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Trade Facilitation and Trade Flows in Africa

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Abstract

Despite a significant trade expansion that has been above the world average in the recent period, 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 Africa may have contributed to shape trade patterns both within the continent and with the outside world. Various trade facilitation aspects are aggregated into four main indicators using alternatively simple average and factor analysis: border efficiency, physical infrastructure, regulatory environment, information and communication technology, as well as the World Bank's Logistics Performance Index. These indicators are then related to bilateral trade flows in a gravity framework that accounts for a number of theoretical and empirical issues, and that distinguishes between agricultural and non-agricultural commodity trade and among various trading partners. The results indicate facilitating trade would generate varying trade gains, depending on which of the trade cost landscape, which commodity, which trading partner one considers, and which country in the bilateral trade relationship undertakes the reforms. These results offer a strong basis for designing targeted trade facilitation reforms that would improve Africa's international trade position.

1   Introduction

Over the first decade of the XXIst century, trade expanded significantly across Africa. In effect, trade volume grew at an annual rate of 5.9 percent, and this increase was well above the world average of 3.8 percent.[1] This trade pattern happened in a general context of relatively strong economic growth of African economies, with an annual rate of 5.0 percent (5.3 percent 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 percent against 6.9 percent, suggesting a further worsening of African economies' international trade position. Moreover, Africa is still a marginalized region in

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[1]World Bank's World Development Indicators online (the subsequent data are from the same source).

the world trading system, with a meager 2.8 percent share of the global trade volume in 2010 (1.9 percent 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.[2]

Major trade reforms have been successfully implemented all over Africa. They range from trade liberalization to regional integration and other bilateral and multilateral trade agreements. As a result, tariffs have been at all-time low, in line with a 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, Africa 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.[3] In addition, over the course of trading across African borders, it is required far greater number of documents: 8 when exporting and 9 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 Banks' Logistics Performance Index: 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's score of 2.48.[4] All of 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 aiming 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".[5] 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 (Moïsé, 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 percent (see also 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 Moïsé-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

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[2] Some of the gains include foreign technology acquisition and increased productivity (see, for instance, Seck, 2012).

[3] World Bank's Ease of Doing Business (http://www.doingbusiness.org/data). Accessed in December 2013.

[4] See http://lpi.worldbank.org/ for more details (accessed in April 2014).

[5] World Trade Organization, cited by Portugal-Perez and Wilson (2010, p. 2), and Moïsé (2013, p. 7).

firms are very likely to start exporting, and existing exporters increase their trade volume (see 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 transports, 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 African economies? Which economic sector is more likely to benefit the most from trade facilitation? Which trading partners are more responsive to trade facilitation measures?

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 Africa. 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 sets out to assess the benefits that would result from greater facilitation of trade in Africa. More specifically, it discusses how the different components of trade costs impede African countries' trade performance, and how removing such hurdles could boost African trade on various products both within the continent and with the rest of the world.

The three-part empirical approach first deals with constructing four aggregate indicators of trade facilitation: physical infrastructure, border efficiency, regulatory environment, and e-business. The World Bank's Logistics Performance Index is also considered. Two alternative weighting schemes are considered: equal weights and factor loadings from factor analysis. Second, these measures are related to bilateral trade flows within a gravity model. Additional explanatory variables includes add-valorem tariffs, and the traditional variables such as distance. Third, comparing the results allows one to simulate the gains from trade facilitation as a distance-reduction equivalent or an ad-valorem-tariff equivalent.

The results based on 105 countries (with 19 from Africa) and two years (2012 and 210) clearly indicate that trade facilitation measures have varying effects on African countries' exports. The extent to which they affect trade depends on the type of measures, the export destinations (Africa or the rest of the world), the commodities being traded (agricultural versus non-agricultural products), and the country at the end of the bilateral trade relationship which costs are accounted for (exporter or importer). For instance, the results show that if trade reforms targeting physical infrastructure of the like of ports or airports were to raise the average African country to the world best performing standard, then trade would increase by 6.8 to 15.1 percent. This amounts to getting the country closer to its trading partners by 125.9 to 570.5 km, depending on whether the reforms were to be undertaken by the importing or exporting country and whether intra-African trade or trade with the outside world is considered. These results appear to be more driven by non-agricultural commodities, agricultural ones being more responsive to measures related to ICT usage, especially

in the exporting countries. Other trade cost measures such as border efficiency (number of required documents), regulatory environment, and LPI also appear to have shaped in various ways Africa's trade patterns.

The remainder of the paper is organized as follows: section 2 offers some insights from the literature, section 3 details the methodology, section 4 describes the data, section 5 presents and discusses the results, and section 6 offers some concluding remarks.

2   Literature review

Thanks to various international organizations that have recently been collecting survey data on various aspects of trade facilitation at a country level, there has been a 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 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 on one hand, and trade costs on the other. 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 costs declines. In effect, the latter explain roughly 55 percent of trade boom in the first period, and 33 percent 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 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 trade costs are declining with income per capita: developed countries are experiencing 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 percent. 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 aiming 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 exports markets is mainly attributable to poor infrastructure and unfriendly institutional environment. Their results based on a gravity model indicate that trade facilitation could unlock Africa's trade potential on manufacturing goods. These reforms should 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-percent 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 ten-percent increase in the number of web hosts is associated with a one-percent 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 linked 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 consists of constructing aggregate indicators. Next, a gravity model of trade follows 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.

3.1 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 (see 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 infrastructure. The existence of such trade infrastructure determines to a greater extent the very possibility for a 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 on one hand, and reduces trade transaction costs on the other.

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 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	Source
Physical infrastructure indicator	
Quality of ports infrastructure	WCR
Quality of airports infrastructure	WCR
Quality of roads infrastructure	WCR
Quality of railroad infrastructure	WCR
Border efficiency indicator	
Number of documents required to export	EDB
Number of documents required to import	EDB
Regulatory environment indicator	
Transparency of government policy-making	WCR
Public trust in politicians	WCR
Irregular payments and bribes	WCR
Favoritism in decisions of government officials	WCR
E-business indicator	
Availability of latest technologies	WCR
Internet usage	WCR
Firm-level technology absorption	WCR
Internet bandwidth	WCR

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.[6] Turkson (2011) indicated that this indicator is a good indicator of bilateral export performance in developing countries. To the extent that the degree of colinearity with the above indicators allows, this can be used to measure the impact of trade facilitation on trade performance.

Various approaches to aggregating the individual aspects of the trade environment into gross measures have been used in the empirical literature. As a first approximation, we will use the simple average. Averaging over these different aspects is the simplest one, be it arithmetically or geometrically. It is used for instance by Wilson et al. (2005). This approach arbitrary assigns equal weight to each input element, thereby suggesting that an improvement along any input dimension would yield equal trade gains. Such a hypothesis might be valid if there is a one-unit correlation among the individual inputs, which is not always the case.

