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Abstract

Bilateral Investment Treaties (BITs) have become increasingly popular as a means of encouraging FDI from developed to developing countries. We adopt a matched difference-in-difference estimation to deal with the problem of endogeneity when estimating the effects of BITs on inward FDI. Our results indicate that forming a BIT with a developed country approximately doubles FDI inflows and stocks to developing countries on average, with a significant part of this arising from the development of new FDI relationships. The effects of BIT formation on FDI tend to increase with the size and similarity of the host and source economies and BITs may be complementary to institutional quality in the host country.

JEL Classification: C21, F21

Keywords: Foreign Direct Investment, Bilateral Investment Treaties, Endogenous treatment effects

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1. Introduction

The last 30 years have seen a proliferation of international bilateral or plurilateral agreements covering the flows of trade, investment and people. While the scope of Preferential Trade Agreements (PTAs) tends to be the widest, with currently around 300 PTAs in force and each PTA having an average of around 12 members (see WTO, 2011), Bilateral Investment Treaties (BITs) have also increased in popularity. At the end of the 1960s there were only 75 BITs in force. This increased to 167 by the end of the 1970s, and 389 by the end of the 1980s. Today there are 2,807 BITs in existence, with 2,103 in force.[1] Investment agreements have become an important policy tool with many proposed PTAs considering the inclusion of an investment chapter (e.g. the Trans-Atlantic Trade and Investment Partnership (TTIP), EU-Canada, EU-India). Understanding their impact both on foreign direct investment (FDI) flows and on economic performance more generally is therefore an important issue.

The aim of BITs is to encourage the flows of FDI from generally high-income suppliers to lower-income recipients. FDI is expected to benefit host countries through a number of channels. In addition to the inflow of capital, FDI is often accompanied by the movement of firm-specific assets such as technology, managerial ability, corporate governance and access to networks connecting foreign markets. FDI is also expected to encourage competition among domestic firms, and hopefully therefore increase efficiency. Spillovers from FDI may also be expected through the leakage of proprietary knowledge (see Görg and Greenaway, 2004, for a review of the evidence on spillovers from FDI). These potential gains from FDI lie behind the decision of policymakers in developing countries to sign BITs, despite such agreements impinging on their national sovereignty (Elkins et. al. 2004; Guzman, 1998; and Neumayer, 2005).

[1] http://investmentpolicyhub.unctad.org/IIA, accessed on 16 October 2014.

The benefits from signing BITs for the source countries – and source country firms in particular – arise because BITs guarantee certain levels of treatment for foreign investors. These include most-favoured country treatment, fair and equitable treatment for foreign investors, and the free transfer and repatriation of capital and profits (Dolzer and Stevens, 1995; UNCTAD, 1998). Most controversially, BIT parties agree to be bound by dispute settlement provisions that are intended to ensure basic requirements of credible protection of property and contract rights, but which often result in foreign investors being granted greater security and better treatment than domestic investors (Vandevelde, 1998).[2] The investor settlement procedure potentially involves considerable interference in domestic policy, with practically any public policy being subject to challenge.[3] For individual hosts there are likely to be benefits from being able to provide credible commitments to investors, which can lead to a competitive advantage as long as not all potential hosts have signed such treaties. The costs of BITs can generally be justified if the outcome of the BIT is to increase FDI inflows, and if these FDI inflows provide the benefits discussed above.

The extent to which BITs actually encourage inward FDI is an empirical question. Despite their recent proliferation, there remains relatively little empirical research addressing the impact of BITs on FDI flows (or stocks).[4] What work there is generally adopts one of two approaches. Some studies explain bilateral flows (or stocks) of FDI, usually estimating a gravity-type equation and including as one of its arguments a dummy variable for country-pairs that have a BIT. Others move away from a bilateral focus and examine whether countries that sign BITs see an increase in aggregate FDI inflows. While, in principle, BITs only protect investors from the signatory states to whom binding commitments have been made, their existence may also signal

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[2] Through this mechanism foreign investors can avoid national legal systems, opting instead for international arbitration, where they can choose one of the three panellists, and where consensus is required for one of the other two (Elkins et al, 2004). Recently there has been a strong increase in the number of arbitration cases (Bellack, 2013) and the presence of international arbitrage clauses has caused concern amongst citizens in the EU regarding the proposed TTIP agreement.

[3] Evidence of this is the use of investor-state dispute settlement provisions by Tobacco companies in response to cigarette packaging laws.

