www.elsevier.com/locate/worlddev

World Development Vol. 84, pp. 206–218, 2016

http://dx.doi.org/10.1016/j.worlddev.2016.03.010

Aid for Trade and Greenfield Investment

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Summary. — The Aid for Trade (AfT) Initiative was launched in 2005 at the Hong Kong Ministerial Conference where high-income countries pledged to increase their AfT contributions to developing countries. AfT, comprised almost entirely of aid for trade-related infrastructure and building productive capacity, would promote growth by easing supply-side constraints and improving transportation, energy, and communication infrastructure. By lowering costs of operating in recipient countries, AfT may increase both trade and investment. Most research on the effects of AfT on international transactions focuses on trade. The sparse research on investment investigates aid and net foreign direct investment flows based on the international balance of payments. We contribute to the literature by assessing AfT effects on new greenfield investment.

Using bilateral data for 25 donor and 120 recipient countries for the period 2003–13, we find that bilateral AfT promotes greenfield investment. Our preferred specification includes bilateral and country-time fixed effects and employs the Poisson Pseudo-Maximum Likelihood (PPML) estimator. Robust effects emerge between the top five donors and more developed recipient countries, cases where aid flows are large. Thus, we see evidence that a critical level of aid is required to encourage greenfield investment. Both aid for infrastructure (particularly, transportation and energy) and building productive capacity are found to exert strong effects. To the extent that greenfield investment creates jobs and generates technology transfer, it appears that AfT is accomplishing its development objectives, at least with regard to the more advanced recipient countries.

Key words — Aid for Trade, greenfield investment

1. INTRODUCTION

Recognizing the importance of international trade as a valuable tool for facilitating economic growth and social development in developing countries, the World Trade Organization (WTO) member countries launched the Aid for Trade (AfT) Initiative at the Hong Kong Ministerial Conference in December 2005. AfT is comprised almost entirely of aid for trade-related infrastructure and building productive capacity. High-income member countries pledged to increase their AfT contributions for developing countries, particularly for least developed countries (LDCs), which were suffering from supply-side constraints and poor infrastructure. While the focus of AfT has been on its trade impact, it is likely to influence foreign investment as well. In this paper, we advance the understanding of the economic impact of AfT by considering its effects on new international investment in the form of greenfield projects.

We compile bilateral data for 25 donor and 120 recipient countries for the period 2003–13 in order to investigate the relationship between aid and international investment. We estimate the effects of bilateral AfT on counts and values of bilateral greenfield investment. Our specifications include both bilateral and time-varying country fixed effects. We estimate the relationship by applying the Poisson Pseudo-Maximum Likelihood (PPML) estimator. We find robust evidence that bilateral AfT increases bilateral greenfield investment. A falsification exercise provides only limited support for the proposition that causality runs in the other direction—investment causes additional aid.

The AfT Initiative marked the culmination of many years of great effort by multilateral agencies such as the United Nations, the WTO, and the Organization for Economic Cooperation and Development (OECD). A WTO task force identified AfT as comprising four categories: (1) technical assistance for trade policy and regulations; (2) trade-related infrastructure (transportation, communications, and energy); (3) productive capacity building (assistance for agriculture, manufacturing, trade development, banking, etc.); and (4) trade-related adjustment. Donor countries agreed to increase these types of aid. AfT is a subcomponent of Official Development Assistance (ODA) and is reported in the OECD's Creditor Reporting System (CRS).

AfT is expected to increase trade, thereby giving developing and least developed countries better access to foreign markets and goods. Another avenue through which AfT may promote economic development is foreign direct investment (FDI). There are a number of ways AfT promotes FDI. Aid targeted to improve infrastructure such as transportation, energy, and information technologies makes a recipient country more attractive to investors. It lowers the costs of selling to host-country consumers and of establishing export platforms or other links in the global production chain. Aid to develop productive capacity may be complementary to MNE investment. For example, aid for agricultural research may encourage investment in downstream food processing. The World Bank (2011) argues that aid may promote investment, stating "An important dimension of AfT support spans measures to make countries more attractive to foreign direct investment (FDI)" (page 13).

If AfT does promote investment in developing countries, there may indeed be a number of benefits to those countries. It is well established that multinationals are more productive and pay higher wages than domestic firms (Doms & Jensen,

* We thank three anonymous referees, seminar participants at the University of British Columbia, the University of Oregon, the University of Alberta, Korea University, and Okayama University for helpful comments. An earlier version of this paper was written while Lee was a visiting professor at Sauder School of Business, University of British Columbia. Final revision accepted: March 3, 2016.

1998; Huttunen, 2007). Many studies indicate that FDI provides increased productivity of domestic firms (important papers include Javorcik, 2004 and Haskel, Pereira, & Slaughter, 2007). Finally, Faber, Atkin, and Navarro (2015) find that multinational retail investment in Mexico has generated significant welfare increases, largely due to lower prices.

Most research on the effects of aid on international transactions has focused on trade. The earliest published gravity-based empirical work on aid and trade is Wagner (2003), who finds that aid increased donor exports to recipient countries during the period 1970–90. More recent work considers the effects of AfT and its components on trade.[1] Cali and te Velde (2011) study country-level exports for 99 countries over the period 2002–07 and find that aid for "economic infrastructure" is associated with greater recipient-country exports (aid for "productive capacity" has no significant effect on exports). Vijil and Wagner (2012) use a cross section of 88 countries to also compile evidence that infrastructure AfT promotes trade. Helble, Mann, and Wilson (2012) consider bilateral trade for the period 1990–05 in a gravity framework and find that total AfT (the sum of aid across all donors) increased both recipient exports and imports. Ferro, Portugal-Perez, and Wilson (2014) show that service sector aid promotes downstream manufacturing exports. Linking input–output information to trade and aid data for 132 countries over the period 2002–08, they find that the interaction between service aid and service input intensity of a manufacturing sector enters positively in regression specifications that control for country-year, country-sector, and sector-year fixed effects.[2]

There exists much less research on aid and foreign direct investment. Harms and Lutz (2006) find that the overall effect of foreign aid on the sum of foreign direct and portfolio equity investment was close to zero during the 1990s and, surprisingly, the effect was significantly positive for countries in which foreign investors faced a substantial regulatory burden. Selaya and Sunesen (2012) consider flows of FDI to 99 countries using data averaged over five-year intervals during the period 1970–2001. Their dependent variable is FDI inflows per capita and aid variables are also normalized by population. Their preferred estimation methods are different forms of the Generalized Method of Moments (GMM). They find that aid for social and economic infrastructure is "complementary" in that it is associated with more FDI, while aid for productive capacity deters investment.[3] Bhavan, Xu, and Zhong (2011) employ a similar framework to Selaya and Sunesen but limit their analysis to Bangladesh, Pakistan, India, and Sri Lanka. They claim that infrastructure aid promotes FDI but the negative squared term appears to dominate the direct (unsquared) aid term, indicating a negative relationship. Donabauer, Meyer, and Nunnenkamp (2014) consider multilateral FDI flows scaled by GDP as the dependent variable to assess the influence of aid and an index of physical infrastructure. To account for dependencies between three structural equations on the allocation of sector-specific aid, the determinants of infrastructure, and the determinants of FDI, they employ 3SLS and find strong evidence that aid for infrastructure had a strong direct effect on FDI during the period 1990–2010.

Other papers use bilateral data to investigate the relationship of aid and foreign investment for specific donor countries. Kimura and Todo (2009) use system GMM to evaluate the relationship between FDI and aid by considering five donor countries and 98 recipient countries over the period 1990–2002. Their dependent variable is the log of bilateral FDI and they evaluate aggregate and bilateral aid, sometimes split between "infrastructure" and "non-infrastructure".[4] The effects of aid on FDI are always insignificant, aside from a marginally significant positive impact of Japanese infrastructure aid on Japanese investment in recipient countries, which they term a "vanguard effect". Kang, Lee, and Park (2011) extend Kimura and Todo to show that among seven donor countries, Korea joins Japan as the only countries where aid seems to promote bilateral FDI based on 1980–2003 data.