Alternative approaches involve factor analysis and principal component analysis. Through an analytically-generated weighing scheme, both approaches extract the joint information embodied in a larger set of correlated, observed variables (say, the number of documents required to trade and the number of days), and then summarize it into a smaller set of unobserved or latent variables (say border efficiency), called factors or components. In generating the synthetic indicator, principal component analysis uses statistical procedure to generate the weights, while factor analysis is based on a regression analysis. More specifically, factor analysis estimates the contribution of the unobserved factor to the realization of each observed variable. The estimations provide the correlation coefficients called factor loadings, as well as the predicted common factor. The greater the factor loadings, the more the contribution of the observed variable into the aggregate synthetic measure. Such an approach is used for instance by Portugal-Perez and Wilson (2010) to generate trade facilitation indicators which are then related to trade flows in a gravity framework. We follow suit in this study.

There is a clear advantage of factor loadings over equal weights. When using aggregate measure, such as physical infrastructure indicator, a favorable coefficient estimate would lead to policy recommendation of the like of: "governments need to facilitate trade by improving trade infrastructure". When using equal weights, such a recommendation would fail to tell which component element of the physical infrastructure government efforts should be directed to (seaport, airport, road, or railroad). Factor loadings, instead, indicate which element contributes the most into the unobserved mechanism, thereby revealing a clear policy target. For the sake of robustness check though, both equal weights and factors loadings will be considered.

3.2 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 (GCP 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, etc. For the purpose

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[6]World Bank, 2014: "Connecting to Compete: Trade Logistics in the Global Economy", 4th edition (page v).

of this study, we include trade facilitation measures to further address country heterogeneity. The following basic specification of the gravity model is considered:

$$y_{ijt} = \beta_0 + \sum_{k=1}^{K} \beta_k z_{kijt} + \varepsilon_{ijt} \tag{1}$$

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

Some common issues need to be addressed in order 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 (see for instance 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 consists of making the latter vary across trading partners and over time to fully capture unobservable bilateral trade flows (see also Cheng and Wall, 2004; Wilson et al., 2013). More specifically, the following specification of the error term is considered:

$$\varepsilon_{ijt} = \beta_i + \beta_j + \beta_{ij} + \gamma_t + \nu_{ijt}$$

where β_i and β_j denote country fixed effects that capture unobservable differences in product quality and domestic policies in importing and exporting countries, β_{ij} relates to the pair-wise unobservable trade characteristics, γ_t a time specific fixed effect, and ν_{ijt} a zero-mean, normally-distributed random error.

The general specification of the model that accounts for all of these theoretical and empirical developments is as follows:

$$
\begin{aligned}
\ln X_{ijt} =\ & \beta_0 + \beta_i + \beta_j + \gamma_t + \beta_1 \ln(GDPpc_{it}) + \beta_2 \ln(GDPpc_{jt}) + \beta_3 \ln DST_{ij} \\
& + \beta_4 TFI_{it} + \beta_5 TFI_{jt} + \beta_6 \ln(1 + TARIFF_{ijt}) + \sum_{k=7}^{K} \beta_k z_{kijt} + \nu_{ijt}
\end{aligned}
\tag{2}
$$

where $\ln X_{ijt}$ is the natural logarithm of exports of country i to country j in year t, $GDPpc$ denotes GDP per capita, DST_{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 j to products from i, and z_k the standard trade impeding or enhancing variables (contiguity, language, colonial ties, free trade agreements, currency union, landlocked, etc.).

3.3 Estimation strategies

We consider the regular pooled OLS estimator in a panel data setting, controlling for reporter-, partner-, and pair-wise specific effects, and eventually correcting for any non-spherical disturbance. This estimation strategy is used in conjunction with a specific way of dealing with zero-trade. Some countries do not trade with each other, and as such, the log operator does not apply. A common

solution, which is considered here, consists of replacing these zeroes by a very small positive trade flow (say, 0.01).

Because trade patterns may be different from one product to another, and from one partner to another, we will consider different sets of estimations. First, the model will be estimated using the full sample in order to get the average effects of trade facilitation measures. Next, we estimate the model separately for agriculture products and manufacturing goods. Finally, we split the sample and estimate the model for two groups of countries: African exporters and importers, and Africa vis-a-vis 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 various trade costs into perspective is to get the standardized coefficients, also known as the "beta" coefficients. This will help compare the magnitude of the contribution of each explanatory variable relative to a benchmark variable. For instance, we can express the cost element that is targeted by trade facilitation into a distance equivalence using the distance variable as a reference: delaying imports or export by one day will be equivalent to increasing the geographical distance between a given country and its average trading partner by a given number of kilometers.

The results can also be used to simulate the conditional gains that would result from trade facilitation reforms. It is very likely that depending on the countries' trade profile, an improvement in a given element of trade costs will have differentiated effects. The results will tell about the additional amount of trade flows that a given country would gain were it to raise the quality of its trade infrastructure to the level of the best performing country.

4 Data

Table 2 shows some descriptive statistics of the data. Africa's trade profile positions the continent below the world average. In effect, total exports of the average African economy represent 24.4 percent of its GDP, compared to 35.0 percent for the average country of the outside world. Indicative of a relatively heavy reliance on primary activities, agricultural commodities accounts for a larger part of total exports in Africa than the rest of the world, by a factor of 4.3. As a further indication of Africa's relative marginalization in the world trading system, the continent accounts for only 2.3 percent of the world commodity exports, and a higher proportion of its trade (29.1) remains within the continent. Again, due to the relatively larger importance of the agricultural sector in a typical African economy, the latter commands a relatively higher share in world trade on agricultural commodities, and consequently a lower share in within-Africa trade.

In line with this trade profile, Africa also under-performs as far as the trade cost landscape is concerned. In effect, when it comes to any of the trade facilitation aggregate measures (constructed by using either simple average or factor analysis), or any of their input elements, the average African country is consistently below the average non-African country. Due to the low quality of the physical infrastructure, cross-border trade in and with Africa faces greater hurdles than the average place outside the continent. The same is true when it comes to border efficiency, the regulatory environment, the incidence of ICT, as well as the various component elements of the trading environment captured by the Logistics Performance Index, such as customs, infrastructure, international shipments, tracking and tracing.

Adding to this quite unfavorable set of patterns, trade barriers such as tariffs are still relatively important in Africa, indicating that the continent is lagging behind a world trend towards their

reduction. In effect, ad-valorem tariffs on commodities are almost twice as much in Africa compared with the outside world. The difference is more important for agricultural commodities, with the average ad-valorem tariff rate in Africa representing more than 2.3 times of that in the average country outside the continent. In addition, while trade on agricultural commodities appears to be more constrained by tariffs than other manufacturing goods for example, the difference is again more pronounced in Africa, on average: 40.0 percent against 4.1 percent.