[4] The literature studying the effects of these international agreements tends to be skewed towards studies of PTAs. Cipollina and Salvatici (2010) in their meta-analysis of PTAs include 85 studies, whereas Bellack (2013) in his more recent meta-analysis of the effects of BITs includes estimates from just 33 studies.

to potential investors elsewhere that this host country protects the interests of foreign investors more generally. If this is the case, then BITs encourage FDI inflows from both BIT partners and non-BIT sources.[5]

An example of the bilateral approach is Hallward-Driemeier (2003), who considers bilateral FDI flows from 20 OECD countries to 31 developing countries over the period 1980-2000. Controlling for country size and other country-specific factors, she finds no direct evidence that the existence of a BIT between a developed and a developing country increases the flow of FDI to the latter. If interactions between the BIT dummy and measures of institutional quality are included however, the estimated coefficients are positive and often significant, a result implying that BITs are complementary to institutional quality. Perhaps BITs might seem credible in an environment of good institutional quality? Alternatively, as noted earlier, BITs might substitute for host institutional quality by providing a certain standard of treatment to foreign investors where domestic institutions fail to do so.[6]

An example of the aggregate approach is Tobin and Rose-Ackerman (2005) who examine five year averages of aggregate FDI inflows for 63 countries over the period 1980 to 2000. They find that a higher number of BITs (either in total or signed with a high income country) lowers the share of global FDI a high-risk country receives, but raises the FDI share for low risk countries, results consistent with a complementary relationship between BITs and institutional quality. Neumayer and Spess (2005) follow a similar approach, using aggregate FDI inflows to individual developing countries as their dependent variable. This variable is related to the cumulative number of BITs signed with developed countries (weighted by their share in total OECD FDI) and other explanatory variables. Their results indicate that a higher number of BITs raises FDI to developing countries, a result that is robust to changes in model specification, estimation

[5] Studies following both approaches generally neglect the potential for FDI diversion however, which arises when investors from a BIT signatory are encouraged to invest in the BIT partner at the expense of other non-BIT hosts.
[6] Related to the notion of heterogeneous effects of BITs, Salacuse and Sullivan (2005) also use bilateral FDI data and find that signing a BIT with the US is associated with significantly higher FDI inflows, but that signing a BIT with another OECD country has an insignificant impact of FDI inflows.

technique and sample size. The authors also report some evidence suggesting that BITs might act as substitutes for good domestic institutional quality, though this result is not robust to alternative specifications of institutional quality.

Whatever the approach adopted, the evidence from this literature, while broadly supportive of a positive effect of BITs on FDI inflows, is far from conclusive on its magnitude. In his meta-analysis, Bellack (2013) reports that 11% of the estimated coefficients on the BIT dummy are actually negative (2% being significantly so), with 76% of the coefficients being positive and significant. In addition, he finds that more recent studies have been more likely to find a negative coefficient and that the dispersion of the estimated coefficients has tended to increase over time. Bellack (2013) reports an un-weighted mean semi-elasticity of 17.6 percent in the papers he considers, but the standard deviation is found to be 37.4 with some estimates above 100% and others below -50%.

One issue that has been largely ignored in this literature is the potential endogeneity of the BITs themselves. The majority of existing studies treat BIT formation as exogenous, with country-pairs being implicitly assumed to be randomly assigned into BITs, rather than self-selecting into them. Recent work by Bergstrand and Egger (2013) has shown that the economic fundamentals often found to determine FDI flows are also determinants of BIT membership. This can lead to a self-selection bias in the estimated impact of BITs on FDI flows. Some existing studies do attempt to control for this endogeneity, with Aisbett (2009), for example, using country-pair fixed effects in a model of bilateral FDI to control for self-selection and finding that their inclusion reduces the coefficient on the BIT dummy and renders it insignificant. In contrast Busse et al (2010) use an Instrumental Variables (IV) approach to control for endogeneity and still find a positive and significant impact of BITs on FDI inflows.

This paper extends this literature by using a different methodology to existing studies that allows us to control for potential endogeneity of BIT membership. Specifically, we employ a matched difference-in-difference approach to identify a causal effect of BIT formation on bilateral FDI flows and stocks. By matching we look to reduce the differences in the outcome variable (i.e. FDI flows or stocks) between treated (i.e. new BIT country-pairs) and non-treated (i.e. non-BIT country-pairs) observations by conditioning on a set of observable variables. The difference-in-difference approach allows us to control for time-invariant unobserved effects. Combining the two approaches controls for both observed and unobserved differences between BIT members and non-members, and potentially provides strong evidence of the causal effects of BIT membership on FDI flows and stocks. In our analysis, we also distinguish between the impact of BITs on existing FDI relationships between countries (i.e. the *intensive* margin) and their impact in creating new FDI relationships (i.e. the *extensive* margin). We find that BIT membership has a large positive and significant impact on FDI flows and stocks, with the development of new FDI relationships being an important source of these increases. We further find evidence to suggest that the effect of BIT formation is heterogeneous, with market size and similarity and possibly other factors, impacting upon the relationship between BIT formation and FDI flows and stocks.

The remainder of the paper is set out as follows: Section 2 describes our data; Section 3 presents gravity estimates for FDI levels and Probit estimates for BIT formation; Section 4 describes the matching results; Section 5 looks at heterogeneous matching effects; and Section 6 concludes.

2. Data

Flows of FDI have grown more rapidly than trade for much of the last three decades. FDI inflows were around $400 million in 1995, $1.4 trillion in 2000 and, following slumps in the early 2000s and the recent global crisis, rose to $1.45 trillion in 2013 (World Investment Report, 2014). In our analysis we use the OECD's International Investment Statistics, which report data on bilateral FDI stocks (inward and outward stocks) and flows (inflows and outflows) for OECD reporting countries and a much larger sample of partner countries from 1982 onwards.