We contribute to the literature on aid and foreign investment in a number of dimensions. First, unlike other studies on aid and FDI, we employ greenfield FDI data recently available from fDi Intelligence. Most studies use net FDI flows based on the international balance of payments (BoP). These data include cross-border equity flows as well as changes in retained earnings. FDI flows may imperfectly reflect new greenfield investment (and job creation) for two reasons. First, capital financing new plants may partly be raised in the host market (see Marin & Schnitzer, 2011). Second, retained earnings can be directed into government bonds or other passive investments. In addition, in specifications that use the log of FDI inflows such as Kimura and Todo (2009), the treatment of negative and zero or missing FDI flows poses a challenge for estimation. Counts and values of new greenfield investment do not contain negative values. In contrast to Selaya and Sunesen (2012), who use a semi-log specification (FDI flows scaled by population and logged right-hand-side variables), we handle zeros with the Poisson Pseudo-Maximum Likelihood (PPML) estimator proposed by Santos Silva and Tenreyro (2006). We also employ a larger sample of countries and investigate the subcategories of AfT in greater detail. Finally, our period of study, 2003–13, corresponds to an increase in AfT due to commitments under the AfT Initiative.

The next section briefly describes the AfT and greenfield data used in our study. We identify the empirical specifications in Section 3. The empirical results are presented in Section 4 along with their interpretations. The concluding section summarizes the results and discusses their implications.

2. DATA

(a) *Aid for Trade*

The OECD manages the CRS that contains flows of ODA. Flows are recorded as aid commitments and disbursements. We employ data on disbursements because commitments are not always fulfilled and there may be long lags before the funds are disbursed.[5] The OECD identifies Aid for Trade as comprising the following categories and asks donors to specify the aid falling under each category:[6]

(1) Trade-related infrastructure (INF): transport and storage (210), communications (220), and energy generation and supply (230).
(2) Building productive capacity (BPC): banking and financial services (240), business and other services (250), agriculture (311), forestry (312), fishing (313), industry (321), mineral resources and mining (322), and tourism (332).
(3) Trade policy regulations and trade-related adjustment (TPR): trade policies and regulations (331).

For our sample of 25 donors and 120 recipients for the period 2003–13,[7] the annual average of total disbursements of ODA and AfT was US$50.7 billion and US$11.1 billion, respectively. Figure 1 shows the trends of ODA, AfT, and aid other than AfT (non-AfT) for our sample. We observe a steady increase in AfT over the period. Overall ODA dips in 2007, reflecting a decrease in non-AfT. Figure 2 displays

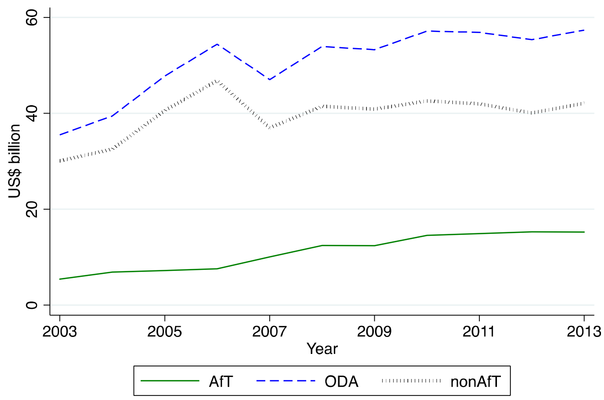

Figure 1. *ODA and AfT. Authors' calculations using the sample of 25 donors and 120 recipients included in the regression analyses.*

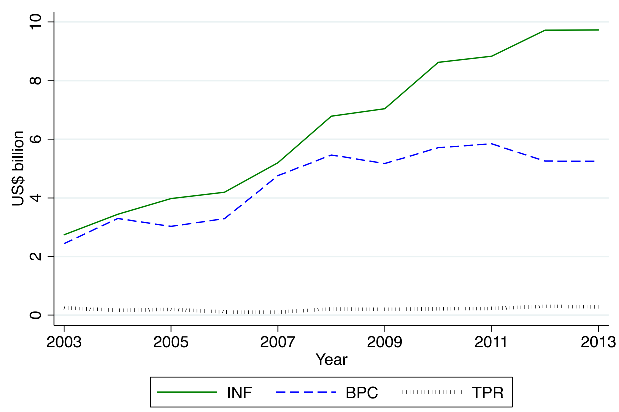

Figure 2. *AfT by Type. Authors' calculations using the sample of 25 donors and 120 recipients included in the regression analyses. INF: trade-related infrastructure; BPC: building productive capacity; TPR: trade policy regulations and trade-related adjustment.*

trends for the three main AfT subcomponents: trade-related infrastructure (INF), building productive capacity (BPC), and trade policy regulations and trade-related adjustment (TPR). The largest component is infrastructure which increases rapidly over the period. Aid for building productive capacity increases until 2008 and then remains roughly constant. Aid for trade policy is relatively very small and fairly constant. The figures suggest that the AfT Initiative (2005) did generate more AfT, particularly that targeted to infrastructure. There is no clear evidence that it substituted away from non-AfT.

Figure 3 shows average annual ODA and AfT for the top 10 donor countries (statistics for all 25 donors are presented in Appendix Table 11). The annual AfT contributions of Japan and the US were US$4.4 billion and US$1.5 billion, respectively. The top five sources of AfT (Japan, US, Germany, France, and UK) account for 78% of the amount contributed by the top 25 donors (with Japan alone accounting for 40% of the total). Japan and the US were also the largest sources of overall ODA (both with an annual average of about US$11 billion). Overall, we observe that development assistance is highly concentrated across donors.

The ODA and AfT of the top 10 recipient countries are shown in Figure 4. India is the largest recipient with average annual disbursements over the 2003–13 period of AfT of US

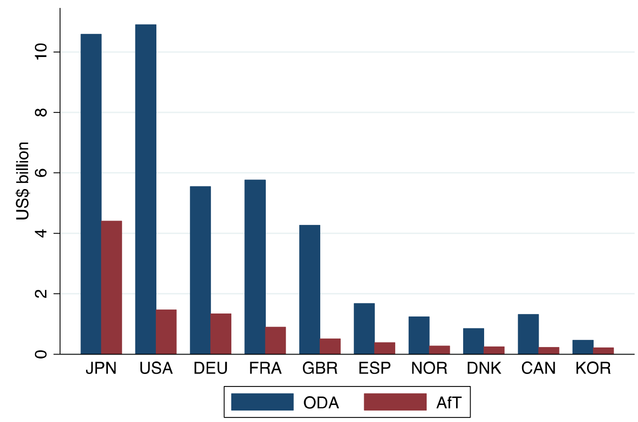

Figure 3. *Aid by donor, annual average 2003–13.*

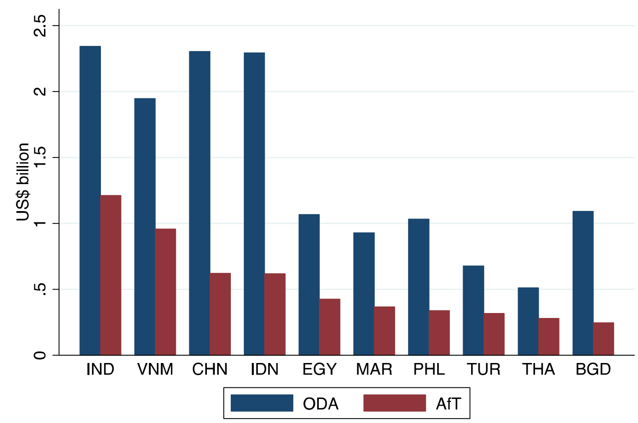

Figure 4. *Aid by recipient, 2003–13 annual average. Authors' calculations.*

$1.2 billion, followed by Vietnam, China, and Indonesia, each of which received more than $600 million annually. We note that none of the top nine recipients are least developed countries. While the aspiration might have been to target these countries, in practice they did not receive large amounts of AfT. The disbursement of AfT is less widely spread than that of overall ODA: the top 25 recipients account for 71% of AfT, while they account for 54% of ODA (statistics for the top 25 recipients are presented in Appendix Table 13).

LDCs tended to receive more multilateral aid than bilateral aid: for example, share of bilateral AfT of total AfT was 40.4% for the top five LDC recipients of AfT—Bangladesh, Tanzania, Kenya, Nepal, and Uganda. Large recipients of bilateral AfT have relatively high bilateral AfT shares: India 75%, Vietnam 61%, China 96%, and Indonesia 82%.

