the literature and hypothesises that the implementation of export-facilitating QI measures in Africa has led to an increase in exports. Thus, this study examines the extent to which QI provisions affect export in Africa using an

augmented gravity model derived from the [Helpman et al. \(2008\)](#) selection model. The findings indicate that the selected hard export-facilitating QIs are significant regarding the decision to export, except for the trade and transport infrastructure; however, they are intensive export-enhancers despite the internet infrastructure usage and trade and transport infrastructure.

In addition to this introductory section, discussion on previous studies is in [section 2](#) while [section 3](#) provides the empirical strategy that includes the model specification and data sources. The research findings are presented and discussed in [section 4](#) while [section 5](#) concludes the study.

2. Literature review

The issue of trade facilitation has been investigated across countries ([Jordaan, 2014](#); [Yadav, 2014](#); [Marti et al., 2014](#); [Shepherd, 2017](#); [Eberhard-Ruiz and Calabrese, 2018](#)), regions ([Portugal-Perez and Wilson, 2009](#); [Francis and Manchin, 2007](#); [Safaeimanesh and Jenkins, 2021](#); [Shepherd and Wilson, 2008](#); [Saslavsky and Shepherd, 2014](#); [Beverelli et al., 2015](#)) and income groups ([Francis and Manchin, 2007](#); [Martinez-Zarzoso and Marquez-Ramos, 2008](#); [Viet, 2015](#); [Iwanow and Kirkpatrick, 2009](#); [Beverelli et al., 2023](#)). The bulk of these studies concentrated or focused on developing countries ([Iwanow and Kirkpatrick, 2009](#); [Hoekman and Shepherd, 2015](#); [Portugal-Perez and Wilson, 2012](#); [Beverelli et al., 2023](#)) as they are deficient in policies, institutional and regulatory frameworks, including soft and hard infrastructure that could facilitate trade. This necessitates reforms of trade procedures and the promotion of ease of trading that could foster and strengthen trade outcomes, especially extensive export flows.

The contemporary issue of export facilitation is because of the continuous export promotion drive of many developing countries, especially within Africa, as part of the *sine qua non* to enhance foreign earnings, create wealth and promote social integration and inclusion. Studies have investigated trade costs ([Portugal-Perez and Wilson, 2009](#); [Seck, 2016](#); [Sithole, 2021](#)), trade performance ([Francois and Manchin, 2007](#); [Sakyi and Afesorgbor, 2019](#); [Jordaan, 2014](#)), economic growth ([Sakyi et al., 2017](#)) and development ([Beverelli et al., 2023](#); [Safaeimanesh and Jenkins, 2021](#); [Sakyi et al., 2018](#)) effects of trade facilitation with the bulk of the studies tilting towards trade-enhancing effects of trade facilitation measures ([Beverelli et al., 2023](#); [Seck, 2016](#); [Eberhard-Ruiz and Calabrese, 2018](#); [Hoekman and Shepherd, 2015](#); [Spence and Karingi, 2011](#); [Sakyi and Afesorgbor, 2019](#)). Diagnosis of the studies on the trade effects of trade facilitation indicates that most of them investigated the issue at the intensive margin of trade ([Sakyi et al., 2017](#); [Sakyi and Afesorgbor, 2019](#); [Shepherd and Wilson, 2008](#); [Safaeimanesh and Jenkins, 2021](#); [Portugal-Perez and Wilson, 2009](#)). Although it is essential to ascertain and understand the actual trade (intensity) impact of trade facilitation, it has become imperative to also know and establish the effects of the implemented trade facilitation on potential traders' decision to explore the trading market and export new commodities (extensive margin of export).

Most empirical studies on trade facilitation distilled the actual trade effects on the implemented trade facilitation or the trade facilitation reform ([Sakyi and Afesorgbor, 2019](#); [Sakyi et al., 2017](#); [Safaeimanesh and Jenkins, 2021](#); [Spence and Karingi, 2011](#); [Beverelli et al., 2023](#)). However, there are only a few studies available on how the implemented trade facilitation measures impact the probability of trade ([Persson, 2013](#); [Beverelli et al., 2015](#)) – the determination of the extent to which trade facilitation could spur the decision to trade, encourage trading in new markets and/or trade new commodities in existing markets. In addition, evidence shows that empirical studies by [Seck \(2017\)](#) and [Lee and Kim \(2012\)](#) explored both the extensive and intensive margins of trade in the empirical analyses. Nevertheless, few empirical studies exist focussing either solely on the extensive margin or at both the extensive and intensive margins of trade ([Seck, 2016](#); [Beverelli et al., 2015](#); [Persson, 2013](#); [Lee and Kim, 2012](#)).

The coverage, data and implementation of the empirical strategies of the studies on both margins of trade are different from this study. For instance, [Beverelli *et al.* \(2015\)](#) and [Persson \(2013\)](#) investigated trade facilitation regarding the extensive margin of export. While the former used the number of sub-Saharan African, Latin American and Caribbean products exported by destination and the number of export destinations served by the product as the measures of export diversification in a simulation, the latter counted 8-digit products from developing countries exported to the EU markets, limiting an extensive margin of trade, as the dependable variable in the estimation. In addition, [Seck \(2016\)](#) used SSAs enterprise survey trade relations data from developed countries in a gravity model and found African firms responded positively to improvements in trade facilitation measures. [Seck \(2016\)](#) had limited SSA coverage and incorporated a specific trade facilitating hard infrastructure measure (used only telecommunications) and, as such, the period, sub-regional and QI coverage currently needs to be updated. [Lee and Kim \(2012\)](#) explored a more composite index to measure trade facilitation with consideration for the export sector and income level in a gravity model, however, it was limited to cross-section data. To this end, this study goes beyond the extensive and intensive margins of trade studies by extending the coverage to Africa, including more export-facilitating hard QIs and exploring panel data over a wider time period.

