Aid for Trade and International Transactions in Goods and Services*

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Abstract

The empirical literature on aid for trade (AfT) mainly considers its effects on merchandise trade and investment. In this paper we provide an in-depth analysis of the relationship between AfT and trade in services using both aggregate and bilateral data. We find a statistically weak effect of AfT on both goods and services trade in our aggregate analysis once we account for endogeneity in the AfT-trade relationship. In contrast, the bilateral analysis suggests that AfT, in particular that allocated to services activities, especially economic infrastructure, has a positive effect on donors' merchandise imports from recipient countries. This novel finding is robust across different lag structures and provides evidence of complementarities between services AfT and goods trade.

JEL-Classification: F10, F14, F35

Keywords: Aid for trade, services trade, goods trade, complementarities, bilateral data, gravity model

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1 Introduction

Trade in services is important for many low-income countries, especially small economies which often derive a significant share of their foreign exchange revenues from services exports. During the 2000s, the group of least developed countries (LDCs) taken together expanded their services exports more rapidly than the world as a whole. LDCs increased their share of global trade in services from 0.4 percent in 2005 to 0.8 percent in 2015, with commercial services exports growing by 14 percent over this period, more than twice the rate of other countries (WTO, 2016).

Services matter not just because they are a potentially important source of foreign exchange revenue and associated employment and household income. Many services are important for economic growth and development by virtue of their role as inputs into production in all sectors of economic activity. Services also figure centrally if a human development perspective is taken. Realization of many of the sustainable development goals (SDGs) depends on the performance of a range of specific services sectors (Fiorini and Hoekman, 2018).

The quality, price and availability of services inputs is determined by a mix of factors, including infrastructure connectivity network investments, the restrictiveness of trade and investment policies for goods and services, and the investment climate/business environment. There is substantial empirical evidence that services trade and FDI in services fosters productivity growth by inducing greater competition in domestic markets and providing firms access to higher-quality, more varied, and cheaper services inputs. This benefits both producers of goods and producers of services. The implication for policy is that a focus on reducing services trade costs may have high payoffs. Trade costs for services are higher than trade costs for goods, and the rate of decline that has been observed in services trade costs since the early 2000s has been much less than for trade costs for goods (Miroudot and Shepherd, 2016). High trade costs reduce services trade volumes by compromising the ability of firms to exploit potential competitive advantages in world markets.

The launch of the Aid for Trade (AfT) initiative at the 2005 WTO Ministerial Conference in Hong Kong reflected a recognition that negotiations to lower trade barriers would benefit developing countries more fully if complemented with development assistance targeted at improving the supply side of the economy (Hoekman, 2011). Aid for trade resources provided by the international development community since the early 2000s have been significant (OECD and WTO, 2017). Much of this assistance has been allocated to im-

proving the quality of economic infrastructure and productive capacities of firms and efforts to lower trade costs through trade facilitation projects. The focus of most of the global AfT effort has been on boosting trade in goods. Consistent with the international development community's AfT strategies, the growing literature assessing the trade effects of AfT has mostly investigated the effects on merchandise trade and on investment in developing countries. There has been little work on the effects of aggregate AfT on trade in services, or on the effects of the sectoral allocation of AfT on different types of trade (goods vs. services).

This paper makes an initial contribution to filling this gap. Our primary interest is to assess the relationship between AfT and trade in services. We decompose AfT into different categories and analyse the effect of AfT as a whole as well sub-components of AfT on both goods and services trade using both aggregate and bilateral data.

Our identification strategy exploits changes in the AfT-recipient status of some of our sample countries over the time period of analysis (2002-2015). While such changes in recipient-status arguably render the treatment effect in our analysis exogenous, we assess the robustness of our results by controlling for potential endogeneity in the aggregate AfT-trade relationship using a synthetic instrument for AfT in our aggregate analysis, following Temple and Van de Sijpe (2017) and by experimenting with GMM specifications. We account for endogeneity in our bilateral analysis by using three-way fixed effects, following Baier and Bergstrand (2007); Baier et al. (2014) who employed a similar strategy in the context of studying the trade effect of preferential trade agreements (PTAs). We also experiment with different lag structures in our empirical analysis to allow for trade to respond to AfT non-contemporaneously.

While there are some suggestive associations between AfT and services trade in aggregate data, especially at the sectoral level and for sub-types of AfT, we find a statistically weak effect of AfT on both goods and services trade in our aggregate analysis once we account for endogeneity in the AfT-trade relationship. In this regard our analysis of AfT and trade in services comes to a similar finding as the literature on AfT and merchandise trade, which finds only a weakly significant relationship between AfT and goods trade. We add to the literature by confirming the presence of correlation but absence of causal effects of AfT on aggregate services trade.

In contrast, the bilateral analysis suggests that AfT, in particular that allocated to services activities, especially economic infrastructure, has a positive effect on donors' merchandise imports from recipient countries. This is a novel finding, which is found to be robust across

different lag structures and provides evidence of complementarities between services AfT and goods trade in the bilateral data. A similar effect in the context of merchandise trade was found by Pettersson and Johansson (2013), who did not decompose AfT into services and non-services categories. Our results suggest that the effect of AfT in expanding exports of recipients to donor countries is associated with AfT for services.

The plan of the paper is as follows. Section 2 briefly reviews the related literature. Section 3 provides an overview of the allocation of AfT across activities and regions. Section 4 presents the empirical methodology and data used in the analysis. Section 5 discusses the results. Section 6 offers some concluding remarks.

2 Related literature

There is a rapidly expanding literature analysing AfT, some of which is surveyed in Cadot et al. (2014). Much of this involves cross-country studies. Examples include Brenton and von Uexkull 2009; Cali and te Velde, 2011; Königer et al. 2011; Skärvall 2011; Busse et al. 2012; Helble et al. 2012; Portugal-Perez and Wilson, 2012; Vijil and Wagner, 2012; Nowak-Lehmann et al. 2013; Pettersson and Johansson 2013; Ferro et al. 2014; and Hühne et al. 2014. All these studies assess the effects of AfT on (different dimensions of) merchandise trade, with a particular focus on support for trade facilitation.

Cali and te Velde (2011) investigate total merchandise trade performance for some 100 countries in the mid-2000s and conclude that AfT for economic infrastructure is associated with greater recipient-country exports, while aid for productive capacity does not appear to influence export performance.[1] Vijil and Wagner (2012) obtain very similar results. Helble et al. (2012) focus on a longer time period and estimate a gravity model using bilateral merchandise trade flows. They conclude that AfT is positively associated with an increase in exports and imports of the countries granted the assistance. Pettersson and Johansson (2013) found bilateral aid to be positively associated with both donor merchandise exports to and imports from recipients for a sample of 184 countries between 1990-2005.

Ferro et al. (2014) is closer in spirit to the present paper in analysing the effect of AfT

[1] Their definitions of AfT in economic infrastructure and productive capacity building are different from those used in this paper. They classify AfT_{INF} as aid going to transport and storage; communications; energy; banking and financial services; and business and other services, whereas AfT_{PC} is classified as aid going to agriculture, forestry and fishing; industry; mining; tourism, construction and aid for trade policy and regulations.

directed towards service sector-related projects and activities, but as is the case for the literature more generally, they focus only on the effect of such AfT on merchandise exports. They find that AfT allocated to services increases exports of manufactured products. AfT targeting services activities benefits most those manufacturing sectors that use services relatively more intensively. In contrast to Ferro et al. (2014), we study the effect of AfT in both services and non-services sectors on services trade as well as trade in goods. More recently, Martínez-Zarzoso et al. (2017) examine the effects of AfT on aggregate goods and services exports and find AfT to promote mainly goods exports for the lower quantiles of the conditional export distribution. Unlike us, however, they do not study disaggregated effects of sectoral AfT or the effects on imports; also, they do not provide any bilateral analysis.

Most cross-country studies of AfT analyze the effects of AfT flows from multiple OECD donors to non-OECD recipients, though there is also work on specific OECD donors. Martínez-Zarzoso et al. (2009), for instance, study the effect of German foreign aid on German exports; Skärvall (2012) examines the impact of Swedish development assistance on Sweden's bilateral trade with the recipient countries; and Bearce et al. (2013) look at the effect of AfT provided by the US on recipient countries' merchandise exports. A general finding of this literature is that AfT, especially aid that supports trade facilitation has a strongly trade-promoting effect and that the return on such AfT is high, substantially exceeding the costs (Hoekman and Shepherd, 2015). Moreover, research suggests one important benefit of AfT for trade facilitation is that it can support greater diversification (Cadot et al. 2011; Beverelli et al. 2015; Persson, 2013).[2]

Previous research on the aggregate AfT-trade relationship has used IVs, GMM and dynamic OLS specifications to account for endogeneity and uniformly found statistically weak effects in the context of merchandise trade. We find similar weak effects of AfT allocated to services on both aggregate goods and services trade using 2SLS-IV and GMM specifications. The existing bilateral analysis has also experimented with the same estimation strategies as those used in the aggregate analysis, but it has not used Poisson-Pseudo Maximum Likelihood or PPML (Silva and Tenreyro, 2006) with three-way fixed effects, which is arguably the gold standard in the estimation of structural gravity models (for instance see Yotov et al. 2016) as it is more effective in mitigating both heteroskedasticity and endogeneity-related concerns. We apply this estimation strategy in our analysis of bilateral

[2]Other research has examined the impact of AfT on investment, including Harms and Lutz, 2006; Selaya and Sunesen, 2012; Donabauer et al. 2016; and Lee and Ries, 2016. These studies generally find positive associations between measures of AfT and investment.

AfT and trade relationships to yield unbiased estimates of the effect of AfT allocated to services sector activities on bilateral trade.