(b) *Greenfield investment*

We acquired data on the counts and values of bilateral greenfield investments from fDi Intelligence (Financial Times Ltd.).[8] Figure 5 uses bars to show the average 2003–13 counts of greenfield investment (measured on the left scale) and dots to represent their values (right scale). It reveals that the "Big 5" aid donors—Japan, the US, Germany, France, and UK—are also the largest investors of greenfield investment, accounting for 69% and 63%, respectively, of the number and value of donor countries' greenfield investment in the 120 recipient countries. While Japan was the largest donor

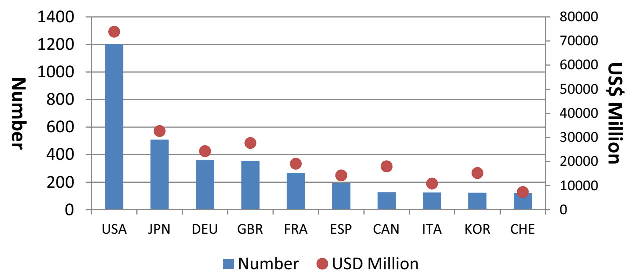

Figure 5. *Greenfield investment of top donors. Authors' calculations.*

of AfT with the US number two, they switch places with regard to greenfield investment. US firms averaged about 1,200 greenfield investments over the period worth about \$74 billion.

Figure 6 shows that China, India, Brazil, and Mexico received the most greenfield investment in terms of both counts and values. China was the top destination, receiving an annual average of 1,100 investments worth \$74 billion. Vietnam was the second largest AfT recipient but only the 6th largest destination of greenfield investment, significantly lower than China and India.

3. EMPIRICAL SPECIFICATION

The theoretical models derive a gravity equation for a variety of international transaction flows. The best known papers generating gravity equations for trade are Anderson and van Wincoop (2003), Eaton and Kortum (2002), and Chaney (2008), but antecedents go back to Anderson (1979). Head and Ries (2008) derive a gravity model for FDI based on the idea of an international market for corporate control.

Most theoretical formulations of the gravity equation specify Y_{ijt}, flows of transactions from origin i to destination j, as the product of country and bilateral-specific terms:

$$Y_{ijt} = a_t M_{it} M_{jt} \phi_{ijt}$$

In our application, Y_{ijt} is either the number or value of greenfield investment. M_{it} and M_{jt} measure the attributes of origin i and destination j at a specific point in time and a_t is a common time-specific factor. Variation in bilateral trade enters through ϕ_{ijt} and its log is typically expressed as a linear combination of time-varying and non-time-varying factors that affect trade costs between i and j plus an error term: $\ln(\phi_{ijt}) = \delta D_{ijt} + u_{ijt}$.

The traditional approach to estimation is to take logs and estimate

$$\ln Y_{ijt} = \ln a_t + \ln M_{it} + \ln M_{jt} + \delta D_{ijt} + u_{ijt} \quad (1)$$

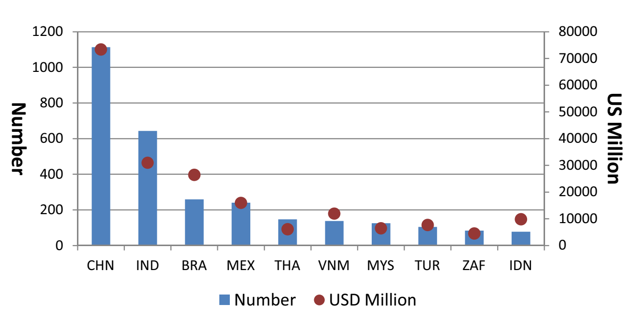

Figure 6. *Greenfield investment of top recipients. Authors' calculations.*

A problem with this approach is that many pairs of countries with zero-reported flows of cross-border investment may indicate that fixed costs exceed expected variable profits (Razin, Rubinstein, & Sadka, 2004, and Davis & Kristjánsdóttir, 2010). Santos Silva and Tenreyro (2006) argue that estimating a log-linearized gravity equation by OLS results in bias based on the property that the expected value of the logarithm of a random variable is different from the logarithm of its expected value (i.e., $E[\ln(y)] \neq \ln E[y]$). The expected value of the log-linear error would often depend on the explanatory variables, and OLS would be inconsistent in the presence of heteroskedasticity, which is highly likely in practice.

The alternative to estimating Eqn. (1) is to re-express the relationship as

$$Y_{ijt} = \exp[\ln a_t + \ln M_{it} + \ln M_{jt} + \delta D_{ijt}]\eta_{ijt} \quad (2)$$

where $\eta_{ijt} = \exp[u_{ijt}]$. This formulation can be estimated using the Poisson Pseudo-Maximum Likelihood (PPML) estimator proposed by Santos Silva and Tenreyro (2006). Note that the PPML estimator estimates the gravity equation without taking the log of the dependent variable. One obvious advantage of utilizing PPML in our study is that the zero-valued observations are naturally included.[9]

Blonigen and Piger (2014) employ Bayesian model averaging to determine robust covariates in FDI gravity model specifications. Their results "suggest a fairly parsimonious FDI specification comprised of mainly gravity variables, cultural distance factors, parent-country per capita GDP, relative labour endowments and trade agreements." We will employ bilateral fixed effects that will capture non-time varying bilateral influences such as distance, common language, relative endowments, etc., and include variables capturing time varying regional trade agreements and bilateral investment treaties. We define country i as donor d and country j as recipient r and specify the bilateral term as

$$D_{drt} = \beta_1 \ln AID_{drt} + \beta_2 \ln AID_{\sim drt} + \beta_3 \ln RTA_{drt} + \beta_4 \ln BIT_{drt} + \theta\, PAIR_{dr} + u_{drt}$$

where $\ln AID_{drt}$ represents the natural logarithm of official aid disbursement from donor d to recipient r. $\ln AID_{\sim drt}$ represents the natural logarithm of aid to r from all donors *other than* from country d, which hereafter we refer to as third-party AfT. This includes not only aid from other country donors but also aid from multilateral donors. Thus, the specification captures not only the effects of bilateral aid on bilateral FDI but also the effects of aid provided by third-party donors on bilateral FDI. The other bilateral variables are dummy variables: RTA_{drt} and BIT_{drt} indicate whether both countries are members of a bilateral/regional trade arrangement or a bilateral investment treaty, respectively, and $PAIR_{dr}$ indicates a bilateral fixed effect between countries d and r. The latter captures non-time-varying influences on international transactions. More importantly, these variables control unobserved factors influencing both aid and international transactions. For example, a donor country is more likely to give more development aid to the countries with which it has a good relationship and close economic linkages. Therefore, we include bilateral fixed effects to mitigate omitted variable bias and endogeneity.

We specify the country-specific terms, M_{dt} and M_{rt}, in two ways. One specification is

$$M_{ht} = \gamma_{1h} \ln POP_{ht} + \gamma_{2h} \ln PCGDP_{ht} \quad \text{for} \quad h = \{d, r\}$$

where POP_{ht} and $PCGDP_{ht}$ are, respectively, the population and per capita GDP (PCGDP) of trading partner h (h = d,r). Since the bilateral fixed effects specified in D_{drt} implicitly define country-fixed effects, the effects of POP and PCGDP are identified from time series variation in these country characteristics.

Our preferred specification incorporates time-varying country-fixed effects that displace the population and per capita GDP variables. This specification is consistent with "structural" gravity models in that it incorporates multilateral resistance effects (as well as other time-varying country characteristics that influence international transactions).[10] The inclusion of time-varying country effects also precludes identification of β_2, the coefficient on the aid from third-party countries ($\ln AID_{\sim drt}$). This variable is calculated as the difference between total aid to a recipient country and the bilateral aid of the donor in question: $AID_{\sim drt} = AID_{total,rt} - AID_{drt}$. Since total aid in a given year to a recipient country is captured by the recipient-time fixed effect, the variation in $AID_{\sim drt}$ is solely attributable to variation in AID_{drt}, the bilateral variable already included in the specification. Thus, in specifications with country-time-fixed effects we omit $AID_{\sim drt}$.

We will consider different types of aid when specifying AID. Our primary focus is AfT, but for the sake of comparison, we will also consider non-AfT (e.g., aid for education and health), which may influence international transactions through the development of human capital. We will then define AID according to its primary subcomponents of AfT--infrastructure, building productive capacity, and trade policy regulations and trade-related adjustment. Aid for infrastructure is further divided into transportation, communication networks, and energy supply as classified in the CRS database, while aid for building productive capacity will be split into the service sector and the production sector.

