

How Facilitating Trade would benefit Trade in Sub-Saharan Africa

By

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Abstract

Despite a significant trade expansion that has been above the world average in the recent period, Sub-Saharan Africa still remains relatively marginalized in the world trading system. This paper sets out to analyze the extent to which various elements of the trade cost landscape in the sub-continent may have contributed to shape trade patterns both within the region and with the outside world. Various trade facilitation measures such as border efficiency, physical infrastructure and regulatory environment are related to bilateral trade flows in a gravity framework. The results based on the Poisson pseudo-maximum likelihood indicate that a one-standard-deviation increase in trade facilitation measures could yield up to 33% increase in exports, and raising the sub-continent to the level of the world average would amount to reducing bilateral distance by 1.8% to 4.5%, or reducing ad valorem tariff by 1.8 to 12.8 percentage points. The extent of the gains varies greatly across the trade facilitation measures, commodity sectors, export destinations, and depends on which trading partner undertakes the corresponding reforms. Policies aimed at boosting trade could focus more on improving border efficiency that appears to be more cost-effective especially in the context of budget-constrained governments across the sub-continent.

JEL codes: *F13, F14.*

Key words: *Trade facilitation, trade flows, Sub-Saharan Africa, gravity model.*

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1. Introduction

Over the first decade of the 21st Century, trade expanded significantly across Sub-Saharan Africa. In effect, trade volume grew at an annual rate of 5.9%. This increase was well above the world average of 3.8%.² This trade pattern happened in a general context of relatively strong economic growth of African economies, with an annual rate of 5.0% (5.3% for Sub-Saharan countries), twice as much as the global economy's growth rate, making the continent the second fastest growing region in the world (UNDP, 2013).

However, this positive trend had more to do with imports than exports. In effect, exports have grown at a lower rate than imports: 5.1% against 6.9%, suggesting a further worsening of African economies' international trade position. Moreover, Sub-Saharan Africa is still a marginalized region in the world trading system with a meagre 2.8% share of the global trade volume in 2010 (1.9% for Sub-Saharan economies). It would certainly take a far greater pace of trade expansion for the continent to become a major player in the global trade arena and reap the economic growth benefits associated with international trade.³

Major trade reforms have been successfully implemented all over the region. They range from trade liberalization to regional integration and other bilateral and multilateral trade agreements. As a result, tariffs have been at an all-time low, in line with the world trend. But these reforms often fall short of addressing the myriad of non-tariff barriers that often have more devastating effects on trade than actual tariffs. In effect, the region is still the place where importers and exporters face far greater hurdles than anywhere else. For instance, it takes on average more time to ship a container from Africa to the rest of the world (31 days) or from the outside world to Africa (38 days) than any other region in the world.⁴ In addition, over the course of trading across African borders, a far greater number of documents is required: eight when exporting and nine when importing. As a consequence, the average cost of flowing goods across borders is larger in Africa: US\$ 2,108 to ship a container outside the average African country, and US\$ 2,793 to send a container in the opposite direction (respectively 2.5 and 3.2 times as much as it costs to trade in East Asia and the Pacific). The same pattern shows in the World Bank's Logistics Performance Index (LPI): Overall, the continent scored 2.47 out of 5 in 2014, which is again below the world average (excluding Africa) of 3.07, and this is a slight worsening compared to the 2012 score of 2.48.⁵ All these impediments spell higher trade costs in Africa (Arvis et al., 2013), and the resulting higher prices tend to discourage both imports and exports, further harming African economies' international competitiveness.

There is a relatively strong belief that reforms aimed at facilitating trade could reduce trade transaction costs and bring significant economic gains. Trade facilitation

refers to the "simplification and harmonization of international trade procedures", or more specifically to the "activities, practices and formalities involved in collecting, presenting, communicating and processing data required for the movement of goods in international trade".⁶ More broadly, trade facilitation encompasses "measures aimed at streamlining trade procedures and reducing the cost and uncertainties of international trade transactions" (UNESCAP, 2011). In addition to traditional issues surrounding customs procedures, transit time and logistics, facilitating trade involves broader aspects related to transport infrastructure, business practices, telecommunications, regulatory environment and even organized crime (Moisé, 2013; Clark et al., 2002).

The existing economic literature on trade facilitation is based on the notion of trade transaction costs, and measures that successfully reduce these costs tend to generate significant trade benefits to the country. For instance, Hummels and Schaur (2013) find that each day in transit generates an additional trade cost similar to an ad valorem tariff of 0.6% to 2.1% (Djankov et al., 2010). Arvis et al. (2013) suggest that the combined effect of maritime transport connectivity and logistics can even be as high as that of geographical distance. Lesser and Moisé-Leeman (2009) show that trade facilitation measures aiming at overcoming border bottlenecks can significantly reduce informal cross-border trade in Sub-Saharan Africa.

At a micro-level, trade facilitation is found to increase firms' performance. For instance, as a result of falling trade costs, industries enjoy relatively strong productivity growth, non-exporting firms are very likely to start exporting, and existing exporters increase their trade volume (Bernard et al., 2006). Furthermore, lowering trade costs has an important resource re-allocation effect: It improves the efficiency of an industry by both increasing the likelihood that inefficient producers exit the industry, and allowing efficient ones to expand and export more (Blyde and Iberti, 2010).

But trade facilitation involves various components, and their impacts on trade are very different depending on the traded goods, trade routes, modes of transport and trading partners. Adding to the complexity, while some measures are very costly to implement, others require greater operating costs. All of these call for a detailed analysis of how country specifics contribute to shape the effectiveness of any trade facilitation reform. More specifically, such analysis should answer the following questions: Which trade facilitation measures have greater trade potential in the specific context of Sub-Saharan African economies? Which trade sector (agriculture, manufacturing or minerals) is more likely to benefit the most from trade facilitation? Which trading partners are more responsive to trade facilitation measures (within the sub-continent or in the outside world)?

A clear assessment of the inefficiency costs of various elements that influence the cross-border movement of goods can offer a formal basis for a good understanding of the economic importance and relevance of trade facilitation measures. It will also feed into the momentum sparked by the recent success of the World Trade Organization's negotiations over trade facilitation and further strengthen the political will for reforms. The results can also help in the prioritization of trade facilitation actions in the face of overstretched government budgets in the sub-continent. By contributing towards increasing Africa's trade potential, successful trade facilitation reforms can ultimately reduce the continent's relative marginalization in the world trading system.

The paper revisits the literature on trade facilitation and assesses the associated benefits to Sub-Saharan African economies. More specifically, it discusses how the different components of trade costs impede trade performance, and how removing such hurdles could boost trade on various products both within the sub-continent and with the rest of the world. The paper adds to the literature in various important ways, especially in the Sub-Saharan African context. First, as trade facilitation measurement has been constantly improving, one can expect recent data to provide more relevant and accurate information than previous ones. For instance, in 2007, the World Economic Forum's data collection process underwent a "stringent review" that resulted in "greater data accuracy" and "more robust comparison across economies" with respect to various aspects of the business operating environment, including trade facilitation measures.⁷ These improvements could offer relatively new and better insight into how the trade environment affects trade performance.