Furthermore, the few empirical studies on export effects of the export-facilitating QI at the extensive and intensive margin tended to impact evidence-based policy decisions that could expand the export base, volume and number of exporters. In addition, the deficiencies in policy-oriented and informed studies have consequences on the extent to which trade facilitation policies could be altered and/or repurposed to reduce trade costs, improve trade performance and stimulate sustainable economic development. Hence, the necessity of an evidence-based and policy-oriented empirical study that will investigate export effects on Africa of the implemented export-facilitating QI cannot be overemphasised, which gives credence to this study. This is because it brings to the fore the performance of the implemented export facilitation measures and the mechanisms for improvement. Moreover, it sheds light on factors such as trade policy measures that can complement trade facilitation measures to enhance exports and the export base.

This review of the literature indicates that different empirical strategies have been used to investigate the trade effects of trade facilitation initiatives, especially for developing countries. A strand of the literature used the qualitative and/or descriptive empirical approach to analyse the issues involved in trade facilitation ([Sithole, 2021](#); [Milner *et al.*, 2008](#); [Eberhard-Ruiz and Calabrese, 2018](#); [Amoako-Tuffour *et al.*, 2016](#); [Arthur, 2014](#); [Siziba, 2016](#)) while another strand has adapted the empirical methodological approach ([Persson, 2013](#); [Jordaan, 2014](#); [Debashi and Sacchidananda, 2016](#); [Safaeimanesh and Jenkins, 2021](#); [Martinez-Zarzoso and Marquez-Ramos, 2008](#); [Beverelli *et al.*, 2023](#)). A combination of descriptive and structural approaches has been adopted by [Portugal-Perez and Wilson \(2009\)](#), [Sakyi and Afesorgbor \(2019\)](#) and [Sakyi *et al.* \(2017\)](#) to empirically model the contending issues in trade facilitation between and/or among trading countries. However, studies such as [Safaeimanesh and Jenkins \(2021\)](#) and [Beverelli *et al.* \(2015, 2023\)](#) used the partial or cumulative general equilibrium models. Many of the quantitative approach-oriented studies have used the gravity models ([Seck, 2016](#); [Sakyi and Afesorgbor, 2019](#); [Portugal-Perez and Wilson, 2009](#)), given that the theoretical basis for the gravity model has been established and the fact that the studies investigate trade facilitation in the context of bilateral, regional and/or multilateral trade relations.

Moreover, the “new” new trade theory has comprehensively asserted the importance of considering not only trading countries but also non-trading countries, which brings to the fore the issue of zero trade values in international trade analysis. This theory has been empirically modelled by [Helpman *et al.* \(2008\)](#) (HMR) which provides the basis for the empirical modelling of the selection model employed in this study. To this end, this study departs from previous studies by investigating the export effects of export-facilitating QIs, not only at the intensive margin of export, but also at the extensive margins of export by adopting the

augmented HMR selection model that accounts for firms' heterogeneity in the presence of exporting markets trade policy measures. In addition, this study investigates the export effects of implemented export facilitation beyond the conventional measures of trading time, costs, documentation and customs efficiency to a broader range of export-facilitating hard QI measures in an augmented firm heterogeneity and selection model. Moreover, this study bridges identified gaps by employing panel data from 54 African countries' global exports to 184 countries over a broader timeframe (2005–2020), which serves as a period update for previous studies. In addition, a contribution is made with the extension of the empirical analysis beyond SSA to Africa.

3. The empirical strategy

[Helpman *et al.* \(2008\)](#) (HMR) provided the theoretical and empirical framework for the model in this study, which was derived from the “new” new trade theory as led by [Melitz \(2003\)](#) and [Bernard *et al.* \(2003\)](#). This theory builds on the new trade theory that postulated monopolistic competition and economies of scale, from which [Helpman and Krugman \(1985\)](#) derived the gravity model with the assumption of increasing return to scale, Dixit-Stiglitz utility preferences and a provision for intra-industry trade. However, due to the non-provision of trade barriers in [Helpman and Krugman \(1985\)](#), [Bergstrand \(1985, 1989, 1990\)](#) derived intra and inter-industry gravity models with exogenous price variables. Although [Bergstrand \(1985\)](#) assumed each country had a single factor of production and product differentiation based on the constant elasticity of substitution (CES) utility function and the constant elasticity of transformation (CET) production technology function; the assumptions were relaxed by [Bergstrand \(1989\)](#) but the gravity model derivation from the microeconomics foundations was extended. Using Heckscher-Ohlin (HO) and Linder trade models, [Bergstrand's \(1989\)](#) gravity model posited differences in relative factor endowments with non-homothetic taste based on the Linder hypothesis, trade factor proportion theory in line with HO inter-industry trade model and the Helpman-Krugman-Makursen model of intra-industry trade. He assumed two different industries characterised by two factors of production (assumed fixed factors) with a utility function derived from the nested Cobb Douglas CES-Stone-Geary and identical CET for the supply function. This framework was unique because it provided the theoretical basis for the use of the trading partners' incomes and per capita incomes which was in tandem with the traditional trade theories and new trade theory. Despite its uniqueness, [Bergstrand \(1990\)](#) extended it to provide the theoretical framework for the use of the country pairs share intra-industry trade, average levels of gross domestic product, per capita income and tariffs as determinants of the volume of intra-industry.

