# Infrastructure, Trade Transaction Costs, and Aid for Trade: The Imperatives for African Economies

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**Abstract**: Using the new index of infrastructure and comprehensive bilateral trade costs data spanning the years 2002-2011, we examine: a) the impacts of *aid-for-trade* (*AFT*) from bilateral and multilateral sources on trade costs facing *AFT* recipient countries and b) identify the components of infrastructure that are relatively influential in reducing bilateral trade costs. Our results from the estimation of a multi-level mixed-effects model indicate that increased *AFT* inflows from both bilateral and multilateral sources reduce trading costs as is improved level of infrastructure in the *AFT* recipient countries. While the results are persistent across sectors, the observed effects vary consistently both across the sources of *AFT* (Bilateral or Multilateral) and the quality and components of infrastructure in the recipient countries. Our results have important policy implications relevant for strengthening the effectiveness of *aid-for-trade* and further aid extensions in general and especially targeted toward infrastructure improvements.

*JEL*: F1, F3, C5
*Key Words*: *Aid-for-Trade*, Trading Costs, Mixed-Effects Model

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## I. INTRODUCTION

Emphasizing the relevance of trade related aid for overcoming supply side constraints limiting the active participation of developing countries in the global trading system, the Doha round of negotiations of the World Trade Organization paved the way for a new initiative dubbed as *Aid-for-Trade* (*AFT*). While not entirely new, the initiative quickly grabbed the attention of policy makers both in the developed and developing countries. Consequently, a significant amount of financial resources have been committed and dispersed by various agencies including the OECD member countries and multilateral organizations (e.g., the European Development Fund, the World Bank, the United Nations Funds and Programs) to improve the trade performance of many developing countries.[1] About USD 300 billion has been disbursed for *aid-for-trade* support between 2005 and 2017 and 146 developing countries have received aid for trade the majority of which went to Asia (41.5%) and Africa (38.7%). *AFT* flows to the least developed countries (LDCs) have accounted for about 27%. Sector-wise, three fourth of the total disbursements have been allocated to transportation and storage (28.6%), energy generation and supply (21.6%), agriculture (18.3%), and banking, and (11.1%) in financial services (OECD, 2017). To what extent the funds extended through the *AFT* initiative enhanced improvements in the trade performances of the recipient developing countries, thus, remains to be a timely and relevant research question of interest.

Using comprehensive estimates of bilateral trade costs data spanning the years 2002-2011 and *AFT* disbursements originating from bilateral (*BLT*) and multilateral (*MLT*) sources, we address two broad set of questions. First, we examine the relative impacts of *AFT* inflows from

[1] In addition to the cumulative $264.5 billion in *aid for trade* (*AFT*) disbursements, donors have channeled $190 in gross-trade related other official flows since the inception of the initiative, resulting in the rise of sector-allocable share of *aid for trade* from an average of 32.5% to 38.4% in 2013 (Lammerson and Roberts 2015).

bilateral and multilateral sources on trade costs facing the recipients. Second, we examine whether the level infrastructure in the recipient countries makes a difference in the effectiveness of *AFT* on bilateral trade costs. Our research questions are relevant both from policy-making perspectives and from the effectiveness of development initiatives for a number of reasons.

First, all recipient countries have benefited from *AFT* inflows originating from both sources, though in varying degrees. Assessing the effectiveness of the initiatives both at the aggregate and across the sources, thus, may help in identifying the critical factors underlying their functioning in terms of what works best, what does not, and why. Second, a number of studies (Gnangnon 2018; Wang and Xu 2018; Cadot et al. 2014; Petersson and Johansson2013; Vijil and Wagner 2012) indicate that increased *AFT* inflows correlate with improvements in the trade performance of the recipient countries with considerable variations in the observed effects. Pinning the variations in the effectiveness of the initiatives down to the sources of the funds may enhance our understanding of whether the pitfalls of the traditional development aid disbursements permeate to the functioning of *AFT*. Third, trade costs and the level of infrastructure often interact with one another. High trade costs have the potential to deny firms' access to technology and intermediate inputs, preventing their entry into and movement up the global value chain (WTO, 2017). Thus, all else equal, the extent to which *AFT* improves the trade performance of a country may hinge upon infrastructure endowments which may considerably vary across the trading partners and the economic sectors. An examination of the effect of *AFT* on bilateral trade costs while controlling for infrastructure and the other conventional sources of economic growth may, therefore, provide a more comprehensive picture and tangible measure of the functioning of the initiative.

Finally, the discretion that development aid recipients have in identifying, prioritizing, and channeling aid resources to various economic sectors, or projects is influenced by the sources of aid (Maizels and Nissanke, 1984; Rodrick, 1995, Martens et al., 1996; Burnside and Dollar, 2000; and Neumayer, 2003).[2] Beyond enhancing our understanding of the factors that underlie the overall efficacy of the initiative, examining whether infrastructure has anything to do with creating systematic differences in the observed effects of the *AFT* from alternative sources may yield relevant information for coordinating future aid disbursements.

Our results indicate that an increase in *AFT* inflows from both bilateral and multilateral sources is associated with significant declines in the bilateral trade costs facing the recipients in all regions. We also observe that improved infrastructure enhances the overall effectiveness of *AFT* on trade costs both at the aggregate level and across the sources. Comparing the country-specific effects of *AFT* from the respective sources, we find evidence indicating the country-specific effect of *AFT* from bilateral sources outweighing that of *AFT* from multilateral sources. Infrastructure endowments, however, alter this observation. We take these observations as evidence indicating that infrastructure has the potential to create systematic differences in the relative effectiveness of *AFT* from bilateral and multilateral sources.

The remainder of the paper is organized as follows. Section II provides a brief review of the extant literature on the effectiveness of *aid-for-trade*. In Section III, we discuss the empirical model, data, the variable of interest, and control variables. The results, interpretations, and the robustness checks of our findings are presented in Section IV. Section V summarizes the results and draws some policy inferences based on the results.

[2] Burnside and Dollar (2000) report that multilateral aid results in better outcomes than does bilateral aid. Rodrick (1995), Martens et al. (2002), and Maizels and Nissanke (1984) indicate that multilateral aid is less political, imposes effective controls, and has better outcomes than bilateral aid. Neumayer (2003) attributes these differences to the inability of bilateral donors to be indifferent to biases due to national interests.

## II. RELATED LITERATURE

There has been a steady increase in the total Overseas Development Assistance (*ODA*) disbursements from various sources (bilateral and multilateral), reaching US$153 billion in 2018 (OECD, 2018). Of the aggregate financial flows to the developing countries, US $127 billion (or 83%) are from bilateral sources and US $26 billion from multilateral sources (17%), while non-core multilateral aid accounted for US $17 billion (or 12%) owing to the increased international cooperation and the rapid globalization that had begun since the end of the Cold-War in 1989 (OECD, 2014).

In a recent policy paper, Biscaye et al. (2017) assess the extant theoretical arguments and empirical evidence of the relative effectiveness of foreign aid from either the bilateral, or the multilateral channels based on the conventional measures of growth and development outcomes. Defining aid effectiveness from either source as the ability to achieve targeted outcomes such as GDP growth, a rise in the Human Development Index (HDI), reductions in infant mortality and others, they find no conclusive evidence that either bilateral or multilateral aid is more effective. In particular, they attribute the lack of a conclusive evidence supporting either channel to the possible differences in the empirical methodologies and theoretical foundations of the studies.

Milner and Tingley (2013) argue that multilateral aid is less influenced by the donors' political objectives and, hence, more development-oriented, or needs based. On the contrary, several authors suggest that multilateral aid is more often a function of the income level, population, and the policy of the recipient country (Burnside & Dollar, 2000), while bilateral aid is a function of strategic political motivations (Headey, 2008; Minoiu and Reddy, 2007; Schraeder et al., 1998).

Using a subsample of 40 low-income countries, Burnside & Dollar (2000) find that bilateral aid had a significant positive effect on government consumption with implications to aid fungibility and muted impact on the economic growth in the recipient countries. Ram (2004) finds that bilateral aid has significant growth impact, while multilateral aid has significant negative impact. The observation remains consistent even after controlling for the recipient country's economic policies, supporting the notion that the effectiveness of aid substantially depends on the channel of the aid. On the contrary, using lagged measures of the aid inflows, Headey (2005) finds that multilateral aid has roughly twice the effect of bilateral aid while both channels of aid have significant and positive impact on GDP growth.

Basnett (2013) asserts that *AFT* works best when it is targeted at reducing the cost of trading by investing in infrastructure, improving trade facilitation and strengthening value chains, and addressing the binding constraints to growth. The author further observes that effective coordination between donors and recipients around the design, implementation, and the selection of instruments and modalities for delivering *AFT* play significant roles.

Tadesse et al. (2017) examine whether the *aid-for-trade* (*AFT*) inflows reduce bilateral trade costs facing aid recipients and show the extent to which *AFT* promotes trade flows using comprehensive estimates of ad valorem tariff equivalent bilateral trade costs spanning the time 2002–2010.

## III. MODEL, DATA, and VARIABLES

### *A. The Empirical Model.*

To address our research questions, we use aggregate and sector-specific measures of bilateral trade costs ( $TC_{ijt}^{k}$) facing the i$^{th}$ (i= 1, 2, ….., 135) facing the *AFT* recipient country in the k$^{th}$ (k = 1, …, 5) region, trading with the j$^{th}$ ( j= 1, 2, … ,172) partner, during the $t^{th}$ (t =2002-

2014) year as our dependent variable. Our model attributes, the recipient-trading partner level of bilateral trade costs ( $TC_{ijt}^{k}$), among others, to *AFT* inflows ( $AFT_{ijt-1}^{k}$) one year lagged of *AFT* of the recipient country i's infrastructure endowment ( $iNFR_{ijt}^{k}$), a vector ( $\boldsymbol{Z}$ ) of the recipient-trading country pairs, and time-specific non-stochastic control variables. [3] Equation (1) presents the specification.

$$ln\, TC_{ijt}^{k} = \beta_0 + \beta_1 ln\, AFT_{ijt-1}^{k} + \beta_2\, iNFR_{ijt}^{k} + \boldsymbol{Z}'\beta + u_{ijt}^{k} \quad (1)$$

A voluminous literature documents differences in the effectiveness of the development aid from bilateral and multilateral sources. [4] We, thus, disaggregate the aggregate *AFT* inflows to the given recipient into bilateral ($BLT_{ijt-1}^{k}$), and multilateral ($MLT_{ijt-1}^{k}$) *AFT* to permit heterogeneity in the effects of *AFT* originating from the respective sources. Equation (2) presents the corresponding specification.

$$ln\, TC_{ijt}^{k} = \alpha_0 + \alpha_1 ln\, BLT_{ijt-1}^{k} + \alpha_2\, ln\, MLT_{jt-1}^{k} + \alpha_3\, iNFR_{ijt}^{k} + \boldsymbol{Z}'\beta + u_{ijt}^{k} \quad (2)$$

The coefficients $\alpha_1$ and $\alpha_2$ inform us of the effects of *AFT* from the respective sources, also enabling us to evaluate if there is a difference in the observed effects. As such, Eq. (2) assumes independence in the effects of *AFT* from bilateral and multilateral sources on trade costs. While independence in the inflows of *AFT* from the respective sources is plausible, independence in the

[3] The aggregate *AFT* inflows (from all sources) to recipient *i* during year *t*, is the sum of *AFT* from bilateral (*BLT*) and multilateral (*MLT*) sources (i.e., $AFT_{it} = \sum_{j=1}^{N} BLT_{ijt} + \sum_{j=1}^{M} MLT_{ijt}$). The effect ($\beta_1$ ) of aggregate *AFT* on bilateral trade costs can thus be linearly decomposed into its sources [i.e., $\beta_1\left(lnAFT_{ijt-1}^{k}\right) = \left(\alpha_1 lnBLT_{ijt-1}^{k}\right) + \left(\alpha_2 lnMLT_{ijt-1}^{k}\right)$]. Thus, while it captures the regional country-pair variations, equation (1) assumes no heterogeneity in the effects of *AFT* originating from bilateral and multilateral sources.