There are many observations with zero values for bilateral AID. One common practice is to add one to the AfT value before transformation to the natural logarithm. However, this practice is ill-advised as results become sensitive to the units used to measure aid (e.g., millions of dollars or total dollars). Therefore, following Klette (1996), Wagner (2003), and Cali and te Velde (2011), we split the aid variable into two variables as follows:

$$\beta_1 \ln AID_{drt} = \beta_{11} \ln \max(1, AID_{drt}) + \beta_{12} NAID_{drt}$$

where NAID is a no-aid dummy, which takes the value of 1 when AID = 0 and zero otherwise.[11] In this formulation, the difference in FDI of a recipient country receiving positive aid and a recipient country receiving zero aid (ceteris paribus) is given by

$$FDI|_{AID>0} - FDI|_{AID=0} = \beta_{11} \ln AID_{drt} - \beta_{12}.$$

Our sample comprises country-level and bilateral flows for 25 donors and 120 recipients for the period 2003–13. We reduce the time dimension to four periods by taking the mean of the variables for years 2003–04, 2005–07, 2008–10 and 2011–13. The benefits of this procedure are that random volatility is reduced and allows a larger window for the effects of aid on international transactions to accrue. Averaging also reduces cases of zero values.[12] Our main specifications associate greenfield investment with contemporaneous AfT. At the end of the analysis, we add one-period lagged AfT to allow investment to respond more slowly to aid. We will also introduce a lead AfT variable to generate a falsification exercise.

Our primary specification will be Eqn. (2), which we will estimate using PPML. For the sake of comparison, we will also estimate the traditional linear in logs specification (Eqn. (1)) using ordinary least squares (OLS). All specifications estimate the standard errors by allowing for clustering by donor–recipient pair.

We note that we are only able to estimate using a subset of the possible observations when estimating with PPML. We have AfT data on 25 donors and 120 recipients for four periods (2003–04, 2005–07, 2008–10 and 2011–13), leading to 12,000 potential observations. However, PPML will drop cases where a bilateral fixed effect corresponds to all zero values of greenfield investment. Therefore, the number of observations for the regressions is about 5500.

We will investigate differential effects for the full sample and the major five donors that account for 80% of AfT (Japan, the United States, Germany, France and Great Britain). We consider differential effects for LDCs and non-LDCs and different categories of aid. We will also estimate effects with lags of the aid variables and conduct a falsification exercise involving the use of a lead aid variable.

4. RESULTS

(a) *Results for full, Big 5 Donor, and Other Donor samples*

We provide analysis on the relationship between AfT and the number and value of greenfield FDI. Our analysis is motivated by the potential development benefits of AfT such as additional employment and values are more likely than numbers to be proportional to jobs. However, as detailed in footnote 8, the data provider estimates values using an algorithm when the public announcement does not provide them. Thus, value data may include some inaccuracies.

Table 1 contains results for the structural gravity equation that includes bilateral and country-period fixed effects. We report results for the sample and subsamples of the Big 5 Donors (Japan, US, Germany, France, and Great Britain) and Other Donors. This specification does not allow estimation of AfT effects of third-party countries.

The first two numerical columns show that bilateral AfT to have a positive and significant relationship to both the number and value of greenfield investment. Examining the next four columns reveals that the effect is entirely attributable to the Big 5 Donor sample. For this subsample, the coefficient on AfT for both the number and value of greenfield investment is 0.094 and significant at the 1% level. The coefficients for the sample of Other Donor countries are insignificantly different than zero.

There are 5 donors and 120 recipients or 600 possible donor–recipient pairs. For 120 pairs, PPML drops the observations because greenfield investment is always zero. Of the remaining 480 pairs, 432 are cases where AfT is continuously positive and the coefficient on AfT applies and can be interpreted as an elasticity. In 48 cases, AfT switches from zero to positive (or vice versa) and the coefficient on the dummy variable indicating no aid (AfT0) need be considered. Its positive coefficient indicates offsetting effects of going from zero aid to positive AfT as given by

$$FDI|_{AID>0} - FDI|_{AID=0} = \beta_{11} \ln AID_{drt} - \beta_{12}$$

Using results for the Big 5 sample, where $\beta_{12} = 1.174$ and $\beta_{11} = 0.094$ for greenfield counts and $\beta_{12} = 0.349$ and $\beta_{11} = 0.094$ for greenfield value, the critical level of $\ln AID_{drt}$ (β_{12}/β_{11}) for a positive net effect is 12.5 (AID = \$265,000) for numbers and 3.7 (AID = \$40,000) for value.

In the Big 5 Donor sample, there are 136 observations when AfT goes from zero to positive or positive to zero. The median

Table 1. *Effects of Aid for Trade (AfT) on greenfield FDI, country-period fixed effects*

	All		Big 5 Donors		Other Donors	
	Number	Value	Number	Value	Number	Value
AfT	0.050a	0.041c	0.094a	0.094a	0.003	−0.029
	(0.016)	(0.023)	(0.028)	(0.028)	(0.012)	(0.030)
AfT0	0.587a	0.364	1.174a	0.349	0.085	−0.201
	(0.180)	(0.269)	(0.356)	(0.397)	(0.127)	(0.336)
RTA	0.141	*	0.283b	0.797a	−0.421a	−0.625a
	(0.127)		(0.142)	(0.154)	(0.114)	(0.227)
BIT	0.133	*	−1.328	−1.506b	0.071	−0.709b
	(0.201)		(0.953)	(0.587)	(0.148)	(0.347)
N	5295	5295	1552	1552	3536	3536
R-sq	0.984	0.949	0.988	0.972	0.970	0.910

Estimates are obtained using the Poisson Pseudo-Maximum Likelihood estimator. Numbers in parentheses are standard errors based on clustering by country pair. Significance at 1, 5, and 10% levels are indicated by a, b, and c. All specifications include bilateral fixed effects as well as country-period fixed effects.
* Variables dropped because inclusion prevented estimation from converging.

level of ln AfT is 10.4 for these observations, somewhat below the critical level of 12.5 for the number of investments but above the critical level of 3.7 for greenfield value. Given sampling error, we conclude that the net effect of AfT is approximately zero for the median recipient going from zero AfT to positive AfT (or vice versa). In subsequent analysis, we focus on the elasticity of investment with respect to aid (β_{11}).

We can use the estimated elasticity to calculate the effect of an increase in Big 5 Donor AfT on the number and value of greenfield investment. A 10% increase in annual Big 5 Donor bilateral AfT ($860 million) increases the number and value of greenfield investment from the donor to recipients by 0.94%. This translates to 25 additional greenfield projects per year in the recipient countries (as a group) worth about $1.7 billion.[13]

Now we turn to the effects of RTAs and BITs shown at the bottom of Table 1. The coefficients are not very consistent across samples. RTAs increase greenfield investment for the Big 5 Donor sample but there is a negative association for the sample of Other Donors, leading to insignificant effects for the full sample. BITs tend to have negative effects that occasionally are significant. In the case of the full sample and the value of greenfield investment, the estimates do not converge and we omit the two variables. These inconsistent and sometimes perverse results are inconsistent with Blonigen and Piger (2014) but they consider FDI stocks and do not employ country-time fixed effects.

Table 2 provides corresponding results for aid other than AfT. As shown in Figure 1, this aid comprises the majority of ODA. It includes aid for humanitarian purposes social infrastructure (such as education and health). We do not observe significant effects for the full sample or the Big 5 Donor and Other Donor subsamples. Either this type of aid is not perceived by investors as improving business conditions or the benefits take a long tome to manifest themselves.

Country-period fixed effects prevent inclusion of the variable capturing AfT from third-party donors (AfT_OTH). To consider these effects, we replace country-period fixed effects with period fixed effects and add population and per capita GDP as controls. The results for the full sample and two subsamples (Big 5 Donors and Other donors) are shown in Table 3.

In this specification, the effect of bilateral AfT is somewhat different than what we observe in the previous table. It enters significantly only for the number of greenfield investments and is even significant at the 5% for the Other Donor sample. However, the coefficient is larger for the Big 5 Donor sample than for the sample of other donors (0.100 versus 0.023) and more significant (1% versus 5% level). AfT has a positive but insignificant effect on greenfield value.