Thus, the “new” new trade theory provided the theoretical basis for the derivation of the HMR model. This theory presented the framework for the methodological issue relating to the presence and behaviour of heterogeneous exporting firms. It also gave the foundation for the existence of zero in trade relations, justification for the use of zero trade in the empirical analysis and provided the theoretical explanation for zero trade. The firm heterogeneity was due to the different firms' performance and capacity leading to some firms participating in export markets while others do not. In addition, not all exporting firms export to every country, and some might not have the ability to export specific products to particular markets because of the corresponding fixed costs. The fixed costs are market-specific and higher in international markets than in domestic markets, where these costs are absolved only by the productive firms. Hence, some firms are non-exporting because of the inability to absolve these fixed costs, which leads to zero trade data at the disaggregated product levels (e.g. HS 6-digit and HS 8-digit).

The HMR hypothesises states that the selection of trade data with values will lead to estimation bias in any trade relationship, and that there is estimation bias with the use of standard gravity model specification owing to the embedded symmetry not aligned with data. This framework mitigated the biases and inconsistencies in the data with the consideration of

trade data with values and zeros between and/or among trade partners. Moreover, the HMR empirical models present procedures for the consideration of all information in the trade data – positive trade data and zeroes – for estimation. This allows a consideration of countries that are both trading and non-trading because non-trading countries could trade in the future and the zero trade data contains information. Hence, HMR presented the framework that can be employed to identify irregularities in the trade flows between and among countries, estimating regularities in trade data, including trade outcomes with zero and evaluation of good fit gravity models (Santos Silva and Tenreyro, 2008).

To this end, the HMR framework modelled the probability of exporting that has zero trade data. It hypothesised normality and homoscedasticity and asserted this contains information about trade partners willing to access the export market, those that have traded but disappeared due to some circumstance (e.g. due to trade policies) and exporters that want to explore new products in the export markets. The probability of these three scenarios is specified as a probit equation:

$$\rho_{ij} = Pr(T_{ij} = 1) = \Phi\left(\frac{\gamma_0 + \xi_i + y_i - \gamma d_{ij} - k\phi_{ij}}{\sigma_{u+v}}\right) \quad (1)$$

The parameter T_{ij} is 1 when trade partner j exports to i ; otherwise, 0, while the probability that trade partner j exports to i is ρ_{ij} , based on the variable observed [1]. Further, the unit-normal distribution's cumulative distribution function is $\Phi(\cdot)$, the standard deviation is σ_{u+v} , the export costs natural logarithm is d_{ij} , exporter's market fixed effect is ξ_i , country-specific fixed trade cost is ϕ , exporter fixed effects are y_j and the parameters are γ and k . It is from the decision at the firm's level that the selection equation is specified, and it is without the unobserved and endogenous variables that characterised the exporting firms. The consistent estimation of the unobserved and endogenous variables is contained in the probit model equation, whose structural equation is as follows:

$$M_{ij} = \beta_0 + \lambda_j + \chi_i - \gamma d_{ij} + \ln\left\{\exp\left[\delta\left(z_{ij}^* + \varsigma_{ij}\right)\right] - 1\right\} + \mu_j \quad (2)$$

From Equation (2), $\varsigma_{ij} = (u_{ij} + v_{ij}/\sigma_{u+v})$ and $= \sigma_{u+v}(k - \varepsilon + 1)/\varepsilon - 1$, z_{ij}^* represents the latent variable divided by the standard deviation, while the error term is u_{ij} .

Thus, an augmented HMR model is specified in this study to test the hypothesis that the implementation of export-facilitating QI measures in Africa enhances export flows. There are two steps in the specification and estimation of the HMR. The first step is called the extensive margin of trade, which represents the probability of export while the second step is known as the intensive margin of export, which indicates the actual export values or volumes. At the intensive margin of export, the firms are selected into exporting flows which are derivable from the extensive margin of export based on the addition of the Inverse Mill Ratio (IMR) as an explanatory variable. The IMR corrects the potential selection bias that arises from the firms' heterogeneity and is calculated as the predicted outcomes divided by the probit estimation's standard error. In addition, the exclusion variable exhibits a correlation with the extensive margin of export but not with the intensive margin of export. The reduced equation uses language as the exclusion variable in the selection regression. Hence, the reduced form of the HMR two-step is specified as follows:

$$\begin{aligned} T_{ijt} = & \beta_1 + \sigma_1 GDP_{Ex} + \sigma_2 GDP_{Im} + \sigma_3 GDPPC_{Ex} + \sigma_4 GDPPC_{Im} + \sigma_5 Dist_{ij} \\ & + \sigma_6 ComCol_{ij} + \pi Lang_{ij} + \alpha_1 ExT_{jt} + \alpha_2 Telcom_{jt} + \alpha_3 Inet_{jt} + \alpha_4 TTQI_{jt} \\ & + \alpha_5 LPI_{jt} + \alpha_6 Cust_{jt} + \varepsilon_{ijt} \end{aligned} \quad (3)$$

$$\begin{aligned}
V_{ijt} = & \beta_1 + \sigma_1 GDP_{Ex} + \sigma_2 GDP_{Im} + \sigma_3 GDPPC_{Ex} + \sigma_4 GDPPC_{Im} + \sigma_5 Dist_{ij} + \sigma_6 ComCol_{ij} \\
& + \alpha_1 ExT_{jt} + \alpha_2 Telcom_{jt} + \alpha_3 Inet_{jt} + \alpha_4 TTQI_{jt} + \alpha_5 LPI_{jt} + \alpha_6 Cust_{jt} + \varphi \vartheta_{ij} + \tau_{ij} \\
& + \varepsilon_{ijt}
\end{aligned} \tag{4}$$