3 The allocation of AfT between 2002 and 2015

Data on official development assistance (ODA) committed and disbursed by donor countries in recipient countries are available from the OECD Secretariat for a large sample of countries and sectors over the 2002-2015 period. AfT is one component of total ODA. The OECD defines AfT as comprising the following categories:

• technical assistance for trade policy and regulations (e.g. helping countries to develop trade strategies, negotiate trade agreements, and implement their outcomes)

• trade-related infrastructure (e.g. building roads, ports, and telecommunications networks to connect domestic markets to the global economy)

• productive capacity building, including trade development (e.g. supporting the private sector to exploit their comparative advantages and diversify their exports)

• trade-related adjustment (e.g. helping developing countries with the costs associated with trade liberalisation, such as tariff reductions, preference erosion, or declining terms of trade)

• other trade-related needs, if identified as trade-related development priorities in partner countries' national development strategies

The OECD Creditor Reporting System (CRS) does not provide data that exactly match all of the above AfT categories. Only parts of ODA data are reported as aid going to building economic infrastructure and to the creation of "productive capacity." Infrastructure includes several services sectors – e.g., transport, storage, and information and telecommunications networks – for which data are reported separately. Aid for productive capacity spans all sectors of the economy, and thus includes services. Three services activities are split out in the CRS for this category of AfT: banking and financial services, business and other services, and tourism. It should be noted that these data are proxies at best for aid targeting trade-related infrastructure and productive capacity building, as not all of ODA reported under these headings is trade-related.[3] This said, ODA data reported under these

[3]Also note that we take these AfT sectoral classifications as provided by the OECD at face value. It is not inconceivable that some of the AfT allocated to "services" activities as defined by the OECD may

headings are the closest approximation of AfT that goes to services.[4]

Total AfT disbursements increased from $9.1bn in 2002 to an average of $21bn in 2006-2008 to $39.8bn in 2015 (OECD and WTO, 2017). Asian and African countries have been the major recipients of AfT disbursements, with African (Asian) nations receiving $14.1bn ($14.9bn) in 2015, each region accounting for around 40 percent of total AfT global aid since 2002.

The global distribution is qualitatively similar when we look at AfT that was allocated to services sectors. We define AfT for services to span the following categories of AfT: (1) assistance to economic infrastructure in three sectors, transport/storage; ICT and energy; and (2) assistance for productive capacity building in financial services, business services and tourism activities. We do so largely because these are six categories that are identified in the OECD data on AfT as services. Although technically energy is not regarded as a services sector in the national accounts or the BOP (e.g., electricity is a good), part of the AfT going to this sector involves distribution of energy (grids, pipelines, storage, etc.). Globally, AfT mapped to these six categories increased from $5.3bn in 2002 (59 percent of total AfT) to $23.3bn in 2015 (72.4 percent). Thus, most AfT over the period was allocated to services sectors, a feature of AfT that is generally not emphasized in AfT reporting or analysis.[5] A breakdown of AfT into different categories, following OECD definitions, is provided in Figure 1.

<Insert Figure 1 here>

On average, Asian and African countries account for the largest shares of AfT for services over the post 2002 period. The Asian economies received $11.8bn in AfT in services in 2015, up from $2.6bn in 2002; the corresponding values for AfT in services received by African countries in these years were $9.2bn and $2.0bn, respectively. Relative to their GDP, African (19.9%) and Pacific (16.8%) countries have been the largest recipients. While African and Pacific economies are the largest AfT recipients on a per capita basis and as a share of GDP, this is a function of their small population and GDP.

Within services, the transport and energy sectors have been the largest recipients of global ODA disbursements, accounting for 45.9% and 30.2%, respectively, of total AfT in services

actually be aid going to "goods" sectors. But this is a data reporting and classification issue that we cannot circumvent in our empirical analysis.

[4]No data are reported regarding allocations to services sectors for other categories of AfT (technical assistance for trade policy and regulations, trade-related adjustment and other trade-related needs).

[5]Ferro et al. 2014 is an exception.

disbursed over 2012-2015 on average (see Figure 2). This simply reflects the greater importance of both sectors in building economic infrastructure in countries in general, though the predominance of transport and storage also reflects the cost of infrastructure projects in comparison with other types of AfT spending (ADB, 2015).

<Insert Figure 2 here>

This pattern also holds if we look at the distribution of sectoral AfT in services across geographical regions (see Table 1). The only exception to this trend is Europe where AfT targeting banking and financial services exceeds AfT for the energy sector (although the largest share still goes to transport services).

<Insert Table 1 here>

4 Empirical methodology and data

The empirical analysis is conducted first for aggregate (goods and services) trade of recipient countries and then for bilateral (goods and services) trade between the donor and recipient countries.

4.1 Aggregate analysis for the 2002-2015 period

The methodological approach that is adopted to assess the relationship between AfT and aggregate goods and services trade is to estimate the following augmented export and import demand functions using fixed effects specifications:[6]

$$x_{jt} = \alpha_0 + \alpha_1 aft_{jt-1} + \alpha_2 NAfT_{jt-1} + \Sigma\beta_k z_{kjt} + \delta_j + \delta_t + \varepsilon_{jt} \quad (1)$$

$$m_{jt} = \alpha_0 + \alpha_1 aft_{jt-1} + \alpha_2 NAfT_{jt-1} + \Sigma\beta_k z_{kjt} + \delta_j + \delta_t + \varepsilon_{jt} \quad (2)$$

where x_{jt} = log of services (goods) exports of recipient j in year t; m_{jt} = log of (goods) services imports of recipient j in year t; aft_{jt-1} = log of AfT in recipient j in year $t-1$;

[6]This is consistent with other studies in the literature such as Cali and te Velde (2011) and Martínez-Zarzoso et al. (2017).

z_{kjt} = vector of recipient-time varying controls; δ_j = recipient fixed effects; δ_t = year fixed effects; ε_{jt} = error term.

Following the literature we allow trade flows to respond to AfT with a lag and also experiment with alternative lag structures. To accommodate zero AfT flows in the analysis (which are even more prevalent in the different decompositions of AfT data that we consider), following the methodology suggested by Wagner (2003), we define aft_{jt-1} as $ln(max1, AfT_{jt-1})$ and include a $NAfT_{jt-1}$ dummy in the estimating equations, which takes the value of 1 when $AfT = 0$ and is zero otherwise. Thus, the coefficient of aft_{jt-1} measures the elasticity of exports (or imports) where AfT is positive while the coefficient of $NAfT_{jt-1}$ serves as an adjustment to the constant in cases where AfT is zero. The log of trade when AfT is positive exceeds the log of trade when AfT is zero by $\alpha_1 ln(AfT)$–α_2 i.e. $x_{jt}|AfT > 0 - x_{jt}|AfT = 0 = \alpha_1 ln(AfT)$–$\alpha_2$.

The control variables are those used by Cali and te Velde (2011). They comprise a measure of country size – (log of) population (POP); a measure of geographic distance to global markets – (log of) market penetration (MP), computed as a distance (d_{ij}) weighted measure of other countries'[7] GDP (GDP_{it}) i.e. $MP_{jt} = \sum_i \frac{GDP_{it}}{d_{ij}}$; a measure of domestic prices – (log of) the consumer price index (CPI)[8]; and a measure of government effectiveness (GE) to reflect the institutional strength of the recipient country. Each of these variables is expected to be positively correlated with exports and imports, which justifies their choice as controls in the estimating equations.

In a departure from existing literature, we also use foreign direct investment (FDI) in the recipient country as an additional control. The inclusion of FDI in our empirical model is theoretically motivated by the Chenery and Strout (1966) two-gap models, which postulate that foreign aid may serve as a complement to investment in plugging a country's foreign exchange gap, and by the knowledge capital model of the multinational enterprise (Carr et al. 2001). Particularly relevant in our context is that since two-thirds of international trade in services is delivered via Mode 3 or commercial presence (for instance see Maurer and Magdeleine, 2008), it makes intuitive sense to control for FDI in our empirical analysis, especially in a world of global value chains.

[7]Note that the market potential of country j at time t is calculated as the sum of the (inverse) bilateral distance weighted GDPs of all other countries and not only of all countries for which we analyse the effect of AfT on trade - which are primarily developing countries.

[8]Like Cali and te Velde (2011), we prefer using the CPI over the real effective exchange rate (REER) as this maximizes the number of observations for empirical analysis. Our overall findings are robust to using the REER.

To study the trade effects by type of aid, we follow the OECD classification and decompose aggregate AfT into three broad categories – AfT in economic infrastructure, AfT in productive capacity building and AfT in trade policies and regulation. We also replace total AfT with the sum of AfT in the six aggregate services sectors shown in Figure 2 to arrive at a composite measure of AfT in services (which we include in equations (1) and (2) along with the "residual" non-services AfT). We also examine the sectoral relationship between trade and AfT for seven disaggregated[9] services sectors: business, communications, computer-and-related services, energy, financial, tourism and transport services. Finally, we also consider the effect of non-AfT ODA on trade in both goods and services flows in equations (1) and (2).

The literature on the economic determinants of development assistance (e.g., Neumayer, 2003) suggests that donor countries are more likely to disburse aid to countries which are important markets for their exports. As such, the AfT-trade relationship is expected to be positive. Even if this is not the case, insofar as aid targeted at services sectors has a direct positive impact on the development of economic infrastructure, this is expected to contribute to economic growth and fuel the trading potential of the recipient countries. This again translates into an expected positive AfT-trade relationship.[10]

Finally, to control for possible endogeneity in the aggregate AfT-trade relationship, following Temple and Van de Sijpe (2017), we construct a synthetic measure of AfT_{jt} using each recipient country's share of total aid in each donor country's budget averaged over 2002-2008, multiplied by each donor country's current budget at time t for each year between 2009 and 2015, and aggregate this measure over all donor countries in our dataset. Thus, we use pre-crisis year data to construct an instrument for AfT in the post-crisis years, which is then used in empirical analysis over 2009-2015.[11]

4.2 Bilateral analysis for the 2002-2010 period

Ideally we would want to estimate equations (1) and (2) on a bilateral basis. Unfortunately the available data on services trade do not allow this. The absence of bilateral services trade data has been a long-standing challenge for economic analyses. In 2002, the OECD first published data on bilateral services trade flows for 35 exporting and 53 importing countries,

[9]Computer-and-related services are included in the communications sector in OECD AfT data.