Furthermore, African trade scope tends to be slightly less wide, when it comes to distance. The average distance between an African economy and a trading partner is 7391.8 km, against 7421.8 km for a typical country outside the continent. More revealing of the lower trade performance, the typical African exporter appears to be less able to overcome the distance barrier to trade: when accounting only for destination countries actually reached by African exports, the average distance is reduced by 9.0 percent, against only 1.0 percent for the average non-African country. Agricultural commodities appear to travel farther: while African trade still remains below the average distance with respect to the whole world, that of its outside counterpart goes 3.4 percent farther.

<div align="center">Table 2. Summary statistics</div>

Variables	Africa	World (excluding Africa)
Trade		
All commodities (%GDP)	24.37	34.97
African share (%)	29.12	2.29
Agriculture (% all commodities)	1.02	0.24
African share (%)	18.58	17.95
Trade facilitation indicators		
Physical infrastructure	3.14 (3.26)	3.98 (3.94)
Border efficiency	7.79 (7.79)	5.58 (5.58)
Regulatory environment	2.98 (3.00)	3.50 (3.52)
E-business (ICT)	6.67 (6.86)	23.36 (27.17)
LPI - overall score	3.11 (3.12)	4.10 (4.11)
Other variables		
Ad-valorem tariff: all commodities (%)	11.84	6.89
Ad-valorem tariff: agriculture (%)	16.54	7.17
Distance (km): all countries	7391.80	7421.80
Distance (km): partners, all comm.	6726.47	7347.35
Distance (km): partners, agriculture	7207.23	7597.39
GDP per capita ($US)	2325.04	20866.95

Notes: Data for trade facilitation are all on a 0-7 scale, except for border efficiency (number of documents required to trade) and e-business which comprises among others Internet bandwidth; values are obtained by factor analyis, and those between parentheses are generated using simple average.

In addition, a reduced economic activity could be indicative of a weak export capacity. In effect, the relatively low level of GDP per capita tells about the limited scope of the production base as well as the excess over domestic demand or export supply. This relatively weaker export capacity, in conjunction with less favorable trade environment, is more likely to reduce the continent ability to fully benefit from the relatively larger purchasing power in the developed world, as revealed by

foreign GDP per capita. The extent to which such trade impediments play out is further analyzed in the next section.

5 Results

Table 3 shows the results for all commodity trade. Firstly, the results clearly indicate that the extent to which a given country exports to another one is determined by both countries' trade cost landscape. In effect, trade facilitation indicators for both reporter and partner appear to be significant predictor of a reporter's export to its partners. In addition, the cost element that seems to consistently matter the most for both exporting and importing partners is related to the physical infrastructure of the likes of ports or airports. More specifically, as far as global trade is concerned, improving such infrastructure in the exporting country by one point (on the 0-7 scale) amounts to an increase in exports by 2.0 percent, and by 1.7 percent if a similar improvement occurs in the trading partner. The results can be put into perspective by using the standardized coefficients and compare with the effects of distance. It then appears that a one-point improvement of physical infrastructure in exporting and importing countries is respectively equivalent to reducing the distance between the trading partners by respectively 2.6 and 2.2 percent. This amounts to a reduction by 194.7 km and 167.4 km respectively. These results tend to be consistent with the findings in the literature, such as Portugal-Perez and Wilson (2010).

African trade, both among African countries or with the rest of the world, is also responsive to physical infrastructure, even more so than the world average. In effect, an increase in the quality of infrastructure would lead to an increase in intra-African trade value by 5.1 percent if the improvement were to occur in the exporting partner and by 2.3 percent if it were to originate from the importing partner. These figures translate to a distance equivalence of 93.3 and 42.5 km.

The figures make intra-African trade more responsive to trade costs than trade between Africa and the rest of the world when it comes to trade facilitation measures originating from the exporting countries; the opposite is true for trade costs in the importing countries. In effect, bilateral exports would increase by 3.5 and 2.9 percent respectively, which amount to a reduction in distance-reduction by 2.6 and 2.1 percent, or 192 and 158 km. In addition, because tariffs appear to be a significant barrier to trade only between Africa and the rest of the world, a one-point improvement in the measure in exporting and importing countries is equivalent to reducing ad- valorem tariff by 13.1 and 10.8 percent. Furthermore, because factor loadings are larger with roads and ports than airports and railroads (respectively 0.90, 0.89, 0.87, and 0.76), improving trade infrastructure might focus primarily on these two aspects of the trade cost landscape. The greater contribution of these two aspects of physical infrastructure also shows in Portugal-Perez and Wilson (2010).[7]

The other trade facilitation measures contribute in various degrees to explaining the extent to bilateral trade flows. As one might expect, an improvement of the institutional environment surrounding cross-border trade tends to enhance the latter. In effect, extremely sound "transparency of government policymaking", very high "public trust of politician", never-occurring "irregular payments and bribe", and almost no "favoritism in decisions of government officials" all concur to generate a positive effect of the institutional quality on trade, for example by reducing the level of uncertainty and transaction costs. The results unequivocally indicate a trade-enhancing effect

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[7]Factor loadings and uniqueness for component elements of each aggregate trade facilitation measure are shown in the appendix.

of the regulatory environment in either trading partner, in line with the general findings in the literature.

Table 3. Estimation results (excerpt): all commodities

Variables	All countries		Intra-Africa		Africa-World	
lnGDPpc_reporter	1.6072***	0.2948	2.518***	0.3299	0.9223***	0.1602
	(0.05)		(0.53)		(0.11)	
lnGDPpc_partner	1.0409***	0.1907	-1.2014**	-0.1596	0.0313	0.0054
	(0.05)		(0.54)		(0.12)	
lnDistance	-0.9082***	-0.1064	-3.9147***	-0.3234	-2.3512***	-0.1476
	(0.06)		(0.56)		(0.19)	
Infrastructure_reporter	2.0224***	0.2775	5.0961***	0.4043	3.5245***	0.3804
	(0.07)		(0.59)		(0.16)	
Regulatory env._reporter	2.1226***	0.2529	2.2052***	0.2003	2.3245***	0.2269
	(0.07)		(0.48)		(0.15)	
E-business_reporter	-0.0002	-0.0090	0.3924**	0.1592	-0.0001	-0.0002
	(0.01)		(0.16)		(0.01)	
Border_reporter	-0.0850*	-0.0226	0.2785	0.0550	0.0111	0.0026
	(0.03)		(0.19)		(0.06)	
Infrastructure_partner	1.7358***	0.2385	2.2834***	0.1839	2.8915***	0.3136
	(0.07)		(0.59)		(0.16)	
Regulatory env._partner	1.0860***	0.1296	2.2280***	0.2064	1.0148***	0.0995
	(0.08)		(0.48)		(0.15)	
E-business_partner	-0.0009***	-0.0428	0.3925**	0.1610	-0.0014***	-0.0438
	(0.01)		(0.16)		(0.01)	
Border_partner	0.1633***	0.0433	0.0613	0.0119	0.1387**	0.0326
	(0.03)		(0.20)		(0.07)	
ln(1+tariff)_partner	0.0096	0.0013	-0.1636	-0.0206	-0.2672**	-0.0291
	(0.06)		(0.32)		(0.12)	
Intercept	-5.0574***		52.7314***		11.1873***	
	(1.00)		(7.09)		(2.51)	
N	17957		532		5806	
F-stat	474.9		16.3		124.8	
R2	0.346		0.377		0.302	