Second, by developing a unified framework that combines all the disaggregated measures of trade facilitation and the detailed commodity structure of trade, the paper will reveal which indicators are more relevant for certain types of exports (i.e., agriculture, manufacturing and minerals) and which measures need to be implemented to deliver the required improvements. This could help prioritize among the various policy options in the context of limited government budgets. Third, the paper makes a distinction between trade cost elements in countries at either end of the bilateral trade relationship, suggesting that exporters and importers may not benefit equally from trade facilitation occurring at a given end.

The empirical approach develops a gravity model that relates trade facilitation measures to bilateral trade flows. These measures include the quality of physical infrastructure (roads, ports, airports, and railways), border efficiency (time and number of documents required to trade), regulatory environment (public trust in policy makers, irregular payments and bribes, favoritism in policy decision making, and transparency), e-business (availability of the latest technology and firms' technology absorption) and the Logistics Performance Index (LPI) that regroups elements such as customs, international shipment and timeliness. Additional explanatory variables include ad valorem tariffs, as well as traditional variables such as distance. With data on 41 Sub-Saharan African countries trading with various partners both within the sub-region and in the rest of the world, various model specifications combining disaggregated trade and disaggregated trade facilitation measures are estimated using the Poisson pseudo-maximum likelihood, which appears to be a good approach to dealing with zero trade.

The results suggest that facilitating trade does indeed promote exports in Sub-Saharan Africa. A one-standard deviation change in the trade facilitation measures leads to an increase in exports by up to 33%. If the typical SSA country were to be raised to the world average in terms of the quality of the trading environment, the corresponding gains would be equivalent to reducing the average distance to the typical trading partner by 125 to 783 km (or 1.8% to 4.5%), or reducing the ad valorem bilateral tariff by 1.8 to 12.8 percentage-points. Disaggregating trade into various destinations and commodity groupings, and trade facilitation indicators into individual component elements reveals that: (i) both trade within the sub-continent and with the outside world will benefit from reforms to facilitate trade to the extent that they are undertaken by countries with the lower

quality of trade environment; (ii) improving border efficiency in terms of a reduction in the number of documents required when exporting (and transit time) is associated with a greater expansion of exports; and (iii) mineral trade seems not to benefit from improvement in the regulatory environment such as a reduction irregular payment and bribes or greater transparency.

The remainder of the paper is organized as follows. Section 2 offers a brief summary of the literature. Section 3 details the methodology. Section 4 describes the data. Section 5 presents and discusses the results. Finally, section 6 offers some concluding remarks.

2. Literature review

Various international organizations have recently been collecting survey data on various aspects of trade facilitation at a country level. This has led to renewed interest in measuring their impacts on trade. A typical empirical research starts by aggregating the myriad of indicators into broad measures of trade facilitation, and then tests their explanatory ability of observed trade patterns. What emerges from the large body of empirical literature is that these measures are significant components of trade costs. An improvement in the trade environment generates increased trade flows. The extent of these gains are different across trade facilitation measures, products, and trading partners, rendering the effectiveness of any trade facilitation reforms very dependent upon country and product specifics. Maur and Wilson (2010) provide an extensive survey of the literature.

A historical perspective of world trade dynamics indicates that trade costs have declined significantly over the past century and a half, although not at a regular pace. Over that period, the dynamics of trade flows have been intimately related to the evolution of trade costs. For instance, Jacks et al. (2008) suggest a strong correlation between trade booms and trade busts, and trade costs. The authors indicate that rapid expansion of world trade from 1870 to 1913 and then in the post-World War II period owes greatly to trade cost declines. In effect, the latter explain roughly 55% of trade boom in the first period, and 33% in the second period. On the other hand, the retreat of world trade from 1921 to 1939 is found to be strongly related to a precipitous rise in trade costs. This contribution of the costs of international trade to the evolution of trade flows appears to be larger than that of the growth of global output. Hummels (2007) also suggests that the significant rise in speed of international trade has more to do with falling trade costs, specifically transport costs (air and ocean shipping).

A disaggregation of these global patterns of trade costs and trade flows reveals significant cross-country differences. For instance, Arvis et al. (2013) provide evidence that the rate of decline in trade costs depends on income per capita: developed countries experience faster decline in trade costs than developing countries. In countries such as those in Sub-Saharan Africa, maritime transport connectivity and logistics performance are found to be very important determinants of bilateral trade costs, and their combined effects are comparable to that of geographical distance. This suggests that trade facilitation reforms could reduce Africa's isolation in the world trading system and provide the continent with significant economic gains.

Hummels and Schaur (2013) for instance suggest that reducing transit time by one day can boost trade at a magnitude equivalent to that of a reduction in ad valorem tariff

by 0.6% to 2.1%. These results are consistent with many findings in the literature that view time as a trade barrier (Nordås et al., 2006). In line with these findings, gains from reforms aimed at cutting lengthy trade processes will have differentiated effects across traded goods. Increasingly, time-sensitive goods of the likes of those involved in a global value chain (parts and components) or agricultural products are found to be more responsive to measures that shorten trade time.

Reducing the time it takes to ship a container involves not only improving the quality of trade infrastructure but also streamlining the export and import processes with the use of new technologies, as well as improving the regulatory environment. Iwanow and Kirkpatrick (2009) for instance suggest that the low performance of the African manufacturing sector in export markets is mainly attributable to poor infrastructure and unfriendly institutional environment. Their results based on a gravity model indicate that facilitating trade could potentially unlock Africa's trade potential on manufacturing goods. These reforms should, for instance, improve the quality of the regulatory environment and the quality of the basic transport and communication infrastructure.

Portugal-Perez and Wilson (2010) provide further evidence that trade facilitation also matters for Africa both today and in the long run, where trade costs are found to be higher than in any other region in the world. Their gravity model estimates clearly indicate that trade facilitation measures could yield increased trade flows, more so than substantially cutting tariffs. One specific example is that improving logistics in Ethiopia to the extent of one standard deviation is equivalent to 7.6% decrease in ad valorem tariff.

A move towards paperless commerce is also found to stimulate trade, mostly through a reduction of market-specific sunk costs of exporting. For instance, Freund and Weinhold (2000) show from a gravity model that over the period 1998-1999, a 10% increase in the number of web hosts is associated with a 1% rise in trade flows. These gains are found to be larger in developing countries than in developed ones. But there seems to be little supporting evidence that Internet usage has reduced the impact of geographical distance on trade. In the same vein, Fink et al. (2005) also indicate that bilateral communication costs, measured by per-minute calling prices, have a significant influence on bilateral trade flows both in the aggregate and across sectors.