[4] *AFT* from bilateral sources refers to disbursements by an official bilateral donor (state or local government) directly or through an agency representing the donor's interest in the developing country, or to a multilateral agency with the restrictions of their use. *AFT* from multilateral sources refers to core disbursements made by donors through any of the five clusters of regional, or multilateral organizations without the restrictions of their uses.

functioning of *AFT* from bilateral and multilateral sources is tenuous as all disbursements from both sources often finance projects designed to help overcome the supply-side constraints facing the given recipient's participation in international trade. To account for the covariance (in the inflows and/or the functioning), we estimate a variant of Equation (2) by including an interaction term ($BLT_{ijt} \times MLT_{it}$) between *AFT* from bilateral and multilateral sources. [5]

$$ln\ TC_{ijt}^{k} = \alpha_0 + \alpha_1 ln\ BLT_{ijt-1}^{k} + \ \alpha_2\, ln\ MLT_{it-1}^{k} + \alpha_3 \ln(BLT \times MLT\ )_{ijt-1_2}^{k} + \alpha_4\ iNFR_{ijt}^{k} + \boldsymbol{Z}'\beta\ + \alpha_i + \alpha_j + \phi_t + u_{ijt}^{k} \quad (3)$$

The coefficients $\alpha_i$, $\alpha_j$ and $\phi_t$ capture the unique recipient *i* and its trading partner *j* specific fixed-effects, and the time-specific country invariant changes in trade costs, not accounted for by the covariates, respectively. The term $u_{ijt}^{k}$ represents an assumed i.i.d. random error term. Supply-side constraints facing many developing countries are often, correlated. Thus, we consider that the error terms, $u_{it}^{j}$ and $v_{it}^{j\prime}$ may be correlated, particularly among recipients in the same geographic region. Following Baltagi et.al. (2001), thus, we define a recipient-specific random term $\zeta_i$ that enables us to decompose the error term into two components:

$$u_{ijt}^{k} \equiv \zeta_i + \ \epsilon_{ijt} \quad (4)$$

[5] Bilateral *AFT* extended to the recipient *i (e.g., Ethiopia)* during year *t* from various donors (*e.g., UK and Japan*) may come with different aid conditionalities. The effect ( $\alpha_1$ ) of total bilateral *AFT* inflows ( $\sum_{j=1}^{N} BLT_{it}$) on the bilateral trade costs of country *i* with each of the trading partners (equation 3) can be further disaggregated into the trading partner–specific partial effects ($\gamma_j$) as follows: $\alpha_1\left(lnBLT_{it-1}^{k}\right) = \left\{\gamma_1 lnBLT_{i1t-1}^{k} + \gamma_2 lnBLT_{i2t-1}^{k} + \cdots .. + \gamma_J lnBLT_{ijt-1}^{k}\right\}$. In instances where the trading partner j is an *AFT* recipient, or a non-donor, $BLT_{ijt-1}^{k} = 0$. Given our aggregation of *AFT* at the recipient level with a focus on the examination of the relative effects of *AFT* sources (bilateral vs multilateral) in the estimation of equation (3), we assume no heterogeneity in the effects of bilateral *AFT* originating from various donors.

Substituting Eq. (4) into our baseline specification (Eq. 3) yields a multilevel random intercept and random coefficient (mixed effect) model. Equation (5) illustrates.[6]

$$\begin{aligned} ln\, TC_{ijt}^{k} \;&= (\alpha_0 + \zeta_{0i}) \;+\; (\alpha_1 + \zeta_{i1}) ln\, BLT_{ijt-1}^{k} + \;\; (\alpha_2 + \zeta_{i2})\, ln\, MLT_{it-1}^{k} \;+ \alpha_3\, iNFR_{ijt}^{k} \\ &+ (\alpha_4 + \;\zeta_{i3}) \left[\ln(BLT\,)_{ijt-1}^{k} \times ln(MLT\,)_{ijt-1}^{k} \times \; iNFR_{ijt}^{k}\right] \\ &+ Z'\beta \;+ \left(\alpha_i + \alpha_j + \phi_t + \epsilon_{ijt}\right) \end{aligned} \tag{5}$$

The vector of coefficients $\beta$ represents the unknown fixed-effect parameters to be estimated and as indicated earlier, $\alpha_0$, $\alpha_i$, $\alpha_j$, and $\phi_t$ denote the constant term, the recipient and its trading partner country, and time-specific fixed effects, respectively. Whereas the random parameters, $\zeta_{0i}$ represent the average deviation of the effects of *AFT* due to the regional cluster $k$ in which the recipient is located ($\zeta_{i1} \pm \zeta_{i3}$), and ($\zeta_{i2} + \zeta_{i3}$) represent the recipient country-specific deviation of the effects of *AFT* inflows from bilateral and multilateral sources (at the margin), $\alpha_1$ and $\alpha_2$, respectively. Finally, while we test the null hypothesis of no difference in $\alpha_1$ and $\alpha_2$ (for the entire sample) to evaluate the relative effects of *AFT* from the respective sources, we evaluate the consistency of our observations using the country-specific deviations ($\zeta_{i1} \pm \;\zeta_{i3}$) and ($\zeta_{i2} \pm \;\zeta_{i3}$).

*B. The Variables, Data, and Expected signs*

The trade performance of aid recipients can be viewed using various measures. These measures range from real growth of exports (imports), changes in exports (imports) market shares, the number of products exported (imported), export concentration (diversification) indices, to the efficiency of customs (measured in terms of the time, and the number of

[6] To examine the effect that infrastructure endowment might have on the effectiveness of AFT, we also estimate equations (1) – (3) by adding an interaction term between infrastructure ( $iNFR_{ijt}^{k}$ ) and *AFT* inflow variable(s).

documents it takes to export (import), and logistic performance index). Their use could yield differing conclusions, as each of them provides an incomplete measure of the trade performance of a country. [7]

We overcome the problems arising from these measures that could potentially yield inconclusive results by using bilateral trade costs data (Arvis *et al*., 2013) as our dependent variable series. Our use of bilateral trade costs as dependent variable series has two specific advantages. First, the measure is comprehensive, enabling a direct comparison of the relative effects of *AFT* inflows across recipient as it is derived from the inverse gravity model, (i.e., refers to all costs associated with getting the good to the final user). Second, unlike the traditional measures, it minimizes measurement errors in the dependent variable series.[8] The observed effect of *AFT* is also more meaningful as it provides a coherent picture of the overall effectiveness of the initiative. Table 1 provides descriptive statistics of the average bilateral trade costs (at the aggregate level and across economic sectors), *AFT* inflows (at the aggregate level and across the sources), and infrastructure endowments (decomposed into its four components) together with the gravity model variables included in our empirical model by the broad geographic regions of the recipients included in our study.

*[Insert Table -1 here]*

Results in the table indicate that the average ad valorem tariff equivalent bilateral trade costs of a typical recipient in our study is 305.9%. Not surprisingly, bilateral trade costs facing

[7] For example, while some developing countries observe high growth in their exports by specializing in niche markets and concentrating on a few products, others record a moderate growth in their exports, and yet have well-diversified array of products and partner countries. Successful trade performance can also be the result of a favorable product or market penetration and the ability of a country to adapt its export profile to changing patterns of world demand.

[8] The traditional trade performance indictors (e.g., linear shipping index, transportation costs, trade policy costs, etc.) are partial measures. Our use of trade costs, thus, minimizes the potential differences arising from what is actually captured by the traditional measures of trade performance.

the recipient countries in different regions and the sectors considered (agricultural and manufactured goods trade) differ considerably as are the infrastructure endowments. For example, while recipients in Europe and Asia, on average, face trade costs amounting to 181.8% and 201% of the value of the commodity traded, the corresponding trade costs for typical recipients in Africa, the Americas, and the Pacific amounts 222.3%, 206%, and 204%, respectively. We also find high variability in the infrastructure endowments (both at the aggregate and decomposed into its components) of the recipients in Africa (0.255), the Americas (0.307), Asia (0.337), Pacific region (0.314), and Europe (0.411), indicating the presence of substantial variations among recipients within each geographic cluster. Data on infrastructure is from Donaubauer, et al., (2016).

To account for the structural variations in the trade costs arising from regional locations of the recipients, we estimate the mixed effects model and report results for the entire sample as well as the five regions. We also control for institutional quality and the standard proxies often included in the gravity model of trade: the geodesic distance, common languages, colonial relationships, economic remoteness, access to the sea, regional trading agreements, and common border between the trading partners, and institutional quality. Data on *AFT* receipts and their breakdowns by sources are from the OECD (2014) Credit Reporting System (CRS). All other variables are from CEPII (2014).

The descriptive statistics of the corresponding variables presented in Table-1 indicate that the typical recipient is located about 7,088 kilometers from its typical trading partner, had an economic remoteness index of 4,535, and receives about $250.7 million in total *AFT* per year. About 19% of the recipients have common official language with their trading partners, and 15% are parties to a common regional free trade agreement (*FTA*). Nearly 19% of the recipients and

39% of their trading partners are landlocked. About 3.5% of the recipients have common borders with their trade partners and 1.5% have past colonial relationships. Following the standard trade literature, we expect the coefficients of geodesic distance, economic remoteness, and lack of access to the sea to be positive, and that of common borders, institutional quality, official languages, regional trading agreement, and past colonial relationships to be negative.