[10]See also Cali and te Velde (2011) for AfT in a simple export demand model.

[11]In an earlier version of this paper, we also experimented with GMM specifications. The results from this analysis, available upon request, were found to be both statistically and diagnostically weak.

largely OECD members, over 1999-2002 covering four broad categories: travel services, transportation services, other commercial services and government services. Since then, services trade data collection, compilation and reporting has improved. There are now four international sources of services trade data - the United Nations Services Database (UNSD), managed by UNComtrade; the WTO/UNCTAD/ITC Services Database (WTOSD); the OECD Trade in Services by Partner Database (TISP); and the World Bank Trade in Services Database (WBTSD). The latter provides for much better coverage in terms of the number of reporting countries (over 200), longer time periods (1985-2015) and availability of sectoral data (twelve aggregate 3-digit sector codes according to the extended balance of payments (EBOPS) classification with further breakdowns for the OECD countries).

Despite improvements in the international availability of services trade data, statistics for LDCs and LICs, the major recipients of ODA, remain weak. The most comprehensive coverage of countries is for total or aggregate services flows for trade with the world. Thus for the LDCs and many LICs we are limited to analysis of services trade patterns with the world. Even then it must be recognized that the reliability of services trade data continues to be a problem.[12] There is noticeable variability in the recorded coverage of LDC/LIC services trade across years, alongside at-times significant year-on-year variation, suggesting weaknesses in the quality of data collection and transcription/coding, though other issues such as confidentiality may also play a role (for instance see Shingal, 2015). Since services trade is measured via reported BOP transactions, asymmetries in reporting BOP transactions can lead to serious discrepancies. For instance, commercial banks use different thresholds for reporting BOP transactions to the Central Bank or National Statistical Institute; therefore significant differences in these thresholds has a bearing both on what is recorded as a services transaction and its value (Shingal, 2015). For all of these reasons, bilateral analysis has much more limited coverage than analysis of global trade in services in terms of countries, sectors and years consistent with ODA data availability for the services sectors of interest. [13]

[12]Moreover, most statistics on South-North services trade flows are based on "mirror" flows between the North-South. For example, Fiji's exports of commercial services to Australia are actually Australia's reported imports of commercial services from Fiji. In the absence of "actual" data on trade in services, it is difficult to cross-check reported statistics for inconsistencies.

[13]The BOP services trade data span three of the four GATS modes of supply, modes 1, 2 and 4: cross-border trade, consumption abroad (e.g. tourism) and temporary movement of services suppliers (natural persons). Mode 3 (commercial presence, i.e., FDI) is not captured in the BOP as sales by affiliates of foreign companies are treated as domestic activity in the BOP. While limiting the coverage of what is understood in the WTO as constituting services trade, the approach is consistent with basic national accounts measurement and ensures that our results for trade in services and trade in goods are comparable.

The equations for bilateral analysis are estimated in a structural gravity framework as follows:

$$x_{ijt} = \alpha 1 aft_{ijt-1} + \alpha_2 NAfT_{ijt-1} + \beta PTA_{ijt} + \delta_{it} + \delta_{jt} + \delta_{ij} + \varepsilon_{ijt} \quad (3)$$

$$m_{ijt} = \alpha 1 aft_{ijt-1} + \alpha_2 NAfT_{ijt-1} + \beta PTA_{ijt} + \delta_{it} + \delta_{jt} + \delta_{ij} + \varepsilon_{ijt} \quad (4)$$

where x_{ijt} = log of (goods, services) exports of donor i to recipient j in year t; m_{ijt} = log of (goods, services) imports of donor i from recipient j in year t; aft_{ijt-1} = log of AfT from donor i to recipient j in year $t-1$; $NAfT_{ijt-1}$ is a binary dummy that takes the value of 1 when $AfT_{ijt-1} = 0$ and is zero otherwise; PTA_{ijt} = dummy variable indicating membership of preferential (goods, services) trade agreements notified to the WTO; δ_{it} = donor-year fixed effects; δ_{jt} = recipient-year fixed effects; δ_{ij} = dyadic fixed effects; ε_{ijt} = error term.

In addition to estimating dyadic as opposed to aggregate effects of AfT on trade, the use of three-way fixed effects in these specifications accounts for endogeneity in the AfT-trade relationship (Baier and Bergstrand, 2007; Baier et al. 2014); moreover, the time-varying importer and exporter fixed effects control for multilateral resistance.

We consider AfT and non-AfT ODA; services and non-services AfT; and AfT in economic infrastructure, productive capacity building and trade policies and regulation sequentially in estimating equations (3) and (4). The incidence of zero AfT is much higher in bilateral (compared to aggregate) data; these zero flows are accommodated using Wagner's (2003) methodology as in the aggregate analysis. Note that the use of recipient-year fixed effects in equations (3) and (4) also controls for any third-party aid disbursed to the recipient that may have an effect on its bilateral trade with the donor.

Consistent with recent advancements in estimation of structural gravity models, we estimate equations (3) and (4) using the PPML with three-way fixed effects, which is an additional feature differentiating our analysis from existing work examining the effects of bilateral aid on bilateral merchandise trade (for instance see Novak-Lehmann et al. 2013; Pettersson and Johansson, 2013).[14]

[14]We also attempted the two-step Heckman following the estimation strategy in Helpman et al. (2008) to account for any sample selection bias using the (log) cost of trading from the World Bank's Doing Business Indicators as an exclusion variable in the selection equation. However, the sample selection bias

4.3 Data sources and summary statistics

The aggregate and bilateral goods and aggregate services trade data used in the analysis are sourced from UN Comtrade and correspond to the period of availability of the OECD AfT data i.e. 2002-2015; bilateral services trade data are taken from Francois and Pindyuck (2013) but are only available until 2010. The control variables are sourced as follows: the consumer price index (CPI), foreign direct investment (FDI) and population (POP) are taken from the World Development Indicators; market penetration (MP) is computed using bilateral distance data from CEPII (Head et al. 2010) and GDP data from the World Development Indicators; and government effectiveness (GE) is sourced from the World Governance Indicators (Kaufmann et al. 2011). The binary PTA variable employed in the bilateral regressions is constructed using the WTO's RTA-IS database and corresponds to goods trade agreements notified under Article XXIV of the GATT and services trade agreements notified under Article V of the GATS.

The aggregate analysis is carried out on 159 ODA recipients over 2002-2015; the sample for bilateral analysis comprises 28 donors and 162 recipients over 2002-2010. The sample of recipients and donor-recipients included in both exercises is reported in Annex Tables A1 and A2. Fourteen countries in our sample witnessed a change in their AfT-recipient status over the period of analysis, a fact that we exploit in identification.[15] Summary statistics are reported in Annex Tables B1 and B2, respectively, for the aggregate and bilateral datasets. The aggregate dataset has over 1800 observations on services trade and the aid variables and more than 1300 observations on goods trade. The bilateral dataset has over 18,000 observations on goods and services trade and close to 15,000 observations on different sub-types of AfT.

- coefficient of the inverse mills ratio calculated from the selection equation of the two-step Heckman - was found not to be statistically different from zero in all specifications for both goods and services trade. This also suggested a preference for the PPML as an estimation strategy (for instance see Xiong and Chen, 2014).

[15]These include Bahrain that became an AfT-non-recipient after 2004; Malta and Slovenia that only received AfT in 2002; Saudi Arabia and Turks & Caicos Islands that became AfT-non-recipients after 2007; Kosovo that only began receiving AfT after 2008; Croatia, Mayotte, Oman and Trinidad & Tobago that became AfT-non-recipients after 2010; Belarus, Libya and Ukraine that only began receiving AfT after 2004; and South Sudan that was an AfT-non-recipient before 2011.

5 Results

5.1 Aggregate analysis (OLS)

Tables 2-5 report the results from estimating equations (1) and (2) on exports and imports of goods and services, respectively, for the full sample of AfT recipients in our data set. The AfT variables are lagged by one, two and three time periods, respectively, in columns (1)-(4), (5)-(8) and (9)-(12), respectively. All regressions control for country (recipient) and year fixed effects; standard errors are clustered by $country * year$.

5.1.1 Impact of total AfT on trade

The first set of results reported in Table 2 use data on total AfT as well as non-AfT ODA. The only positive correlation observed in the results is between services exports and total AfT lagged two time periods (column 5) but even this is weakly significant. The coefficient estimate suggests that on average, a doubling of total AfT in a given period would be associated with a 3.6 percent rise in aggregate services exports two years later for the full sample of AfT recipient countries, ceteris paribus.

The coefficient estimates of the AfT variables for services and merchandise trade in all other columns are not statistically different from zero. The addition of FDI as a control variable and including AfT and Non-ODA AfT in the same estimating equation likely accounts for the absence of a positive effect of AfT on merchandise trade that is observed in existing literature. ODA that is not classified as AfT by the OECD does not have a significant impact on either trade in goods or trade in services. All control variables, except MP_{jt}, are significant and have the expected signs. Notably, FDI is strongly significant in these results, justifying its inclusion as a control.

<Insert Table 2 here>

5.1.2 AfT in services and goods and services trade

Focusing on AfT allocated to services-related projects and activities results in a different picture. AfT in services, lagged one and two time periods, is positively associated with services exports. The coefficient estimate reported in column (5) of Table 3 suggests that a 100% increase in AfT in the services sectors in a given period is associated with a 2.9% rise

in aggregate services exports two periods later for the full sample of AfT recipient countries. The weakly significant coefficient estimate in column (1) further suggests that the log of services exports when services AfT is positive exceeds the log of services exports when services AfT is zero by $0.0249 * ln(AfTSer)$–0.168. Thus, the critical level of services AfT for a positive net effect of services AfT on services exports one period later is $e^{(0.168/0.0249)} =$ \$851.5 million. In contrast, the coefficient estimates of the AfT_Ser variables are not statistically different from zero for aggregate merchandise trade in these results.