There is also strong empirical evidence that trade facilitation can have a positive impact on firms' performance. The recent heterogeneous-firm models of international trade have provided theoretical foundations that link trade costs to firms' productivity and export performance. For instance, as trade costs decline, productivity increases both within plants and at the industry level (Bernard et al., 2006). In addition, exports appear to be strongly correlated with productivity, either through a learning-by-exporting process, by which greater interactions with highly efficient foreign firms leads to more productivity gains, or through a self-selection channel by which more productive firms are more likely to enter export markets. Similar findings are also true for African manufacturing plants. Van Biesebroeck (2005), for instance, shows that exporters increase their productivity advantage after entry into export markets, providing support to the selection hypothesis. Clarke (2005) suggests that the main reasons why African manufacturers do not export have greatly to do with restrictive trade and customs regulation as well as poor customs administration. All of these suggest that African firms could greatly benefit from trade facilitation, and the aggregate benefits could translate into an improvement in the continent's international trade position.

3. Methodology

In assessing the impact of trade facilitation on trade flows, the first step involves constructing aggregate indicators. Next, a gravity model of trade flows is developed and augmented with these trade facilitation measures. Finally, the estimation results will be used to simulate how country specifics shape the extent of the gains from any trade facilitation reform.

Constructing aggregate trade facilitation indicators

The literature has suggested various indicators that capture the quality of the environment in which cross-border trading takes place. These measures aggregate different elements that determine the extent to which the environment is conducive to trade performance (Francois and Manchin, 2013; Portugal-Perez and Wilson, 2010; Wilson et al., 2005; Wilson et al., 2003; among others). Following most of the literature, we consider four broad trade facilitation indicators:

- (1) **Physical infrastructure:** It tells about the quality of ports, airports, road, and railroad network. The overall quality pertains to the density, the ease of connectivity and the efficiency of the associated services as perceived by users. The existence and quality of such trade infrastructure determine to a greater extent the very possibility to engage in trade with foreign partners.
- (2) **Border efficiency:** It aims at measuring the efficiency of the customs formalities through which importers and exporters have to go. It relates to the number of required documents, the time it takes to clear the customs, and eventually the dollar costs.
- (3) **Regulatory environment:** It relates to the transparency and predictability of public policies, in particular trade policies. These are of particular importance to traders in the sense that they provide clear information regarding trade procedures and reduce the level of uncertainty and risk.
- (4) **E-business:** This measure indicates the extent to which the use of information and communication technology (ICT) improves paperless trade and efficiency, and reduces trade transaction costs.

The specific inputs that enter the construction of each trade facilitation indicator are collected by yearly surveys, the mostly used in the literature being the World Economic Forum's World Competitiveness Report (WCR) and the World Bank's (WB) Ease of Doing Business (EDB). Table 1 shows the aggregate indicators and their input elements.

Table 1: Trade facilitation indicators, input elements and data sources

Aggregate indicators / Inputs	Sources
Physical infrastructure	WCR
Quality of ports	
Quality of airports	
Quality of roads	
Quality of railroad	
Border efficiency	EDB
Time to export (days)	
Number of documents required to export	
Regulatory environment	WCR
Transparency of government policy making	
Public trust in politicians	
Irregular payments and bribes	
Favouritism in decisions of government officials	
E-business	WCR
Availability of latest technologies	
Firm-level technology absorption	
Logistics Performance Index	WB
Customs	
Infrastructure	
International shipment	
Logistics competence	
Tracking and tracing	
Timeliness	

Additional information regarding the trade environment is offered by the World Bank's Logistics Performance Index (LPI). It measures the “on-the-ground efficiency of trade supply chains, or logistics performance”. It encompasses various elements ranging from customs, infrastructure, international shipment, logistics quality and competence, tracking and tracing, as well as timeliness.⁸ Turkson (2011) suggests that this indicator is a good predictor of bilateral export performance in developing countries. To the extent that the degree of collinearity with the above indicators allows, this can be used to measure the impact of trade facilitation on trade performance.

The individual aspects of the trade environment will be aggregated into gross measures using simple average. Despite the arbitrary nature of the weight assignment (equal weight of unity), it has been widely used in the literature (see for instance Wilson et al., 2005). Alternatively, it can be interesting to tell which elements of the aggregate measures contribute the most to trade of the specific commodity. We may for instance expect agricultural products, with their complex and more demanding logistical network, to be

more sensitive to the quality of ports than mineral commodities. Therefore, a granular analysis that focuses on individual component measures will add relevant information about the contribution of the trade cost landscape to trade performance.

The Gravity model

The gravity model has become a very popular approach to modelling the relationship between trade and geography. More specifically, bilateral trade flows are related to market size (GDP or GDP per capita) and distance to account for intra-industry trade effects that arise between countries with similar size but different tastes (Wilson et al., 2005). Different elements that enter trade costs are also added to the basic formulation. They comprise tariff barriers, trade agreements, currency union, contiguity, landlocked, language/ethnic similarities, colonial heritage, and so on. For the purpose of this study, we include trade facilitation measures to further address country heterogeneity. The following basic specification of the gravity model is considered:

$$y_{ijt} = \beta_0 + \sum_{k=1}^K \beta_k x_{kijt} + \varepsilon_{ijt} \quad (1)$$

where y_{ijt} represents the value of exports from country i to country j in year t , x_{kijt} the gravity variables, and ε_{ijt} an error term.

Some common issues need to be addressed to obtain reliable coefficient estimates. On the theoretical ground, various works have suggested that structural elements be included in the model to better account for the real patterns of international trade. These elements include the heterogeneity of traded goods along many dimensions, especially quality and origins, and price differentials of similar goods that are associated with border effects and transport costs (Anderson, 1979; Balistreri and Hillberry, 2001; Anderson and van Wincoop, 2003).

On the empirical side, Egger and Pfaffermayr (2003) suggest that these various sources of heterogeneity are translated into a misspecification of the intercept term. A correction strategy entails making the error term of the model vary across trading partners and over time to fully capture unobservable bilateral trade flows (Cheng and Wall, 2004; Wilson et al., 2013). More specifically, the following specification of the error term is considered:

$$\varepsilon_{ijt} = \beta_0 + \beta_i + \beta_j + \gamma_t + v_{ijt}$$

with β_i and β_j denoting exporting and importing country's fixed effects that capture unobservable differences in product quality and domestic policies in exporting and importing countries, γ_t a time-specific fixed effect, and v_{ijt} a random disturbance.