Notes: The dependent variable is the logarithm of bilateral commodity trade flows. Only results for explanatory variables relevant to the analysis are shown here. Complete results are shown in the appendix. The estimator is a pooled OLS, and dummies are included to capture individual and time effects. The second column for each series of estimation results represents the standardized coefficient estimates. Values between parentheses are the standard errors. Significance at 1, 5, and 10 percent are indicated by ***, **, and *.

For example, a one-point improvement in the exporting country generates 2.12-, 2.21- and 2.32-percent increase in trade for the whole sample, trade within Africa, and trade between Africa and the outside world, respectively. These figures are equivalent to a distance-reduction by 2.4, 0.6 and

1.6 percent, or 177.5, 46.2, and 114.8 km, respectively. On the other hand, when the improvement originates from the importing country the distance-equivalence gain is respectively 90.9, 47.7, and 50.3 km. Therefore, as opposed to physical infrastructure, institutional environment benefits more trade between Africa and the rest of the world than trade within the continent. Reforms aiming at facilitating trade would focus on reducing favoritism and improving public trust, which loading factors are higher than bribery and transparency (0.95 and 0.90, against 0.87 and 0.85).

When it comes e-business or the extent of ICT usage and quality, the results first indicate that trade within the continent is the sole significant beneficiary from any improvement in the exporting country: a one-point increase in the indicator is associated with an increase in bilateral trade by 0.4 percent. This result could denote the extent of the continent's backwardness as far as elements such as availability of the latest technologies or firm-level technology absorption are concerned, and their translation into far greater potentials for trade than anywhere else in the world.

But, somewhat curiously, when the improvement happens in the trading partners, the associated trade effect appears to be negative for all countries but Africa. The literature tends overwhelmingly to suggest strong positive effects (such as Freund and Weinhold, 2000, or Fink et al., 2005), but it does not go as far as to break the overall gains into different trading partners. The result could first contribute to further reinforce the previous results on the trade potentials associated with ICT usage in Africa. But the significant and negative effect on trade when other countries are involved is very counterintuitive. It might be the case that further improvement of an already-high quality bandwidth and the corresponding greater adjustment of firms to continually absorb continuing technology flows are associated with costs that outweigh any benefits. The negative result could be indicative of this net trade loss to exporting countries that have to adjust to this often unfamiliar technologically-moving environment in their trading partners, on average.

As far as paperless trade is concerned, reducing the number of required documents in a given country increases its exports if one considers global trade. In effect, one less document generates an increase in trade by 0.09 percent. Trade in which African countries are involved as exporters, either within the continent or with the outside world, appears to be irresponsive to border efficiency, potentially indicating that traders have already adjusted to the many hurdles associated with bottlenecks associated with border formalities. On the other hand, it is quite surprising that an increase in the number of documents in the importing partners is associated with positive effect on trade. Rather than denoting any meaningful generating economic mechanisms, these results are more of a statistical curiosity.

In sum, when it comes to trade flows in Africa, not all trade elements of the trade cost landscape matter to the same extent. As it shows with physical infrastructure and the regulatory environment, the effect of trade facilitation vary with respect to the trading partners (either in Africa or outside).

To check whether similar patterns from overall trade also holds with agricultural commodities, Table 4 shows estimation results for this sub-sample of products, again distinguishing between trading partners. First, physical infrastructure seems not to matter for African trade, whether any improvement happens in exporting or importing countries. This suggests that the significant and positive relation in Table 3 is more driven by non-agricultural commodities. Therefore, improving the quality of ports, airports, roads or railroads in either trading partner would benefit generate significant trade benefits only for manufacturing goods.

Second, improving the regulatory environment also benefits African economies' agricultural trade, except for trade within the continent when such improvement is occurs in the exporting countries. Third, ICT is associated with great agricultural trade gains. These benefits shows in

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intra-African Trade where a one-point improvement in the trading leads to a 0.6 percent increase in trade flows, as well as trade between Africa and the rest of the world where similar improvement in importing countries generates a 0.001-percent increase in trade. Compared to the results in Table 3, agricultural commodities tend to benefit more responsive to trade-related ICT development than non-agricultural commodities.

Table 4. Estimation results (excerpt): agricultural commodities

Variables	All countries		Intra-Africa		Africa-World	
lnGDPpc_reporter	0.1250	0.0182	1.2591	0.1313	0.5891***	0.0915
	(0.08)		(0.812)		(0.15)	
lnGDPpc_partner	0.2520***	0.0367	0.3280	0.0347	-0.1042	-0.0162
	(0.09)		(0.83)		(0.16)	
lnDistance	-0.2723***	-0.0254	0.4887	0.0321	-0.4388*	-0.0246
	(0.10)		(0.84)		(0.26)	
Infrastructure_reporter	0.4953***	0.0540	1.0073	0.0636	0.1009	0.0097
	(0.12)		(0.89)		(0.22)	
Regulatory env._reporter	0.7186***	0.0681	-0.4687	-0.0339	0.4527**	0.0395
	(0.12)		(0.74)		(0.19)	
E-business_reporter	0.0015***	0.0571	0.6286**	0.2030	0.0013***	0.0365
	(0.01)		(0.24)		(0.01)	
Border_reporter	0.4379***	0.0925	-0.1906	-0.0299	0.2977***	0.0627
	(0.05)		(0.29)		(0.09)	
Infrastructure_partner	0.1130	0.0123	1.0087	0.0647	0.0045	0.0004
	(0.12)		(0.90)		(0.22)	
Regulatory env._partner	0.1976*	0.0187	2.0599***	0.1519	0.8340***	0.0731
	(0.12)		(0.73)		(0.19)	
E-business_partner	0.0012***	0.0453	0.1119	0.0365	0.0013***	0.0371
	(0.01)		(0.24)		(0.01)	
Border_partner	-0.0696	-0.0147	-0.0959	-0.0148	0.0885	0.0186
	(0.05)		(0.31)		(0.09)	
ln(1+tariff)_partner	-0.0778	-0.0097	0.2517	0.0337	-0.1827	-0.0237
	(0.07)		(0.35)		(0.12)	
Intercept	9.3788***		0.5879		1.7522	
	(1.54)		(10.81)		(3.31)	
N	17957		532		5806	
F-stat	20.8		2.35		8.0	
R2	0.023		0.08		0.027	

Notes: The dependent variable is the logarithm of bilateral agricultural commodity trade flows. As before, only results for explanatory variables relevant to the analysis are shown here; the estimator is a pooled OLS, and dummies are included to captures individual and time effects; the second column for each series of estimation results represents the standardized coefficient estimates. Values between parentheses are the standard errors. Significance at 1, 5, and 10 percent are indicated by ***, **, and *.