## IV. EMPIRICAL RESULTS

In Table 2, we report results from a random-effects panel data-model estimation of our specification in equation (1) without controlling for the structural variation of trade costs across broad regional locations of the recipients. Results from four variants of the model: a base line in which only the gravity variables are accounted for, column (a), variables in (a) plus aggregate *AFT* inflows in column (b), *AFT* inflows decomposed into its sources (*AFT* from bilateral and multilateral sources, with and without interaction effects in columns (c), (d), and (e), respectively. Table 3 presents results from specifications in which we account for infrastructure endowments of the recipient countries.

[Insert Tables 2 around here]

Results from estimation of the base model of the total bilateral trade costs in column (a) indicate that all control variables included in the specification have the theoretically anticipated signs and are statistically significant coefficients. Greater geodesic distance between the *AFT* recipients and their trading partners corresponds with higher trade costs, as are the lack of access to the sea and economic remoteness of the recipients as well as their trading partners. Accordingly, keeping all other variables constant, a 10% increase in the geodesic distance between the typical recipient and its trading partner and the economic remoteness of the

recipients and their trading partners, and would result in a 2.30% and 2.91% increase in the total bilateral trade costs, respectively. As compared to recipients that have access to the sea, total bilateral trade costs of a typical land locked recipient are 17.3% higher, on the average.

We find that trade costs facing *AFT* recipients are lower among recipients (29.9%) that had colonial relationships (bilateral and/or common), share common borders (43.3%), official languages (15.7%), and those that are parties to a trading agreement (29.2%), respectively compared, or to the contrary. Similarly, a 10% increase in the aggregate index of the institutional quality (measured by the strength of corruption control measures in place, effectiveness of the government, rule of law and regulatory quality) reduces bilateral trade costs facing the *AFT* recipient countries by 7.74%, on average. [9] Finally, both the Wald Chi-Square statistics and the Log-likelihood ratio tests clearly indicate that the model performs well.

### *4.1. Does AFT Reduce Bilateral Trade Costs?*

As has been shown in several recent studies, our results in Table 2 column (b) with the specification in which the base line model (at the aggregate level) is appended with (one year) lagged aggregate *AFT* inflow indicate a statistically significant effect on the total bilateral trade cost reductions of the recipients. Given the double logarithmic specification of our model, the results suggest that, c*eteris paribus*, a 10% rise in *AFT* inflow to a typical recipient is associated with a 0.97% decrease in total bilateral trade costs facing the typical recipient, on average.

#### *4.1.1. Decomposing the Effects of Aggregate AFT from Bilateral and Multilateral Sources*

AFT disbursements to developing countries originate from bilateral and multilateral sources. Some countries receive a significant amount of AFT from bilateral sources (whether

[9] With little or, no variation in the observed magnitudes, the findings remain consistent across the specifications and alternative estimation methods that we employ in most cases.

from just a few, or multiple donors), others obtain a large proportion of AFT from multilateral sources. Although the magnitudes of the disbursements from either source might be independent, it is reasonable to assume that the effectiveness of AFT from a given source (e.g., bilateral) has the potential to influence the functioning of AFT from the other source (say, Multilateral). Given our desire for understanding the functioning and effectiveness of AFT, we decompose the AFT inflows into the respective sources. Results from the specifications that include AFT from bilateral and multilateral sources, with and without the interaction effects are presented in columns (c), (d), and (e) of Table 2.

Results presented in columns (c) and (d) assume independence in the functionality of *AFT* from bilateral and multilateral sources. Results in column (e) of the table account for the presence of a potential mediation effect of *AFT* originating from either source. The significance of the coefficient of the interaction term column (d) leads us to reject the null of independence (no mediation) in the functionality of *AFT* from the respective sources. The result clearly indicates that *AFT* from both bilateral and multilateral sources have statistically significant and negative effects on trade costs. Using results in column ( e) of the table, and computing the marginal effects, we, therefore, observe that that a 10% increase in *AFT* from bilateral and multilateral sources are associated with a 0.12% and 0.08% decline in total bilateral trade costs facing the typical recipient, respectively.

*4.1.2. The Role of Infrastructure*

Table 3 presents results from specifications in which we account for differences in the infrastructure endowments may have on bilateral trade costs facing the recipients, both at the aggregate level and its components (Transportation, ICT, Energy, and Finance). The figures in the table clearly indicate both at the aggregate level as well as across its components, and

consistent with the expectations, infrastructure improvement results in a statistically significant reduction in bilateral trade costs facing the recipients' countries. Given the fact that one of the primary targets of *AFT* inflows is building infrastructure, we examine whether after controlling for the infrastructure endowment of the recipients the *AFT* variable remains to have a statistically significant coefficient. Results in column (c) where we include the interaction term between aggregate *AFT*, lagged one year, and current level of infrastructure endowment of the recipients, and column (e) where the *AFT* inflow is interacted with the sub-components of infrastructure indicate that better infrastructure makes *AFT* more effective in reducing bilateral trade costs.

[Insert Tables 3 and 4 around here]

Table 4 (for bilateral *AFT* inflows) and Table 5 (for multilateral *AFT* inflows) present results of the corresponding estimations in which we decompose aggregate *AFT* inflows into the bilateral and multilateral sources. To facilitate discussion of the results, we also provide a summary of the effects of a contemporaneous one standard deviation increase in infrastructure endowment by regional location of the recipients and economic sectors in Table 6.

The results indicate that ranging from reducing total bilateral trade costs from 0.135% among recipients in Europe to 0.154% among recipients in the Pacific, a one standard deviation increase in the infrastructure endowment is associated with 0.171% (total trade costs), 0.161% (for manufactured goods), and 0.111% (for agricultural goods) decline, on average. At the aggregate level, the effects of a comparable increase in the finance component of infrastructure yields a significantly larger decline for typical recipients in Africa (0.134%), the Americas (0.126%), and the Pacific (0.083%). Improvements in the ICT produces significantly larger trade costs reduction effects among recipients in Asia (0.086%) and Europe (0.088%). Consistent with the overall effects, sector wise, while finance has a much larger effect in Africa (0.132%) and the

Americas (0.128%), the ICT component has a larger trade costs reductions effects involving manufactured goods in Asia (0.096%) and Europe (0.077%). For trade costs involving agricultural goods, transport component of infrastructure yields a much higher dividend for recipients in Africa (0.06%) and Asia (0.045%). Energy has the largest effect among recipients in the Pacific (0.166), and the finance component of infrastructure has the largest effect among recipients in the Americas (0.117%) and Europe (0.037%).

[Insert Tables 5 and 6 around here]

*4.1.3. Consistency of the Observed Effects AFT inflows on Trade Costs*

Significant supply-side constraint variations exist facing developing countries located in various geographic regions. For example, trade costs, on average, are higher for African countries than for other developing countries due to irregularities associated with border and behind-the border issues and higher than average costs of transportation and compliance with rules of origin specific to various preferential trade agreements (Portugal-Perez and Wilson, 2008). Supporting this notion, results in our descriptive statistics Table 1 indicate that bilateral trade costs are highest, on average, among recipients in Africa (325.2%), followed by those in the Pacific (321.6%), and the Americas (305.9%) relative to that of recipients in Asia (285%) and Europe (280.9%).

To ascertain the validity of the observed trade cost reduction effects of *AFT* (at the aggregate level and from bilateral and multilateral sources) while controlling for infrastructure endowment, we examine whether the results apply across broad geographic regions. To this end, we estimate a variant of our specifications in Equations (1) and (3) which involves an interaction term between regional dummy variables and the *AFT* variable employing a mixed (random intercept and random coefficient) effects model. Tables 5 presents summary of the effects of

*AFT* inflows (both at the aggregate level and across the sources) by geographic regions of the recipients and economic sectors (all computed at the margins).

[Insert Tables 7 around here]

Three clear observations can be gleaned from the marginal effects summarized in Table 7. First, the effect of increased *AFT* inflows on total bilateral trade costs (at the aggregate level) remains significant effect across recipients in all geographic regions except the Pacific. Accordingly, a 10% increase in the aggregate *AFT* inflow yields, on average, reduces total bilateral trade costs ranging from a 0.88% (among recipients in Asia), and 0.13% (the Americas), 0.23% (in Africa) to 0.49% (Europe). The result holds invariably true across the sectors (i.e., increased aggregate *AFT* inflow results in significant bilateral trade costs reductions for manufactured goods and agricultural products in each of the regions), with the exception of Asia (for trade costs involving agricultural products).

Second, assessing the effects of *AFT* from bilateral and multilateral sources at the sectoral level reveals that *AFT* from multilateral sources remain significant and negative across both sectors and four of the five regions (ranging from 0.09% (in Africa) to 0.19% (in Europe) for manufactured goods, and 0.09% (Asia) to 0.61% (in Africa) for agricultural products. Similarly, a corresponding 10% increase in *AFT* inflows from bilateral sources reduces trade costs ranging from 0.14% (in the Americas) to 0.16% (in Asia) for manufactured goods, and 0.15% (in the Americas) to 0.87% (in Africa) for agricultural products.

Finally, the effect of *AFT* inflows on trade costs facing recipients in the Pacific region remains statistically indiscernible (both at the aggregate level and across the sectors considered). In a few regional instances, (Africa and Europe for manufactured goods), Asia and Europe for agricultural goods), the effects of *AFT* from bilateral or multilateral sources on sector specific-

trade costs are not significant. Overall, these results indicate that the trade costs reduction effects of *AFT* has been consequential across all regions (although variable across regions with few exceptions).

*4.1.4. Comparing the Relative Effects of AFT from Bilateral and Multilateral Sources*

Regardless of its origin (bilateral, or multilateral), the overall goal of *AFT* inflows is to reduce supply side constraints limiting developing countries from actively participating and/or benefiting from the global trading system. However, the amount, primary target sector of interest, specific projects financed, and the conditionality underlying the disbursement of *AFT* inflows differ across countries. Consequently, the effectiveness of *AFT* from the bilateral and multilateral sources may vary. While the literature on the relative effectiveness of development aid from bilateral and multilateral sources is extensive, empirical evidence on *AFT* is scant. To fill the void, we evaluate the null hypothesis of no difference in the coefficients of *AFT* from bilateral and multilateral sources using the Wald test. We then compare the corresponding effects among the five broad geographic regions using the average marginal effects of the variables.