Specifically, we use data on FDI flows and stocks (measured in thousands of US dollars) from 22 OECD reporting countries (the 'North') to up to 118 other countries[7] (the 'South'). Since we use data on the five years prior to and subsequent to a particular year in the difference-in-difference analysis, we are restricted to the years 1990-2006 for our regression analysis.[8]

Recently, Bergstrand and Egger (2013) developed an econometric model that simultaneously explained the "economic" determinants of BITs and PTAs. In our analysis we include a similar set of variables, such that the basic specification of the Probit model of selection into a BIT can be written as:

$$BIT_{ijt} = \alpha_{ij} + \beta_1 \ln(GDP_{it} + GDP_{jt}) + \beta_2 GDPsim_{ijt} + \beta_3 \ln Dist_{ij} + \beta_4 Contig_{ij} + \beta_5 Comlang_{ij} + \beta_6 Colony_{ij} + \beta_7 \frac{K_{it}}{(K_{it}+K_{jt})} + \beta_8 PTA_{ijt} + \beta_9 POLCON_{jt} + \varepsilon_{ijt} \quad (1)$$

where (i) BIT_{ijt} is a dummy variable that takes the value one if reporter i and partner j have a BIT in force in year t. Our information source is UNCTAD's Investment Policy Hub (http://investmentpolicyhub.unctad.org/IIA); (ii) $\ln(GDP_{it} + GDP_{jt})$ is a measure of bilateral economic size; (iii) $GDPsim_{ijt} \equiv \ln[sh_{it}(1 - sh_{it})]$, where sh_i is the share of country i's GDP in the total GDP of country-pair i and j, is a measure of similarity in bilateral economic size; (iv) $K_{it}/(K_{it} + K_{jt})$ is the share of the source country capital in their combined capital stocks, and gives a measure of relative factor endowments. The capital stock is calculated using data on gross capital formation and the perpetual inventory method assuming a depreciation rate of 13%. Data on GDP and gross capital formation are from the World Bank's World Development Indicators; (v) $Contig_{ij}$, $Comlang_{ij}$ and $Colony_{ij}$ are dummy variables taking the value one if the two countries share a border, a language or had a colonial relationship; (vi) $Dist_{ij}$ is the great circle distance between the two countries' capital cities. Data on gravity determinants are from CEPII;

[7] The full sets of reporter and recipient countries included in the analysis are listed in the Appendix.

[8] The average number of new BITs per year between 1990 and 2006 was 46, with a minimum of 13 in 2005 and a maximum of 66 in 1999.

(vii) PTA_{ijt} is a dummy variable taking the value one if the source and host are in the same PTA at time t. Data on PTAs is taken from the Global Preferential Trade Agreements Database (http://wits.worldbank.org/gptad/)); and (viii) $POLCON_{jt}$ is an index which measures the extent to which political actors in the host country are constrained in their choice of future policies by the existence of other political actors with veto power. This index was developed by Henisz (2000) and has recently been updated to 2011.[9] It ranges between zero (the executive has complete discretion and can change policies at any time) and one (a change of existing policies is infeasible)[10] and is an indicator of the ability of political institutions to make credible commitments to an existing policy regime. It is argued by both Henisz (2000) and Neumayer and Spess (2005) to be the political variable most relevant to potential investors.

In addition to these variables,[11] we report results including time-specific dummy variables and using the random effects panel Probit model to account for country-pair fixed effects (α_{ij}). In further specifications we also control for interdependence amongst countries. Anderson and van Wincoop (2003) have shown that trade between two countries is decreasing in their bilateral trade costs relative to the corresponding average with all their partners, rather than to absolute trade barriers. This they referred to as multilateral resistance. Paniagua (2011) derives a theory-based gravity model for FDI flows and also obtains multilateral resistance terms, implying that third country variables can impact upon the flows and stocks of FDI between two countries, as well as upon the probability that they sign a BIT. One way of capturing these multilateral resistance terms is through the inclusion of (time-varying) reporter and partner fixed effects,[12]

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[9] Data can be downloaded from http://www-management.wharton.upenn.edu/henisz/ (accessed 16th October 2014)

[10] As a robustness check we use an indicator of the extent of checks and balances on the executive from Beck et al (2001), which has been updated to 2012. Results using this alternative indicator of political stability are available upon request, and are consistent with those reported here.

[11] Descriptive statistics for our explanatory variables are given in Table 3 below.

[12] Since the multilateral resistance terms are found to be importer and exporter specific they are often captured by importer and exporter specific fixed effects. In a time-varying panel setting the possibility that the multilateral resistance terms are time-varying also arises. In this case, importer-time and exporter-time fixed effects can be used to capture the time-varying nature of the multilateral resistance terms.

but these require estimation of a large number of additional coefficients, and time-varying country-specific variables cannot be included alongside these fixed effects. Since this can be a significant drawback, we adopt the alternative approach of Baier and Bergstrand (2009b), who suggest controlling for multilateral resistance by including GDP-weighted distance, common language, common border and PTA variables as multilateral resistance controls.