<Insert Table 3 here>

AfT going to non-services sectors is associated with greater merchandise trade in the subsequent time period (though the relationship is statistically weak for goods exports), but not with services trade, irrespective of the lag structure.

5.1.3 Trade-AfT relationships by type of AfT

Table 4 reports results for regressions where the AfT variable is disaggregated into the three major categories defined by the OECD: AfT for economic infrastructure, for productive capacity building and in support of trade policies and regulation. We further divide AfT for productive capacity building into projects and programs that involve service activities as opposed to aid that benefits non-services sectors.

<Insert Table 4 here>

AfT for economic infrastructure does not have a significant association with either services or goods trade in these results. Given that the bulk of AfT allocated to services involves the energy and transport sectors, this is a striking finding.

AfT for productive capacity building that is directed towards services (AfT_PCB_Ser) has a statistically significant association with services exports, especially three time periods later, as well as with goods trade. In contrast, AfT for PCB in non-services sectors has a positive and statistically significant relationship with only merchandise imports in the subsequent period but not with services trade.

AfT for trade policies and regulations (AfT_TPR) is positively correlated with goods exports, especially two and three time periods later. Specifically, a 100% increase in AfT_TPR in a given period is associated with a 3.65% rise in aggregate goods exports

three periods later, ceteris paribus and on average. A similar association is not observed in these results for merchandise imports or services trade.

5.1.4 Trade-AfT relationships across AfT for different services sectors

We next report results for analysis of AfT broken down by services sector to which AfT is allocated. This breakdown combines different types of AfT. Our interest here is whether there are any statistically significant "sector-specific" correlations between AfT and trade. As can be seen from Table 5, there is considerable heterogeneity in the impact of sectoral AfT on goods and services trade both across sectors and lag structures. AfT allocated to computer-related services shows the most consistent association in these results, with a doubling of the AfT in this sector being associated with between 4-5% greater merchandise imports in subsequent time periods. In other results, a 100% rise in AfT allocated to communications services is associated with a 2.8% increase in goods imports after two time periods; a doubling of AfT allocated to business services is associated with a 4% and 3% rise in the exports and imports of aggregate services, respectively, after three time periods; and a 100% rise in tourism AfT is associated with a 4% increase in goods imports, two periods later. These results are suggestive that some types of AfT allocated to individual services sectors may be associated with greater goods and services trade, but that in most instances, there is no relationship.[16]

<Insert Table 5 here>

[16]The impact of services AfT on services trade may be more discernible at the level of the individual services sectors for which both trade and AfT data are available. To examine this proposition, we also estimated equations (1) and (2) at the most disaggregated services sector level possible. In unreported results available upon request, the OLS estimates revealed a positive relationship of sectoral AfT with some components of services trade performance. Overall, the results are broadly consistent with the findings from the more aggregate analysis. While the relationships are statistically weak, they are nonetheless suggestive that some types of AfT for services may matter for services trade. This was found to be the case in particular for AfT in energy, with a positive association with transport, communications, CRS and other business services exports; AfT in financial services, which was found to have a positive association with financial services exports and travel; AfT for ICT, which was found to be relevant for CRS exports; AfT for transport – which was found to be associated with transport exports; and AfT for CRS, which was found to be associated with financial services exports. AfT for travel was found to be associated with transport and financial services imports, while AfT in financial services was found to be positively associated with greater imports of transport and travel. Transport imports were found to be also associated with AfT for CRS.

5.2 Robustness checks

To address possible endogeneity in the aggregate AfT-trade relationship, we experimented with both GMM specifications and IV analysis using a synthetic instrument for AfT in two-stage least squares (2SLS) IV regressions. In both cases, the results were found to be statistically and diagnostically weak across specifications and are not reported. Given the country and time coverage of our data, we also examined the sensitivity of our aggregate IV results to including different sub-samples. We began by excluding Arab oil exporters and decomposed the country sample by World Bank income classification. We also experimented with other sub-samples including splitting the panel into two time periods, defined by the global financial crisis; and considering cross-sectional analysis by averaging all data over 2002-2015. All these IV results were found to be statistically insignificant.

While this suggests that the results from the aggregate analysis should be considered to be indicative, a similar finding characterises the literature analysing AfT and aggregate merchandise trade of recipient countries. Our results confirm the presence of correlation but an absence of causal effects of AfT on aggregate services trade.

5.3 Bilateral analysis

Results from PPML estimation of equations (3) and (4) are reported in Table 8 for bilateral AfT (and its types) and bilateral goods and services trade. Columns (1)-(4) report the results for AfT and non-AfT bilateral aid; columns (5)-(8) report the results for services and non-services bilateral AfT; and columns (9)-(12) report the results for bilateral AfT disaggregated into its sub-components.

<Insert Table 6 here>

Bilateral AfT is positively correlated with bilateral merchandise imports in these results (see column 4). In particular, a doubling of donor-to-recipient AfT is associated with a 3.8% increase in the donor's goods imports from the recipient, ceteris paribus and on average.

Column (8) suggests that bilateral AfT in services is important for donor's goods imports from recipients; column (12) suggests that this stems mainly from donor AfT directed

towards economic infrastructure in the recipient countries. Unlike the findings from aggregate analysis, these results reveal complementarities between services AfT and merchandise trade.

Significantly, the biggest economic impact in the bilateral results is observed between donor-to-recipient AfT directed towards trade policies and regulations and donor's goods imports from recipients; a doubling of such bilateral AfT is associated with a 9.66% rise in bilateral goods imports, ceteris paribus and on average. This finding suggests that aid actually directed towards trade is effective.[17]

6 Conclusion

The empirical literature has investigated many dimensions of the potential relationship between AfT and the trade performance of recipient economies. A common characteristic of this body of research is that it focuses on the effects of AfT on merchandise trade, and to a lesser extent, on investment flows. Little work has focused on the effects of AfT on trade in services. Our analysis seeks to begin to address this gap.

The results from bilateral analysis provide robust evidence for complementarities between services AfT and merchandise imports of donors from recipient countries across lag structures. This novel finding is consistent with the role that services play as inputs into production and the fact that much (most) of AfT is allocated to services sectors. That said, the evidence for complementary relationships is weaker than would be expected a priori based on the literature analysing the relationships between manufacturing sector competitiveness and the performance of domestic services sectors (e.g., Beverelli, Fiorini and Hoekman, 2017). In fact, most of our results suggest a statistically weak effect of AfT on both goods and services trade.

It may well be that analysis of the type undertaken here is asking too much of the relatively limited data that is available on trade in services. But the fact that we find hints that there are statistically significant associations between some types of AfT for services and trade in specific categories of services suggests there is value in devoting greater attention to the design of AfT to make this a more effective mechanism to support services trade.

[17]Note that these findings account for endogeneity in the AfT-trade relationship, as the estimations include three-way fixed effects. Also, while trade is allowed to respond to AfT with a one period lag in these specifications, the overall findings are robust to using a two period lag.

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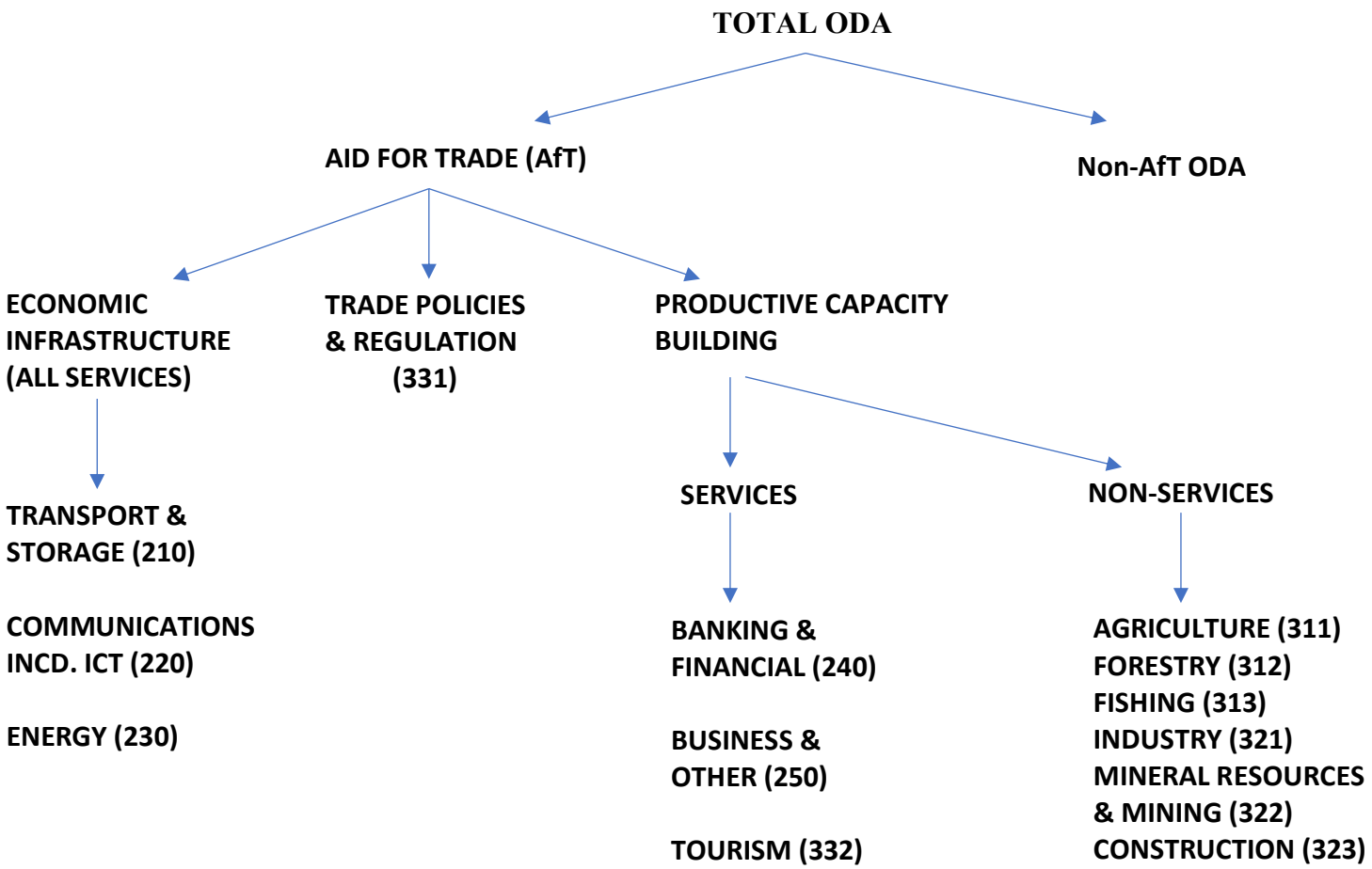
Data citation:

ODA/AfT database; OECD; 2002-2015; Query Wizard for International Development Statistics; https://stats.oecd.org/qwids/

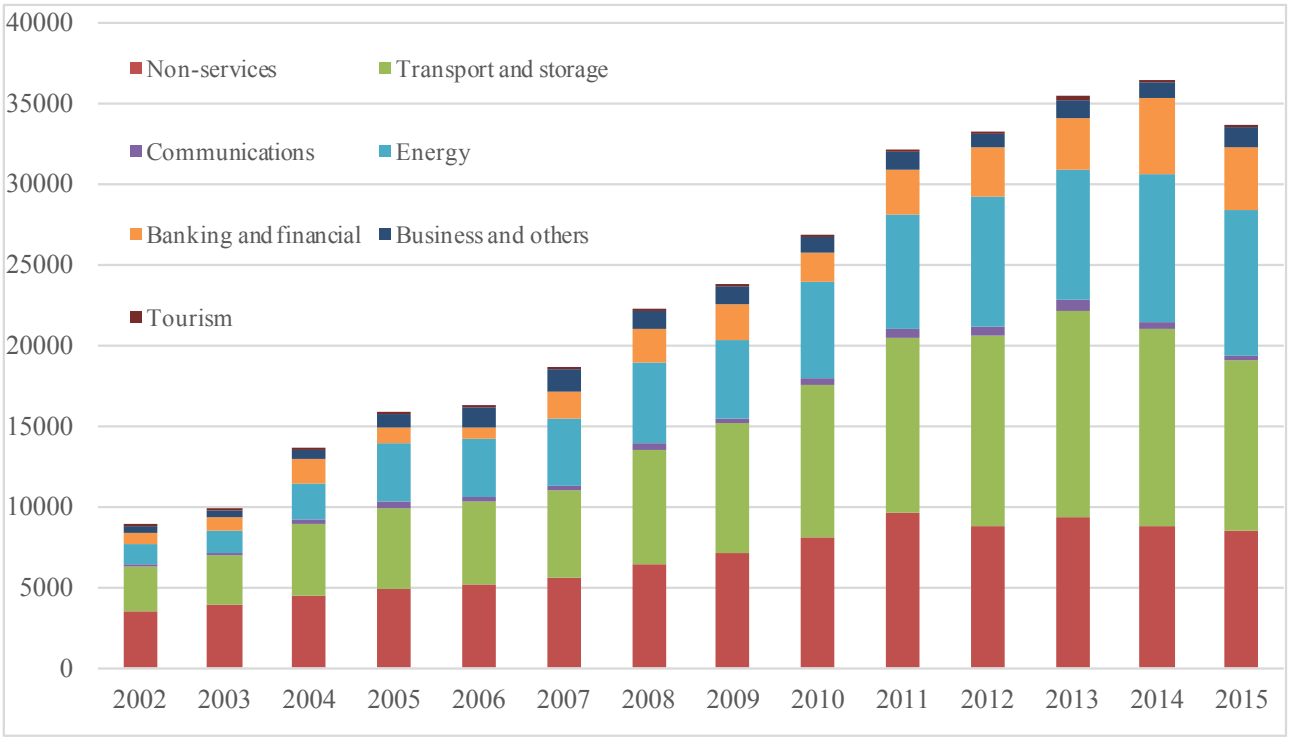
Trade in Goods and Services database; UN Comtrade; 2002-2015; International Trade Statistics Database; https://comtrade.un.org/data

Figure 1: Breakdown of ODA and AfT categories



Note: Numbers in parentheses indicate OECD CRS codes

Figure 2: Sectoral distribution of global AfT ($mn)



Source: OECD QWIDS; own calculation

Table 1: Geographical distribution of AfT in services by sector ($mn)

AfT in services (avg. 2002-2015, $mn)	Africa	America	Asia	Europe	Pacific	Global
Transport & Storage	2942.6	474.8	3690.5	611.5	154.6	7771.3
Communications	158.9	46.6	185.0	60.1	9.1	450.6
Energy	1826.0	424.8	2780.1	393.4	36.5	5394.1
Banking & Financial	791.1	206.0	858.6	508.1	6.4	2296.1
Business & Other Services	376.0	89.7	498.0	144.1	12.6	1094.3
Tourism	45.5	21.5	28.2	6.6	4.3	105.0
SERVICES	**6140.2**	**1263.3**	**7718.3**	**1723.7**	**223.5**	**17111.3**

Source: OECD QWIDS; own calculation

Note: For Europe, the average is over 2002-2013 as the European countries in the sample did not receive any AfT in 2014-2015 as reported in the OECD database.

Table 2: Impact of total AfT on trade in services and trade in goods (OLS)

	AfT variables lagged one time period				AfT variables lagged two time periods				AfT variables lagged three time periods			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	$\ln(X^S)$	$\ln(X^G)$	$\ln(M^S)$	$\ln(M^G)$	$\ln(X^S)$	$\ln(X^G)$	$\ln(M^S)$	$\ln(M^G)$	$\ln(X^S)$	$\ln(X^G)$	$\ln(M^S)$	$\ln(M^G)$
$\ln(AfT_{jt-1})$	0.0177	-0.00368	-0.00887	0.00283	0.0360*	-0.0150	-0.0125	-0.00509	0.0219	-0.00757	-0.0182	-0.00702
	(0.0155)	(0.0152)	(0.0115)	(0.00948)	(0.0191)	(0.0148)	(0.0182)	(0.0100)	(0.0163)	(0.0128)	(0.0126)	(0.0105)
$NAfT_{jt-1}$	0.0448	-0.0942	0.0659	-0.0693	-0.138	-0.0486	0.165**	-0.137	0.0108	-0.123	0.120	-0.431***
	(0.213)	(0.0848)	(0.101)	(0.115)	(0.253)	(0.0877)	(0.0746)	(0.118)	(0.232)	(0.0883)	(0.125)	(0.103)
$\ln(Non\_AfT_{jt-1})$	-0.0271	-0.0226	0.00821	0.0130	-0.0382**	-0.0400*	0.0177	0.000870	-0.0255	-0.0404**	-0.0354	0.00455
	(0.0209)	(0.0216)	(0.0141)	(0.0140)	(0.0183)	(0.0220)	(0.0181)	(0.0135)	(0.0171)	(0.0184)	(0.0258)	(0.0146)
$NNon\_AfT_{jt-1}$	-0.0804	-0.110	-0.165	-0.0528	0.110	-0.197	-0.187	0.0127	-0.0905	-0.0764	-0.247	0.338***
	(0.241)	(0.105)	(0.147)	(0.118)	(0.279)	(0.122)	(0.144)	(0.132)	(0.263)	(0.122)	(0.202)	(0.121)
$\ln(Pop_{jt})$	0.404*	0.740***	0.752***	0.961***	0.275	0.731***	0.676***	1.028***	0.168	0.570*	0.653**	1.023***
	(0.242)	(0.229)	(0.200)	(0.143)	(0.252)	(0.266)	(0.225)	(0.153)	(0.262)	(0.306)	(0.257)	(0.170)
$\ln(MP_{jt})$	0.290	-0.814***	0.00495	0.375*	0.282	-0.661***	-0.186	0.394*	0.134	-0.570**	-0.388	0.372*
	(0.283)	(0.227)	(0.310)	(0.215)	(0.285)	(0.236)	(0.326)	(0.215)	(0.281)	(0.248)	(0.326)	(0.210)
$\ln(CPI_{jt})$	0.317***	0.269***	0.221***	0.140**	0.353***	0.235**	0.206***	0.125*	0.325***	0.183*	0.150*	0.0969
	(0.0914)	(0.0886)	(0.0710)	(0.0645)	(0.0921)	(0.0915)	(0.0775)	(0.0686)	(0.0891)	(0.101)	(0.0850)	(0.0749)
GE_{jt}	0.198***	0.172***	0.00432	0.224***	0.242***	0.172***	0.0302	0.238***	0.274***	0.148**	0.0769	0.219***
	(0.0642)	(0.0643)	(0.0570)	(0.0430)	(0.0708)	(0.0647)	(0.0640)	(0.0435)	(0.0728)	(0.0663)	(0.0615)	(0.0450)
$\ln(FDI_{jt})$	0.0496***	0.0388***	0.0692***	0.0579***	0.0481***	0.0424***	0.0656***	0.0607***	0.0422***	0.0481***	0.0579***	0.0641***
	(0.0118)	(0.0138)	(0.0145)	(0.00985)	(0.0122)	(0.0146)	(0.0156)	(0.0105)	(0.0124)	(0.0154)	(0.0161)	(0.0112)
Constant	-7.111	10.34	-7.049	-16.94***	-5.398	7.484	-2.128	-18.28***	-0.0532	7.818	3.554	-17.63***
	(7.948)	(6.761)	(7.831)	(5.527)	(8.054)	(7.607)	(8.239)	(5.606)	(7.908)	(8.279)	(8.060)	(5.659)
N	1,421	1,053	1,421	1,051	1,318	1,004	1,318	1,002	1,209	943	1,209	941
r2	0.981	0.990	0.974	0.992	0.982	0.990	0.974	0.992	0.984	0.991	0.975	0.993

Note: Standard errors, clustered by AfT-recipient*year, reported in parentheses. Levels of significance: * (10%), ** (5%), *** (1%). All estimations include recipient and year fixed effects.