Table 2. *Effects of non-AfT on greenfield FDI, country-period fixed effects*

	All		Big 5 Donors		Other Donors	
	Number	Value	Number	Value	Number	Value
Non-AfT	−0.006	−0.025	0.030	0.060	−0.018	−0.073
	(0.020)	(0.036)	(0.034)	(0.052)	(0.019)	(0.048)
NonAfT0	0.181	−0.290	0.627	0.496	−0.005	−0.453
	(0.273)	(0.490)	(0.499)	(0.801)	(0.253)	(0.601)
RTA	0.171	0.359b	0.366b	0.879a	−0.425a	−0.633a
	(0.140)	(0.165)	(0.170)	(0.174)	(0.115)	(0.233)
BIT	0.088	−0.523c	−1.754c	−2.218a	0.070	−0.684c
	(0.193)	(0.289)	(1.010)	(0.566)	(0.148)	(0.351)
N	5312	5312	1553	1553	3551	3551
R-sq	0.981	0.952	0.984	0.969	0.970	0.909

Estimates are obtained using the Poisson Pseudo-Maximum Likelihood estimator. Numbers in parentheses are standard errors based on clustering by country pair. Significance at 1, 5, and 10% levels are indicated by a, b, and c. All specifications include bilateral fixed effects as well as country-period fixed effects.

Table 3. *Effects on greenfield FDI, bilateral and period fixed effects*

	All		Big 5 Donors		Other Donors	
	Number	Value	Number	Value	Number	Value
AfT	0.052a	0.017	0.100a	0.039	0.023b	0.036
	(0.020)	(0.023)	(0.032)	(0.034)	(0.011)	(0.026)
AfT0	0.671a	−0.021	1.138a	−0.132	0.277b	0.242
	(0.232)	(0.301)	(0.376)	(0.490)	(0.137)	(0.327)
AfT_OTH	0.071b	0.138a	0.039	0.100	0.094a	0.159b
	(0.032)	(0.048)	(0.047)	(0.067)	(0.033)	(0.068)
POP_r	1.673c	−2.190	1.806	−3.099	1.157	−0.822
	(0.904)	(1.527)	(1.148)	(1.955)	(1.137)	(1.752)
PCGDP_r	−0.397a	−0.755a	−0.455a	−1.094a	−0.207	−0.085
	(0.129)	(0.257)	(0.150)	(0.315)	(0.153)	(0.229)
POP_d	−0.067	−2.977c	−0.232	−0.923	5.683a	0.788
	(1.921)	(1.697)	(3.137)	(2.858)	(1.398)	(2.615)
PCGDP_d	0.250	−0.355	1.151	1.423c	−1.036a	−1.676a
	(0.311)	(0.375)	(0.937)	(0.852)	(0.231)	(0.511)
RTA	0.080	0.154	0.205	0.433a	−0.205	−0.274
	(0.099)	(0.142)	(0.134)	(0.149)	(0.135)	(0.256)
BIT	0.628a	−0.052	−0.143	0.311	0.361b	−0.170
	(0.206)	(0.268)	(1.105)	(0.740)	(0.166)	(0.288)
N	5452	5452	1715	1715	3737	3737
R-sq	0.946	0.896	0.958	0.925	0.935	0.767

Estimates are obtained using the Poisson Pseudo-Maximum Likelihood estimator. Numbers in parentheses are standard errors based on clustering by country pair. Significance at 1, 5, and 10% levels are indicated by a, b, and c. All specifications include bilateral fixed effects and period fixed effects.

AfT from third-party donors (AfT_OTH) has positive and significant effects in the case of the Other Donor sample but not the Big 5 Donor sample where the effects are positive but insignificant. The top five donors account for 78% of AfT. This substantial aid appears to encourage the greenfield investment of other donors whereas the much smaller own AfT of these other donors tends not to influence their own investment.

In this specification, the coefficient on RTA tends to be insignificant. The one exception is a positive and significant effect for greenfield value in the Big 5 sample. In two cases, BIT is positive and significant (full sample and Other Donor samples and greenfield numbers). The coefficients on control variables population and per capita do not exhibit a consistent pattern, entering both positively and negatively.

Table 4 compares PPML and OLS estimates for the Big 5 Donor sample. PPML results are taken from Tables 1 and 2. In the OLS specifications, we add one to all zero values of the dependent variable before taking logs. The coefficients on AfT are positive and generally significant both PPML and OLS estimation. The exception is the greenfield value regressions with period fixed effects where the estimates are positive and insignificant in both cases. The PPML estimate in larger in the other cases. Neither specification yields significant results for AfT_OTH and the generally negative and perverse BIT effect persists even when estimating with OLS.

Table 4. *Comparison of PPML and OLS results, Big 5 Donors*

	Country-period fixed effects				Period fixed effects			
	Number		Value		Number		Value	
	PPML	OLS	PPML	OLS	PPML	OLS	PPML	OLS
AfT	0.094a	0.020b	0.094a	0.036	0.100a	0.037a	0.039	0.043
	(0.028)	(0.008)	(0.028)	(0.033)	(0.032)	(0.008)	(0.034)	(0.029)
AfT0	1.174a	0.281a	0.349	0.153	1.138a	0.465a	−0.132	0.351
	(0.356)	(0.103)	(0.397)	(0.415)	(0.376)	(0.104)	(0.490)	(0.378)
AFT_OTH					0.039	0.028	0.100	−0.041
					(0.047)	(0.017)	(0.067)	(0.060)
RTA	0.283b	0.121	0.797a	0.076	0.205	−0.014	0.433a	−0.275
	(0.142)	(0.086)	(0.154)	(0.328)	(0.134)	(0.074)	(0.149)	(0.251)
BIT	−1.328	−0.474a	−1.506b	−0.993b	−0.143	−0.573a	0.311	−2.065a
	(0.953)	(0.168)	(0.587)	(0.482)	(1.105)	(0.219)	(0.740)	(0.755)
N	1552	2398	1552	2398	1715	2387	1715	2387
R-sq	0.988	0.351	0.972	0.268	0.958	0.037	0.925	0.055

Estimates are obtained using the Poisson Pseudo-Maximum Likelihood estimator (PPML) or Ordinary Least Squares (OLS). Numbers in parentheses are standard errors based on clustering by country pair. Significance at 1, 5, and 10% levels indicated by a, b, and c. Specifications in columns (1)–(4) include bilateral fixed effects as well as country-period fixed effects, whereas specifications in columns (5)–(8) include bilateral fixed effects and period fixed effects.

In subsequent analysis, we confine analysis to the Big 5 Donor sample and employ the PPML estimator and country-period fixed effects for the following reasons. The Big 5 Donor sample is responsible for the significant AfT effects. Country-period fixed effects capture multilateral resistance and PPML is consistent in the presence of heteroskedasticity and naturally includes the zero-valued observations.

(b) *Different groups of recipients: LDCs versus non-LDCs*

We estimate results for separate samples of LDCs and non-LDCs. Previously, we observed that AfT flows were much smaller for LDCs despite them being a presumed target under the Hong Kong 2005 AfT Initiative. The results in Table 5 indicate that the small flows resulted in limited new greenfield investment. The results for the LDC sample show insignificant effects on the number of investments and large and significant effects for the value of greenfield investment. This latter result is significant at the 5% level. Its magnitude should be interpreted with caution due to the high standard error. Nonetheless, there is some evidence that AfT also contributes to greenfield investment in LDCs. The AfT effects for non-LDCs are very similar in magnitude and significance to those we report for the full sample.

(c) *Different categories of AfT*

Cali and te Velde (2011) and Vijil and Wagner (2012) find that aid for economic infrastructure is associated with greater recipient-country exports, while aid for productive capacity has no significant effect on exports. Similarly, Selaya and Sunesen (2012) find that aid for social and economic infrastructure is associated with more FDI, while aid for productive capacity deters FDI.

We assess how differently three categories of AfT—infrastructure, building productive capacity, and trade policy and regulation—contribute to cross-border investment activities between donor and recipient countries. Aid for infrastructure is further split into transportation, communication networks, and energy supply, while aid for building productive capacity is split into the service sector and the production sector.

Each estimate in Table 6 corresponds to a separate regression where the subcomponent of aid in question enters the specification individually as an explanatory variable. We find that among different types of aid, aid for trade-related infrastructure and building productive capacity contributes to greenfield investment most significantly. We do not observe significant results for trade regulations and policy.

Among the three sub-categories of infrastructure aid, transportation, and energy have positive and significant effects on greenfield. In contrast, aid for communication is associated with significantly less greenfield investment. In the case of AfT for building productive capacity, AfT for both service and production sectors increase greenfield investment with service AfT having a larger effect than production AfT.