One issue with the FDI data that requires discussion is the presence of a large number of zero flows and stocks, as well as some negative values of FDI flows, which involve instances of reverse or dis-investment.[13] Following the majority of the literature using the gravity equation we include our FDI measures in logs, which has the advantage of reducing the skewness of the distribution. Since we cannot take the log of zero or a negative number, these observations would be excluded from our analysis, which can lead to a sample selection bias. In our difference-in-difference analysis, where we use the difference in the log of the average values of FDI between two time periods, we have the further issue that all cases in which FDI was zero prior to signing a BIT will be ignored, thus excluding all observations in which FDI changed from zero (or a negative value) to some positive number following the formation of a BIT. To get around this issue, we follow the standard approach, also adopted by Neumayer and Spess (2005), of giving negative and zero FDI flows and stocks a logged value of zero (which is equivalent to setting the value of FDI to \$1,000, since the FDI data are measured in thousands of US dollars).[14] We are then able to include observations for which FDI changed from zero to

[13] There are also a small number of negative values for FDI stocks. The OECD writes that these can arise since the "changes in FDI positions are affected by the accumulated flows and hence may also result in negative values, but mainly for other capital (e.g. when the loans from the direct investment enterprise to the parent exceed the loans – or even the original capital – given by the parent to the direct investment enterprise. It could be the case where conduits or treasury companies are involved)".
(source: www.oecd.org/daf/inv/investmentstatisticsandanalysis/fdistatisticsanddata-frequentlyaskedquestions.htm).
[14] In the literature on the gravity equation attempts have recently been made to deal with a form of endogeneity that arises due to the presence of zero trade flows. Helpman et al (2008) for example propose a modified Heckman selection type model, while Santos and Tenreyro (2006) suggest using a Pseudo Poisson Maximum Likelihood model. Neither of these approaches is possible in our (matched) difference-in-difference framework however. In the latter case, this is because the changes in FDI can be negative, which is not allowed in the Poisson regression model. In the former case, negative values are allowed, which implies that values of the changes in FDI are no longer censored at zero as would be the case when using the level of (rather than the change in) FDI, further implying that there is no natural cut-off value for the selection equation.

some positive number (and vice versa), and so we are able to include observations for which BIT formation led to the birth of a new FDI relationship (or even the death of a previous one). In other words, this transformation allows us to capture the effect of BIT formation on both the intensive (i.e. the increase in the intensity of already existing FDI relationships) and the extensive (i.e. the formation of new FDI relationships) margins of FDI.[15]

3. Gravity and Probit Results

We begin by using annual data to estimate a standard gravity equation explaining the *level* of FDI flows or stocks using the variables listed in equation (1) plus the BIT dummy. This allows for a comparison with earlier work and with the matched difference-in-difference results that follow. The results reported in Table 1 are largely as expected. FDI flows are positively associated with the sum of the combined size of the source and host economies and negatively associated with the distance between them. The coefficient on distance is somewhat lower (in absolute value) than that found in studies of trade (where a value of around -1.0 is often reported). Bergstrand and Egger (2013) argue that this could arise because trade costs (in this case costs associated with distance) would negatively impact upon vertical FDI, which seeks export platforms, but positively impact upon horizontal FDI, which seeks to 'jump-over' trade barriers. A common border, a former colonial relationship, a common language, and the presence of a PTA between the two countries are all associated with increased FDI flows. The outcomes for the other variables are sensitive to the inclusion or exclusion of country-pair fixed effects. The estimated coefficient on GDP similarity switches from positive and significant to negative and significant once these effects are included. Likewise for the political constraints variable, though the coefficients are not significant when country-pair fixed effects are included. Of most interest

[15] It should be kept in mind that when we are considering differences in five-year averages, there is the possibility that a bilateral-pair are classed as being in a new FDI relationship in cases where an FDI relationship did already exist, but not in the five-years prior to the year of interest. Indeed there are 1,922 observations where average flows were zero but average stocks were positive. The extensive margin therefore captures the formation of new FDI relationships as well as the renewal of old FDI relationships therefore.

here however, are the coefficients on the BIT dummy. These are consistently positive and significant, with the coefficient ranging from 0.873 to 1.415, and tending to decline as additional fixed effects and MR controls are added. These estimates imply that the presence of a BIT is associated with an increase in bilateral FDI flows of between 139% and 312%.[16] While large these estimates are not out of line with those in Bellack (2013), where a number of estimates around 300% are reported.[17]

The results on FDI stocks are very similar to those for FDI flows. Again some estimates are sensitive to the inclusion of country-pair fixed effects. Specifically, the sum of GDPs, GDP similarity and the capital-share variable (which is now significant) switch from positive and significant to negative and significant, as country-pair fixed effects are included. The coefficients on the BIT dummy are again positive and significant, implying an increase in FDI stocks of between 238% and 419%. Overall, these results provide strong support for a relatively large positive (linear) impact of BITs on North-South FDI flows and stocks using the traditional gravity approach.

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[16] Calculated as $100(\exp(\beta) - 1)$, where β is the estimated coefficient on the BIT dummy.