The Wald test results suggest the rejection of the null hypothesis of no difference in the effects of *AFT* from bilateral and multilateral sources reported in Table 6 (at $p < 0.05$, standard errors labeled with superscript (a)) at the aggregate level (Total Trade Costs, with reference to regional locations of the recipients). Evaluating the same hypothesis across the regions, we also observe that the effect of *AFT* from bilateral sources is significantly higher than that of *AFT* from multilateral sources among recipients in Africa, the Americas, and Asia. The observed effects of a 1% increase in *AFT* from bilateral sources specifically in Africa (-0.0395 vs -0.0211) and the Americas (-0.0141 vs. -0.0077) is roughly double that of *AFT* from multilateral sources. Among recipients in Europe, however, while the corresponding effect of a 10% increase in *AFT* from

multilateral sources is both substantial and statistically significant (-0.0149), increased inflows of *AFT* from bilateral sources do not have statistically discernible effect.

Examining the corresponding effects across sectors, we find that for manufactured goods, the marginal trade cost reduction effects of *AFT* from multilateral source exceeds that of *AFT* from bilateral sources for the entire sample, and in Africa and Europe. However, the reverse is true among recipients in the Americas and Asia. For agricultural products, the effect of *AFT* from multilateral sources outweighs that of *AFT* from bilateral sources among recipients in Asia and Europe for trade costs involving agricultural products, while *AFT* from bilateral sources have significantly higher effect than *AFT* from multilateral sources among recipients in Africa and the Americas.

Summing up, while the sector wise and regional comparison do not yield conclusive evidence indicating the relative effects of *AFT* from either source outweighing the other; our analysis at the aggregate level suggest *AFT* from bilateral sources having larger (stronger) than that of *AFT* from multilateral sources (for the entire sample and in three of the five regions). These observations might be the results of the statistically significant interaction effect present between *AFT* from the respective sources. Thus, we examine what happens to the marginal effects of *AFT* from one source in response to changes in the levels of the *AFT* from the other source. In addition to arriving at a conclusive evidence with regard to the relative effects of *AFT* from multilateral and bilateral sources, such an analysis would help us to determine, the threshold level of inflows that generates meaningful declines in trade costs.

Figure 1.1 presents results depicting the marginal effects, together with the 95% confidence interval estimates of the observed effects of a percent change in *AFT* from bilateral sources on total trade costs, computed at various levels of *AFT* from multilateral sources. To

facilitate a better understanding of the observed effects, we incorporate the kernel (density) distribution of recipients across the contours of *AFT* inflows from multilateral sources. Figure 1.2 presents the corresponding effects of *AFT* from multilateral sources computed at various levels of *AFT* from bilateral sources.

As evident from the graphs, inflows from either source do not immediately lead to a fall in bilateral trade cost at the very low end of *AFT* from the respective sources. For example, the effect of *AFT* from bilateral sources remains positive, or negative but statistically insignificant) when the average annual *AFT* inflows from multilateral sources to the typical recipient in our study is below $6.4 million. Similarly, for *AFT* from multilateral sources, the effect remains low and statistically insignificant for inflows of *AFT* from bilateral sources below $14.03 million.

[Insert Figs. 1.1 and 1.2. around here]

However, once inflows from the respective sources surpass the respective thresholds, the effects of *AFT* from bilateral sources range from -0.0046 to -0.0352, and that of *AFT* from multilateral sources range from -0.0026 to -0.0295. Comparing the relative effects, we observe that at the lower ends (close to the threshold levels), *AFT* from bilateral sources tend to have larger effect. At the upper ends of the respective kernels (i.e., in countries that receive relatively larger amounts of *AFT* from both sources), however, there is not much difference in the extent to which a proportional increase in *AFT* from either of the sources reduces bilateral trade costs facing the recipients. These results clearly suggest that once *AFT* inflows from either source surpass the thresholds identified, statistically significant and comparable (i.e., equivalent) reductions of bilateral trade costs prevail regardless of the source from which the proportionate increase in *AFT* inflows originate (for the entire sample).

*4.1.5. Heterogeneity and Systematic Differences*

The average values from the entire sample or regions may mask more than what they reveal. Thus, we examine whether systematic differences in the effects of *AFT* from bilateral and multilateral sources are present by placing each recipient into one of four mutually exclusive quadrants indicating *AFT* inflows from bilateral (Horizontal axis) and multilateral sources (Vertical axis) and comparing country-specific effects of *AFT* from among recipients in each of the quadrants. While recipients in Q-I (top-right) receive larger amounts of AFT from both bilateral and multilateral sources, recipients in Q-III receive significantly lower amounts *AFT* inflows from both sources. Those in Q-II receive lower inflows of *AFT* from bilateral sources, while the inflow of *AFT* from multilateral sources is larger than average. The reverse is true of recipients in Q-IV.

Comparing the country-specific effects among 49 countries that receive more than the median amounts of *AFT* from both sources (Q-I), we find that in 23 (54.7%) *AFT* from bilateral sources have significantly higher effect than *AFT* from multilateral sources, on the average. In 10 (20.4%) countries, the country-specific effects of *AFT* from multilateral sources is significantly higher than that of *AFT* from bilateral sources. In the remaining 11 (22.4%) countries, the effects are either positive (i.e., unexpected), or statistically insignificant.[10]

Among recipients (50) that received relatively lower levels of *AFT* from both sources (Q III), we find statistically significant bilateral trade costs reduction effects of *AFT* inflows from either sources only in 12 (24%) countries. In five (41.7%) of the recipients in this category, the country-specific effects of *AFT* from bilateral sources is larger; in six (50%) of the recipients, the country-specific effects of *AFT* from multilateral sources outweighs that of *AFT* from bilateral

[10] In five countries, the effect from one source is significant while the effect from the other source is not.

sources. In a large proportion of recipients that fall in this category, while the observed effects are often negative, they statistically insignificant and/or positive and unexpected, a potential consequence o*f AFT* from either sources not surpassing the threshold levels that yield statistically discernible effects. Among those in the middle quadrants (QII and QIV), the country-specific effects of *AFT* from either sources can't be conclusively established to be higher or lower, in countries where we can make clear cut comparison, the effects of *AFT* from bilateral sources outweigh that of *AFT* from multilateral sources.

*4.1.6. Imperatives for Africa*

Our analysis thus far indicates that although variable across the sources, sectors, and recipients, *AFT* inflow has invariably significant bilateral trade costs reduction effects across a large number of recipients in our study, and at regional levels, across all regions including Africa. We have established that infrastructure plays a much larger role in reducing the bilateral trade costs facing the recipients. To show the significance, particularly for recipients in Africa, in Table-8, we report the country-specific trade costs reduction effects (both at the aggregate level and across the economic sectors) of a contemporaneous one standard deviation increase in infrastructure endowment for Africa. A graphical summary of the corresponding effects for total trade costs is presented in Fig. 1.3.

[Insert Table 8 and Fig 1.3. around here]

The results indicate that ranging from 0.264% (Madagascar), 0.259% (Ghana), and 0.234% (Ethiopia) -African countries where we observe the highest trade costs reduction effects given their current average *AFT* receipts, to 0.103% (Togo), 0.105% (Comoros and Burkina Faso), improvement in infrastructure has a substantially large bilateral trade costs reduction

effects. The effects are not statistically discernible only in five (Cape Verde, Eritrea, the Gambia, Senegal and Sierra Leon) of the 51 African countries examined.

## V. Conclusion

Using comprehensive bilateral trade costs data spanning the years 2002-2011, we examine: a) the impact of *aid for trade* (*AFT*) from bilateral and multilateral sources on bilateral trade costs (both at aggregate level and across sectors), b) identify country-specific effects of aid from the respective sources, and c) assess whether the differences in the observed effects are systemic. Using the results, we explore imperatives for African countries.

Based on the results obtained from the estimation of a multi-level mixed-effects model in which we account for differences in the contemporaneous infrastructure endowment of the recipient countries, our findings indicate that increased inflow of *AFT* invariably reduces trading costs. Although variable in magnitudes across the sources (bilateral and multilateral) of *AFT* inflows and regional locations of the recipients, the observed effects remain consistent across the sectors. Comparing the country specific effects of *AFT* from bilateral and multilateral sources, we find evidence indicating the country-specific effect of *AFT* from bilateral sources outweighing that of *AFT* from multilateral sources. However, infrastructure endowments of the recipients' do alter this observation. Accordingly, *AFT* is more effective in reducing bilateral trade costs either among countries that receive larger amounts of *AFT* from both sources and in countries with better infrastructure endowments. The implication is that it is possible to promote the effectiveness of *AFT* by coordinating inflows from bilateral and multilateral sources, directing more aid towards building infrastructure, and/or focusing on new approaches used in the identification and implementation of projects funded by the initiative.

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Table-1: Descriptive Statistics (Means and St. Dev.) of the Variables by Geographic Regions of AFT Recipient Countries (2002-2011)