To summarize, the positive effect of AfT on both greenfield FDI is driven by aid for trade-related infrastructure and building productive capacity (BPC). The infrastructure result is consistent with previous research whereas the significant BPC result is in contrast to this research.

(d) *Individual Big 5 Donors*

As discussed in Section 2, the five major donors (Japan, US, Germany, France, and Great Britain) account for about two-thirds of the 25 donors' greenfield FDI, while their AfT accounts for about 80% of the donor total AfT. The AfT flows are larger for the major donors and potentially more likely to influence investment.[14] In this section, estimate AfT effects for each of the five major donors.

Table 7 reveals significant AfT effects for four out of the five donors. The exception, Germany, has positive effects that are not significant. For three donors—United States, France, and Great Britain—effects are positive but only significant for either the number of investment specification or the value of investment specification but not both. The results are striking for Japan. Both the specifications are large and significant. The estimated elasticities for the number and value of investments are 0.276 and 0.214, respectively. These elasticities are both 0.094 for the Big 5 Donor sample as a whole.

Kimura and Todo (2009) also assess the effects of aid on FDI (balance of payments basis) for the five major donors in aggregate and individually. They find that aggregate foreign aid from these five donors does not significantly promote FDI from these countries to the recipient countries. However, when they allow for differences across donors, they establish that only Japanese aid to a recipient country promotes Japanese FDI to the same recipient country. Using a more recent sample period and a different estimation method than Kimura and Todo (2009), we corroborate their Japan results and also find significant effects for a larger set of donor countries.

Table 5. *LDC and non-LDC recipients, Big 5 Donors*

	LDC		Non-LDC	
	Number	Value	Number	Value
AfT	0.039	0.165b	0.095a	0.093a
	(0.068)	(0.074)	(0.028)	(0.030)
AfT0	−0.397	0.929	1.246a	0.587
	(0.885)	(1.057)	(0.365)	(0.392)
RTA	1.240b	3.303a	0.280b	0.784a
	(0.532)	(1.234)	(0.140)	(0.150)
BIT	−6.767b	−18.312a	−1.088	−1.135b
	(3.012)	(3.486)	(0.998)	(0.554)
N	366	366	1186	1186
R-sq	0.937	0.996	0.988	0.973

Estimates are obtained using the Poisson Pseudo-Maximum Likelihood estimator. Numbers in parentheses are standard errors based on clustering by country pair. Significance at 1, 5, and 10% levels indicated by a, b, and c. Specifications include bilateral and country-period fixed effects and BIT and RTA.

Table 6. *Effects of different categories of ODA on greenfield FDI, Big 5 Donors*

Infrastructure	All	Transportation	Communication	Energy
Number	0.064a	0.059a	−0.040b	0.042b
	(0.019)	(0.013)	(0.019)	(0.019)
Value	0.050b	0.040b	−0.055a	0.014
	(0.023)	(0.017)	(0.020)	(0.025)
Building productive capacity	All	Services	Production	
Number	0.083a	0.071a	0.032b	
	(0.026)	(0.018)	(0.015)	
Value	0.055b	0.031	0.043c	
	(0.023)	(0.021)	(0.025)	
Trade policy and regulations	All			
Number	−0.001			
	(0.018)			
Value	−0.007			
	(0.025)			

Estimates are obtained using the Poisson Pseudo-Maximum Likelihood estimator. Numbers in parentheses are standard errors based on clustering by country pair. Significance at 1, 5, and 10% levels indicated by a, b, and c. Specifications include bilateral and country-period fixed effects and BIT and RTA.

Table 7. *Effects of Aid for Trade (AfT), Individual Donors*

	Number	Value
All Five	0.094a	0.094a
	(0.028)	(0.028)
Japan	0.276a	0.214b
	(0.089)	(0.086)
USA	0.076	0.239a
	(0.051)	(0.061)
Germany	0.061	0.024
	(0.041)	(0.092)
France	0.031	0.086b
	(0.022)	(0.035)
Great Britain	0.094a	0.010
	(0.032)	(0.034)
N	1551	1551
R-sq	0.991	0.975

Estimates are obtained using the Poisson Pseudo-Maximum Likelihood estimator. Numbers in parentheses are standard errors based on clustering by country pair. Significance at 1, 5, and 10% levels indicated by a, b, and c. Specifications include bilateral and country-period fixed effects and BIT and RTA.

Table 8. *Largest bilateral AfT flows (annual average $US million)*

Donor	Recipient	AfT
Japan	India	829.1
Japan	Vietnam	704.6
Japan	Indonesia	438.0
Japan	China	297.4
Japan	Thailand	257.5
Japan	Philippines	239.5
Germany	India	225.0
United States	Egypt	182.4
Japan	Sri Lanka	175.8
Japan	Turkey	168.9
Germany	China	165.9
France	Morocco	154.7
United Kingdom	India	105.4
United States	Pakistan	97.4
Japan	Bangladesh	96.9
Japan	Egypt	80.9
Germany	Egypt	78.5
United States	Colombia	73.6
France	Vietnam	72.4
Japan	Pakistan	69.7
Japan	Morocco	68.1
United States	Tanzania	66.8
United States	Georgia	66.2
Australia	Papua New Guinea	64.1
Japan	Kenya	59.3

One possible reason for the large AfT elasticity for Japan is that Japan's aid is tied. However, the OECD provides data on the degree of tied aid and over our sample period (2003–13). 93% of Japanese aid was untied, a similar level to the other major donors aside from the US with a 67% untied share.

Another explanation is that a critical mass of aid is required to affect investment and Japan provides the largest amount of AfT. Table 8 lists the largest (annual) average donor–recipient AfT flows. The top six involve Japan and Asian recipients, lending some credence to the proposition that volume matters for AfT effectiveness. We also observe from the table that geopolitics and historical linkages may play a role in AfT allocation: the top recipients of the US are Egypt, Pakistan, and Colombia, geopolitically important countries. Top recipients for France and the United Kingdom are former colonies. Thus, another possibly explanation for lesser aid effectiveness for major donors compared to Japan is that their AfT is driven by political rather than economic considerations. Note that since our specification includes recipient-period fixed effects, Japan's large AfT effect cannot be attributed to high growth of the countries to which it concentrates its investments.

(e) *Lag and lead effects of AfT*

While our three-year periods allow time for international investment to respond to changes in AfT within the period, we might expect that adjustment may take longer. To investi-

Table 9. *Lagged AfT, Big 5 Donors*

	Number	Number	Value	Value
AfT	0.048a	0.051a	0.082b	0.087a
	(0.017)	(0.017)	(0.033)	(0.033)
AfT0	0.375	0.389	0.538	0.579
	(0.254)	(0.248)	(0.483)	(0.488)
LagAfT		0.043b		0.026
		(0.018)		(0.032)
LagAfT0		0.293		0.325
		(0.260)		(0.449)
N	1192	1190	1192	1190
R-sq	0.993	0.994	0.978	0.978

Estimates are obtained using the Poisson Pseudo-Maximum Likelihood estimator. Numbers in parentheses are standard errors based on clustering by country pair. Significance at 1, 5, and 10% levels indicated by a, b, and c. Specifications include bilateral and country-period fixed effects and BIT and RTA.

Table 10. *Lead effects, five major donors*

	Number	Number	Value	Value
AfT	0.115a	0.118a	0.087b	0.095a
	(0.038)	(0.036)	(0.036)	(0.035)
AfT0	1.395a	1.375a	0.051	0.004
	(0.480)	(0.463)	(0.507)	(0.478)
LeadAfT		0.042c		0.027
		(0.024)		(0.028)
LeadAfT0		0.771b		0.771c
		(0.315)		(0.450)
N	1056	1055	1056	1055
R-sq	0.991	0.992	0.977	0.978

Estimates are obtained using the Poisson Pseudo-Maximum Likelihood estimator. Numbers in parentheses are standard errors based on clustering by country pair. Significance at 1, 5, and 10% levels indicated by a, b, and c. Specifications include bilateral and country-period fixed effects and BIT and RTA.

gate this possibility, we amend the specification to include the one-period lagged value of AfT. Another benefit of this specification is that the lagged AfT variable is less likely to reflect unobserved time-varying bilateral influences that may lead to bias.

The first and third columns of Table 9 show baseline results where period 1 is eliminated. The AfT effect is smaller when the estimates are based on periods 2–4 but remain statistically significant. We observe that introducing the lagged variable does not reduce the size or significance level of the estimated coefficients for contemporaneous AfT. Lagged AfT is estimated to have a positive effect on the number greenfield investments with a magnitude slightly smaller than that for contemporaneous AfT. The lagged effect on the value of greenfield investment is positive but insignificant. Overall, we find some evidence that greenfield investment responds slowly to AfT disbursements.