The binary variable that is equal to 1 when export from trade partner j to i at time t is a positive value, otherwise zero is T_{ijt} ; the actual export from trade partner j to i at time t is V_{ijt} ; β_1 and β_2 are the intercepts, while the vector of pair-varying control variables are as follows: the gross domestic product of exporting countries (GDP_{Ex}); GDP_{Im} for the importing countries; $GDPPC_{Ex}$ is the exporters' GDP per capita; $GDPPC_{Im}$ is importers' GDP per capita; $Dist_{ij}$ stands for distance; and $ComCol_{ij}$ is the common colonial affiliation. The extensive margin-specific exclusion variable which is not included in the intensive margin of export is $Lang_{ij}$ (language). The exclusion variable does not directly impact the outcome variable but through a variable that directly affects the outcome variable. This indicates that the exclusion variable is associated with the probability of export but does not necessarily influence the actual export. The HMR gravity model uses language as the exclusion variable but also states that religion can be used. The unobserved firm heterogeneity is represented by τ_{ij} , the Inverse Mill Ratio (IMR) extracted from the extensive margin of export and is represented by ϑ_{ij} while ExT_{it} is the exporting time. The export-facilitating QI measures are: $Telcom_{jt}$ representing mobile telecommunication; $Inet_{jt}$ is the internet infrastructure usage; $TTQI_{jt}$ stands for trade and transport QI; LPI_{jt} is the logistics performance index; and $Cust_{jt}$ represents customs efficiency. It is expected that $\sigma_1, \sigma_2, \sigma_3, \sigma_4, \sigma_6, \pi, \alpha_2, \alpha_3, \alpha_4, \alpha_5, \alpha_6$ are positives while σ_5 and α_1 are negatives. Equation (3) is estimated with probit regression while Equation (4) is estimated using feasible general least squares (FGLS), which are efficient in the correction of the standard error heteroscedasticity and endogeneity problem.

The regression data for the reduced form equation was sourced from the United Nations Conference for Trade and Development (UNCTAD) Statistics, which provided data on the economic size and per capita income (GDPs); the data on trade was sourced from the World Integrated Trade Solution (WITS) of the World Bank; the World Development Indicators provided the export facilitation variables; and the language and distance data was sourced from the CEPII. The data point for the model estimation estimations covers the period from 2005 to 2018 for 54 countries exporting to 184 countries across the globe.

In the tables of results, there are five estimation columns in the baseline results, labelled Scenarios 1–5. The export-facilitating variables are included in the regressions gradually in line with the intensity of their inclusion in the literature. The last column, Scenario 5, contains all the focus export-facilitating variables that are discussed in this study. The robustness check has three estimations columns, Scenarios 1–3, where the last column is the focus and the results that are discussed. The description and definition of the variables are presented in Table A1 in the Appendix, while the pairwise variables correlation is shown in Table A2 in the Appendix.

4. The results and discussion

Extensive margin: Distance remained a significant inhibiting factor for exporters in Africa wanting to explore and contemplate exporting to new markets, export new products or exporters who want to re-enter export markets after disappearing due to exporting incapacitation. The degree of responsiveness of the probability of export is impeded by 1.05 for every kilometre increase in distance to the export market (Table 1). The economic size of Africa, measured by the GDP, significantly propels decisions to export to new markets or export new products. Exports increased by 8.17% for every percentage rise in the GDP which

Table 1. Extensive margin of export

Variable	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Distance	−1.0028*** (0.0060)	−1.7198*** (0.0000)	−1.5884*** (0.0000)	−1.2432*** (0.0000)	−1.0538*** (0.0020)
Africa GDP	8.0824*** (0.0000)	0.7677*** (0.0000)	0.6611*** (0.0000)	0.2201*** (0.0000)	8.1667*** (0.0000)
Export-market GDP	2.8041*** (0.0000)	1.1531*** (0.0000)	1.1023*** (0.0000)	1.137*** (0.0000)	2.8303*** (0.0000)
Africa GDPPC		−0.0639** (0.0240)	−0.0271 (0.6250)	−0.0164 (0.5230)	−0.1412*** (0.0000)
Export-market GDPPC		−0.0008 (0.9670)	0.0653*** (0.0061)	0.0752*** (0.0072)	0.0269 (0.2380)
Exporting time	2.4821*** (0.0010)	−0.0862 (0.2850)	−0.8762*** (0.0000)	−0.3648*** (0.0000)	−0.9142*** (0.0240)
Telecoms	0.6710*** (0.0020)	−0.2369*** (0.0000)	−0.3783*** (0.0000)	−0.3572*** (0.0000)	0.8412*** (0.0000)
Internet usage	0.3393* (0.0650)	0.0165** (0.0480)	0.0109 (0.3220)	0.0237 (0.3140)	0.5822*** (0.0000)
Logistics_Perf_Index			0.1352*** (0.0093)	0.1695*** (0.0140)	0.1524*** (0.0070)
QI_Trade and transport				−0.0151 (0.6410)	−0.0346 (0.4070)
Customs efficiency					−0.0130 (0.7530)
Common colony	0.6705*** (0.0000)	0.8655*** (0.0000)	0.6873*** (0.0000)	0.5267*** (0.0000)	0.6752*** (0.0000)
Language	9.0973*** (0.0000)	0.4828*** (0.0000)	0.5026*** (0.0000)	0.6786*** (0.0000)	3.2259*** (0.0000)
Constant	463.6728*** (0.0000)	−23.1558*** (0.0000)	−14.1335*** (0.0000)	−13.4350*** (0.0000)	−25.5577*** (0.0750)
Wald χ^2	455.28*** (0.0000)	14763.31*** (0.0000)	21082.81*** (0.0000)	28301.53*** (0.0000)	111.54*** (0.0000)
Observation	18,142	15,175	12,834	12,658	12,573
Remoteness_Exporter	Yes	Yes	Yes	Yes	Yes
Remoteness_Importer	Yes	Yes	Yes	Yes	Yes