| | Africa | America | Asia | Europe | Pacific | Total |
|---|---|---|---|---|---|---|
| **Trade Cost Measure:** | | | | | | |
| Total Bilateral Trade Costs of Recipients | 325.2*** | 305.3 | 285.0*** | 280.9*** | 321.6*** | 305.9*** |
| | (167.9) | (164.1) | (158.1) | (164.9) | (174.1) | (165.2) |
| Manufacured Goods, Trade Costs | 223.8*** | 215.6*** | 195.9*** | 177.4*** | 205.0 | 207.9*** |
| | (116.0) | (109.2) | (97.34) | (95.68) | (88.79) | (107.2) |
| Agricultural Goods, Trade Costs | 360.2*** | 326.4*** | 343.2* | 300.2*** | 334.0** | 340.9*** |
| | (174.4) | (157.7) | (166.2) | (139.5) | (148.7) | (165.6) |
| **Aid for Trade Inflows (Millions, USD):** | | | | | | |
| Aggregate AFT | 230.8 | 78.98 | 406.6 | 310.2 | 34.18 | 250.7 |
| | (259.8) | (101.9) | (523.7) | (656.7) | (42.65) | (394.9) |
| AFT-Bilateral Sources | 112.4 | 56.67 | 301.2 | 105.6 | 28.51 | 152.7 |
| | (158.3) | (80.91) | (421.4) | (140.2) | (37.92) | (271.7) |
| AFT-Multilateral Sources | 118.4 | 22.31 | 105.4 | 204.6 | 5.675 | 97.98 |
| | (138.8) | (38.53) | (168.0) | (591.0) | (7.594) | (212.2) |
| **Institutional Quality Measures:** | | | | | | |
| Aggregate Institutional Quality (Index) | 0.391*** | 0.479*** | 0.4023*** | 0.456*** | 0.430 | 0.427*** |
| | (0.118) | (0.128) | (0.104) | (0.0952) | (0.0740) | (0.119) |
| **Infrastructure Components** | | | | | | |
| Overall | 0.255*** | 0.307*** | 0.337** | 0.411** | 0.314*** | 0.401*** |
| | (0.086) | (0.063) | (0.103) | (0.086) | (0.099) | (0.513) |
| iTRN (Transport) | 0.160** | 0.189* | 0.246 | 0.316** | 0.214* | 0.230*** |
| | (0.068) | (0.073) | (0.125) | (0.134) | (0.112) | (0.642) |
| iICT (Communication) | 0.286* | 0.389 | 0.315* | 0.436** | 0.339 | 0.372*** |
| | (0.049) | (0.053) | (0.057) | (0.061) | (0.075) | (0.202) |
| iEGY (Energy) | 0.301** | 0.342** | 0.331** | 0.340** | 0.326** | 0.328*** |
| | (0.066) | (0.043) | (0.048) | (0.064) | (0.057) | (0.157) |
| iFIN (Finance) | 0.330** | 0.297** | 0.418* | 0.417* | 0.362** | 0.401*** |
| | (0.139) | (0.122) | (0.165) | (0.0830) | (0.149) | (0.829) |
| **Gravity Model Variables:** | | | | | | |
| Geodesic Distance | 6046.7*** | 9206.8*** | 7073.0 | 4815.3*** | 10208.8*** | 7088.9*** |
| | (3499.7) | (4841.3) | (4397.8) | (3890.8) | (4930.9) | (4413.6) |
| Land Locked (i) | 0.267*** | 0.0669*** | 0.228*** | 0.111*** | -- | 0.192*** |
| | (0.442) | (0.250) | (0.420) | (0.314) | -- | (0.394) |
| Land Locked (j) | 0.152 | 0.115*** | 0.175*** | 0.177*** | 0.0531*** | 0.150*** |
| | (0.359) | (0.319) | (0.380) | (0.382) | (0.224) | (0.358) |
| Index of Economic Remoteness (i) | 4621.3*** | 4578.7*** | 4559.2*** | 3772.1*** | 6585.2*** | 4535.9*** |
| | (2602.7) | (2495.8) | (2426.2) | (2127.9) | (4019.0) | (2512.9) |
| Index of Economic Remoteness (j) | 0.241*** | 0.212*** | 0.156*** | 0.337*** | 0.217*** | 0.212*** |
| | (0.428) | (0.409) | (0.363) | (0.473) | (0.413) | (0.408) |
| Trading Agreement (i) | 0.164*** | 0.150 | 0.106*** | 0.215 | 0.132*** | 0.146*** |
| | (0.370) | (0.357) | (0.307) | (0.411) | (0.339) | (0.353) |
| Common Border (Dummy) | 0.0439*** | 0.0291*** | 0.0313*** | 0.0337 | 0.00421*** | 0.0351*** |
| | (0.205) | (0.168) | (0.174) | (0.181) | (0.0648) | (0.184) |
| Common Language (Dummy) | 0.287*** | 0.212*** | 0.0788*** | 0.00650*** | 0.413*** | 0.189*** |
| | (0.452) | (0.409) | (0.269) | (0.0803) | (0.492) | (0.391) |
| Colnial Relationship (Dummy) | 0.0156 | 0.0127*** | 0.00945*** | 0.0253*** | 0.0678*** | 0.0148*** |
| | (0.124) | (0.112) | (0.0967) | (0.157) | (0.251) | (0.121) |
| No. of Observations | 44,734 | 28,207 | 36,068 | 8,767 | 2,375 | 103,497 |

Mean of the Variables; Standard Dev. in Parentheses; ***, **, * indicate statistically significant difference between the mean value of each continent reported in the given cell and the correponding mean of all recipients reported in the correspnding row of the last column of the table at the 1%, 5%, and 10% levels, respectively.

Table-2: AFT and TOTAL Bilateral Trade Costs, Results from Random Effects Panel Data Model, Baseline Estimations

| VARIABLES | (a) Gravity Var | (b) AGT AFT | ( c ) BLT AFT | (d) MLT AFT | (e) Intermediation |
|---|---|---|---|---|---|
| ln Geodesic Distance | 0.203*** | 0.202*** | 0.203*** | 0.203*** | 0.203*** |
| | (0.00213) | (0.00219) | (0.00213) | (0.00213) | (0.00213) |
| Land Locked (i) | 0.173*** | 0.186*** | 0.180*** | 0.179*** | 0.181*** |
| | (0.0459) | (0.0452) | (0.0448) | (0.0463) | (0.0444) |
| Land Locked (j) | 0.291*** | 0.293*** | 0.291*** | 0.291*** | 0.291*** |
| | (0.00350) | (0.00359) | (0.00350) | (0.00350) | (0.00350) |
| ln Remoteness (i) | 0.189*** | 0.153*** | 0.167*** | 0.201*** | 0.133*** |
| | (0.0401) | (0.0412) | (0.0398) | (0.0405) | (0.0397) |
| ln Remoteness (j) | 0.254*** | 0.256*** | 0.254*** | 0.254*** | 0.254*** |
| | (0.00223) | (0.00231) | (0.00224) | (0.00224) | (0.00224) |
| Common Border (ijt) | -0.437*** | -0.442*** | -0.437*** | -0.437*** | -0.437*** |
| | (0.00749) | (0.00773) | (0.00749) | (0.00749) | (0.00749) |
| Trading Agreements (ijt) | -0.292*** | -0.291*** | -0.292*** | -0.292*** | -0.292*** |
| | (0.00431) | (0.00442) | (0.00432) | (0.00433) | (0.00433) |
| Common Language (ijt) | -0.157*** | -0.159*** | -0.157*** | -0.156*** | -0.156*** |
| | (0.00366) | (0.00377) | (0.00366) | (0.00366) | (0.00367) |
| Colnial Relationship (ijt) | -0.299*** | -0.293*** | -0.299*** | -0.299*** | -0.299*** |
| | (0.0105) | (0.0108) | (0.0105) | (0.0105) | (0.0105) |
| Institutional Quality (it) | -0.0774*** | -0.0509** | -0.0664*** | -0.0537*** | -0.0489** |
| | (0.0192) | (0.0212) | (0.0194) | (0.0197) | (0.0197) |
| lnAGGAFT (it-1) | | -0.097*** | | | |
| | | (0.0018) | | | |
| lnBLTAFT (it-1) | | | -0.0752*** | | 0.0392* |
| | | | (0.0017) | | (0.0019) |
| lnMLTAFT (it-1) | | | | -0.0443*** | 0.0137*** |
| | | | | (0.0009) | (0.0017) |
| lnBLT x lnMLT (it-1) | | | | | -0.0049*** |
| | | | | | (0.0004) |
| Constant | 0.0984 | 0.460 | 0.321 | 0.0279 | 0.610* |
| | (0.350) | (0.359) | (0.348) | (0.353) | (0.347) |
| Observations | 103,497 | 103,497 | 108,570 | 108,330 | 108,330 |
| No. of Recipients | 130 | 130 | 130 | 130 | 130 |
| Psuedo R-Squared | 0.318 | 0.317 | 0.318 | 0.318 | 0.319 |
| Wald Chi-Square | 52415 | 50002 | 52389 | 52257 | 52367 |
| Log Likelihood | -56165 | -53854 | -56111 | -55947 | -55826 |

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table-3: AFT, INFRASTUCTURE and TOTAL Bilateral Trade Costs, Results from Random Effects Panel Data Model, Baseline Estimations

| VARIABLES | (a) AGT AFT | (b) iNFR | ( c ) AFT * iNFR | (d) iNFRC | ( e) AFT * iINFC |
|---|---|---|---|---|---|
| ln Geodesic Distance | 0.202*** | 0.260*** | 0.257*** | 0.266*** | 0.264*** |
| | (0.0021) | (0.0026) | (0.0026) | (0.0027) | (0.0027) |
| Land Locked (i) | 0.186*** | 0.186*** | 0.188*** | 0.194*** | 0.196*** |
| | (0.045) | (0.0528) | (0.0524) | (0.0547) | (0.0543) |
| Land Locked (j) | 0.293*** | 0.235*** | 0.233*** | 0.186*** | 0.184*** |
| | (0.0035) | (0.0042) | (0.0042) | (0.00495) | (0.0049) |
| ln Remoteness (i) | 0.153*** | 0.160*** | 0.160*** | 0.153*** | 0.147*** |
| | (0.0412) | (0.0553) | (0.0550) | (0.0573) | (0.0570) |
| ln Remoteness (j) | 0.256*** | 0.0164*** | 0.0175*** | -0.00465 | -0.0041 |
| | (0.0023) | (0.0037) | (0.0037) | (0.0042) | (0.0042) |
| Common Border (ijt) | -0.442*** | -0.402*** | -0.406*** | -0.399*** | -0.404*** |
| | (0.0077) | (0.0089) | (0.0089) | (0.0098) | (0.0098) |
| Trading Agreements (ijt) | -0.291*** | -0.254*** | -0.254*** | -0.253*** | -0.253*** |
| | (0.0044) | (0.0053) | (0.0053) | (0.0056) | (0.0056) |
| Common Language (ijt) | -0.159*** | -0.150*** | -0.150*** | -0.148*** | -0.148*** |
| | (0.0037) | (0.0043) | (0.0043) | (0.0046) | (0.0045) |
| Colnial Relationship (ijt) | -0.293*** | -0.312*** | -0.315*** | -0.302*** | -0.305*** |
| | (0.0108) | (0.0120) | (0.0120) | (0.0119) | (0.0119) |
| Institutional Quality (it) | -0.0509** | -0.0592** | -0.0614** | -0.0658** | -0.0670** |
| | (0.0212) | (0.0261) | (0.0261) | (0.0268) | (0.0267) |
| ln. AFT (it-1) | -0.0096*** | -0.0046** | 0.0050** | -0.0057** | 0.0072*** |
| | (0.0018) | (0.0023) | (0.0023) | (0.0024) | (0.0024) |
| iNFR | | -0.171*** | -0.136*** | | |
| | | (0.0020) | (0.0039) | | |
| lnAFT x iNFR | | | -0.0081*** | | |
| | | | (0.0008) | | |
| iTRA | | | | -0.0430*** | -0.0658*** |
| | | | | (0.0023) | (0.0058) |
| lnAFT x iTRA | | | | | 0.0056*** |
| | | | | | (0.0012) |
| iICT | | | | -0.0633*** | -0.0298*** |
| | | | | (0.0031) | (0.0076) |
| lnAFT x iICT | | | | | -0.0082*** |
| | | | | | (0.0016) |
| iEGY | | | | 0.00673*** | 0.0248*** |
| | | | | (0.0023) | (0.0063) |
| lnAFT x iEGY | | | | | -0.0042*** |
| | | | | | (0.0014) |
| iFIN | | | | -0.0990*** | -0.0835*** |
| | | | | (0.0020) | (0.0054) |
| lnAFT x iFIN | | | | | -0.0037*** |
| | | | | | (0.0012) |
| Constant | 0.460 | 1.916*** | 1.908*** | 2.102*** | 2.136*** |
| | (0.359) | (0.482) | (0.480) | (0.500) | (0.498) |
| Observations | 103,497 | 69,663 | 69,663 | 63,055 | 63,055 |
| No. of Recipients | 130 | 130 | 130 | 130 | 130 |
| Psuedo R-Squared | 0.317 | 0.391 | 0.392 | 0.397 | 0.398 |
| Wald Chi-Square | 50002 | 40293 | 40395 | 35961 | 36096 |
| Log Likelihood | -53854 | -31396 | -31345 | -27311 | -27244 |
| Standard errors in parentheses | | | *** p<0.01, ** p<0.05, * p<0.1 | | |