Table 3: Impact of AfT in services on goods and services trade (OLS)

	AfT variables lagged one time period				AfT variables lagged two time periods				AfT variables lagged three time periods			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	$\ln(X^S)$	$\ln(X^G)$	$\ln(M^S)$	$\ln(M^G)$	$\ln(X^S)$	$\ln(X^G)$	$\ln(M^S)$	$\ln(M^G)$	$\ln(X^S)$	$\ln(X^G)$	$\ln(M^S)$	$\ln(M^G)$
$\ln(AfT\_Ser_{jt-1})$	0.0249*	-0.0125	0.00863	0.00267	0.0291**	-0.0157*	-0.00118	-0.00226	0.0208	-0.00992	-0.0199*	-0.00684
	(0.0131)	(0.0104)	(0.0103)	(0.00746)	(0.0116)	(0.00940)	(0.0101)	(0.00713)	(0.0129)	(0.0102)	(0.0106)	(0.00714)
$NAfT\_Ser_{jt-1}$	0.168**	0.0834	0.0532	-0.0114	-0.174	-0.0296	-0.129	-0.159*	-0.0508	-0.0715	0.0475	-0.118
	(0.0750)	(0.109)	(0.108)	(0.123)	(0.176)	(0.0881)	(0.160)	(0.0915)	(0.114)	(0.0770)	(0.100)	(0.0972)
$\ln(AfT\_Non\_Ser_{jt-1})$	-0.0166	0.0281*	-0.00154	0.0221**	-0.0102	-0.00248	-0.00539	0.00663	-0.00286	-0.00647	0.00283	0.00334
	(0.0154)	(0.0160)	(0.0126)	(0.0103)	(0.0171)	(0.0155)	(0.0147)	(0.0104)	(0.0165)	(0.0142)	(0.0163)	(0.0104)
$NAfT\_Non\_Ser_{jt-1}$	-0.148	-0.199*	-0.135	-0.0807	0.157	-0.114	0.0922	0.0624	0.00513	-0.0466	-0.0494	-0.00905
	(0.108)	(0.111)	(0.136)	(0.123)	(0.185)	(0.0950)	(0.167)	(0.0900)	(0.135)	(0.0757)	(0.121)	(0.0954)
$\ln(Pop_{jt})$	0.400*	0.619***	0.743***	0.918***	0.308	0.636**	0.689***	1.018***	0.167	0.510*	0.604**	1.046***
	(0.236)	(0.227)	(0.197)	(0.144)	(0.252)	(0.254)	(0.224)	(0.151)	(0.257)	(0.302)	(0.246)	(0.166)
$\ln(MP_{jt})$	0.259	-0.867***	0.0193	0.395*	0.303	-0.736***	-0.159	0.412*	0.152	-0.602**	-0.377	0.392*
	(0.284)	(0.225)	(0.311)	(0.216)	(0.288)	(0.233)	(0.328)	(0.215)	(0.284)	(0.249)	(0.315)	(0.213)
$\ln(CPI_{jt})$	0.322***	0.277***	0.221***	0.148**	0.340***	0.243***	0.203***	0.126*	0.324***	0.187*	0.147*	0.0960
	(0.0893)	(0.0893)	(0.0708)	(0.0641)	(0.0890)	(0.0911)	(0.0733)	(0.0684)	(0.0874)	(0.0984)	(0.0880)	(0.0747)
GE_{jt}	0.187***	0.165***	-0.000353	0.226***	0.226***	0.147**	0.0314	0.237***	0.267***	0.132**	0.0643	0.221***
	(0.0625)	(0.0636)	(0.0546)	(0.0431)	(0.0699)	(0.0636)	(0.0625)	(0.0434)	(0.0720)	(0.0662)	(0.0636)	(0.0449)
$\ln(FDI_{jt})$	0.0495***	0.0396***	0.0685***	0.0586***	0.0473***	0.0439***	0.0656***	0.0611***	0.0422***	0.0484***	0.0595***	0.0630***
	(0.0119)	(0.0139)	(0.0146)	(0.00995)	(0.0123)	(0.0146)	(0.0155)	(0.0105)	(0.0123)	(0.0151)	(0.0160)	(0.0111)
Constant	-6.581	13.25**	-7.269	-16.71***	-6.555	10.41	-2.845	-18.58***	-0.584	9.243	3.878	-18.42***
	(7.909)	(6.630)	(7.874)	(5.516)	(8.129)	(7.342)	(8.250)	(5.574)	(7.944)	(8.327)	(7.900)	(5.646)
N	1,421	1,053	1,421	1,051	1,318	1,004	1,318	1,002	1,209	943	1,209	941
r2	0.981	0.990	0.974	0.992	0.982	0.990	0.974	0.993	0.984	0.991	0.974	0.993

Note: Standard errors, clustered by AfT-recipient*year, reported in parentheses. Levels of significance: * (10%), ** (5%), *** (1%). All estimations include recipient and year fixed effects.

Table 4: Impact of AfT on trade by type of AfT (OLS)

	AfT variables lagged one time period				AfT variables lagged two time periods				AfT variables lagged three time periods			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	$\ln(X^S)$	$\ln(X^G)$	$\ln(M^S)$	$\ln(M^G)$	$\ln(X^S)$	$\ln(X^G)$	$\ln(M^S)$	$\ln(M^G)$	$\ln(X^S)$	$\ln(X^G)$	$\ln(M^S)$	$\ln(M^G)$
$\ln(AfT\_EI_{jt-1})$	0.0105	-0.0123	6.62e-05	-0.00355	0.0119	-0.0145	-0.00860	-0.00250	-0.00170	-0.0221**	-0.0240**	-0.0190***
	(0.0103)	(0.00904)	(0.00905)	(0.00623)	(0.0104)	(0.00925)	(0.00989)	(0.00652)	(0.0111)	(0.0108)	(0.00986)	(0.00697)
$NAfT\_EI_{jt-1}$	0.0893	-0.0270	-0.0325	-0.00948	-0.165	0.0566	-0.148	-0.0647	-0.0757	-0.0860	-0.128	-0.0781
	(0.0602)	(0.0726)	(0.0711)	(0.0661)	(0.109)	(0.117)	(0.105)	(0.0882)	(0.0883)	(0.0659)	(0.0888)	(0.0658)
$\ln(AfT\_PCB\_Ser_{jt-1})$	0.0155	0.0107	0.0136	0.00700	0.0199*	0.00863	0.0131	-0.00172	0.0352***	0.0264*	0.0142	0.0185**
	(0.0137)	(0.0116)	(0.0109)	(0.00798)	(0.0114)	(0.0125)	(0.00939)	(0.00771)	(0.0126)	(0.0139)	(0.0103)	(0.00803)
$NAfT\_PCB\_Ser_{jt-1}$	0.0906	0.0856	0.128**	0.121**	0.108	-0.0284	0.122*	0.0954*	0.0968	0.138*	0.185***	0.0503
	(0.0902)	(0.0672)	(0.0537)	(0.0559)	(0.0687)	(0.0672)	(0.0632)	(0.0515)	(0.0681)	(0.0740)	(0.0590)	(0.0618)
$\ln(AfT\_PCB\_Non\_Ser_{jt-1})$	-0.0226	0.0218	0.00129	0.0217**	-0.0136	-0.0140	-0.00228	0.00874	-0.00728	-0.0181	0.00508	0.00103
	(0.0149)	(0.0146)	(0.0130)	(0.00976)	(0.0176)	(0.0139)	(0.0155)	(0.0102)	(0.0170)	(0.0138)	(0.0179)	(0.0105)
$NAfT\_PCB\_Non\_Ser_{jt-1}$	-0.112	-0.131	-0.126	-0.135*	0.0730	-0.168	0.0716	-0.0827	-0.0627	-0.122*	-0.0313	-0.0598
	(0.102)	(0.0951)	(0.109)	(0.0754)	(0.151)	(0.105)	(0.136)	(0.0828)	(0.125)	(0.0700)	(0.102)	(0.0882)
$\ln(AfT\_TPR_{jt-1})$	0.0231	0.0268*	0.0141	0.0112	0.0149	0.0333***	-0.000469	0.00623	0.00422	0.0365***	-0.00414	0.00697
	(0.0145)	(0.0138)	(0.0110)	(0.0108)	(0.0138)	(0.0129)	(0.0115)	(0.00912)	(0.0139)	(0.0141)	(0.0127)	(0.00936)
$NAfT\_TPR_{jt-1}$	-0.0501	0.0350	0.000756	-0.0356	-0.0358	0.0158	-0.0624	0.00727	-0.0168	0.0377	0.0494	-0.0255
	(0.0381)	(0.0469)	(0.0303)	(0.0322)	(0.0373)	(0.0515)	(0.0802)	(0.0316)	(0.0319)	(0.0413)	(0.0353)	(0.0295)
Constant	-4.576	12.62*	-6.405	-16.14***	-5.369	10.57	-2.634	-18.10***	0.0757	8.840	2.987	-17.39***
	(7.797)	(6.592)	(7.693)	(5.515)	(8.002)	(7.287)	(7.998)	(5.619)	(7.836)	(8.241)	(7.717)	(5.664)
N	1,421	1,053	1,421	1,051	1,318	1,004	1,318	1,002	1,209	943	1,209	941
r2	0.981	0.990	0.974	0.992	0.982	0.990	0.974	0.993	0.984	0.991	0.975	0.993

Note: Standard errors, clustered by AfT-recipient*year, reported in parentheses. Levels of significance: * (10%), ** (5%), *** (1%). All estimations include recipient and year fixed effects. All estimations include control variables, output unreported.