Note(s): All variables are in logarithm form except the dummy and index variables. The standard errors have been corrected for heteroscedasticity and are presented in parentheses. The Wald χ^2 parentheses are the probability values. The significant variables are denoted by the *, **, and *** at 10, 5, and 1 per cent significance levels, respectively. The trade facilitation measures are included gradually from Scenarios 1–5

Source(s): Author's estimation

means the African economic size has been used to stimulate and/or encourage productive firms to enter export markets. The export markets (importing countries) GDPs act as a stimulus to the probability of export, indicating potential demand and absorptive capacity for the export. However, given the inadequate income level and purchasing power in Africa, the per capita income is not a factor that propels the probability of export.

In addition, the exporting time significantly impacted the probability of export, which indicates that this was an essential determinant of the decision to enter export markets. [Beverelli et al. \(2015\)](#) found that firms not prioritising speedy exporting were encouraged to export faster, as one less day enhanced probability of export by 0.91%.

The export-facilitating QI measures such as telecommunications and internet infrastructure usage directly impacted exporting probability, indicating they were facilitating factors in exporters' decisions to export. Scenario 5 of [Table 1](#) shows that the probability of export increased by 0.84% and 0.58% for every percentage rise in telecommunications and internet usage, respectively, affirming Seck's findings (2017). The implication is that the proliferation

of telephone usage, especially mobile phones, and internet infrastructure usage has increased e-transactions, thus facilitating and streamlining exporting procedures. The improvement in telecommunication cables and internet bandwidth, along with associated cost reductions, reduced potential costs of exporting, thereby facilitating prospective exporters choices to export.

The logistics performance index, an export-facilitating QI measure, significantly propels the probability of global exports such that, for every unit improvement within the index, Africans' decisions to export increased by 0.15. This indicates the logistics performance index has the potential to facilitate export, and remains a significant indicator for exporters to consider before deciding to enter new markets or export new products. However, the trade and transport quality infrastructure and customs efficiency insignificantly determined the probability of export as prospective exporters are discouraged due to trade and transport infrastructure deficiencies, customs inefficiency and inefficacy that historically characterised exporting procedures. This finding differs from [Seck \(2017\)](#) and [Lee and Kim \(2012\)](#) who found that trade facilitation measures expanded the probability of export.

Intensive margin: The estimation result in the last column (Scenario 5) of [Table 2](#) indicates that distance, a measure of trade cost, significantly inhibits the flow of Africa's exports to the export market. This implies that the cost of trading is still a relevant factor in determining the intensity with which Africa can access its export markets. The intensity of the export was impeded by 1.40% for every percentage increase in distance to the export market. Distance remains an issue for consideration in Africa's global exports, illustrating the underdevelopment of the quality infrastructure, especially those in the supply chains and transportation systems. Although African GDPs have improved over the years, they have not channelled improving or facilitating exports. The degree of export responsiveness to changes in African GDPs is -0.96% , implying that the rising economic size was not reflected in the intensity of exports, despite the drive for export promotion. In addition, it means development funding and investments in the export sector have not translated to improvement in export facilitation.

The African export market income, or the demand capacity, significantly increased by 1.14%, implying there is demand for exports, namely normal goods, in the global export markets. Moreover, given that the standards of living in the export markets are high, especially in Europe, the US (Africa's traditional trade partners) and China, GDP per capita in the export markets drive the intensity of Africa's exports. This indicates that there is an improvement in the per capita demand for Africa's exports in these markets; for every percentage rise in the exporting markets' GDP per capita, the demand for Africa's increased by 0.05%.

Furthermore, there have been improvements and ease of exporting in many African countries due to the export promotion industrialisation strategies that reduce obstacles associated with actual exporting, including significant reduction in export time and enhanced export flows. The degree of responsiveness of export intensity was 0.64% for every reduction in the number of export days. The export-facilitating QI such as the telecommunication service usage significantly propelled the intensity of export to the global market. Many exporting firms increasingly have been using modern facilities from telecommunication service providers to interact with their trade partners. This enhances export performance such that every improvement in these services stimulates export intensity by 0.08% ([Table 2](#)), which conformed with the findings of [Portugal-Perez and Wilson \(2012\)](#) and [Seck \(2017\)](#). However, this was not the case for internet infrastructure usage, as it has not increased export flows but instead been reduced by 0.23% for every percentage rise in internet service usage. Part of the issue is that there has been a deficiency in the quality of internet provision which impeded its usage for export transactions.