[17] It should also be borne in mind that including the zero flows/stocks, albeit with an imposed value of $1,000, reduces the mean value of FDI flows/stocks considerably. In the case of FDI flows for example, the mean FDI flow (stock) is US$43.9 million (US$344 million) when the zeros are included and US$120.3 million (US$967 million) when the zeros are excluded. Indeed, when estimating the gravity equation on the subset of positive FDI flows (stocks), we obtain estimated increases in FDI flows (stocks) of BIT membership between 47-68% (8-36%). The choice of including or excluding the zero flows (stocks) may help to explain the wide variety of estimates found in the literature therefore.

Table 1: Gravity Model of North-South FDI Flows and Stocks

	FDI Flows					FDI Stocks				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
BIT	1.415***	1.282***	1.150***	0.885***	0.873***	1.647***	1.365***	1.427***	1.235***	1.220***
	(0.121)	(0.123)	(0.123)	(0.113)	(0.113)	(0.159)	(0.162)	(0.162)	(0.157)	(0.157)
$\ln(GDP_{it} + GDP_{jt})$	1.582***	1.555***	1.562***	0.539	0.856**	2.371***	2.333***	2.252***	-2.306***	-2.217***
	(0.0656)	(0.0664)	(0.0657)	(0.358)	(0.366)	(0.0778)	(0.0785)	(0.0760)	(0.547)	(0.558)
$GDPsim_{ijt}$	0.936***	0.927***	0.907***	-0.246**	-0.223**	1.316***	1.312***	1.317***	-0.848***	-0.842***
	(0.0486)	(0.0492)	(0.0486)	(0.100)	(0.100)	(0.0622)	(0.0628)	(0.0616)	(0.183)	(0.184)
$\ln Dist_{ij}$	-0.348***	-0.412***	-0.324***			-0.417***	-0.533***	-0.577***		
	(0.0751)	(0.0758)	(0.0821)			(0.100)	(0.101)	(0.108)		
$Contig_{ij}$	2.765***	2.715***	2.711***			3.354***	3.263***	2.396***		
	(0.850)	(0.867)	(0.883)			(0.817)	(0.820)	(0.815)		
$Comlang_{ij}$	0.234	0.221	0.745***			0.695***	0.678***	0.853***		
	(0.152)	(0.151)	(0.165)			(0.201)	(0.201)	(0.216)		
$Colony_{ij}$	1.794***	1.876***	1.807***			1.586***	1.743***	2.279***		
	(0.323)	(0.322)	(0.310)			(0.462)	(0.456)	(0.424)		
$K_{it}/(K_{it} + K_{jt})$	0.187	0.0701	0.0368	-1.044	-0.372	1.318***	1.119***	1.293***	-7.361***	-7.157***
	(0.311)	(0.314)	(0.308)	(1.075)	(1.083)	(0.415)	(0.419)	(0.406)	(1.647)	(1.657)
$POLCON_{jt}$	0.328*	0.401**	0.416**	-0.121	-0.1000	0.505*	0.609**	0.601**	-0.0922	-0.0912
	(0.191)	(0.195)	(0.193)	(0.158)	(0.158)	(0.261)	(0.265)	(0.260)	(0.204)	(0.204)
PTA_{ijt}	0.952***	0.766***	0.802***	0.755***	0.620***	1.012***	0.677***	1.020***	0.942***	0.790***
	(0.164)	(0.166)	(0.163)	(0.144)	(0.149)	(0.214)	(0.214)	(0.203)	(0.195)	(0.201)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MR Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Country-Pair FE	No	No	Yes	Yes	No	No	Yes	Yes	No	No
Observations	47,317	47,317	47,317	47,317	47,317	47,317	47,317	47,317	47,317	47,317
R-squared	0.315	0.324	0.331	0.093	0.096	0.370	0.386	0.398	0.177	0.178
F-Stat	217.1***	90.32***	84.39***	41.96***	38.14***	236.7***	102.3***	97.92***	54.66***	48.15***

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; MR controls refer to the set of GDP-weighted distance and other explanatory variables that are used to control for the multilateral resistance terms.

We now estimate a Probit model of BIT membership, using the same explanatory variables, to confirm that many of the factors that contribute to larger FDI flows also make BIT arrangements more likely. This provides a comparison with Bergstrand and Egger (2013), and allows us to assess the performance of our selection variables in the matching analysis that follows. Table 2 presents results from a simple Probit model of BIT membership estimated on the full sample using annual data for the period 1990-2011. In the final three specifications we account for the panel structure of the data through the use of a random effects Probit model.

With few exceptions, the results are similar across the different specifications and also correspond quite closely with those in the equivalent FDI equations (i.e. those excluding country-pair fixed effects) in terms of the sign and significance of the coefficients on both FDI stocks and flows. They are broadly consistent with those of Bergstrand and Egger (2013).[18] Large, similar sized and closer economies tend to have more FDI so that the benefits of a BIT between them are larger. The colony variable is positive and significant, consistent with the view that FDI flows between countries sharing common institutions are larger, as are the benefits of a BIT agreement. The measure of differences in capital stocks between country-pairs is insignificant for FDI flows, positive and significant for FDI stocks and negative and significant for the probability of BIT formation. This suggests that a wider difference in capital stocks (endowments) between country-pairs may encourage FDI but lowers the benefits of BITs. Lower levels of discretion of the executive (i.e. more political checks) are associated with higher levels of FDI and a higher probability of two countries being BIT partners. Finally, being in a trade agreement encourages FDI and makes it more likely that two countries will also have a BIT. In contrast, while common borders or a common language both tend to encourage FDI, a