Thus far, our regression results indicate that AfT of major donors increases greenfield investment of recipient countries. We include bilateral and country-period fixed effects to control for contemporaneous factors that may cause a spurious relationship. There remains the concern, however, that the causality runs in the other direction: investment causes AfT and the controls are inadequate. A case in point would be the situation where a company with investment in a recipient country lobbies to receive a subsidy in the form of complementary aid. In this case, investment causes AfT.

We examine whether our results reflect reverse causality by conducting a falsification exercise. If firms with investment in a donor country lobby for supporting AfT, then we would expect a positive relationship between current investment and future AfT. To investigate, we add the one-period lead of the AfT variable. If the lead variable enters positively and significantly, there is support for reverse causality. However, a positive relationship may not necessarily reflect reverse causality: future disbursements may also exert causal effects on current investment if they reflect new commitments in the current period that change investor expectations of the business environment.

The first and third columns of Table 10 show baseline results where period 4 is eliminated. We observe somewhat stronger results for AfT when estimating using periods 1–3. Examining the coefficients on lead AfT, it is marginally significant (10% level) in the case of the number of investment but its magnitude is smaller than contemporaneous AfT (0.042 versus 0.118). Lead AfT is insignificant in the greenfield value specification.

These results do not provide strong support for reverse causality. There is a marginally significant effect for the number of investment but the contemporaneous effect is much larger. If we interpret the lead effect as reverse causality and discount the contemporaneous effect by its estimated magnitude, there is still a net AfT effect of 0.076 (0.118–0.042).

5. SUMMARY AND CONCLUDING REMARKS

Using data from 2003–13 and specifications employing bilateral and country-period fixed effects, we investigate whether AfT from a donor country to a recipient country increases greenfield investment from the donor to the recipient. We uncover evidence that AfT promotes investment, particularly aid directed toward infrastructure and building productive capacity.

Our results are driven by the Big 5 Donors—Japan, the United States, France, Germany, and Great Britain—countries that account for about 80% of AfT. We find that 10% increase in annual Big 5 Donor bilateral AfT translates to 25 additional greenfield projects per year in the recipient countries (as a group) worth about $1.7 billion. Robust results emerge when these donors send aid to non-LDC recipients, countries that receive the most AfT. Thus, we see evidence that a critical level of aid is required to encourage greenfield investment. Japan accounts for 40% of AfT and its AfT has the largest investment creation effects.

Previous research has shown that greenfield investment is associated with increases in wages and productivity in the host economy as well as lower prices. We observe that AfT is associated with additional greenfield investment but we only find weak evidence that LDCs are among the beneficiaries. AfT appears to be promoting the development of some recipient countries but perhaps not that of the poorest and neediest.

NOTES

1. Another group of researchers has assessed how the AfT has been allocated. For example, Lee, Park, and Shin (2015) assess whether and to what extent WTO's developing member countries have received more AfT.

2. Other empirical investigations of aid and trade include Brenton and von Uexkull (2009), Skärvall (2011), Nowak-Lehmann, Martınez-Zarzoso, Herzer, Klasen, and Cardozo (2013), and Pettersson and Johansson (2013). Suwa-Eisenmann and Verdier (2007) survey the earlier literature on this topic.

3. Thus, their findings differ from Beladi and Oladi (2007), who show theoretically that foreign aid used to finance public consumption could crowd out foreign investment.

4. In their study, aid for infrastructure is defined as the sum of aid for social infrastructure, economic infrastructure, production activities, and multi-sector/cross-cutting classified in the CRS database, whereas aid for non-infrastructure is defined as the sum of commodity aid and general program assistance, action relating to debt, and humanitarian aid.

5. Hudson (2013) studies the relationship between aid commitments and disbursements and notes lags are particularly long in the case of aid for infrastructure. Cali and te Velde (2011) and Ferro *et al.* (2014) also use aid disbursement data.

6. CRS codes are in parentheses. See http://www.oecd.org/dac/aft/aid-for-tradestatisticalqueries.htm.

7. The CRS provides data for 145 recipient countries but we exclude Afghanistan, Belarus, Iraq, Libya, and Ukraine due to their peculiar circumstances. We also exclude 13 recipient countries for whom the World Bank's "World Development Indicators" does not provide GDP and population data. Of remaining 127 recipient countries, seven recipient countries are further excluded because there was no greenfield investment in these countries during the period 2003–13.

8. fDi Intelligence uses an algorithm to estimate the value of investment when the company does not provide this information in the public announcement. The value is inferred from similar investments. No information is provided about the share of the value data that is estimated.

9. The data are characterized by a large share of zeros. The balanced data set (25 donors, 120 recipients, 11 years) totals 33,000 bilateral pair observations. Positive new greenfield investment occurs for 5,981 of these observations (18.1%).

10. Baier and Bergstrand (2007) estimate the gravity equation with '"time-varying multilateral price terms"' as well as bilateral fixed effects to account for such an endogeneity problem when they assess the effects of preferential regional arrangements on bilateral trade.

11. We do not implement this approach for AID of third-party countries (AID $\sim$ drt) because there are very few zero observations for this variable.

12. The share of positive observations rises from 18.1% to 27.7% for greenfield investment when we aggregate the annual data to data for three-year periods.

13. See Appendix Table 12 for aggregate statistics for the Big 5 Donor sample.

14. While some studies (e.g., Berthélemy, 2006) differentiate donor countries in terms of altruistic donors, moderate donors, and egoistic donors, we do not attempt to assess the differences among these three groups of donors because in the case of altruistic groups, the donors are rather small in terms of the size of cross-border investment and hence there are a substantial number of zero observations for greenfield investment.

REFERENCES

Anderson, J. E. (1979). A theoretical foundation for the gravity equation. *American Economic Review, 93*(1), 170–192.

Anderson, J. E., & van Wincoop, E. (2003). Gravity with gravitas: A solution to the border puzzle. *American Economic Review, 93*(1), 170–192.

Baier, S. L., & Bergstrand, J. H. (2007). Do free trade agreements actually increase members' international trade?. *Journal of International Economics, 71*(1), 72–95.

Beladi, H., & Oladi, R. (2007). Does foreign aid impede foreign investment?. In S. Lahiri (Ed.), *Theory and practice of foreign aid.* Amsterdam: Elsevier.

Berthélemy, J.-C. (2006). Bilateral donors' interest vs. recipients' development motives in aid allocation: Do all donors behave the same?. *Review of Development Economics, 10*(2), 179–194.

Bhavan, T., Xu, C., & Zhong, C. (2011). The relationship between foreign aid and FDI in South Asian economies. *International Journal of Economics and Finance, 3*(2), 143–149.