The logistics performance index is directly associated with the intensity of exports. This means that the relative improvements made in Africa in recent years concerning the provision of QI in logistics services, such as functional warehousing, facility-equipped laboratories and appropriate technology for the ease of consignment tracking, tracing and port clearance, have

Table 2. Intensive margin of export

Variable	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Distance	−1.6250*** (0.0000)	−1.6247*** (0.0000)	−1.5672*** (0.0000)	−1.6918*** (0.0000)	−1.3950*** (0.0000)
Africa GDP	0.7656*** (0.0000)	0.7775*** (0.0000)	0.6842*** (0.0000)	0.7833*** (0.0000)	−0.9605*** (0.0000)
Export-market GDP	1.1919*** (0.0000)	1.1881*** (0.0000)	1.1611*** (0.0000)	1.2483*** (0.0000)	1.1372*** (0.0000)
Africa GDPPC		−0.0706*** (0.0120)	−0.2254*** (0.0000)	−0.0162 (0.6630)	−0.0284 (0.4300)
Export-market GDPPC		0.0091 (0.6520)	−0.0502*** (0.0090)	0.0990** (0.0000)	0.0479*** (0.0000)
Exporting time	−0.0725 (0.3640)	−0.0964 (0.2300)	−0.1663** (0.0320)	−0.6312*** (0.0000)	−0.6418*** (0.0000)
Telecoms	−0.2581*** (0.0000)	−0.2491*** (0.0000)	−0.2916*** (0.0000)	−0.2916*** (0.0000)	0.0758*** (0.0000)
Internet usage	0.0114 (0.1600)	0.0160** (0.0540)	0.0105 (0.4210)	0.0105 (0.4210)	−0.2250*** (0.0000)
Logistics_Perf_Index			0.1532*** (0.0070)	0.1532*** (0.0070)	0.2018*** (0.0100)
QI_Trade and transport				−0.0391 (0.3490)	−0.0563 (0.3700)
Customs efficiency					−0.0689 (0.1220)
Common colony	0.6752*** (0.0000)	0.6730*** (0.0000)	0.6705*** (0.0000)	0.7944*** (0.0000)	0.7960*** (0.0000)
Inverse mill ratio	0.5113*** (0.0000)	0.5188*** (0.0000)	0.3827*** (0.0000)	0.4267*** (0.0000)	0.0916*** (0.0000)
Constant	−25.5577*** (0.0000)	−23.2526*** (0.0000)	−22.2847*** (0.0000)	−26.7075*** (0.0000)	38.2969*** (0.0000)
Wald χ^2	14348.58*** (0.0000)	15436.84*** (0.0000)	16358.29*** (0.0000)	16571.31*** (0.0000)	17410.61*** (0.0000)
Observation	19,129	19,347	12,989	12,768	12,536
Remoteness_Exporter	Yes	Yes	Yes	Yes	Yes
Remoteness_Importer	Yes	Yes	Yes	Yes	Yes

Note(s): All variables are in logarithm form except the dummy and index variables. The standard errors have been corrected for heteroscedasticity and are presented in parentheses. The Wald χ^2 parentheses are the probability values. The significant variables are denoted by the *, **, and *** at 10, 5, and 1 per cent significance levels, respectively. The trade facilitation measures are included gradually from Scenarios 1–5

Source(s): Author's estimation

stimulated exports. This improvement in the African export performance index has propelled export by more than 0.20% for every percentage rise in the index. This implies that the continuous improvement in the six dimensions [2] that make up the logistics performance index are critical factors in facilitating export and the ease of transactions across all the segments of the supply chains, and affirmed by Portugal-Perez and Wilson (2008), Saslavsky and Shepherd (2014) and Marti *et al.* (2014). However, the estimate of trade and transport quality infrastructure is statistically insignificant which implies the provision of trade and transport infrastructure is still too porous to effectively expand exports. Nevertheless, the results show that exports are facilitated by the common colonial affiliation such that an increase in the common colony by 1% led to a 0.80% rise in exports.

Customs' efficiency, another measure of export-facilitating quality infrastructure, indicated that exporters manoeuvre the weaknesses in African customs operations to intensify their exporting activities; though statistically insignificant, it shows the level of inefficiencies in African institutions (Kareem, 2022; Kareem and Rau, 2018). In addition, there

are deficiencies of quality infrastructure in the customs operations in many African countries, i.e. inadequacies in automation of customs procedures, which lead to delays in exit ports and customs documentation and clearance completion. This finding was in contrast to [Jordaan \(2014\)](#), who discovered that trade flow increased due to the improvements in the customs environment.

4.1 The robustness check

The sensitivity of the results to the inclusion of different regressors is ascertained in this section. The baseline regressions were adjusted with the inclusion of some explanatory variables, hitherto not part of the regressors. The robustness check estimations are readjusted with the inclusion of trade partners' real value economic sizes (GDP) and per capita incomes as parts of the control variables at both the extensive and intensive margins of export (see [Tables 3 and 4](#)). As in the case of baseline regressions ([Tables 1 and 2](#)) the regressors are included step-wise in [Tables 3 and 4](#) with Scenario 1 (estimation column 1) presenting the standard gravity model estimation with the inclusion of exporting time as the export-facilitating variable. Additional export-facilitating variables are deployed in Scenario 2 while in Scenario 3, all the identified export-facilitating measures are included, and its results are discussed.

Rearranging the regressors created estimations different from the baseline regression, in terms of the magnitude of the impacts, significance level and, to an extent, the degree of the association at the extensive margin of export, especially the export-facilitating variables ([Table 3](#)). The exporting time has become positive and insignificant, while the other export-facilitating QIs are statistically insignificant.