The general specification of the model that accounts for all of these theoretical and

empirical developments is as follows:

$$\begin{aligned} \ln X_{ijt} = & \beta_0 + \beta_i + \beta_j + \gamma_t + \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{jt} + \beta_3 \ln DIST_{ij} + \\ & \beta_4 \ln (1 + TARIFF_{ijt} / 100) + \beta_5 \ln TFI_{it} + \beta_6 \ln TFI_{jt} + \\ & \sum_{k=7}^K \beta_k Z_{kijt} + v_{ijt} \end{aligned} \quad (2)$$

where $\ln X_{ijt}$ is the natural logarithm of exports of country i to country j in year t , GDP denotes Gross Domestic Product, $DIST_{ij}$ the distance between capital cities of countries i and j , TFI trade facilitation indicators in importing and exporting countries, $TARIFF_{ijt}$ the ad valorem tariff rate applied by importing country j to products from exporting country i , and Z_{kijt} the standard trade impeding or enhancing variables, such as contiguity, language and colonial ties.

Estimation strategies

The general estimation strategy of the gravity has evolved around the issue of missing trade (or zero-trade, which represents 68% of the data we will use in this study). A somewhat naive approach would consist of dropping those observations consisting of country pairs that do not trade with each other, one obvious reason being that the log operator does not apply to zero. The resulting outcome of the estimation through a pooled OLS, for instance, is more likely to be plagued with selection bias. An alternative approach, which has become a common practice, consists of replacing the zeros by a small number, say 0.01. However, this approach tends to limit the scope of the analysis by not telling why countries engage in trade while others do not, which is equally important as modelling the volume of trade.

More satisfactory approaches to dealing with the zeros include the Poisson pseudo-maximum likelihood (PPML). Its advantages for gravity models over the log-level specification of the OLS models have been highlighted by Santos Silva and Tenreyro (2010; 2006). In particular, they show that due to no-spherical disturbances and following Jensen's inequality, the log-linear specification leads to biased estimates, and they provide evidence that the PPML is more efficient than the non-linear least squares estimator. As a result, the PPML has been widely used to estimate gravity models.

Various extensions of the PPML estimator have been suggested, such as the negative binomial pseudo-maximum likelihood (NBPMML). While the first estimator assumes proportionality between the conditional variance and the conditional expectation of trade flows, the negative binomial distribution relies on the assumption that the conditional variance is a linear combination of the conditional mean and its square. Although the NBPMML is a more general version that encompasses the broad family of pseudo-maximum likelihood (such as PPML or gamma PML), it has been shown that in many cases it is inappropriate when dealing with continuous data, and is very scale-dependent (Bosquet and Boulhol, 2010). In effect, whether trade is measured in thousands or millions tends

to generate significant differences in the estimates. The PPML estimator, towards which converges the NBPML estimator when flows are measured in large units, will be considered in this paper.

A potentially important issue is the endogeneity of the trade facilitation variables. In effect, as trade flows increase, the overall trade infrastructure could become crowded, adding extra cost to cross-border trading and delays, all of which translate into reduced quality captured by the trade facilitation measures. Furthermore, as trade expands, there may be a lobbying pressure on the government to improve the trade environment. To avoid this endogeneity bias, we use the lag of the trade facilitation measures. It turns out that the indicators generated in a given year are based on data collected by means of survey the prior year. Therefore, although TFI_{it} refers to year t , it tells about the quality of the trade environment in year $t-1$. Taking the lags also allows capturing a full impact of any trade facilitation reform which could likely go beyond the contemporaneous effect.

Because trade patterns may be different from one product to another and from one partner to another, we will consider different sets of estimations. We therefore consider different sets of commodities (agriculture, manufacture, and mineral) and different trading partners (among Sub-Saharan African countries and between these countries and the rest of the world). This will reveal whether trade facilitation will benefit more intra-African trade than trade with the outside world.

An interesting way to put the effect of trade facilitator indicators into perspective is to get their distance-equivalence or tariff-equivalence (or subsidy-equivalence). This would give a clear sense of the gains resulting from trade facilitation in terms of a hypothetical reduction of the distance between trading patterns or a reduction in tariff barriers. In addition, because the measurement scales of the trade facilitation indicators are not identical (for instance the quality of road infrastructure is on a 0-10-scale, while the number of documents to trade could be greater than 10), the impact of the reforms could be expressed in terms of how exports would respond to a one-standard-deviation change in the indicators.

4. Data

Table 2 shows some descriptive statistics of the data. Commodity trade within the continent represented close to 15% of GDP on average in 2012, and almost 18% with the outside world. This fact that Africa trades more with the rest of the world than with itself is well-documented from both statistical observations and empirical results that often use the gravity model. From 2007 to 2012, relative to GDP, trade declined by more than 8 percentage points, and this reduction affected both intra- and extra-African trade. The adverse effects of the global economic crisis of 2008 and its aftermath may have reduced the demand for commodities, in particular those originating from Africa.

Trade structure both within Africa and with the rest of the world reveals that most of the commodities being traded are agriculture and minerals (more than 90% on average) as opposed to manufacturing goods whose share has declined since 2007 (as well as mineral exports). This is suggestive of the relatively low-valued exports that do not go very far in the value chain through an industrial transformation process. This structural composition of exports may have more to do with the demand side, especially in terms of value, which is driven by the world price. Manufactures have always been a small share of Africa's exports, except for countries such as South Africa and Mauritius. The data show that although these countries may be major exporters of manufactures, they may not be significantly driving the results. For instance, factoring out South Africa would decrease intra-SSA trade in manufacturing by a 1.3 percentage point relative to GDP. Minerals became even more important in the 2000s as a result of a significantly large demand from China but declined after 2007 (financial and economic crises). At the same time, agricultural exports remained fairly stable and became proportionally greater since 2007.

All component elements of the trade environment have been improved. However, they still remain below the world average. The average gap is about 1 point on a 1-to-10 scale, except for border efficiency (time it takes to trade), which indicates an extra 12-day duration to ship a container outside the sub-continent; the same time it took the average country outside Africa in 2007 to do the same. It is also remarkable that improvement on any trade facilitation front is happening faster in Africa than in the outside world. This could indicate some form of diminishing returns whereby changes get easier for laggard countries that have more space than countries that are closer to the frontier.

These aggregate figures hide a great deal of heterogeneity, as one would expect. When it comes to infrastructure, airports appear to be less burdensome, with a perceived quality of 6.1 out of 10 in 2012. Countries that top the list include South Africa (11th in the world ranking of 106 countries with a score of 8.7 out of 10) and Ethiopia (40th with 7.3 out

of 10). This infrastructure pillar has also witnessed one of the greatest improvements, along with roads, with a change in the index value of 2.3 and 2.4, respectively, from 2007. On the opposite, railroads appear to be the less friendly infrastructure component, with even a quality decline over the period across the region (-0.5). Furthermore, these improvements tend to be widely distributed across the continent rather than being concentrated on a small number of countries. For instance, the Logistics Performance Index that summarizes various components of the trade environment has improved in 61.7% of the SSA countries included in the sample.