[18] Bergstrand and Egger (2013) conclude that the potential welfare gains from and likelihood of forming a BIT between a country-pair are higher: the larger and more similar in GDP are the country-pair; the closer in distance are the two countries; if the two countries are not adjacent and do not share a common language; and the higher the degrees of political stability and of expropriation risk of the pair. They further find some evidence to indicate that current PTAs positively impact upon BIT formation.

common border tends to reduce the probability of a BIT and a common language has no consistent effect. Bergstrand and Egger (2013) tend to find negative coefficients on these two variables in their BIT regression, arguing that they reduce trade costs and hence encourage trade rather than horizontal FDI, which in turn lowers the probability of two countries entering a BIT agreement. Finally, Table 2 also reports information on the percentage of observations that are correctly predicted,[19] which ranges from 73% to 77%. Although the percent of correct predictions for when a BIT is in place is somewhat lower (ranging between 24% and 54%), the results provide support for the notion that countries self-select into BITs based upon these observable variables.

[19] An observation is said to be correctly predicted if the predicted probability is greater than or equal to 0.5 and the BIT dummy is equal to one, or if the predicted probability is less than 0.5 and the BIT dummy is equal to zero.

Table 2: Probit Model of Selection into BITs

	(1)	(2)	(3)	(4)	(5)	(6)
$\ln(GDP_{it} + GDP_{jt})$	0.413***	0.402***	0.466***	6.560***	3.123***	3.202***
	(0.0259)	(0.0269)	(0.0281)	(0.0368)	(0.0838)	(0.109)
$GDPsim_{ijt}$	0.230***	0.232***	0.214***	3.608***	2.148***	1.948***
	(0.0219)	(0.0228)	(0.0233)	(0.0456)	(0.0667)	(0.0872)
$\ln Dist_{ij}$	-0.459***	-0.515***	-0.410***	-2.163***	-4.070***	-4.069***
	(0.0330)	(0.0350)	(0.0384)	(0.0917)	(0.139)	(0.183)
$Contig_{ij}$	-0.939***	-0.973***	-0.716**	-9.419***	-1.498	-2.583***
	(0.326)	(0.330)	(0.304)	(0.567)	(1.652)	(0.993)
$Comlang_{ij}$	-0.0213	-0.0206	0.368***	2.075***	-1.617***	0.866**
	(0.0976)	(0.101)	(0.109)	(0.211)	(0.275)	(0.357)
$Colony_{ij}$	0.697***	0.766***	0.561***	1.791***	7.820***	8.608***
	(0.140)	(0.146)	(0.156)	(0.356)	(0.518)	(0.521)
$K_{it}/(K_{it} + K_{jt})$	-0.349**	-0.428***	-0.524***	5.443***	-4.530***	-6.383***
	(0.151)	(0.159)	(0.155)	(0.364)	(0.579)	(1.023)
$POLCON_{jt}$	0.269***	0.294***	0.310***	1.033***	0.895***	0.701**
	(0.100)	(0.106)	(0.107)	(0.124)	(0.279)	(0.313)
PTA_{ijt}	0.355***	0.198***	0.160**	2.924***	1.769***	1.184***
	(0.0652)	(0.0672)	(0.0712)	(0.166)	(0.214)	(0.288)
Year FE	No	Yes	Yes	No	Yes	Yes
MR Controls	No	No	Yes	No	No	Yes
Country-Pair FE	No	No	No	Yes	Yes	Yes
Observations	47,317	47,317	47,317	47,317	47,317	47,317
log L	-24,084	-23,163	-22,169	-6,230	-3,989	-4,040
Percent correctly predicted						
$BIT = 1$	43.70	47.48	50.80	53.99	38.05	24.30
$BIT = 0$	88.54	89.41	89.87	81.95	93.10	97.27
Overall	74.28	76.07	76.76	73.06	75.59	74.06

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; MR controls refer to the set of GDP-weighted distance and other explanatory variables that are used to control for the multilateral resistance terms.

4. Matched Difference-in-Difference Results

We now move away from existing approaches and use matching techniques to identify the causal effect of BITs on FDI flows and stocks.[20] [21] Our general problem is to compare the change in the FDI variable (flow or stock) for countries that enter into a BIT at time t with what it would have

[20] Matching econometrics has been used in labour economics to identify the effect of treatment for some time, and has become increasingly popular in other areas of economics. In the trade literature for example, matching has been employed to consider the causal effect of exporting on firm productivity (see for example, Girma et al, 2003) and to examine the impact of PTAs on international trade (see Egger et al, 2008; Baier and Bergstrand, 2009a).