Finally, while agricultural trade within the continent is not significantly influenced by border efficiency (number of documents), following in that the overall trend shown in Table 3, trade between

the continent and the rest of the world reacts very significantly to an improvement occurring in the exporting country: the corresponding marginal distance-equivalent is 190.3 km. This is greater than the overall effect found in Table 3, which in fact appears to be insignificant. But the opposite is true when the improvement is made in the importing country. It therefore matters which trading partner undertakes the reforms aiming at enhancing African trade performance.

Alternative estimation results based on the average measures of trade facilitation, as well as those on the Logistics Performance Index, tend grossly to tell similar story. They are shown in the appendix.

Table 5 offers some simulation results. They tell how much the average African economy would gain had it or its average partner to reform the trade environment. Such reforms would have to raise the index value to that of the world best performing country. To the extent that the original coefficient estimates shown in Tables 3 and 4 are significant, facilitating trade would generate important gains in terms of increased flows, which in some cases has its equivalence in terms of getting the partners closer to each other. Following the previous results, it matters which trade facilitation measure, which trading partner, which commodity one considers, as well as which end of the bilateral trade relationship the reform occurs.

More specifically, reforms undertaken by the exporting countries tend to be associated with greater benefits. This suggests that African economies wanting to improve their position in the global trading system should focus more on domestic reforms than on reforms in their trading partners. For the latter that is out of Africa's hands, international agreements such as those from the recent WTO deal over trade facilitation might help.

Table 5. Simulation results of trade facilitation reforms in Africa

Indicators	All commodities				Agriculture			
	Intra-Africa		Africa-World		Intra-Africa		Africa-World	
	Trade	DE	Trade	DE	Trade	DE	Trade	DE
Infrastructure_reporter	15.1	276.7	10.4	570.5				
Regulatory env._reporter	6.1	127.4	6.4	316.1			1.2	330.1
E-business_reporter	42.8	4011.0			68.6		0.1	12089.4
Border_reporter								
LPI_reporter	8.2	103.0	10.0	21.3	10.9		7.3	
Infrastructure_partner	6.8	125.9	8.6	470.3				
Regulatory env._partner	6.1	131.2	2.8	138.6	5.7		2.3	611.1
E-business_partner	42.8	4056.3					0.1	12288.1
Border_partner								
LPI_partner	7.5	92.5	10.0					

Notes: Change of trade is measured in percentage, and its translation in distance equivalence (DE) in km. Simulation results for trade are based on the coefficient estimate of the corresponding trade facilitation measure, and those for the distance equivalence use the standardized coefficients of both the trade facilitation variable and the distance variable. Missing values indicate insignificant coefficient estimate of either variable.

In addition, where comparison is possible, while some measures tend to benefit more intra-African trade than trade with the outside world (infrastructure on the reporter side and the regulatory environment on the partner side), other measures prove the opposite (such as LPI). As for

agricultural commodities, all of the relevant measures on both sides tend to yield greater gains to trade within Africa than trade with the outside world. This further contributes to make the sector a good target for trade facilitation reforms.

6   Conclusion

Facilitating trade appears to have a great potential to improving export performance of African countries. The effectiveness of trade reforms need to account for many factors. One such factor is the type of measures, as they have varying effects on trade flows. Other factors pertain to trading partners (intra-African trade or trade with the rest of the world), as well the commodities being trade (agricultural or non-agricultural).

A clear understanding of the various elements that make up the trade cost landscape and the way they interact to generate low performance is undoubtedly a crucial step towards reforming the trade environment in Africa. But whether such reforms might be effective, or even successfully implemented, is 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 interest at both ends of the bilateral trade relationship is as much crucial as the knowledge of the extent of the trade gains associated with reducing trade costs.

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Appendix

A1. Additional and detailed results

Table A1.1. Factor loadings and trade facilitation indicators

Aggregate indicators / Inputs	Factor1	Uniqueness
Physical infrastructure indicator		
Quality of ports infrastructure	0.885	0.216
Quality of airports infrastructure	0.866	0.250
Quality of roads infrastructure	0.905	0.181
Quality of railroad infrastructure	0.756	0.428
Border efficiency indicator		
Number of documents required to export	0.878	0.229
Number of documents required to import	0.878	0.229
Regulatory environment indicator		
Transparency of government policy-making	0.848	0.281
Public trust in politicians	0.904	0.182
Irregular payments and bribes	0.874	0.236
Favoritism in decisions of government officials	0.949	0.099
E-business indicator		
Availability of latest technologies	0.969	0.059
Internet usage	0.778	0.394
Firm-level technology absorption	0.921	0.152
Internet bandwidth	0.560	0.686
Logistics Performance Index		
Customs	0.959	0.079
Infrastructure	0.974	0.051
International Shipment	0.944	0.109
Logistics Competence and Quality	0.979	0.040
Tracking and Tracing	0.974	0.052
Timeliness	0.938	0.121