Improvement in the regulatory environment has occurred mainly on two fronts: public trust in policy decision makers and irregular payments and bribes, with an increase in the perceived quality of 1.2 and 1.4, respectively. But favouritism in decisions of government officials has worsened significantly, going from being one of the best aspects of the regulatory environment to the worst, with a decline in its index value of 1.3. This is indicative of some inconsistency in the general public effort to improve the overall regulatory environment, hence a mixed signal sent to the various export markets.

Table 2: Summary statistics

	SSA	RoW	All
Exports (% GDP)	14.9 (-8.7)	17.9 (-8.9)	15.0 (-8.8)
Agriculture (% exports)	45.2 (6.2)	49.5 (19.5)	48.1 (18.1)
Manufacturing (% exports)	15.3 (-5.7)	6.2 (-10.8)	9.2 (-7.1)
Minerals (% exports)	39.4 (-0.6)	44.4 (-8.6)	42.7 (-10.3)
Trade facilitation			
Physical infrastructure	5.1 (1.3)	6.2 (0.6)	6.0 (0.8)
Regulatory environment	4.9 (0.3)	6.0 (0.2)	5.9 (0.2)
e-Business (ICT)	6.7 (1.8)	7.4 (1.0)	7.3 (1.2)
Border efficiency	31.0 (-5.1)	19.2 (-3.6)	22.2 (-4.2)
LPI - overall score	5.0 (0.3)	5.9 (0.2)	5.7 (0.2)
Tariff (%)			
Agriculture	17.1 (1.0)	9.5 (-0.9)	11.0 (-0.4)
Manufacturing	14.0 (-0.5)	7.0 (-0.8)	8.5 (-0.7)
Minerals	13.3 (-0.7)	5.5 (-0.4)	7.4 (-0.3)

Notes: "SSA" stands for Sub-Saharan Africa, and "RoW" the rest of the world. Data for trade facilitation have been rescaled to 1-10 to allow comparison, except for border efficiency (time to export), and values are averages of 2012 over component elements. Values between parentheses represent changes between 2007 and 2012.

The greater expansion of ICT into trade relations has been consistent with increased border efficiency. In effect, as a result of more availability of the latest technologies and greater firm-level technology absorption, exporting a container outside the sub-region takes less time (5 days less) and involves less documents (1 less). It is also revealing that countries that fall farther behind the technology frontier tend to be those with less efficient borders, such as Chad, Niger, Central African Republic and Zimbabwe.

The LPI sub-indices also reveal similar features of the trade environment in Sub-Saharan Africa, although to a lesser extent. For instance, all sub-measures of trade facilitation have been improved from 2007 to 2012. Timeliness is still clearly the component that is perceived with the relatively highest quality, with an average score of

5.5 out of 10 in 2012. The next two most important elements are international shipment and logistics performance quality. All of these positive developments certainly had the potential to contribute to export promotion.

The historical downward trend of tariff worldwide has meant that the rates are lower than before, but they are still important in Sub-Saharan Africa where they represent a significant source of government revenue. In effect, the simple averages of effective tariffs shown in Table 2 indicate that these barriers are on average twice as high in the sub-continent than in the outside world. This could reflect the heavy reliance of African government budgets on tariffs as a measure of source of income as opposed to the advanced countries, despite an important web of preferential trade agreements, which are counterbalanced by significantly lower intra-trade flows. The actual distribution of tariffs and the way they are measured (i.e., simple average) are believed to fully account for the preferential agreements within which bilateral tariffs could be as low as zero. This is the case, for instance, for certain destinations (intra-trade in West African or trade between most African countries and the European Union) and for certain commodities (raw materials against processed products). The average tariffs that hide such detailed information show, nevertheless, that these barriers are more important for agricultural commodities than for minerals and manufactured goods, in part because of the challenging balance of developing a robust agricultural sector *vis-a-vis* highly competitive and often subsidized imports, while at the same time guaranteeing affordable food products to the general population.

How all of these aspects of the trade cost landscape interact to drive export performance of Sub-Saharan Africa is empirically shown in the next section.

5. Results

There is a relatively high level of pair-wise collinearity among aggregate trade facilitation indicators, and among component elements of each aggregate indicator. Separate regressions are therefore considered for indicators and for component elements, considering simultaneously exporters and partners.

Table 3 shows the first set of results, which consider Sub-Saharan African countries' exports of all commodities to all destinations as well as aggregate trade facilitation measures. Firstly, the results clearly indicate that facilitating trade in the sub-continent has a great potential of improving commodity exports. For instance, a one-point improvement in physical infrastructure could lead to an increase of 16.6%, which is equivalent to a US\$ 75.1 increase in exports. For the average country in the region, this figure amounts to US\$ 75.1 million per year. Similar improvement in the regulatory environment, e-business or the LPI overall index yields equally important trade benefits to the tune of 25.6%, 14.6% and 36% increase, respectively. When it comes to border efficiency, a one-day reduction in the time it takes to export increases trade by half-a-percentage point. These results tend to be consistent with the general findings in the literature that facilitating trade improves trade (Portugal-Perez and Wilson, 2010).

The results also indicate that overall, the trade cost landscape at the exporting end matters more than that at the importing end. In effect, except for border efficiency, trade facilitation indicators of the importing countries tend to exert no statistically significant effect on exports. Sub-Saharan African countries have therefore more to gain from improving the domestic trade environment than from improvement in their trading partners. This suggests that trade facilitation benefits more the country that undertakes the corresponding reforms than its partners. Trade facilitation seems therefore to generate one-sided gains. This result tends, however, to differ from an emerging consensus in the literature that suggests that trade facilitation occurring at one end generates two-sided gains (Freund and Weinhold, 2000; Fink et al., 2005). Our results focus solely on countries that are at the lower end of trade environment quality exporting to countries that are more often at the upper end, and thus suggest that trade is much more impeded in the former than in the latter. To the extent that there may be some form of diminishing returns on trade facilitation reforms, there is therefore much more to gain from improving hard and soft infrastructure in laggard countries than in frontier countries that have less room remaining for similar reforms.