Table-4: BLT AFT, INFRASTUCTURE and TOTAL Bilateral Trade Costs, Results from Random Effects Panel Data Model, Baseline Estimations

| VARIABLES | (a) bltAFT | (b) iNFR | ( c ) bltAFT * iNFR | (d) iNFRC | ( e) bltAFT x iINFC |
|---|---|---|---|---|---|
| ln Geodesic Distance | 0.203*** | 0.260*** | 0.256*** | 0.266*** | 0.264*** |
| | (0.0021) | (0.0025) | (0.0025) | (0.00263) | (0.0026) |
| Land Locked (i) | 0.180*** | 0.182*** | 0.185*** | 0.189*** | 0.192*** |
| | (0.0448) | (0.0517) | (0.0514) | (0.0537) | (0.0533) |
| Land Locked (j) | 0.291*** | 0.235*** | 0.232*** | 0.185*** | 0.182*** |
| | (0.0035) | (0.0041) | (0.0040) | (0.0047) | (0.0047) |
| ln Remoteness (i) | 0.167*** | 0.194*** | 0.198*** | 0.184*** | 0.178*** |
| | (0.0398) | (0.0535) | (0.0534) | (0.0553) | (0.0550) |
| ln Remoteness (j) | 0.254*** | 0.0198*** | 0.0215*** | -0.00131 | -0.00038 |
| | (0.0022) | (0.0035) | (0.0035) | (0.0041) | (0.0040) |
| Common Border (ijt) | -0.437*** | -0.399*** | -0.405*** | -0.395*** | -0.402*** |
| | (0.0074) | (0.0085) | (0.0085) | (0.0094) | (0.0094) |
| Trading Agreements (ijt) | -0.292*** | -0.256*** | -0.254*** | -0.256*** | -0.254*** |
| | (0.0043) | (0.0051) | (0.0051) | (0.0054) | (0.0054) |
| Common Language (ijt) | -0.157*** | -0.146*** | -0.146*** | -0.143*** | -0.143*** |
| | (0.0036) | (0.0041) | (0.0041) | (0.0044) | (0.0044) |
| Colnial Relationship (ijt) | -0.299*** | -0.321*** | -0.326*** | -0.311*** | -0.314*** |
| | (0.0105) | (0.0115) | (0.0115) | (0.0114) | (0.0114) |
| Institutional Quality (it) | -0.0664*** | -0.0690*** | -0.0712*** | -0.0738*** | -0.0747*** |
| | (0.0194) | (0.0232) | (0.0232) | (0.0238) | (0.0237) |
| ln. bltAFT (it-1) | -0.0074*** | -0.0039* | -0.00316*** | -0.0037*** | -0.0029*** |
| | (0.0017) | (0.0022) | (0.0012) | (0.0012) | (0.0013) |
| iNFR | | -0.168*** | -0.131*** | | |
| | | (0.0019) | (0.0034) | | |
| lnbltAFT x iNFR | | | -0.0098*** | | |
| | | | (0.0007) | | |
| iTRA | | | | -0.0454*** | -0.0704*** |
| | | | | (0.0022) | (0.0049) |
| lnbltAFT x iTRA | | | | | 0.00711*** |
| | | | | | (0.0012) |
| iICT | | | | -0.0602*** | -0.0191*** |
| | | | | (0.0029) | (0.0063) |
| lnbltAFT x iICT | | | | | -0.0115*** |
| | | | | | (0.0015) |
| iEGY | | | | 0.00849*** | 0.0312*** |
| | | | | (0.0022) | (0.0053) |
| lnbltAFT x iEGY | | | | | -0.0059*** |
| | | | | | (0.0012) |
| iFIN | | | | -0.0979*** | -0.0890*** |
| | | | | (0.0019) | (0.0045) |
| lnbltAFT x iFIN | | | | | -0.0025** |
| | | | | | (0.0011) |
| Constant | 0.321 | 1.600*** | 1.563*** | 1.811*** | 1.841*** |
| | (0.348) | (0.468) | (0.467) | (0.484) | (0.481) |
| Observations | 108,570 | 74,483 | 74,483 | 67,478 | 67,478 |
| No. of Recipients | 131 | 131 | 131 | 131 | 131 |
| Psuedo R-Squared | 0.318 | 0.393 | 0.394 | 0.400 | 0.402 |
| Wald Chi-Square | 52389 | 42975 | 43147 | 38448 | 38703 |
| Log Likelihood | -56111 | -33239 | -33153 | -28892 | -28765 |
| Standard errors in parentheses | | | *** p<0.01, ** p<0.05, * p<0.1 | | |

Table-5: MLT AFT, INFRASTUCTURE and TOTAL Bilateral Trade Costs, Results from Random Effects Panel Data Model, Baseline Estimations

| VARIABLES | (a) mltAFT | (b) iNFR | ( c ) mltAFT * iNFR | (d) iNFRC | ( e) mltAFT x iINFC |
|---|---|---|---|---|---|
| ln Geodesic Distance | 0.203*** | 0.260*** | 0.259*** | 0.266*** | 0.266*** |
| | (0.00213) | (0.00253) | (0.00253) | (0.00264) | (0.00264) |
| Land Locked (i) | 0.179*** | 0.177*** | 0.177*** | 0.186*** | 0.187*** |
| | (0.0463) | (0.0526) | (0.0526) | (0.0544) | (0.0544) |
| Land Locked (j) | 0.291*** | 0.235*** | 0.235*** | 0.185*** | 0.185*** |
| | (0.00350) | (0.00405) | (0.00405) | (0.00477) | (0.00477) |
| ln Remoteness (i) | 0.201*** | 0.205*** | 0.204*** | 0.191*** | 0.189*** |
| | (0.0405) | (0.0539) | (0.0539) | (0.0557) | (0.0557) |
| ln Remoteness (j) | 0.254*** | 0.0204*** | 0.0205*** | -0.000433 | -0.000394 |
| | (0.00224) | (0.00358) | (0.00358) | (0.00407) | (0.00407) |
| Common Border (ijt) | -0.437*** | -0.398*** | -0.398*** | -0.394*** | -0.394*** |
| | (0.00749) | (0.00856) | (0.00856) | (0.00947) | (0.00948) |
| Trading Agreements (ijt) | -0.292*** | -0.257*** | -0.257*** | -0.257*** | -0.257*** |
| | (0.0043) | (0.0051) | (0.0051) | (0.0054) | (0.0054) |
| Common Language (ijt) | -0.156*** | -0.145*** | -0.145*** | -0.143*** | -0.143*** |
| | (0.0036) | (0.0041) | (0.0041) | (0.0044) | (0.0044) |
| Colnial Relationship (ijt) | -0.299*** | -0.321*** | -0.322*** | -0.312*** | -0.312*** |
| | (0.0105) | (0.0115) | (0.0115) | (0.0114) | (0.0114) |
| Institutional Quality (it) | -0.0537*** | -0.0749*** | -0.0749*** | -0.0781*** | -0.0779*** |
| | (0.0197) | (0.0235) | (0.0235) | (0.0240) | (0.0240) |
| ln. mltAFT (it-1) | -0.0043*** | -0.00214* | -0.0024** | -0.0019* | -0.0024** |
| | (0.0009) | (0.0011) | (0.0011) | (0.0012) | (0.0012) |
| iNFR | | -0.168*** | -0.166*** | | |
| | | (0.0019) | (0.0024) | | |
| ln mltAFT x iNFR | | | -0.00063 | | |
| | | | (0.00054) | | |
| iTRA | | | | -0.0452*** | -0.0467*** |
| | | | | (0.0022) | (0.0033) |
| ln mltAFT x iTRA | | | | | 0.0005 |
| | | | | | (0.0009) |
| iICT | | | | -0.0597*** | -0.0585*** |
| | | | | (0.0029) | (0.0043) |
| ln mltAFT x iICT | | | | | -0.0004 |
| | | | | | (0.0011) |
| iEGY | | | | 0.0082*** | 0.0067* |
| | | | | (0.0022) | (0.0035) |
| ln mltAFT x iEGY | | | | | 0.00053 |
| | | | | | (0.00095) |
| iFIN | | | | -0.0976*** | -0.0938*** |
| | | | | (0.00195) | (0.0029) |
| ln mltAFT x iFIN | | | | | -0.0013* |
| | | | | | (0.0007) |
| Constant | 0.0279 | 1.481*** | 1.487*** | 1.729*** | 1.742*** |
| | (0.353) | (0.470) | (0.470) | (0.485) | (0.485) |
| Observations | 108,330 | 74,252 | 74,252 | 67,265 | 67,265 |
| No. of Recipients | 130 | 130 | 130 | 130 | 130 |
| Psuedo R-Squared | 0.318 | 0.392 | 0.392 | 0.399 | 0.399 |
| Wald Chi-Square | 52257 | 42758 | 42759 | 38237 | 38240 |
| Log Likelihood | -55947 | -33126 | -33125 | -28800 | -28798 |
| Standard errors in parentheses | | | *** p<0.01, ** p<0.05, * p<0.1 | | |