This sensitivity test for the intensive margin of export with the inclusion of the aforementioned variables made all explanatory variables significant, indicating that the exploration of the real GDP and real per capita has given more relevance for the export-facilitating quality infrastructure in determining the intensity of export ([Table 4](#)). However, the real economic sizes (GDP) of the

Table 3. Extensive margin of export

Variable	Scenario 1	Scenario 2	Scenario 3
Distance	-0.4682* (0.0864)	-0.0216*** (0.0000)	-0.2766*** (0.0080)
Africa GDP_real	0.5118* (0.1031)	-0.0223 (0.9770)	2.7616*** (0.0000)
Export-market GDP_real	0.3591** (0.0506)	0.0457** (0.0420)	0.1306*** (0.0000)
Africa GDPPC_real			-0.1305 (0.1490)
Export-market GDPPC_real			-0.2493*** (0.0000)
Exporting time	0.5630 (0.3870)	-0.1057** (0.0487)	0.1012 (0.7240)
Telecoms		0.0348** (0.0358)	0.1634* (0.0630)
Internet usage		-0.0257* (0.0894)	-0.0630 (0.3560)
Logistics_Perf_Index			0.3174 (0.3450)
QI_Trade and transport			-0.2737 (0.2540)
Customs efficiency			-0.1700 (0.5850)
Common colony	0.09504 (0.4210)	0.0028 (0.2510)	4.7267 (0.9900)
Language	2.0753* (0.7510)	-0.0193 (0.1732)	5.0263 (0.9790)
Constant	108.9097** (0.0502)	2.7916* (0.1007)	-171.2125*** (0.0000)
Wald χ^2	455.28*** (0.0000)	337.10*** (0.0000)	156.64*** (0.0000)
Observation	10,556	12,397	12,438
Remoteness_Exporter	Yes	Yes	Yes
Remoteness_Importer	Yes	Yes	Yes

Note(s): All variables are in logarithm form except the dummy and index variables. The standard errors have been corrected for heteroscedasticity and are presented in parentheses. The Wald χ^2 parentheses are the probability values. The significant variables are denoted by the *, ** and *** at 10, 5, and 1 per cent significance levels, respectively. The trade facilitation measures are included gradually from Scenarios 1–3

Source(s): Author's estimation

Table 4. Intensive margin of export

Variable	Scenario 1	Scenario 2	Scenario 3
Distance	−1.67230*** (0.0000)	27.2195*** (0.0000)	25.5212*** (0.0000)
Africa GDP_real	0.7656*** (0.0000)	−1.0561*** (0.0000)	−0.7551*** (0.0000)
Export-market GDP_real	1.2565*** (0.0000)	−1.0205*** (0.0000)	−0.8576*** (0.0000)
Africa GDPPC_real		0.0609*** (0.0020)	0.0638** (0.0210)
Export-market GDPPC-real		0.1029*** (0.0000)	0.1384*** (0.0000)
Exporting time	27.7985*** (0.0000)	−58.6952*** (0.0000)	−54.9212*** (0.0000)
Telecoms	0.1000*** (0.0000)	0.4495*** (0.0000)	0.3242*** (0.0000)
Internet usage	−0.1495*** (0.0000)	−0.3268*** (0.0000)	−0.3445*** (0.0000)
Logistics_Perf_Index		0.6231*** (0.0000)	0.7943*** (0.0000)
QI_Trade and transport			0.2742*** (0.0000)
Customs efficiency			−0.5206*** (0.0000)
Common colony			1.1829*** (0.0000)
Inverse mill ratio	1.7485*** (0.0000)	3.7508*** (0.0000)	3.5224*** (0.0000)
Constant	−211.6655*** (0.0000)	−449.1782*** (0.0000)	−431.0057*** (0.0000)
Wald χ^2	57402.01*** (0.0000)	293776.76*** (0.0000)	76815.94*** (0.0000)
Observation	9,463	3,169	3,169
Remoteness_Exporter	Yes	Yes	Yes
Remoteness_Importer	Yes	Yes	Yes

Note(s): All variables are in logarithm form except the dummy and index variables. The standard errors have been corrected for heteroscedasticity and are presented in parentheses. The Wald χ^2 parentheses are the probability values. The significant variables are denoted by the *, ** and *** at 10, 5, and 1 per cent significance levels, respectively. The trade facilitation measures are included gradually from Scenarios 1–3

Source(s): Author's estimation

trading partners have not propelled export flows; despite this, export promotion and demand came from the improved standard of living and purchasing power in Africa and the export markets, respectively.

5. Conclusion

Export facilitation policies have been embarked upon in many countries, particularly Africa, because of the continuous export challenges caused by disruptions and barriers associated with exporting and export procedures. To overcome these export challenges, African countries have put in place export-facilitating policy measures to ease export procedures, ensure disruption-free supply chains and improve and automate ports' activities. The key aspect of export facilitation is the quality infrastructure that will ensure the accomplishment of ease of export. Hence, the importance of export-facilitating QI to exporting extensiveness and intensiveness cannot be overemphasised. This study investigated the effects of the implemented export-facilitating quality infrastructure on Africa's exports.

To test the implementation of export-facilitating QI measures increased Africa's exports hypothesis, this study employed an augmented Helpmann, Melitz and Rubenstein's theoretical framework that allowed for asymmetric country-paired bilateral trade flows and zero trade regularity. The results indicated that the export procedures timings eased and served as an impetus for both prospective and previous exporters wanting to re-enter the export markets. In addition, the improvements in export time enhanced export intensity. At both margins of exports, export-facilitating QIs such as telecommunications and logistics performance index propelled export extensity and intensity, while the internet infrastructure usage only stimulated the probability of export. Further, the trade and transport and customs efficiency export-facilitating QIs did not determine the extensiveness and intensiveness of exports. However, the sensitivity of the baseline regressions to variables readjustments (robustness check) suggested different results at both the extensive and intensive margins of exports, particularly at the

intensive margin where all the export-facilitating QI measures significantly enhanced export flows, except the internet infrastructure usage.