Table 3: Estimation results: All commodities, all destinations

	(i)	(ii)	(iii)	(iv)	(v)
ln_GDP_exporter	0.180*	0.450***	0.043	0.139	0.286***
	(0.10)	(0.12)	(0.11)	(0.12)	(0.10)
ln_GDP_importer	0.01	0.047*	-0.02	-0.01	0.032*
	(0.07)	(0.03)	(0.07)	(0.07)	(0.02)
ln_distance	-0.174***	-0.222***	-0.206***	-0.211***	-0.185***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)
ln_tariff	-0.824***	-0.603*	-0.714**	-0.750**	-0.684**
	(0.31)	(0.32)	(0.31)	(0.31)	(0.30)
Contiguity	0.044	0.056	0.034	0.032	0.078*
	(0.04)	(0.05)	(0.04)	(0.05)	(0.05)
Language	0.071**	0.192***	0.080**	0.086**	0.136***
	(0.04)	(0.03)	(0.04)	(0.04)	(0.03)
Colony	-0.075	-0.034	-0.049	-0.052	-0.024
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
Infrastructure_exporter	0.166**				
	(0.07)				
Infrastructure_importer	0.010				
	(0.03)				
Border_exporter (time to export)		-0.005**			
		(0.00)			
Border_importer (time to import)		0.010***			
		(0.00)			
Regulatory_exporter			0.256***		
			(0.07)		
Regulatory_importer			0.010		
			(0.03)		
e-business_exporter				0.146**	
				(0.07)	
e-business_importer				0.018	
				(0.04)	
LPI_score_exporter					0.360***
					(0.05)
LPI_score_importer					0.029
					(0.04)
Constant	9.024***	14.033***	5.005*	8.577***	8.576***
	(2.93)	(2.85)	(2.97)	(3.09)	(2.22)
N	2139	3255	2208	2208	3234
Pseudo log-likelihood	-4231.2	-10662.8	-4597.9	4601.0	-10304.7
R-Square	0.52	0.51	0.54	0.54	0.50

Notes: The dependent variable is the logarithm of bilateral commodity exports of Sub-Saharan African countries. The estimator is PPML. All regressions include exporter and importer dummies, as well as a time dummy. Values between parentheses are the standard errors. Significance at 1%, 5%, and 10% are indicated by ***, **, and *.

The remaining results tend to align with the general literature on the determinants of bilateral trade: Country size matters, as increased GDP in either trading partners increases trade flows; distance reduces or hinders trade, as well as tariff barriers; similar official language as well as shared borders encourages trade; colonial ties appear to have an insignificant effect on trade, in opposition to the general finding in the literature that they do promote trade.

To highlight the trade gains associated with facilitating trade in Sub-Saharan Africa, Table 4 considers the regression results with standardized trade facilitation variables

(detailed estimation results are shown in Appendix Tables). With the same measurement scale, changes in trade facilitation measures can now be compared with one another in terms of their impact on trade, and one can consequently tell which measure matters the most. As shown in Table 4, exports appear to be more responsive to a change in border efficiency. In effect, a one-standard-deviation change in the number of documents required to export generates an increase in exports by 32.6%. This is a 3-percentage point higher than the impact of a similar change in LPI, and more than five times larger than the gains from equal improvement in infrastructure, regulatory environment or e-business. To the extent that reducing the number of documents required to trade (and the corresponding delay in transit) could be less costly than improving any other element of the trade environment, reforms aimed at increasing border efficiency would be the most cost-effective policy approach, and therefore very welcome by the budget-constrained SSA governments.

Table 4: Trade gains from one-standard-deviation change in trade facilitation

	Change in exports (%)
Infrastructure	5.96*
Border	32.60***
Regulatory	3.54***
e-Business	-4.62
LPI	29.54***

Source: From estimation results of the model that considers total trade to all destinations, with standardized variables (see in Appendix). Values represent the impact on trade (percentage change) of a change in the trade facilitation measures by one standard deviation (an increase in all measures, except for border – number of documents required to export).

Another perspective of the results entails envisioning the average SSA country being raised to the world average (excluding the sub-region). The simulation results are shown in Table 5. Improving any component of trade facilitation amounts to reducing the distance between the African exporter and its typical trading partner by 125km to 783km. This represents a reduction in the average bilateral distance of 6,937.5km by 1.8% to 4.5%. As far as tariff barriers are concerned, reforming the trade environment in the continent is equivalent to a reduction by 1.8 up to 12.8 percentage points. For countries where the hypothetical reduction in tariffs is higher than the actual tariffs, then this reduction can be viewed as a subsidy-equivalent. In both equivalence scales, the extent of the gains is more pronounced for border efficiency because of both the larger gap with respect to the world average and, as shown in Table 4, the higher marginal gains.

Table 5: Distance- and tariff/-equivalence of improving trade environment to the world average

	Gap	Distance equivalent (km)	Tariff equivalent (%)
Infrastructure	-1.09	311.9	5.4
Border	+11.7	782.6	12.8
Regulatory	-1.16	255.3	3.2
e-Business	-0.70	273.1	3.6
LPI	-0.97	124.9	1.8

Source: Author's calculations

All of these results are based on aggregate commodity trade, aggregate trade facilitation indicators, and all trade within Sub-Saharan African and the rest of the world. More disaggregated results are shown in various tables in the Appendix. First, Table A5 in the Appendix focuses on how intra-African trade responds to an improvement in the trading environment. The results first indicate that when it comes to physical infrastructure and border efficiency, the quality on the receiving end of the trading relationship matters more than that on the exporter end, contrary to what is suggested in the previous results that consider all destinations. This reinforces the argument developed therein that the trade environment of the partners matters only to the extent that it's farther behind the frontier and therefore offers less room for improvement. This holds particularly for infrastructure and border. The regulatory environment and e-business seem not to matter, at least when ignoring LPI components on the exporter side.

Table A6 in the Appendix shows results from various estimations that disaggregate both trade over commodities (agricultural, manufacturing and minerals) and trade facilitation measures across their component elements. As shown previously, overall, Sub-Saharan African trade appears to benefit more from domestic trade facilitation reforms than from reforms undertaken by the trading partners, irrespective of the commodities being exported.

Agricultural commodities seem to be more responsive to physical infrastructure (roads, ports and airports), e-business, as well as various elements captured by the LPI index (customs, international shipment, logistics, tracking and tracing and timeliness). Border efficiency – captured by time to trade or number of documents required to export – seems to play no significant role in explaining agricultural exports, neither does the quality of the regulatory environment in any meaningful way.

Trade in manufactured goods is responsive to all elements of physical infrastructure, as well as to bribe, transparency and favouritism; in other words, all components of the regulatory environment and international shipment and logistics as captured by the LPI index. Trade in these commodities appears to be unresponsive to border and technology usage.

As far as trade in minerals is concerned, competitiveness seems to be shaped by physical infrastructure (roads only) and all components of the LPI index. Interestingly, a worsening (improvement) of all elements of the regulatory environment appears to be associated with increased (decreased) trade in mineral commodities. This could be suggestive of the often-secretive world of the mineral resource management in major exporting countries that have relatively poor governance.

Overall, trade facilitation elements that matter to all commodities alike are road infrastructure, international shipment, and logistics competence. Focusing on improving these aspects of the trade cost landscape would bring about significant gains across the board.

6. Conclusion

Recent positive trends in the trade cost landscape, as captured by various trade facilitation measures, have contributed to explaining export competitiveness of Sub-Saharan Africa. The existing gap between the sub-continent and the outside world with respect to any element of the landscape is highly suggestive of the potentially large impact of improving the trade environment.

The results also suggest various policy options to be explored to materialize those gains, as they indicate that the plethora of the sub-measures of trade facilitation have varying effects depending on the commodity being traded, the destinations one considers, and the end-of-the-trade relationships. Measures that appear to be more effective in generating export gains across all trade sectors to all destinations (within the region or in the outside world) are road infrastructure, international shipment and logistics competence. Reforms along these lines need to be undertaken by the countries as both exporters to the outside world and importers within the region.