Table A1.2. Estimation results: all commodities, factor analysis

Variables	All countries	Intra-Africa	Africa-World
lnGDPpc_rep	1.6072*** (0.05)[0.2948]	2.518*** (0.53)[0.3299]	0.9223*** (0.11)[0.1602]
lnGDPpc_par	1.0409*** (0.05)[0.1907]	-1.2014** (0.54)[-0.1596]	0.0313 (0.12)[0.0054]
lnDistance	-0.9082***(0.06)[-0.1064]	-3.9147***(0.56)[-0.3234]	-2.3512***(0.19)[-0.1476]
Infrastructure_rep	2.0224*** (0.07)[0.2775]	5.0961*** (0.59)[0.4043]	3.5245*** (0.16)[0.3804]
Regulatory env._rep	2.1226*** (0.07)[0.2529]	2.2052*** (0.48)[0.2003]	2.3245*** (0.15)[0.2269]
E-business_rep	-0.0002 (0.01)[-0.0090]	0.3924** (0.16)[0.1592]	-0.0001 (0.01)[-0.0002]
Border_rep	-0.0850* (0.03)[-0.0226]	0.2785 (0.19)[0.0550]	0.0111 (0.06)[0.0026]
Infrastructure_par	1.7358*** (0.07)[0.2385]	2.2834*** (0.59)[0.1839]	2.8915*** (0.16)[0.3136]
Regulatory env._par	1.0860*** (0.08)[0.1296]	2.2280*** (0.48)[0.2064]	1.0148*** (0.15)[0.0995]
E-business_par	-0.0009***(0.01)[-0.0428]	0.3925** (0.16)[0.1610]	-0.0014***(0.01)[-0.0438]
Border_par	0.1633*** (0.03)[0.0433]	0.0613 (0.20)[0.0119]	0.1387** (0.07)[0.0326]
ln(1+tariff)_par	0.0096 (0.06)[0.0013]	-0.1636 (0.32)[-0.0206]	-0.2672** (0.12)[-0.0291]
FTA	0.03505***(0.13)[0.0206]	0.1460 (1.07)[0.0056]	-0.0192 (0.12)[-0.0291]
Common currency	-0.9815** (0.37)[-0.0160]		-3.1654***(0.90)[-0.0397]
Contiguity	2.9414*** (0.32)[0.0609]	1.1881 (1.29)[0.0378]	2.8748** (1.23)[0.0273]
Common language	2.7856*** (0.16)[0.1085]	5.0169*** (0.77)[0.3232]	3.2538*** (0.28)[0.1358]
Colony	0.9157*** (0.34)[0.0164]		1.9256** (0.85)[0.0258]
Common colonizer		-1.3911 (0.98)[-0.0695]	
Landlocked_rep	-1.7421***(0.13)[-.0887]	-3.9889***(0.82)[-0.1375]	-1.8550***(0.25)[-0.0904]
Landlocked_par	-1.9709***(0.13)[-0.1003]	-2.3257***(0.83)[-0.1357]	-2.8151***(0.25)[-0.1376]
Year2012	-0.3835***(0.09)[-0.0250]	-1.9740** (0.82)[-0.1272]	-0.2692 (0.19)[-0.0155]
Intercept	-5.0574***(1.00)	52.7314***(7.09)	11.1873***(2.51)
N	17957	532	5806
F-stat	474.9	16.3	124.8
R2	0.346	0.377	0.302

Notes: The dependent variable is the logarithm of bilateral trade flows. The regressions consider all commodities, and trade facilitation measures are aggregated using factor analysis. The extensions "rep" and "par" refer to "reporter" and "partner". Values between parentheses represent standard errors, and those between brackets standardized coefficients. The same applies in the tables below, as well the standard indication of significance.

Table A1.3. Estimation results: all commodities, simple averages

Variables	All countries	Intra-Africa	Africa-World
lnGDPpc_rep	1.7941*** (0.05)[0.3306]	2.8499*** (0.62)[0.3734]	1.2393*** (0.12)[0.2152]
lnGDPpc_par	1.1721*** (0.06)[0.2157]	-1.0124 (0.62)[0.1345]	-0.1947 (0.12) [0.0338]
lnDistance	-1.0605***(0.06)[-0.1237]	-4.0055***(0.59)[-0.3309]	-2.1133***(0.21)[-0.1326]
Infrastructure_rep	1.2456*** (0.08)[0.1753]	5.0842*** (0.86)[0.4331]	2.4105*** (0.20)[0.2646]
Regulatory env._rep	1.8117*** (0.08)[0.2163]	4.0613*** (0.62)[0.3688]	2.3443*** (0.17)[0.2284]
E-business_rep	-0.0001 (0.00)[-0.0094]	0.4180* (0.16)[0.1817]	0.0001 (0.01)[0.0037]
Border_reporter	-0.1619***(0.03)[-0.0432]	0.4631** (0.21)[0.0914]	-0.0494 (0.07)[-0.0116]
Infrastructure_par	1.2327*** (0.08)[0.1737]	1.3138 (0.86)[0.1137]	2.4249*** (0.20)[0.2674]
Regulatory env._par	0.9006*** (0.08)[0.1076]	2.7437*** (0.61)[0.2542]	1.2479*** (0.18)[0.1221]
E-business_par	-0.0002***(0.01)[-0.0420]	0.4117*** (0.15)[0.1812]	-0.0003***(0.01)[-0.0387]
Border_par	0.1058*** (0.03)[0.0282]	0.0495 (0.22)[0.0096]	0.1158* (0.07)[0.0272]
ln(1+tariff)_par	0.0811 (0.06)[0.0107]	0.0627 (0.33)[0.0079]	-0.1820 (0.13)[-0.0198]
FTA	0.3581*** (0.13)[0.0211]	1.3495 (1.12)[0.0517]	0.8125** (0.36)[0.0293]
Common currency	-1.2128***(0.38)[-0.0198]		-3.8217***(0.94)[-0.0480]
Contiguity	2.8297*** (0.32)[0.0589]	2.3123* (1.39)[0.0749]	3.4373*** (1.27)[0.0327]
Common language	2.7046*** (0.16)[0.1059]	5.4172*** (0.79)[0.3490]	3.3822*** (0.29)[0.1411]
Colony	0.6760* (0.35)[0.0122]	-6.0715* (3.67)[-0.0676]	1.1798 (0.88)[0.0158]
Common colonizer		-2.7430***(1.01)[-0.1371]	
Landlocked_rep	-1.7893***(0.13)[-0.0915]	-4.2659***(0.87)[-0.2503]	-1.7571***(0.26)[-0.0857]
Landlocked_par	-2.0080***(0.13)[-0.1027]	-2.3286***(0.87)[-0.1376]	-2.7064***(0.26)[-0.1323]
Year2012	-0.4264***(0.09) [-0.0279]	-2.9222***(0.89)[-0.1883]	-0.4655** (0.20)[-0.0268]
Intercept	-2.4542** (1.02)	63.7452***(7.55)	12.1990***(2.60)
N	17957	532	5806
F-stat	435.5	12.7	95.0
R2	0.33	0.33	0.25