[21] There are alternative approaches. One is to use IV estimation, but this requires strong assumptions about functional form, and typically requires the existence of instruments that are correlated with the selection indicators but not directly with the outcome. A second alternative is to control for unobserved heterogeneity through the use of country-pair fixed effects (e.g. Aisbett, 2009). Such a method only gives unbiased estimates if new BIT membership is uncorrelated with the time-variant error, however. As mentioned by Aisbett (2009), the approach can also reduce the variability in the data, which can result in insignificant coefficients.

been in the absence of the BIT. The problem is that the counterfactual is unobservable, and this is where matching can help. We can estimate the counterfactual, using the average value of the change in FDI for country-pairs that didn't have a BIT at time t. In order for this to be valid however, we require that any differences in the changes in the FDI variable between BIT members and the non-BIT control group (other than those due to the presence of the BIT) are eliminated. We thus require a suitable control group. The basic idea behind matching is to find for each treated individual in the sample (e.g. for each country pair entering into a BIT) an untreated individual (i.e. country pair not entering a BIT) with similar characteristics. We match on the characteristics listed in Table 2, under the assumption that once these characteristics have been controlled for, country pairs are effectively randomly assigned to the BIT and non-BIT groups.[22] A comparison of the outcomes for the treated and the matched untreated groups then gives an estimate of the effect of the treatment.[23]

It is generally impractical to match on many explanatory variables. Similarity is therefore defined according to some metric that maps the vector of observables into a univariate variable. Two approaches are often adopted. The first approach is called Mahalanobis matching, and involves weighting the coordinates of the covariates matrix by the inverse of that variable. The second is called propensity score weighting and involves constructing the probability of treatment using a Logit or Probit equation.[24] For the latter approach, we use Probit specification 3 in Table 2, albeit considering the probability of new BIT formation only. This specification has the highest

[22] This approach is often termed 'selection on observables' and relies upon the assumption of ignorability of treatment (Rosenbaum and Rubin, 1983).

[23] In particular, this gives an estimate of the average treatment effect on the treated (ATT, see below), which in our case gives the expected impact of new BIT membership on FDI flows (or stocks) for a randomly drawn country-pair in the subsample of country-pairs that actually entered into a BIT agreement. Note that the ATT can be obtained from a weighted least squares regression, where the weights for the untreated observations correspond to the weights used in the construction of the control group.

[24] For more information on the difference between these estimators see Wooldridge (2010) and the Stata help file for psmatch2. Each method has strengths and weaknesses, and so we present results from both below. Wooldridge (2002) does note however that the Mahalanobis approach of matching on the full set of covariates can be computationally intensive. It has also been shown that a large number of covariates can lead to substantial bias (see Fröhlich, 2004). To overcome this problem, Abadie and Imbens (2006) suggest a bias correction that renders the matching estimator consistent. In the analysis below, we apply this bias correction when using the Mahalanobis estimator.

overall percent correctly predicted and reports relatively high values of the percent correctly predicted for both $BIT = 0$ and, more importantly, $BIT = 1$.[25]

Using one of these two approaches, it is possible to match a treated individual to either one or multiple untreated individuals. In the analysis below for example, we report results when matching with a single nearest neighbour and when matching with the five nearest neighbours. In the case of propensity score matching we further report results from alternative weighting methods. In particular, we use radius matching and kernel density matching. In the former case a radius of 0.1 (i.e. ten percentage points of the likelihood of becoming a new BIT pair) is chosen, such that all country-pairs within that radius will be included in the control group. The latter case uses all untreated observations in the control group, with the weights attached to each untreated individual declining with the propensity score difference of the treated observation.

Since the matching approach is only valid on a cross-section basis, we modify our cross-country time-series data using an approach similar to that of Egger et al (2008).[26] This involves the following steps:

1. For each year in our dataset, we calculate the log of the average of the FDI flow (or stock) from source i to host j in the five years *prior* to that year, ($\ln PAFDI_{ijt}$), as well as the logged average of FDI flows or stocks in the five years subsequent to our year of interest ($\ln SAFDI_{ijt}$). We further calculate the average over the previous five years of each of the continuous explanatory variables (PAX_{ijt}).

2. We then drop all observations for which a BIT was already in force prior to year t, ensuring that existing BITs will never be used in the comparison group in the matching procedure.

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[25] As a robustness check we repeat the matching analysis using specification 6, which has the highest overall percentage correctly predicted. These results are not reported for reasons of brevity, but are consistent with the results reported below and available upon request.

[26] An alternative approach is to ignore the time-series dimension and concentrate on a single cross-section, as adopted by Baier and Bergstrand (2009a) in their study of the trade effects of PTAs.

3. The difference in the FDI stocks and flows between the two time periods is then calculated for the remaining country-pairs:

$$\Delta \ln FDI_{ijt} = (\ln SAFDI_{ijt}) - (\ln PAFDI_{ijt})$$

By concentrating on five-year windows on either side of the date a BIT is entered into we are considering the contemporaneous (or short-run) impact of BITs on FDI flows and stocks. We can view our modified data as a cross-section of new BIT signing events (though we do control for differences in the change in FDI over time by including year fixed effects in the list of explanatory variables in various specifications).

4. Using either Mahalanobis or propensity score matching, we match new BIT country-pairs to non-BIT country-pairs at time t on the basis of the observable explanatory variables, PAX_{ijt}.