Blonigen, Bruce., & Piger, Jeremy. (2014). Determinants of foreign direct investment. *Canadian Journal of Economics, 47*(3), 775–812.
Brenton, P., & von Uexkull, E. (2009). Product specific technical assistance for exports – Has it been effective?. *Journal of International Trade & Economic Development, 18*(2), 235–254.
Cali, M., & te Velde, D. W. (2011). Does aid for trade really improve trade performance. *World Development, 39*(5), 725–740.
Chaney, T. (2008). Distorted gravity: The intensive and extensive margins of international trade. *American Economic Review, 98*(4), 1707–1721.
Davis, R. B., & Kristjánsdóttir, H. (2010). Fixed costs, foreign direct investment, and gravity with zeros. *Review of International Economics, 18*(1), 47–62.
Doms, M. E., & Jensen, J. B. (1998). Comparing wages, skills, and productivity between domestically and foreign-owned manufacturing establishments in the United States. In R. E. Baldwin, R. E. Lipsey, & J. D. Richardson (Eds.), *Geography and ownership as bases for economic accounting* (pp. 235–255). Chicago: Univ. of Chicago Press.
Donabauer, J., Meyer, B., & Nunnenkamp, P. (2014). *Aid, infrastructure, and FDI: assessing the transmission channel with a new index of infrastructure* KIEL working paper No.1954. Kiel Institute for the World Economy.
Eaton, J., & Kortum, S. (2002). Technology, geography, and trade. *Econometrica, 70*(5), 1741–1779.
Faber, B., Atkin, D., & Navarro, M. G. (2015). *Retail globalization and household welfare: Evidence from Mexico* NBER working paper No.21176. National Bureau of Economic Research.
Ferro Portugal-Perez, E. A., & Wilson, J. S. (2014). Aid to the services sector: Does it affect manufacturing exports. *World Economy, 37*(4), 530–541.
Harms, P., & Lutz, M. (2006). Aid, governance and private foreign investment: Some puzzling findings for the 1990s. *The Economic Journal, 116*, 773–790.
Haskel, J. E., Pereira, S. C., & Slaughter, M. J. (2007). Does inward foreign direct investment boost the productivity of domestic firms?. *Review of Economics and Statistics, 89*(3), 482–496.
Head, K., & Ries, J. (2008). FDI as an outcome of the market for corporate control: Theory and evidence. *Journal of International Economics, 74*(1), 2–20.
Helble, M., Mann, C. L., & Wilson, J. S. (2012). Aid-for-trade facilitation. *Review of World Economics, 148*, 357–376.
Hudson, J. (2013). Promises kept, promises broken? The relationship between aid commitments and disbursements. *Review of Development Finance, 3*, 109–210.
Huttunen, K. (2007). The effect of foreign acquisition on employment and wages: Evidence from Finnish establishments. *Review of Economics and Statistics, 89*(3), 497–509.
Javorcik, B. S. (2004). Does foreign direct investment increase the productivity of domestic firms? In search of spillovers through backward linkages. *American Economic Review*, 605–627.
Kang, S. J., Lee, H., & Park, B. (2011). Does Korea follow Japan in foreign aid? Relation-ships between aid and foreign investment. *Japan and the World Economy, 23*(1), 19–27.
Kimura, H., & Todo, Y. (2009). Is foreign aid a vanguard of foreign direct investment? A gravity-equation approach. *World Development, 38*(4), 482–497.
Klette, Jacob. (1996). R&D, scope economies, and plant performance. *The RAND Journal of Economics, 27*(3), 502–522.
Lee, H.-H., Park, D., & Shin, M. (2015). Do developing-country WTO members receive more aid for trade (AfT)?. *The World Economy, 38*(9), 1462–1485.
Marin, Dalia., & Schnitzer, Monika. (2011). When is FDI a capital flow?. *European Economic Review, 55*(6), 845–861.
Nowak-Lehmann, F., Martınez-Zarzoso, I., Herzer, D., Klasen, S., & Cardozo, A. (2013). Does foreign aid promote recipient exports to donor countries?. *Review of World Economics, 149*, 505–535.
Pettersson, J., & Johansson, L. (2013). Aid, aid for trade, and bilateral trade: An empirical study. *Journal of International Trade & Economic Development, 22*(6), 866–894.
Razin, A., Rubinstein, Y., & Sadka, E. (2004). *Fixed costs and FDI: The conflicting effects of productivity shocks* NBER working paper series No.10864. National Bureau of Economic Research.
Santos Silva, J. M. C., & Tenreyro, S. (2006). The log of gravity. *Review of Economics and Statistics, 88*(4), 641–658.
Selaya, P., & Sunesen, E. R. (2012). Does foreign aid increase foreign direct investment. *World Development, 40*(11), 2155–2176.
Skärvall, L. (2011). *Does Swedish aid help or hinder bilateral trade*. Nationalekonomiska Institutionen, Uppsala Universitet.
Suwa-Eisenmann, A., & Verdier, T. (2007). Aid and trade. *Oxford Review of Economic Policy, 23*(3), 481–507.
Vijil, M., & Wagner, L. (2012). Does aid for trade enhance export performance? Investigating the infrastructure channel. *World Economy, 35*(7), 838–868.
Wagner, D. (2003). Aid and trade – An empirical study. *Journal of the Japanese and International Economies, 17*, 153–173.
World Bank (2011). *The role of international business in aid for trade: Building capacity for trade in developing countries*. , <http://siteresources.worldbank.org/INTRANETTRADE/Resources/AFTWB4.pdf>.

APPENDIX A. DATA SOURCES

Bilateral Aid for Trade (disbursements in dollar value): OECD, Creditor Reporting System (CRS).

Bilateral Greenfield FDI (the number of projects): fDi Intelligence (Financial Times Ltd).

Exports and imports data (dollar value): International Monetary Fund, Direction of Trade.

APPENDIX B.

(See Tables 11–13).

Table 11. *Donor ODA, annual average, 2003–13, $millions*

Donor	ISO	Aid		Greenfield	
		ODA	AfT	Value	No.
Japan	JPN	10589.3	4406.6	509.3	32.7
United States	USA	10904.8	1472.1	1203.6	73.9
Germany	DEU	5549.9	1339.5	359.7	24.4
France	FRA	5771.8	895.4	265.5	19.2
United Kingdom	GBR	4265.4	516.0	354.3	27.8
Spain	ESP	1684.0	388.3	193.2	14.3
Norway	NOR	1240.7	276.1	24.5	2.8
Denmark	DNK	853.4	251.6	40.2	2.0
Canada	CAN	1321.7	228.5	126.6	18.1

(*continued on next page*)

Table 11 (*continued*)

Donor	ISO	Aid		Greenfield	
		ODA	AfT	Value	No.
Korea	KOR	464.0	214.3	124.1	15.3
Australia	AUS	1468.4	207.0	63.6	8.6
Sweden	SWE	1097.0	151.6	66.9	3.0
Netherlands	NLD	1633.9	150.7	99.8	8.4
Belgium	BEL	655.4	142.9	34.5	1.5
Switzerland	CHE	754.3	134.5	122.6	7.4
Italy	ITA	743.1	133.7	124.9	10.9
Finland	FIN	267.1	43.6	42.3	2.5
Ireland	IRL	406.3	40.1	25.7	1.4
Portugal	PRT	310.6	37.3	12.6	0.7
Austria	AUT	369.9	18.6	40.0	2.4
Luxembourg	LUX	163.7	18.2	24.5	3.3
New Zealand	NZL	96.6	13.5	7.5	0.3
Greece	GRC	113.9	13.0	9.3	0.4
Czech Republic	CZE	9.6	2.2	8.0	0.6
Iceland	ISL	3.1	1.0	2.9	0.6

Table 12. *Aggregate AfT and greenfield investment, Big 5 Donor Countries (annual average, 2003–13)*

Variable	Obs	Mean	Std. Dev.	Min	Max
AfT (US$b.)	11	8.63	3.11	4.21	12.55
AfT_OTH (US$b.)	11	102.13	41.76	47.79	164.81
Greenfield FDI number	11	2692.46	389.47	2200	3422
Greenfield FDI value (US$b.)	11	177.93	44.77	125.48	283.41

Table 13. *Top 25 recipients, annual average, 2003–13, $millions*

Recipient	ISO	Aid		Greenfield	
		ODA	AfT	Value	No.
India	IND	2343.3	1213.5	643.1	31.0
Vietnam	VNM	1948.0	957.9	137.8	12.0
China	CHN	2305.1	622.6	1113.1	73.4
Indonesia	IDN	2293.4	619.4	77.9	9.9
Egypt	EGY	1069.3	427.0	32.9	3.1
Morocco	MAR	929.3	368.6	49.6	3.0
Philippines	PHL	1033.0	339.8	75.3	4.6
Turkey	TUR	678.8	318.1	104.6	7.7
Thailand	THA	513.2	280.9	146.7	6.2
Bangladesh	BGD	1092.0	248.4	8.9	0.4
Tanzania	TZA	1404.6	241.1	7.0	0.8
Sri Lanka	LKA	663.7	236.5	11.4	0.4
Pakistan	PAK	1509.0	208.7	16.4	1.9
Ghana	GHA	875.0	199.5	13.4	1.2
Kenya	KEN	1158.4	198.9	17.4	0.5
Mozambique	MOZ	1175.6	196.8	7.6	1.3
Ethiopia	ETH	1507.4	170.0	3.1	0.5
Tunisia	TUN	489.9	157.3	28.5	1.4
Brazil	BRA	619.9	151.9	259.5	26.5
Peru	PER	592.5	127.1	31.0	4.4
South Africa	ZAF	772.2	125.2	83.5	4.6
Colombia	COL	774.3	122.2	63.2	4.5
Uganda	UGA	882.5	115.3	4.7	1.0
Nepal	NPL	435.4	115.2	1.3	0.0
Cambodia	KHM	448.0	113.7	8.8	0.5