Table 5: Impact of services AfT by sector on aggregate trade (OLS)

	AfT variables lagged one time period				AfT variables lagged two time periods				AfT variables lagged three time periods			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	$\ln(X^S)$	$\ln(X^G)$	$\ln(M^S)$	$\ln(M^G)$	$\ln(X^S)$	$\ln(X^G)$	$\ln(M^S)$	$\ln(M^G)$	$\ln(X^S)$	$\ln(X^G)$	$\ln(M^S)$	$\ln(M^G)$
$\ln(AfT\_Transport_{jt-1})$	-0.00388	0.00673	0.00178	0.00398	-0.00855	-0.0160*	-0.0134	-0.00501	-0.0118	-0.0197**	-0.0221***	-0.0116*
	(0.00896)	(0.00853)	(0.00921)	(0.00628)	(0.00882)	(0.00825)	(0.00976)	(0.00628)	(0.00967)	(0.00882)	(0.00815)	(0.00653)
$\ln(AfT\_Communications_{jt-1})$	-0.0128	0.00658	0.0177	0.0180*	0.00302	0.0198	0.0281**	0.0129	0.0186	0.0148	0.0130	-0.00485
	(0.0140)	(0.0127)	(0.0123)	(0.00955)	(0.0151)	(0.0130)	(0.0117)	(0.00914)	(0.0175)	(0.0133)	(0.0120)	(0.00863)
$\ln(AfT\_Financial_{jt-1})$	0.0121	0.0150*	0.0137*	-0.00278	0.00773	0.00662	0.00564	-0.00482	0.00407	0.00855	-0.00335	0.00644
	(0.00981)	(0.00859)	(0.00809)	(0.00626)	(0.00965)	(0.00892)	(0.00751)	(0.00642)	(0.00955)	(0.00930)	(0.00817)	(0.00651)
$\ln(AfT\_Energy_{jt-1})$	0.0122	-0.00389	-0.00342	-0.000350	0.00711	0.00301	-0.00938	-0.000720	-0.00266	-0.00378	-0.0143*	-0.00766
	(0.00872)	(0.00826)	(0.00724)	(0.00583)	(0.00954)	(0.00942)	(0.00851)	(0.00626)	(0.0102)	(0.0101)	(0.00822)	(0.00625)
$\ln(AfT\_OBS_{jt-1})$	-0.0114	0.00119	0.00133	0.0105	0.00903	0.00194	0.00717	-0.00484	0.0402***	0.0229	0.0305***	0.0115
	(0.0161)	(0.0134)	(0.0114)	(0.00942)	(0.0127)	(0.0145)	(0.0109)	(0.00902)	(0.0132)	(0.0168)	(0.0117)	(0.00974)
$\ln(AfT\_Travel_{jt-1})$	-0.0186	0.00942	0.0145	0.0188	-0.00455	0.0296	0.0301	0.0400***	-0.00774	0.0368	0.00598	0.0297*
	(0.0182)	(0.0199)	(0.0159)	(0.0123)	(0.0189)	(0.0206)	(0.0186)	(0.0133)	(0.0186)	(0.0239)	(0.0236)	(0.0156)
$\ln(AfT\_CRS_{jt-1})$	0.000822	0.00951	0.0117	0.0511***	-0.0109	0.0181	0.0333	0.0451***	0.0115	0.0371*	0.0387	0.0402*
	(0.0279)	(0.0201)	(0.0212)	(0.0174)	(0.0251)	(0.0223)	(0.0261)	(0.0162)	(0.0248)	(0.0219)	(0.0306)	(0.0218)
Constant	-9.165	13.28**	-8.538	-15.44***	-4.726	9.040	-3.021	-19.04***	4.351	10.27	7.410	-17.21***
	(7.892)	(6.757)	(7.660)	(5.763)	(8.205)	(7.360)	(7.912)	(5.862)	(8.324)	(8.519)	(7.817)	(6.083)
N	1,421	1,053	1,421	1,051	1,318	1,004	1,318	1,002	1,209	943	1,209	941
r2	0.981	0.990	0.975	0.992	0.982	0.990	0.975	0.993	0.984	0.991	0.975	0.993

Note: Standard errors, clustered by AfT-recipient*year, reported in parentheses. Levels of significance: * (10%), ** (5%), *** (1%). All estimations include recipient and year fixed effects. OBS = Other business bervices; CRS = Computer-related services. All estimations include control and NAfT variables, output unreported.

Table 6: Impact of bilateral AfT on bilateral trade in goods and services (PPML estimates)

	(1) X^S_{ijt}	(2) M^S_{ijt}	(3) X^G_{ijt}	(4) M^G_{ijt}	(5) X^S_{ijt}	(6) M^S_{ijt}	(7) X^G_{ijt}	(8) M^G_{ijt}	(9) X^S_{ijt}	(10) M^S_{ijt}	(11) X^G_{ijt}	(12) M^G_{ijt}
$\ln(AfT_{ijt-1})$	-0.0385**	-0.00946	-0.0125***	0.0290***								
	(0.0152)	(0.0162)	(0.00476)	(0.00589)								
$\ln(Non\_AfT_{ijt-1})$	-0.0320	-0.0357**	-0.00611	-0.00855								
	(0.0235)	(0.0173)	(0.00616)	(0.00954)								
$\ln(AfT\_Ser_{ijt-1})$					-0.0443***	-0.00828	-0.0102**	0.0281***				
					(0.0155)	(0.0156)	(0.00396)	(0.00516)				
$\ln(AfT\_Non\_Ser_{ijt-1})$					0.0137	0.0223	-5.58e-05	-0.00803				
					(0.0199)	(0.0222)	(0.00706)	(0.00748)				
$\ln(AfT\_EI_{ijt-1})$									-0.0334*	-0.0481***	-0.0143***	0.0272***
									(0.0173)	(0.0171)	(0.00445)	(0.00618)
$\ln(AfT\_PCB\_Ser_{ijt-1})$									-0.0199	0.0297*	-0.000535	0.0115**
									(0.0189)	(0.0166)	(0.00522)	(0.00575)
$\ln(AfT\_PCB\_Non\_Ser_{ijt-1})$									0.0123	0.00787	-0.00119	-0.00847
									(0.0195)	(0.0214)	(0.00723)	(0.00804)
$\ln(AfT\_TPR_{ijt-1})$									0.0370	-0.0167	0.0214	0.0471*
									(0.0493)	(0.0546)	(0.0145)	(0.0270)
PTA_{ijt}	0.0865	-0.0158	0.144***	0.0185	0.109	-0.0232	0.148***	0.0231	0.105	-0.0196	0.145***	0.0209
	(0.0733)	(0.0789)	(0.0298)	(0.0723)	(0.0724)	(0.0768)	(0.0296)	(0.0736)	(0.0719)	(0.0795)	(0.0301)	(0.0727)
Observations	12,146	16,169	17,538	13,778	12,146	16,169	17,538	13,778	12,146	16,169	17,538	13,778
r2	0.966	0.971	0.999	0.999	0.966	0.970	0.999	0.999	0.966	0.971	0.999	0.999
Fixed effects	it, jt, ij	it, jt, ij	it, jt, ij	it, jt, ij	it, jt, ij	it, jt, ij	it, jt, ij	it, jt, ij	it, jt, ij	it, jt, ij	it, jt, ij	it, jt, ij

Note: Standard errors, clustered by AfT-donor*recipient*year, reported in parentheses. Levels of significance: * (10%), ** (5%), *** (1%). All estimations include time-varying donor and recipient, and bilateral, fixed effects. All estimations include NAfT variables, output unreported.

Annex Table A1: Full sample of AfT recipients (aggregate analysis)

Afghanistan Albania Algeria Angola Anguilla Antigua and Barbuda Argentina Armenia Azerbaijan Bahrain Bangladesh Barbados Belarus Belize Benin Bhutan Bolivia Bosnia and Herzegovina Botswana Brazil Burkina Faso Burundi Cabo Verde Cambodia Cameroon Central African Republic Chad Chile China Colombia Comoros Congo, Dem. Rep. Congo, Rep. Costa Rica Côte d'Ivoire Croatia Cuba Djibouti Dominica Dominican Republic Ecuador Egypt, Arab Rep. El Salvador Equatorial Guinea Ethiopia Fiji Gabon Gambia, The Georgia Ghana Grenada Guatemala Guinea Guinea-Bissau Guyana Haiti Honduras India Indonesia Iran Iraq Jamaica Jordan Kazakhstan Kenya Kiribati Kyrgyzstan Laos Lebanon Lesotho Liberia Libya Macedonia Madagascar Malawi Malaysia Maldives Mali Malta Marshall Islands Mauritania Mauritius Mexico Micronesia Moldova Mongolia Montenegro Montserrat Morocco Mozambique Myanmar Namibia Nepal Nicaragua Niger Nigeria Oman Pakistan Palestine Panama Papua New Guinea Paraguay Peru Philippines Rwanda Samoa Sao Tome and Principe Saudi Arabia Senegal Serbia Seychelles Sierra Leone Slovenia Solomon Islands South Africa Sri Lanka St. Helena St. Kitts and Nevis St. Lucia St. Vincent and the Grenadines Sudan Suriname Swaziland Syria Tajikistan Tanzania Thailand Timor-Leste Togo Tonga Trinidad and Tobago Tunisia Turkey Tuvalu Uganda Ukraine Uruguay Uzbekistan Vanuatu Venezuela Vietnam Yemen Zambia Zimbabwe

Annex Table A2: Full sample of donor and recipients (bilateral analysis)

Donor: Australia Austria Belgium Canada Czech Republic Denmark Finland France Germany Greece Iceland Ireland Italy Japan Luxembourg Netherlands New Zealand Norway Poland Portugal Slovak Republic Slovenia South Korea Spain Sweden Switzerland United Kingdom United States