But whether such reforms might be effective, or even successfully implemented, is a matter that needs to be addressed. The issue pertains to the political economy of trade reforms not only in Africa but also in its trading partners. An understanding of the mechanisms that underlie special interests at both ends of the bilateral trade relationship is as much crucial in the general context of the ongoing international negotiations over trade facilitation as the knowledge of the extent of the trade gains associated with reducing trade costs.

Notes

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2. World Bank's World Development Indicators online (the subsequent data are from the same source).
3. Some of the gains include foreign technology acquisition and increased aggregate productivity (see, for instance, Seck, 2012).
4. World Bank's Ease of Doing Business (<http://www.doingbusiness.org/data>). Accessed in December 2013.
5. See <http://lpi.worldbank.org/> for more details (accessed in April 2014).
6. World Trade Organization, cited by Portugal-Perez and Wilson (2010, p. 2), and Moïsé and Sorescu (2013, p. 7).
7. World Economic Forum (2013): The Global Competitiveness Report 2012–2013 (p. 71).
8. World Bank (2014). Connecting to Compete: Trade Logistics in the Global Economy, 4th edition (page v).

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Appendix

Additional estimation results

Table A1: Pair-wise correlation of aggregate trade facilitation measures

	INF	BE	RE	EB	LPI
Infrastructure (INF)	1.00				
Border efficiency (BE)	-0.61	1.00			
Regulatory environment (RE)	0.59	-0.46	1.00		
E-business (EB)	0.86	-0.65	0.47	1.00	
LPI	0.62	-0.38	0.43	0.67	1.00

Table A2: Pair-wise correlation of trade facilitation sub-indicators

INFRASTRUCTURE	RD	RW	PT	AP		
Roads (RD)	1.00					
Railways (RW)	0.43	1.00				
Ports (PT)	0.69	0.57	1.00			
Airports (AP)	0.91	0.43	0.69	1.00		
BORDER EFFICIENCY	TE	DE				
Time to export (TE)	1.00					
Documents to export (DE)	0.35	1.00				
REGULATORY ENVIRONMENT	PT	BB	FV	TS		
Public trust (PT)	1.00					
Bribes (BB)	0.80	1.00				
Favoritism (FV)	0.38	0.13	1.00			
Transparency (TS)	0.56	0.57	0.16	1.00		
E-BUSINESS	LT	TA				
Latest technology (LT)	1.00					
Technology absorption (TA)	0.71	1.00				
LOGISTICS PERFORMANCE INDEX	CUST	INF	IS	LC	TT	TL
Customs (CUST)	1.00					
Infrastructure (INF)	0.74	1.00				
International shipment (IS)	0.65	0.64	1.00			
Logistics competence (LC)	0.74	0.68	0.76	1.00		
Tracking and tracing (TT)	0.65	0.64	0.71	0.78	1.00	
Timeliness (TL)	0.65	0.64	0.71	0.78	1.00	1.00

Table A3: Pair-wise correlation of standardized aggregate trade facilitation measures

	INF	BE	RE	EB	LPI
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Infrastructure (INF)	1.00				
Border efficiency (BE)	0.60	1.00			
Regulatory environment (RE)	0.69	-0.02	1.00		
E-business (EB)	-0.31	-0.95	0.33	1.00	
LPI	0.99	0.72	0.59	-0.46	1.00

Table A4: Estimation results with standardized variables: All commodities, all destinations

	(i)	(ii)	(iii)	(iv)	(v)	(vi)
ln_GDP_exporter	0.2896*** (0.10)	0.1482 (0.17)	0.2222** (0.10)	0.3046*** (0.10)	0.3694*** (0.09)	1.1198 (5.61)
ln_GDP_partner	0.1115 (0.08)	0.0221** (0.01)	0.0969 (0.09)	0.0743 (0.09)	0.0204* (0.01)	-0.0767 (0.20)
ln_distance	-0.1611** (0.07)	-0.2163*** (0.03)	-0.2570*** (0.05)	-0.1997*** (0.06)	-0.1738*** (0.03)	-0.7196** (0.36)
ln_tariff	-0.7052 (0.49)	-0.7974** (0.34)	-0.7738* (0.45)	-0.5728 (0.48)	-0.5722 (0.35)	1.4374 (0.97)
Contiguity	-0.0953 (0.15)	0.0648 (0.05)	0.0213 (0.09)	-0.1238 (0.15)	0.0479 (0.06)	0.1531 (0.45)
Language	0.0275 (0.06)	0.1793*** (0.03)	0.0971* (0.06)	0.0241 (0.06)	0.1347*** (0.03)	0.1628 (0.16)
Colony	-0.0643 (0.08)	0.0662 (0.06)	-0.1500** (0.07)	-0.0778 (0.06)	-0.0175 (0.07)	0.0651 (0.17)
Infrastructure_exporter	0.0596* (0.03)					0.0971 (0.08)
Infrastructure_partner	-0.0001** (0.00)					0.0001 (0.00)
Border_exporter (time to export)		-0.3260*** (0.06)				0.0445 (1.92)
Border_partner (time to import)		0.0148 (0.02)				0.0237 (0.02)
Regulatory_exporter			0.0354*** (0.01)			-0.0931 (1.12)
Regulatory_partner			-0.0147 (0.03)			0.1163 (0.07)
e-business_exporter				-0.0462 (0.04)		0.0562 (1.54)
e-business_partner				-0.003 (0.02)		-0.0712 (0.05)
LPI_score_exporter					0.2954*** (0.04)	(dropped) ---
LPI_score_partner					0.0061 (0.01)	-0.001 (0.02)
Constant	8.9696*** (2.88)	11.6007*** (4.23)	8.0465** (3.33)	10.0724*** (3.08)	6.8763*** (2.19)	49.9888 (64.83)
N	2139	3255	2208	2208	3234	2021
Log-likelihood	-2097.1	-6239.3	-2700.0	-2247.6	-8669.5	-412.5

R-square 0.52 0.55 0.53 0.54 0.55 0.69

Notes: The dependent variable is the logarithm of total bilateral commodity exports. The estimator is PPML. All regressions include exporter and importer dummies, as well as a time dummy. Values between parentheses are the standard errors. As a result of the multicollinearity in regression (vi) that includes all TF measures, very few coefficients are significant (only one) while the overall significance of the model is high (as suggested by the high R-square). Significance at 1%, 5%, and 10% are indicated by ***, **, and *.