Table-6 Summary of Elasticity of Bilateral Trade Costs with respect to INFRASTRUCTURE (iNFR), by Broad Geographic Region of Recipients and Economic Sectors (2002-2011)

| Sector | Source of AFT | All Recipients | Africa | Americas | Asia | Europe | Pacific |
|---|---|---|---|---|---|---|---|
| Total Trade Costs | Infrastructure(130) | -0.171*** | -0.141*** | -0.213*** | -0.176*** | -0.135*** | -0.154*** |
| | | (0.0020) | (0.0035) | (0.0041) | (0.0036) | (0.0072) | (0.0118) |
| | iTRN | -0.0430*** | -0.038*** | -0.036*** | -0.053*** | -0.034*** | -0.021 |
| | | (0.00233) | (0.0038) | (0.0047) | (0.0043) | (0.0080) | (0.0127) |
| | iICT | -0.0633*** | -0.014** | -0.071*** | **-0.086*** ** | **-0.088*** ** | -0.046** |
| | | (0.00310) | (0.0051) | (0.0065) | **(0.0060)** | **(0.0105)** | (0.0160) |
| | iEGY | 0.00673*** | 0.035*** | -0.018*** | -0.013** | 0.003 | -0.016 |
| | | (0.00231) | (0.0037) | (0.0049) | (0.0043) | (0.0079) | (0.0130) |
| | iFIN | ***-0.0990****** | **-0.134*** ** | **-0.126*** ** | -0.060*** | -0.047*** | **-0.083*** ** |
| | | ***(0.00203)*** | **(0.0034)** | **(0.0042)** | (0.0037) | (0.0067) | **(0.0136)** |
| MNF Goods TC | Infrastructure (125) | -0.161*** | -0.137*** | -0.193*** | -0.175*** | -0.128*** | -0.163*** |
| | | (0.0022) | (0.0039) | (0.0044) | (0.0038) | (0.0076) | (0.0155) |
| | iTRN | -0.0446*** | -0.047*** | -0.035*** | -0.049*** | -0.034*** | -0.042** |
| | | (0.00250) | (0.0042) | (0.0050) | (0.0046) | (0.0084) | (0.0152) |
| | iICT | -0.0667*** | -0.021*** | -0.072*** | **-0.096*** ** | **-0.077*** ** | -0.022 |
| | | (0.00333) | (0.0056) | (0.0068) | **(0.0063)** | **(0.0111)** | (0.0198) |
| | iEGY | 0.0193*** | 0.046*** | 0.006 | -0.004 | 0.005 | -0.015 |
| | | (0.00247) | (0.0040) | (0.0052) | (0.0045) | (0.0083) | (0.0161) |
| | iFIN | ***-0.0985****** | **-0.132*** ** | **-0.128*** ** | -0.065*** | -0.051*** | **-0.103*** ** |
| | | ***(0.00218)*** | **(0.0038)** | **(0.0045)** | (0.0040) | (0.0071) | **(0.0167)** |
| Agricultral Products TC | Infrastructure (129) | -0.111*** | -0.096*** | -0.156*** | -0.099*** | -0.063*** | -0.242*** |
| | | (0.0029) | (0.0054) | (0.0061) | (0.0048) | (0.0099) | (0.0202) |
| | iTRN | ***-0.0466****** | **-0.060*** ** | -0.020** | **-0.045*** ** | -0.034*** | -0.058** |
| | | ***(0.00306)*** | **(0.0052)** | (0.0064) | **(0.0053)** | (0.0100) | (0.0185) |
| | iICT | -0.00654 | 0.008 | 0.004 | -0.023** | -0.019 | -0.085** |
| | | (0.00420) | (0.0073) | (0.0088) | (0.0074) | (0.0135) | (0.0309) |
| | iEGY | -0.0239*** | -0.016* | -0.036*** | -0.020*** | 0.021* | **-0.166*** ** |
| | | (0.00347) | (0.0062) | (0.0073) | (0.0057) | (0.0107) | **(0.0284)** |
| | iFIN | -0.0460*** | -0.031*** | **-0.117*** ** | -0.029*** | **-0.037*** ** | 0.040 |
| | | (0.00296) | (0.0053) | **(0.0067)** | (0.0049) | **(0.0093)** | (0.0263) |
| | No. of Observations | 63,055 (130) | 23,675(48) | 13,803(30) | 19,141(32) | 5,086(8) | 797(7) |

Standard Errors in Parentheses *** p<0.01, ** p<0.05, * p<0.1

Table-7 Summary of Elasticity of Trade Costs with respect to AFT, by Economic Sectors, Sources of AFT and Broad Regional Locations of the Recipients (2002-2014)

| Sector | Source of AFT | (a) All Recipients | (b) Africa | ( c ) America | (d) Asia | ( e ) Europe | (f) Pacific |
|---|---|---|---|---|---|---|---|
| Total Trade Costs | Aggregate AFT | ***-0.0890****** | ***-0.0234***** | -0.0126*** | -0.088** | -0.0499*** | 0.00744 |
| | | ***(0.00184)*** | ***(0.00115)*** | (0.00361) | (0.00375) | (0.00606) | (0.0183) |
| | Bilateral | ***-0.0217***** | ***-0.0395***** | -0.0141*** | -0.0130*** | -0.0055 | 0.0050 |
| | | ***(0.00212)*** [a] | ***(0.0032)*** [a] | (0.0043)[a] | (0.0040)[a] | (0.0091) | (0.0188) |
| | Multilateral | ***-0.00321***** | ***-0.0211***** | -0.0077*** | -0.0105*** | -0.0149*** | -0.0057 |
| | | ***(0.00131)*** | ***(0.0019)*** | (0.0024) | (0.0031) | (0.0027) | (0.0091) |
| Manufactured Goods Trade Costs | Aggregate AFT | ***-0.0158***** | ***-0.0692**** | -0.0165*** | -0.0128*** | -0.0527*** | 0.0150 |
| | | ***(0.00207)*** | ***(0.0035)*** | (0.0040) | (0.0040) | -0.0065 | (0.0222) |
| | Bilateral | ***-0.0130***** | -0.0049 | -0.0140*** | -0.0163*** | 0.0123 | -0.0001 |
| | | ***(0.00230)*** | (0.0036) | (0.0046)[a] | (0.0043)[a] | -0.0096 | (0.0231) |
| | Multilateral | ***-0.0198***** | ***-0.0913***** | -0.0077*** | -0.0106*** | -0.0189*** | 0.0056 |
| | | ***(0.00124)*** [b] | ***(0.00211)*** [b] | (0.00259) | (0.00328) | (0.0028)[b] | (0.0124) |
| Agricultral Products Trade Costs | Aggregate AFT | ***-0.0973***** | ***-0.0691**** | -0.0136*** | -0.0009 | -0.0362*** | 0.0148 |
| | | ***(0.00244)*** | ***(0.00412)*** | (0.00502) | (0.0046) | -0.0069 | (0.0304) |
| | Bilateral | ***-0.0767***** | ***-0.0873**** | -0.0147** | -0.0069 | 0.00294 | 0.0041 |
| | | ***(0.00284)*** | ***(0.0048)*** [a] | (0.0058)[a] | (0.0049) | -0.0118 | (0.0304) |
| | Multilateral | ***-0.075***** | ***-0.0612**** | -0.00510 | -0.0097** | -0.0139*** | 0.0068 |
| | | ***(0.0015)*** | ***(0.0029)*** | (0.0032) | (0.0038)[b] | (0.0031)[b] | (0.0157) |

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

**Marginal Effects of AFT from Bilateral and Multilateral Sources at Various Levels of AFT from either sources**

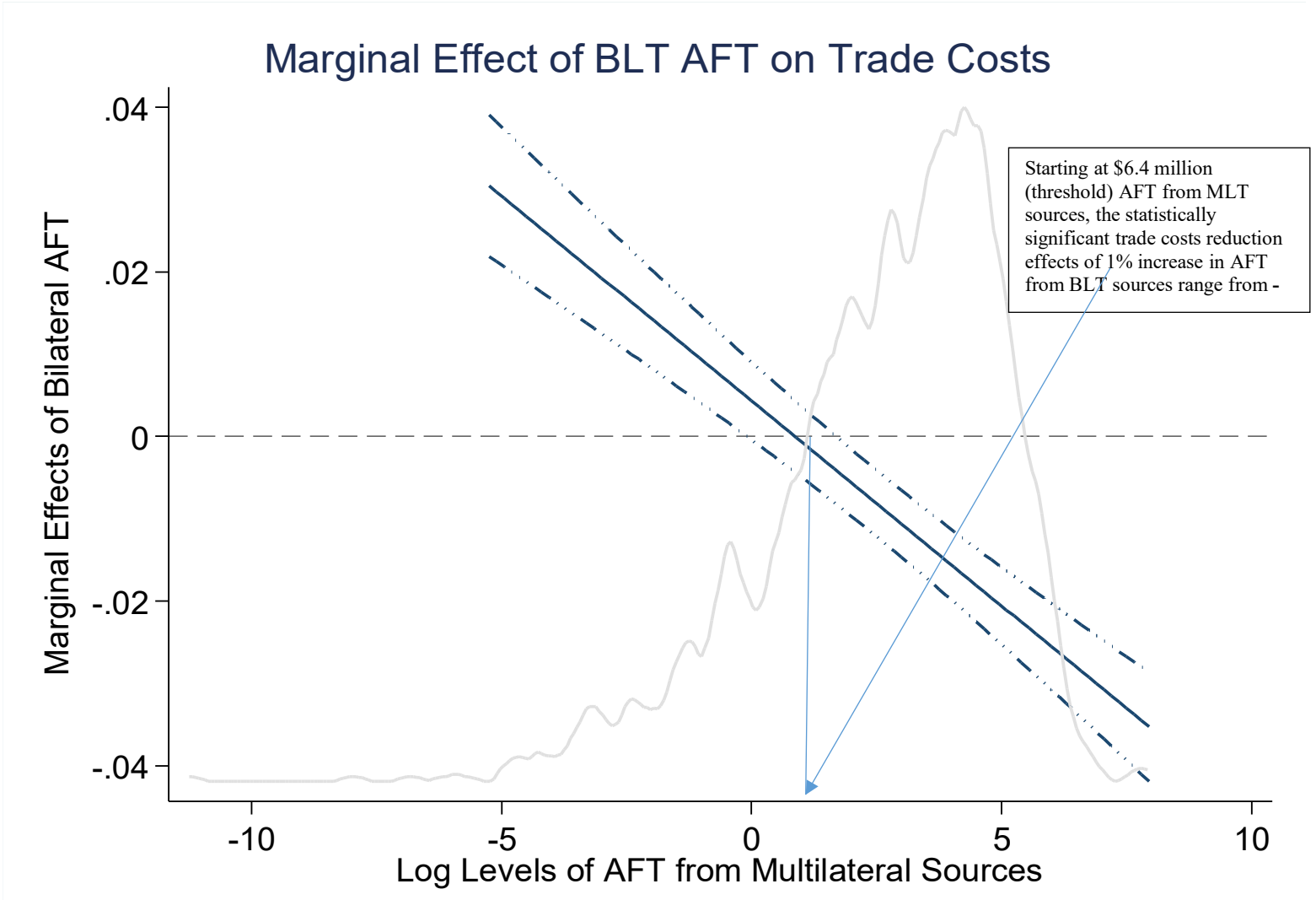


Fig.1.1: Marginal effects of AFT from bilateral sources on trade costs at various levels of AFT from multilateral sources