Table A1.4. Estimation results: agricultural commodities, factor analysis

Variables	All countries	Intra-Africa	Africa-World
lnGDPpc_rep	0.1250 (0.08)[0.0182]	1.2591 (0.81)[0.1313]	0.5891*** (0.15)[0.0915]
lnGDPpc_par	0.2520*** (0.09)[0.0367]	0.3280 (0.83)[0.0347]	-0.1042 (0.16)[-0.0162]
lnDistance	-0.2723***(0.10)[-0.0254]	0.4887 (0.84)[0.0321]	-0.4388* (0.26)[-0.0246]
Infrastructure_rep	0.4953*** (0.12)[0.0540]	1.0073 (0.89)[0.0636]	0.1009 (0.22)[0.0097]
Regulatory env._rep	0.7186*** (0.12)[0.0681]	-0.4687 (0.74)[-0.0339]	0.4527** (0.19)[0.0395]
E-business_rep	0.0015*** (0.01)[0.0571]	0.6286** (0.24)[0.2030]	0.0013*** (0.01)[0.0365]
Border_rep	0.4379*** (0.05)[0.0925]	-0.1906 (0.29)[-0.0299]	0.2977*** (0.09)[0.0627]
Infrastructure_par	0.1130 (0.12)[0.0123]	-1.0087 (0.90)[-0.0647]	0.0045 (0.22)[0.0004]
Regulatory env._par	0.1976* (0.12)[0.0187]	2.0599***(0.73)[0.1519]	0.8340*** (0.19)[0.0731]
E-business_par	0.0012*** (0.01)[0.0453]	0.1119 (0.24)[0.0365]	0.0013*** (0.01)[0.0371]
Border_par	-0.0696 (0.05)[-0.0147]	-0.0959 (0.31)[-0.0148]	0.0885 (0.09)[0.0186]
ln(1+tariff)_par	-0.0778 (0.07)[-0.0097]	0.2517 (0.35)[0.0337]	-0.1827 (0.12)[-0.0237]
FTA	-0.1106 (0.20)[-0.0052]	0.0125 (1.63)[0.0004]	-0.1443 (0.46)[-0.0046]
Common currency	-0.9294 (0.58)[-0.0120]		1.3276 (1.19)[0.0149]
Contiguity	-0.2318 (0.49)[-0.0038]	2.6794 (1.98)[0.0691]	2.4452 (1.62)[0.0208]
Common language	0.2647 (0.25)[0.0082]	0.7132 (1.18)[0.0366]	0.9626*** (0.37)[0.0359]
Colony	-0.4926 (0.54)[-0.0070]		-0.6714 (1.12)[-0.0081]
Common colonizer		0.4425 (1.49)[0.0176]	
Landlocked_rep	1.4364*** (0.19)[0.0582]	-1.9916 (1.26)[-0.0930]	0.0006 (0.33)[0.0001]
Landlocked_par	-0.4773** (0.19)[-0.0193]	-4.1725***(1.27)[-0.1963]	-1.9850***(0.33)[-0.0868]
Year2012	-0.2950** (0.14)[-0.0153]	1.1352 (1.26)[0.0582]	0.0019 (0.26)[0.0001]
Intercept	9.3788*** (1.54)	0.5879 (10.81)	1.7522 (3.31)
N	17957	532	5806
F-stat	20.8	2.4	8.0
R2	0.02	0.08	0.03

Table A1.5. Estimation results: agricultural commodities, simple averages

Variables	All countries	Intra-Africa	Africa-World
lnGDPpc_rep	0.1310 (0.08)[0.0191]	0.8227 (0.91)[0.0858]	0.7310*** (0.15)[0.1136]
lnGDPpc_par	0.2711*** (0.09)[0.0395]	0.2640 (0.92)[0.0279]	-0.0703 (0.16)[-0.0109]
lnDistance	-0.2838***(0.09)[-0.0262]	0.5187 (0.85)[0.0341]	-0.4642* (0.26)[-0.0261]
Infrastructure_rep	0.5851*** (0.12) [0.0652]	0.5745 (1.27)[0.0390]	0.6924*** (0.25)[0.0680]
Regulatory env._rep	0.8007*** (0.12)[0.0757]	-0.5671 (0.91)[-0.0410]	-0.1421 (0.22)[-0.0124]
E-business_rep	0.0004*** (0.01)[0.0576]	0.3385 (0.23)[0.1172]	0.0004*** (0.01)[0.0374]
Border_rep	-0.4459***(0.05)[-0.0941]	-0.1637 (0.31)[-0.0257]	-0.3481***(0.09)[-0.0733]
Infrastructure_par	0.0214 (0.12)[0.0024]	-0.3151 (1.27)[-0.0217]	-0.0321 (0.25)[-0.0032]
Regulatory env._par	0.2336* (0.12)[0.0221]	2.1147** (0.90)[0.1559]	0.8259*** (0.22)[0.0723]
E-business_par	0.0003*** (0.01)[0.0443]	0.1496 (0.23)[0.0524]	0.0004*** (0.01)[0.0374]
Border_par	-0.0841* (0.05)[-0.0177]	-0.0735 (0.32)[-0.0114]	0.0769 (0.09)[0.0162]
ln(1+tariff)_par	-0.0627 (0.07)[-0.0078]	0.1735 (0.35)[0.0232]	-0.1777 (0.12)[-0.0230]
FTA	-0.0933 (0.20)[-0.0044]	0.1147 (1.65)[0.0035]	-0.0160 (0.46)[-0.0005]
Common currency	-0.8916 (0.58)[-0.0115]		1.1918 (1.19)[0.0134]
Contiguity	-0.2884 (0.49)[-0.0048]	3.6898* (2.06)[0.0951]	2.4954 (1.62)[0.0212]
Common language	0.2646 (0.25)[0.0082]	0.9567 (1.18)[0.0491]	1.0291*** (0.37)[0.0384]
Colony	-0.3741 (0.54)[-0.0053]	-9.3846* (5.40)[-0.0832]	
Common colonizer		0.3349 (1.50)[0.0133]	-0.4824 (1.12)[-0.0058]
Landlocked_rep	1.4328*** (0.19)[0.0580]	-1.8626 (1.28)[-0.0870]	0.0119 (0.33)[0.0005]
Landlocked_par	-0.4690** (0.19)[-0.0190]	-4.3800***(1.29)[-0.2061]	-1.9530***(0.33)[0.0854]
Year2012	-0.3116** (0.15)[-0.0161]	0.7570 (1.32)[0.0388]	0.0002 (0.26)[0.0001]
Intercept	9.6432*** (1.56)	-1.4231 (11.13)	1.8324 (3.31)
N	17953	532	5806
F-stat	20.8	2.1	8.3
R2	0.02	0.07	0.03