To this end, this study attests to the literature strand that asserts the trade-enhancing effects of trade facilitation. Beyond this, the export-facilitating effects of the implemented export-oriented quality infrastructure measures, except for internet usage, trade and transport infrastructure and customs efficiency, were also affirmed. The decision to enter the export markets and the export intensity are driven by time, telecommunications, internet services usage and logistic services. However, the implemented export-facilitating quality infrastructure measures have not yielded the expected export outcome owing to the inadequacies, obsolete information and deficiencies in the handling of the quality infrastructure. There is a need to mobilise investment and development finance into the provision of export-facilitating quality infrastructure in Africa. Modern and sophisticated supply chains and transport infrastructures are also required, as well as further automation of the customs activities. Thus, investment and development finance-friendly policies are required to promote a sustainable inflow of investors' capital to the export sector, which will improve the extensiveness and intensiveness of exports that can contribute to the achievement of sustainable development in Africa.

Notes

1. Helpman *et al.* (2008).
2. The dimension is: customs performance, infrastructure quality, ease of arranging shipment, logistics service quality, consigning tracking and tracing and timeliness of shipments.

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(The Appendix follows overleaf)

Appendix

Table A1. Descriptive statistics and variables' definitions

Variable	Definition	Min.	Max.	Source
Distance	Distance between most populated cities in kilometres	8.02	19904.45	Centre d'Etudes Prospectives et d'Informations Internationales (CEPII)
Africa GDP	Current African gross domestic product, US\$	1.36e+08	5.68e+11	UNCTADstat
Importer GDP	Current importers' gross domestic products, US\$	2.18e+07	1.87e+13	UNCTADstat
Africa GDPPC	Current African gross domestic product per capita, US\$	151.68	22942.58	UNCTADstat
Importer GDPPC	Current importers' gross domestic products per capita, US\$	151.68	118823.6	UNCTADstat
Exporting time	The number of days required to export	10	78	World Development Indicators
Importing time	The number of days required to import	9	102	World Development Indicators
Telecoms	Mobile cellular subscriptions per 100 persons	0.54	176.69	World Development Indicators
Internet usage	Internet subscription per 100 persons	0	16.84	World Development Indicators
Logistics_Perf_Index	Overall logistics performance index	1.34	3.78	World Development Indicators
QI_Trade and transport	Quality of trade and transport-related infrastructure	1.27	3.79	World Development Indicators
Customs efficiency	The efficiency of the customs clearance process	1.29	3.60	World Development Indicators
Common colony	Common colonial affiliation; 1 for common coloniser post-1945	0	1	Centre d'Etudes Prospectives et d'Informations Internationales (CEPII)
Language	Common official language; 1 for common official primary language	0	1	Centre d'Etudes Prospectives et d'Informations Internationales (CEPII)
Source(s): Author's estimation				

Table A2. Pairwise correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
(1) lBilateral_Exp~s	1.000																	
(2) ldist	-0.137	1.000																
(3) lAfrica_GDP_cu~t	0.270	-0.034	1.000															
(4) lImporter_GDP_~t	0.578	0.047	0.015	1.000														
(5) lAfrica_GDPPC_~t	0.087	0.016	0.346	0.016	1.000													
(6) Importer_GDPPC~t	0.272	0.101	0.011	0.473	0.012	1.000												
(7) comlang_off	0.007	-0.137	0.016	-0.167	0.029	-0.022	1.000											
(8) lTime_to_Export	-0.097	-0.006	-0.204	-0.019	-0.493	-0.014	-0.029	1.000										
(9) lTime_to_Import	-0.042	-0.025	-0.037	-0.020	-0.459	-0.015	-0.021	0.901	1.000									
(10) lMobile_Cellu~i	0.090	0.012	0.313	0.062	0.602	0.041	-0.006	-0.578	-0.520	1.000								
(11) lIndividuals_~t	0.087	0.011	0.300	0.047	0.666	0.028	0.018	-0.633	-0.602	0.815	1.000							
(12) Logistics_Per~x	0.111	0.023	0.377	0.010	0.267	0.005	-0.005	-0.342	-0.289	0.405	0.413	1.000						
(13) QualityTradeT~u	0.105	0.034	0.344	0.013	0.296	0.008	0.001	-0.406	-0.328	0.418	0.443	0.855	1.000					
(14) Efficiency_of~r	0.064	0.034	0.225	0.009	0.184	0.004	0.000	-0.274	-0.228	0.310	0.324	0.857	0.780	1.000				
(15) comcol	-0.045	-0.100	-0.009	-0.199	-0.007	-0.111	0.483	0.000	0.010	0.007	0.021	-0.035	-0.024	-0.040	1.000			
(16) lSimpleAverage	-0.206	0.113	-0.084	0.010	-0.178	-0.041	-0.037	0.088	0.127	-0.124	-0.137	-0.152	-0.201	-0.154	-0.007	1.000		
(17) lExporter_Rem~d	-0.271	0.044	-0.993	-0.005	-0.322	-0.004	-0.013	0.179	0.004	-0.240	-0.242	-0.356	-0.315	-0.201	0.012	0.059	1.000	
(18) lImporter_Rem~d	-0.600	0.098	-0.004	-0.978	-0.005	-0.440	0.138	0.006	0.006	-0.017	-0.012	-0.002	-0.003	-0.002	0.178	-0.017	0.001	1.000

Source(s): Author's estimation

About the author

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