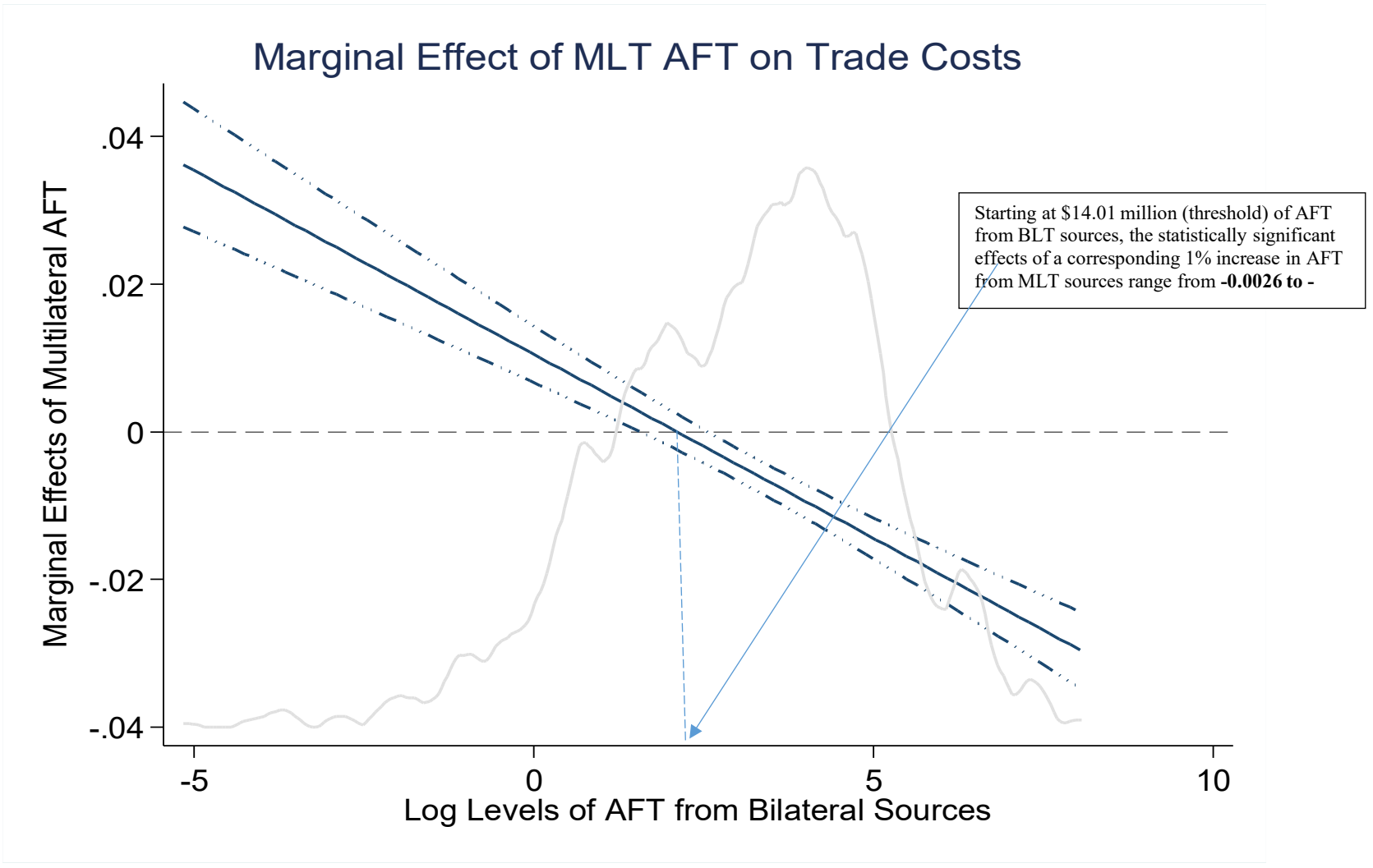


Fig.1.2: Marginal effects of AFT from multilatera sources on trade costs at various Levels of AFT from bilteral sources

Table-8: Summary of Country-Specific Effects of Improvements in Infrastructure on Bilateral Trade Costs facing African Economies, by Economic Sectors (2002-2011). Results from Mixed Effects (Random Interceopt, Random Coeffifents) Model.

| Country | Total Trade Costs | MNF Trade Costs | AGR Trade Costs |
|---|---|---|---|
| Algeria | -0.142(0.011)*** | -0.146(-0.003)*** | -0.122(-0.011)*** |
| Angola | -0.181(-0.028)*** | -0.171(-0.028)*** | -0.162(-0.051)*** |
| Benin | -0.115(0.039)*** | -0.087(0.057) | -0.140(-0.030)*** |
| Botswana | -0.190(-0.037)*** | -0.174(-0.031)*** | -0.007(0.104) |
| Burkina Faso | -0.105(0.048)** | -0.075(0.068) | -0.113(-0.003)*** |
| Burundi | -0.118(0.036)*** | -0.089(0.055) | -0.156(-0.046)*** |
| Cape Verde | -0.069(0.085) | -0.088(0.055) | -0.045(0.066) |
| Cameroon | -0.115(0.038)*** | -0.086(0.057) | -0.174(-0.064)** |
| Central African Rep. | -0.190(-0.036)*** | -0.189(-0.046)*** | -0.211(-0.100)* |
| Chad | -0.139(0.014)*** | -0.122(0.021)*** | -0.204(-0.094)* |
| Comoros | -0.105(0.049)** | -0.090(0.053) | -0.125(-0.015)*** |
| Congo, Dem. Rep. | -0.132(0.022)*** | -0.111(0.032)*** | -0.128(-0.018)*** |
| Congo, Rep. | -0.172(-0.018)*** | -0.130(0.013)*** | -0.212(-0.102)* |
| Cote d'Ivoire | -0.155(-0.001)*** | -0.125(0.018)*** | -0.132(-0.022)*** |
| Egypt, Arab Rep. | -0.158(-0.004)*** | -0.153(-0.010)*** | -0.112(-0.002)*** |
| Equatorial Guinea | -0.114(0.040)*** | -0.097(0.047)* | -0.171(-0.061)** |
| Eritrea | -0.106(0.067) | -0.089(0.054) | -0.101(0.009)*** |
| Ethiopia | -0.234(-0.080)*** | -0.200(-0.057)*** | -0.178(-0.067)*** |
| Gabon | -0.172(-0.019)*** | -0.127(0.016)*** | -0.224(-0.113)* |
| Gambia, The | -0.090(0.064) | -0.069(0.074) | -0.050(0.060) |
| Ghana | -0.259(-0.106)** | -0.220(-0.077)*** | -0.205(-0.094)* |
| Guinea | -0.176(-0.022)*** | -0.158(-0.015)*** | -0.171(-0.061)** |
| Guinea Bissau | -0.131(0.022)*** | | -0.160(-0.050)*** |
| Kenya | -0.195(-0.042)*** | -0.147(-0.004)*** | -0.133(-0.022)*** |
| Lesotho | -0.126(0.027)*** | -0.142(0.002)*** | -0.063(0.047) |
| Liberia | -0.205(-0.051)*** | | -0.181(-0.070)** |
| Libya | -0.206(-0.053)*** | -0.207(-0.064)*** | -0.100(0.010)*** |
| Madagascar | -0.264(-0.111)** | -0.253(-0.110)** | -0.154(-0.043)*** |
| Malawi | -0.184(-0.031)*** | -0.153(-0.010)*** | -0.126(-0.016)*** |
| Mali | -0.103(0.051)** | | -0.071(0.040) |
| Mauritania | -0.112(0.042)** | -0.121(0.022)*** | -0.174(-0.064)** |
| Mauritius | -0.203(-0.049)*** | -0.194(-0.051)*** | -0.115(-0.004)*** |
| Morocco | -0.133(0.021)*** | -0.136(0.008)*** | -0.130(-0.020)*** |
| Mozambique | -0.159(-0.005)*** | -0.133(0.010)*** | -0.103(0.007)*** |
| Namibia | -0.227(-0.073)*** | -0.218(-0.075)*** | -0.147(-0.037)*** |
| Niger | -0.116(0.037)*** | -0.098(0.046)** | 0.039(0.149) |
| Nigeria | -0.218(-0.064)*** | -0.199(-0.056)*** | -0.124(-0.013)*** |
| Rwanda | -0.171(-0.018)*** | -0.134(0.009)*** | -0.064(0.047) |
| Sao Tome and Principe | -0.102(0.052)* | -0.063(0.080) | -0.186(-0.075)** |
| Senegal | -0.089(0.065) | -0.060(0.083) | -0.157(-0.046)*** |
| Seychelles | -0.155(-0.001)*** | -0.128(0.016)*** | -0.116(-0.006)*** |
| Sierra Leone | -0.057(0.097) | -0.043(0.100) | -0.008(0.102) |
| South Africa | -0.187(-0.033)*** | -0.180(-0.037)*** | -0.150(-0.040)*** |
| Sudan | -0.180(-0.026)*** | -0.150(-0.007)*** | -0.100(0.011)*** |
| Swaziland | -0.128(0.025)*** | -0.132(0.011)*** | -0.005(0.105) |
| Tanzania | -0.200(-0.047)*** | -0.159(-0.016)*** | -0.144(-0.033)*** |
| Togo | -0.103(0.051)* | -0.060(0.083) | -0.127(-0.016)*** |
| Tunisia | -0.121(0.032)*** | -0.114(0.029)*** | -0.063(0.047) |
| Uganda | -0.255(-0.102)** | -0.217(-0.073)*** | -0.227(-0.116) |
| Zambia | -0.195(-0.041)*** | -0.175(-0.032)*** | -0.083(0.028)*** |
| Zimbabwe | -0.178(-0.024)*** | -0.151(-0.008)*** | -0.114(-0.004)*** |

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

**Fig.1.3: Country-Specific Estimates of the Marginal Effects of 1SD increase in AG. iNFR on Total Bilateral Trade Costs of African Countries (2002-2011). Results from Mixed Effects (Random-Intercept and Random-Coefficient) Model**