Table A1.6. Estimation results: LPI (factor analysis), all commodities, LPI

Variables	All countries	Intra-Africa	Africa-World
lnGDPpc_rep	0.0320 (0.05)[0.0058]	0.2917 (0.35)[0.0427]	0.4715*** (0.10)[0.0844]
lnGDPpc_par	0.1997*** (0.056)[0.0364]	0.4585 (0.35)[0.0681]	0.4190*** (0.11)[0.0753]
lnDistance	-1.5740***(0.06)[-0.1816]	-3.8898***(0.49)[-0.3962]	-2.9392***(0.18)[-0.1938]
LPI_rep	4.3147*** (0.09)[0.4261]	4.0439*** (0.66)[0.2627]	4.7981*** (0.19)[0.4030]
LPI_par	3.5788*** (0.10)[0.3534]	3.6170*** (0.66)[0.2360]	4.7947*** (0.19)[0.4037]
ln(1+tariff)_par	0.2646*** (0.06)[0.0343]	0.5749* (0.30)[0.0803]	0.1372 (0.11)[0.0149]
FTA	0.2024 (0.12)[0.0116]	0.8944 (1.03)[0.0367]	0.3867 (0.33)[0.0141]
Common currency	-0.2185 (0.36)[-0.0035]	0.8345 (1.22)[0.0308]	-0.1483 (0.94)[-0.0017]
Contiguity	2.3943*** (0.31)[0.0484]	0.3442 (0.83)[0.0198]	3.4711*** (1.15)[0.0334]
Common language	1.8190*** (0.15)[0.0702]	1.1383 (0.69)[0.0792]	1.8067*** (0.27)[0.0773]
Colony	1.1415*** (0.34)[0.0201]		0.2148 (0.82)[0.0029]
Common colonizer			1.1647*** (0.40)[0.0337]
Landlocked_rep	-2.1404***(0.12)[-0.1058]	-2.1277***(0.79)[-0.1318]	-2.8060***(0.24)[-0.1343]
Landlocked_par	-2.1738***(0.12)[-0.1077]	-1.2563 (0.79)[-0.0787]	-3.2381***(0.24)[-0.1558]
Year2012	0.1259 (0.09)[0.0081]	-1.3563** (0.56)[-0.0944]	-0.5980***(0.18)[-0.0345]
Intercept	-4.5245***(0.73)	9.9162* (5.09)	-0.9576 (1.85)
N	18438	501	5726
F-stat	873.6900	16.1	255.6
R2	0.3990	0.30	0.37

Table A1.7. Estimation results: LPI (factor analysis), agricultural commodities

Variables	All countries	Intra-Africa	Africa-World
lnGDPpc_rep	0.8029*** (0.09)[0.1180]	1.8025*** (0.53)[0.1960]	0.9606*** (0.14)[0.1543]
lnGDPpc_par	0.0041 (0.08)[0.0006]	0.2118 (0.54)[0.0234]	-0.0409 (0.15)[0.0066]
lnDistance	-0.3175***(0.10)[-0.0295]	-0.3985 (0.74)[-0.0302]	-0.0731 (0.25)[-0.0043]
LPI_rep	2.5612*** (0.16)[0.2040]	5.2248*** (1.01)[0.2524]	3.4897*** (0.27)[0.2628]
LPI_par	0.8181*** (0.15)[0.0652]	-1.1939 (1.01)[-0.0579]	-0.0404 (0.27)[-0.0031]
ln(1+tariff)_par	-0.1955***(0.08)[-0.0243]	-0.0323 (0.34)[-0.0045]	-0.4538***(0.12)[-0.0589]
FTA	-0.1417 (0.20)[-0.0066]	-1.3699 (1.58)[-0.0419]	-0.6027 (0.45)[-0.0197]
Common currency	1.3318** (0.57)[0.0172]		1.2980 (1.29)[0.0133]
Contiguity	-0.5674 (0.50)[-0.0093]	-0.6813 (1.86)[-0.0187]	-0.5988 (1.59)[-0.0052]
Common language	0.1835 (0.24)[0.0057]	2.8338*** (1.07)[0.1467]	0.5607 (0.37)[0.0215]
Colony	-0.7935 (0.53)[-0.0113]		-1.6895 (1.12)[-0.0203]
Common colonizer		-1.1778 (1.27)[-0.0503]	-0.1990 (0.55)[-0.0052]
Landlocked_rep	-0.9932***(0.19)[-0.0396]	-3.1540** (1.22)[-0.1453]	-1.1651***(0.32)[-0.0500]
Landlocked_par	-0.5123***(0.19)[-0.0205]	-2.5495** (1.21)[-0.1188]	-1.5428***(0.33)[-0.0666]
Year2012	-0.1484 (0.14)[-0.0077]	-1.5985* (0.86)[-0.0828]	-0.0543 (0.25)[-0.0028]
Intercept	4.8004*** (1.14)	9.3012 (7.78)	5.2730** (2.52)
N	18438	501	5726
F-stat	33.0	4.0	15.4
R2	0.03	0.10	0.04

A2. Data sources

The dataset covers 105 countries, 19 of which are African, and two time points: 2012 and 2010. Bilateral trade flows are compiled from COMTRADE. As mentioned above, data used to construct trade facilitation indicators come from two main sources: the World Economic Forum's annual World Competitiveness Reports and the World Bank (Ease of Doing Business and LPI). Data on tariffs are from TRAINS. The core gravity variables, such as geographical distance, colonial ties and heritage, common language, landlocked, common border dummies are obtained from the CEPII website. Free trade agreements and currency unions are available from WTO, and GDP per capita are from the World Bank's World Development Indicators (WDI).

A3. Country list

Albania, Algeria, Argentina, Armenia, Australia, Austria, Azerbaijan, Belarus, Belgium, Belize, Bolivia, Bosnia Herzegovina, Brazil, Bulgaria, Cambodia, Canada, Cape Verde, Chile, China, Colombia, Costa Rica, , Cote d'Ivoire, Croatia, Cyprus, Czech Republic, Denmark, Dominica, Dominican Republic, Ecuador, Egypt, El Salvador, Estonia, Ethiopia, Fiji, Finland, France, Georgia, Germany, Ghana, Greece, Greenland, Guatemala, Guyana, Honduras, Hungary, Iceland, India, Indonesia, Ireland, Israel, Italy, Japan, Jordan, Kazakhstan, Korea, Kyrgyz Republic, Latvia, Lebanon, Lithuania, Luxembourg, Macedonia, Madagascar, Malaysia, Maldives, Mali, Malta, Mauritius, Mexico, Moldova, Namibia, Netherlands, New Caledonia, New Zealand, Nicaragua, Niger, Nigeria, Norway, Pakistan, Paraguay, Peru, Poland, Portugal, Romania, Russian Federation, Rwanda, Saudi Arabia, Senegal, Singapore, Slovak Republic, Slovenia, South Africa, Spain, Sri Lanka, Sweden, Switzerland, Tanzania, Thailand, Togo, Turkey, Uganda, United Kingdom, United States, Uruguay, Vietnam, Zimbabwe.