Table A5: Estimation results for intra-Sub-Saharan Africa trade, all commodities

	(i)	(ii)	(iii)	(iv)	(v)
ln_GDP_exporter	0.472 (0.35)	0.070 (0.17)	0.216 (0.33)	0.554 (0.41)	0.225 (0.16)
ln_GDP_partner	0.047 (0.16)	0.028*** (0.01)	0.215 (0.26)	0.043 (0.23)	0.015** (0.01)
ln_distance	-0.222*** (0.04)	-0.195*** (0.03)	-0.258*** (0.05)	-0.265*** (0.05)	-0.189*** (0.03)
ln_tariff	-0.125 (0.44)	-0.292 (0.53)	0.058 (0.44)	-0.01 (0.43)	-0.017 (0.53)
Contiguity	-0.013 (0.04)	0.076* (0.04)	-0.018 (0.05)	-0.017 (0.04)	0.05 (0.05)
Language	0.125* (0.06)	0.180*** (0.04)	0.11 (0.07)	0.114 (0.07)	0.153*** (0.04)
Infrastructure_exporter	0.161 (0.32)				
Infrastructure_partner	0.145* (0.09)				
Border_expoter (time to export)		-0.004 (0.00)			
Border_partner (time to import)		0.009** (0.00)			
Regulatory_exporter			-0.258 (0.18)		
Regulatory_partner			0.076 (0.13)		
e-business_exporter				0.118 (0.33)	
e-business_partner				-0.124 (0.16)	
LPI_score_exporter					0.289*** (0.09)
LPI_score_partner					-0.071 (0.06)
Constant	16.198* (9.13)	5.363 (3.92)	15.171 (9.67)	18.332 (11.33)	8.079** (3.54)

N	1192	1606	1203	1203	1502
Pseudo log-likelihood	-661.6	-2623.4	-726.7	-729.3	-2055.6
R-Square	0.47	0.45	0.49	0.48	0.43

Notes: The dependent variable is the logarithm of bilateral commodity exports within Sub-Sahara Africa. The estimator is PPML. All regressions include exporter and importer dummies, as well as a time dummy. Values between parentheses are the standard errors. Significance at 1%, 5%, and 10% are indicated by ***, **, and *.

Table A6: Estimation results with disaggregated commodities and trade facilitation measures

		Exporter			Partner		
		Agric.	Manu- facture	Mineral	Agric.	Manu- facture	Mineral
Infrastructure	Roads	0.540***	0.021***	0.138***	0.023	-0.002	0.012
	Railways	0.075	0.017**	0.006	-0.024	-0.007	0.007
	Ports	0.120***	0.054***	0.008	0.031	0.009	0.003
	Airports	0.276***	0.051***	0.010	0.001	0.005	0.025
Border	Time to trade	-0.002	-0.001	-0.002	0.010*	0.001	0.004*
	Docs to trade	0.023	-0.002	0.006	0.007	0.003	0.004
Regulatory	Public trust	-0.086*	0.004	-0.137***	0.001	0.009	0.025
	Bribes	-0.250***	0.082***	-0.135***	0.036	-0.01	0.025
	Favoritism	0.018	0.021***	-0.016*	-0.019	0.015*	-0.004
	Transparency	-0.548***	-0.075***	-0.061***	0.017	0.008	-0.002
E-Business	Latest technologies	0.550***	-0.001	0.111***	0.007	0.012	0.010
	Technology absorption	0.202***	-0.017	0.010	0.083	-0.007	0.015
LPI	Customs	0.264***	0.009	0.051**	-0.023	-0.01	0.002
	Infrastructure	0.044	0.011	0.034	-0.015	0.015	0.008
	International shipment	0.151***	0.029***	0.050***	-0.015	0.016*	-0.001
	Logistics competence	0.175***	0.041***	0.101***	0.065*	0.002	-0.008

Tracking and tracing	0.261***	0.01	.047*	-0.041	0.01	-0.030
Timeliness	0.212***	-0.008	0.034*	-0.030	-0.009	0.001

Notes: The results come from various model specifications, due to multicollinearities of the sub-indices. The latter are included, one at a time, for both reporters and partners. A total of 54 regressions were then considered (18 sub-indices across 3 commodity groupings). Significance levels are indicated by *** (1%), ** (5%), and * (10%).

Table A7: Country list

Afghanistan	Cuba	Lebanon	Saudi Arabia
Albania	Cyprus	Lesotho	Senegal
Algeria	Djibouti	Liberia	Seychelles
Angola	Dominica	Libya	Sierra Leone
Antigua and Barbuda	Dominican Republic	Lithuania	Singapore
Argentina	Ecuador	Luxembourg	Slovak Republic
Armenia	El Salvador	Madagascar	Slovenia
Australia	Equatorial Guinea	Malawi	South Africa
Austria	Eritrea	Malaysia	Spain
Azerbaijan	Estonia	Maldives	Sri Lanka
Bahamas, The	Ethiopia (excludes Eritrea)	Mali	St. Kitts and Nevis
Bahrain	Fiji	Malta	Vincent and the Grenadines
Bangladesh	Finland	Mauritania	Sudan
Barbados	France	Mauritius	Suriname
Belarus	Gabon	Mexico	Swaziland
Belgium	Gambia, The	Moldova	Sweden
Belize	Georgia	Mongolia	Switzerland
Benin	Germany	Morocco	Tanzania
Bermuda	Ghana	Mozambique	Thailand
Bhutan	Greece	Myanmar	Togo
Bolivia	Grenada	Namibia	Tonga
Bosnia and Herzegovina	Guatemala	Nepal	Trinidad and Tobago
Botswana	Guinea	Netherlands	Tunisia
Brazil	Guinea-Bissau	New Zealand	Turkey
Brunei	Guyana	Nicaragua	Turkmenistan
Bulgaria	Haiti	Niger	Uganda
Burkina Faso	Honduras	Nigeria	Ukraine
Burundi	Hungary	Norway	United Arab Emirates
Cambodia	Iceland	Oman	United Kingdom
Cameroon	India	Pakistan	United States
Canada	Indonesia	Panama	Uruguay
Cape Verde	Iran, Islamic Rep.	Papua New Guinea	Uzbekistan
Central African Republic	Ireland	Paraguay	Vanuatu
Chad	Israel	Peru	Venezuela
Chile	Jamaica	Philippines	Vietnam
China	Japan	Poland	Yemen
Colombia	Jordan	Portugal	Zambia
Comoros	Kazakhstan	Qatar	Zimbabwe
Congo. Rep.	Kenya	Romania	
Costa Rica	Kuwait	Russian Federation	
Cote d'Ivoire	Kyrgyz Republic	Rwanda	
Croatia	Latvia	Samoa	

Note: Countries in Sub-Saharan Africa are highlighted in bold

Data sources

Data on bilateral trade are compiled from UNCOMTRADE. Trade facilitation measures are from various sources as indicated in the text, and a detailed description of how the data are collected and the indices constructed can also be found there. The core gravity variables, such as geographical distance, colonial ties, common language, and contiguity are obtained from the CEPII website. GDP is from the World Development Indicators (WDI).