Recipient: Afghanistan Albania Algeria Angola Anguilla Antigua and Barbuda Argentina Armenia Azerbaijan Bahrain Bangladesh Barbados Belarus Belize Benin Bhutan Bolivia Bosnia and Herzegovina Botswana Brazil Burkina Faso Burundi Cabo Verde Cambodia Cameroon Central African Republic Chad Chile China Colombia Comoros Congo Cook Islands Costa Rica Croatia Cuba Côte d'Ivoire Democratic Republic of the Congo Djibouti Dominica Dominican Republic Ecuador Egypt El Salvador Equatorial Guinea Eritrea Ethiopia Fiji Gabon Gambia Georgia Ghana Grenada Guatemala Guinea Guinea-Bissau Guyana Haiti Honduras India Indonesia Iran Iraq Jamaica Jordan Kazakhstan Kenya Kiribati Kyrgyzstan Laos Lebanon Lesotho Liberia Libya Macedonia Madagascar Malawi Malaysia Maldives Mali Malta Marshall Islands Mauritania Mauritius Mayotte Mexico Micronesia Moldova Mongolia Montenegro Montserrat Morocco Mozambique Myanmar Namibia Nauru Nepal Nicaragua Niger Nigeria Niue North Korea Oman Pakistan Palau Panama Papua New Guinea Paraguay Peru Philippines Rwanda Samoa Sao Tome and Principe Saudi Arabia Senegal Serbia Seychelles Sierra Leone Solomon Islands Somalia South Africa Sri Lanka St. Helena St. Kitts and Nevis St. Lucia St. Vincent and the Grenadines Sudan Suriname Swaziland Syria Tajikistan Tanzania Thailand Timor-Leste Togo Tokelau Tonga Trinidad and Tobago Tunisia Turkey Turkmenistan Turks and Caicos Islands Tuvalu Uganda Ukraine United Arab Emirates Uruguay Uzbekistan Vanuatu Venezuela Vietnam Wallis and Futuna West Bank and Gaza Yemen Yugoslavia Zambia Zimbabwe

Annex Table B1: Summary statistics (aggregate data)

	Aggregate exports of recipient					Aggregate imports of recipient				
Variable	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
AID ($ mn)										
Total	2,119	661.0897	1148.972	0.095669	21747.91	2,119	661.0897	1148.972	0.095669	21747.91
Transportation	1,952	55.56358	126.9979	-1.688756	1621.018	1,952	55.56358	126.9979	-1.688756	1621.018
Travel	1,494	0.9422122	3.513761	-0.019474	79.24411	1,494	0.9422122	3.513761	-0.019474	79.24411
Communications	1,819	2.438257	12.4537	-8.747788	360.1552	1,819	2.438257	12.4537	-8.747788	360.1552
Comptuter-related	1,127	1.038337	2.430153	-1.5	31.6613	1,127	1.038337	2.430153	-1.5	31.6613
Energy	1,854	39.36329	103.1598	-5.792794	1475.002	1,854	39.36329	103.1598	-5.792794	1475.002
Financial	1,756	17.17677	76.48937	-2.047174	1738.172	1,756	17.17677	76.48937	-2.047174	1738.172
Business	1,798	7.491399	22.97945	-2.136141	480.6981	1,798	7.491399	22.97945	-2.136141	480.6981
Agriculture	1,981	28.06268	50.72854	0.00014	571.6846	1,981	28.06268	50.72854	0.00014	571.6846
Forestry	1,438	4.421154	14.31882	-0.413632	208.996	1,438	4.421154	14.31882	-0.413632	208.996
Fishing	1,541	1.765939	3.9492	-6.0254	78.73472	1,541	1.765939	3.9492	-6.0254	78.73472
Industry	1,849	8.391316	24.36596	-0.347324	470.8252	1,849	8.391316	24.36596	-0.347324	470.8252
Mining	1,157	6.099436	43.11883	-4.627965	957.3649	1,157	6.099436	43.11883	-4.627965	957.3649
Construction	671	0.7427091	3.262765	-1.268064	50.25599	671	0.7427091	3.262765	-1.268064	50.25599
AfT_EI	2,070	90.35993	207.3331	-0.00377	2422.776	2,070	90.35993	207.3331	-0.00377	2422.776
AfT_PCB	2,102	63.16919	133.8926	0.003527	2164.208	2,102	63.16919	133.8926	0.003527	2164.208
AfT_PCB_Services	1,997	22.55363	78.28466	-2.13614	1754.119	1,997	22.55363	78.28466	-2.13614	1754.119
AfT_PCB_Non-Services	2,082	42.14315	79.21089	0.003527	1065.419	2,082	42.14315	79.21089	0.003527	1065.419
AfT_TPR	1,766	3.440087	11.81081	-0.066788	328.35	1,766	3.440087	11.81081	-0.066788	328.35
Total AfT	2,112	154.3096	321.6611	0.003449	3162.586	2,112	154.3096	321.6611	0.003449	3162.586
Total Non_AfT	2,119	507.2899	936.3704	0.05005	19117.66	2,119	507.2899	936.3704	0.05005	19117.66
AfT_Services	2,091	110.9922	256.5237	-2.13614	2751.688	2,091	110.9922	256.5237	-2.13614	2751.688
AfT_Non-Services	2,084	45.01787	82.40597	0.003527	1072.222	2,084	45.01787	82.40597	0.003527	1072.222
TRADE ($ mn)										
Total services	1,852	4680	15500	0.05089	211000	1,852	5710	19600	0.02	383000
Transportation	1,723	973	2980	0.011828	38900	1,738	1880	5880	0.01	96200
Travel	1,736	1870	5000	0.057	56900	1,715	1430	6730	0.01	165000
Communications	1,291	133	254	0.009475	2480	1,278	95	236	-3.81	3130
Financial	1,052	136	563	-1.2	6380	1,192	157	580	-10.00	8300
Comptuter-related	983	753	5510	-0.062	72600	1,167	149	615	-4.80	10700
Business	1,476	1030	4910	-38.8	68900	1,580	1220	4280	-110.00	53400
Total goods	1,325	40600	165000	0.002344	2340000	1,329	37500	133000	28.70	1810000
CONTROLS										
Population (mn)	1,811	40	153	0	1360	1,811	40	153	0.010	1360
FDI ($ mn)	2,052	3400	17100	-7120	291000	2,052	3400	17100	-7120	291000
CPI	1,649	93.01479	30.58031	15.34757	730.0414	1,649	93.01479	30.58031	15.34757	730.0414
REER	773	99.20476	30.4206	52.15331	827.1733	773	99.20476	30.4206	52.15331	827.1733
Government effectiveness	1,819	-0.413602	0.65701	-2.24773	1.59649	1,819	-0.413602	0.65701	-2.24773	1.59649
Market penetration (mn)	1,822	4210	4240	0	32600	1,822	4210	4240	0	32600

Annex Table B2: Summary statistics (bilateral data)

	Donor exports to recipient					Donor imports from recipient				
Variable	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
AID ($ mn)										
Total	35,299	25.4548	127.927	-17.7363	11227.6	32,019	22.57288	116.1134	-17.7363	11227.6
Transportation	5,684	10.82422	52.16562	-21.3097	1051.07	3,989	6.427511	26.69096	-21.3097	668.412
Travel	3,060	0.312404	2.294057	-0.110701	79.0875	2,004	0.2837553	1.414397	-0.110701	33.7382
Communications	5,726	0.553905	3.255528	-8.83258	151.276	3,744	0.4003043	3.117038	-8.83258	151.276
Comptuter-related	2,120	0.3508618	1.259159	-1.83185	31.0732	1,483	0.2241202	1.03953	-1.83185	31.0732
Energy	6,962	6.350533	36.12228	-12.1588	1430.59	5,496	5.139097	34.05949	-12.1588	1430.59
Financial	6,866	2.048732	13.28517	-2.15226	580.573	5,860	2.331796	14.34413	-2.15226	580.573
Business	6,801	1.428806	9.696149	-2.1622	465.098	5,626	1.681148	10.6419	-2.1622	465.098
Agriculture	13,635	2.422132	9.170346	-0.69195	412.325	11,509	2.301185	9.119794	-0.69195	412.325
Forestry	3,769	1.181829	6.181429	-1.51446	115.837	2,890	0.7321174	1.834566	-1.51446	46.4477
Fishing	3,452	0.6221891	2.214204	-0.635998	69.9486	2,129	0.4855408	1.870697	-0.635998	63.8364
Industry	8,073	1.028852	5.584271	-1.636	253.643	6,347	0.8726493	4.123489	-1.636	253.643
Mining	1,838	2.026778	25.46458	-0.03475	631.73	1,209	2.518727	30.35517	-0.03475	631.73
Construction	816	0.3568214	1.755665	-1.28931	32.0192	637	0.4124695	1.968253	-1.28931	32.0192
AfT_TPR	4,898	0.7455007	6.216411	-4.13743	328.344	3,204	1.030974	7.641905	-4.13743	328.344
AfT_EI	11,700	9.308454	56.78821	-21.3097	1845.469	9,220	6.006785	39.0481	-21.3097	1845.469
AfT_PCB_Services	11,308	2.187819	13.22339	-3.92862	581.1441	9,626	2.461158	14.24902	-3.92862	581.1441
AfT_PCB_Non-Services	16,653	3.11957	14.90426	-2.045531	685.382	14,122	2.724859	13.62819	-2.045531	685.382
AfT_Services	15,964	8.371885	52.57808	-19.85748	2028.847	13,350	5.923121	38.88003	-19.85748	2028.847
AfT_PCB	19,000	4.036318	19.42683	-3.785272	868.76	16,426	3.784949	19.19116	-3.785272	868.76
Total AfT	20,913	9.049415	56.54675	-19.85748	2714.245	17,993	6.716911	43.76349	-19.85748	2714.245
Total Non_AfT	34,787	20.38919	101.3123	-17.74124	8669.558	31,587	19.05543	93.52496	-17.74124	8669.558
AfT_Non-Services	17,222	3.228525	15.3047	-4.13743	685.398	14,589	2.864055	14.17532	-4.13743	685.398
TRADE ($ mn)										
Total services	18,156	105.1113	555.2308	0	16167.8	20,227	142.4665	749.8923	0	23852.4
Total goods	18,156	493.304	3910.846	0	131602	20,227	499.5071	5739.417	0	252844
CONTROLS										
PTA membership (goods)	18,156	0.130315	0.336659	0	1	20,227	0.1345232	0.341222	0	1
PTA membership (services)	18,156	0.0479731	0.2137153	0	1	20,227	0.0514164	0.2208511	0	1