5. We define $NewBIT_{ijt} = 1$ if i and j formed a BIT in period t, and zero otherwise; and $\Delta lnFDI_{ijt}^{T}$ as the change in FDI if i and j are 'treated' (i.e. form a BIT) in year t, and $\Delta lnFDI_{ijt}^{U}$ as the change in FDI otherwise. We can then calculate the following: (i) the average treatment effect (ATE) defined as

$$ATE = E(\Delta lnFDI_{ijt}^{T} - \Delta lnFDI_{ijt}^{U})$$

which gives an estimate of the expected effect of treatment for a randomly drawn country pair from the population; (ii) the Average Treatment effect of the Treated (ATT) defined as

$$ATT = E(\Delta lnFDI_{ijt}^{T} - \Delta lnFDI_{ijt}^{U} | NewBIT_{ijt} = 1)$$

which provides an estimate of the mean effect of treatment for those pairs which are actually treated; and (iii) the Average Treatment effect of the Untreated (ATU) defined as:

$$ATU = E(\Delta lnFDI_{ijt}^{T} - \Delta lnFDI_{ijt}^{U} | NewBIT_{ijt} = 0)$$

which gives the expected effect of hypothetical treatment for those pairs not treated.

This approach of comparing the difference in FDI flows and stocks immediately prior to and after the formation of a BIT for both new BIT partners and a control group of non-BIT partners is termed the matched difference-in-difference estimator. In addition to controlling for observed heterogeneity between the BIT and non-BIT samples through the use of the matching procedure, the method also controls for unobserved heterogeneity through the use of the difference-in-difference procedure, thus potentially providing strong evidence of the causal effects of BITs on FDI.

In our analysis, we use the information on whether FDI flows or stocks were initially non-positive to capture the separate effects of BITs on the intensive (IM) and extensive (EM) margins of FDI. We do this through two additional variables, namely:

$$\Delta \ln FDI_{ijt}^{IM} = \begin{cases} (\ln SAFDI_{ijt}) - (\ln PAFDI_{ijt}) & \text{if } PAFDI_{ijt} > 0 \\ 0 & \text{if } PAFDI_{ijt} \leq 0 \end{cases}$$

$$\Delta \ln FDI_{ijt}^{EM} = \begin{cases} (\ln SAFDI_{ijt}) - 0 & \text{if } PAFDI_{ijt} \leq 0 \\ 0 & \text{if } PAFDI_{ijt} > 0 \end{cases}$$

Given that we use linear estimators in our regression analysis and given that each country-pair lies at either the intensive or extensive margin (i.e. $\Delta \ln FDI_{ijt} = \Delta \ln FDI_{ijt}^{IM} + \Delta \ln FDI_{ijt}^{EM}$), we can separate the overall effect of BIT formation into an effect that works along the intensive margin and one that works along the extensive margin.

Table 3 reports descriptive statistics for our dependent and explanatory variables based upon the final dataset used for the difference-in-difference analysis. The continuous explanatory variables are the averages of the five years prior to the year of interest. The mean values of the FDI variables indicate a general tendency for the change in FDI flows and stocks between two five year periods to be positive. Since these are differences in logged averages, we can state that on average FDI flows showed an increase between two five-year periods of 79.3%, with the average change for FDI stocks being 101.7%. Interestingly, we observe an average change in the intensive margin for FDI flows that is negative (-11.7%), with that in the case of FDI stocks being positive, but small (0.3%), suggesting that much of the increase in FDI flows and stocks has occurred along the extensive margin.

Table 3 further includes information on discrete variables, such as the number of observations for which we observe a movement along the extensive margin (i.e. FDI births, $FDI^{j,BIRTH}, j = F, S$) and the number for which we observe the death of an FDI relationship ($FDI^{j,DEATH}$ $j = F, S$). The Table indicates that 12% (11%) of observations had a shift from zero to positive FDI flows (stocks) in the sample period, with 3% (1.5%) seeing a shift from positive to zero flows (stocks). In 2.5% of observations a new BIT was formed during the sample period.

Table 3: Descriptive Statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
$PAFDI^F$	32,275	14,659.6	179,494.9	0.6	871,5401.0
$SAFDI^F$	32,275	30,002.4	282,634.4	0.6	9,602,991.0
$PAFDI^S$	32,275	127,760.7	1,388,279.0	1.0	60,600,000.0
$SAFDI^S$	32,275	262,131.7	2,611,473.0	1.0	96,500,000.0
$\Delta \ln FDI^F$	32,275	0.793	3.028	-13.524	15.149
$\Delta \ln FDI^{F,IM}$	32,275	-0.117	1.452	-13.524	10.069
$\Delta \ln FDI^{F,EM}$	32,275	0.910	2.616	-0.511	15.149
$\Delta \ln FDI^S$	32,275	1.017	3.214	-17.799	16.600
$\Delta \ln FDI^{S,IM}$	32,275	0.003	1.229	-17.799	11.067
$\Delta \ln FDI^{S,EM}$	32,275	1.014	2.971	0.000	16.600
$\ln(GDP_i + GDP_j)$	31,462	26.820	1.329	22.112	30.282
$GDPsim_{ij}$	31,462	-4.069	1.856	-11.189	-1.386
$\ln Dist_{ij}$	32,289	8.770	0.659	4.088	9.850
$K_i/(K_i + K_j)$	32,289	0.737	0.352	0	1.000
$POLCON_j$	32,289	0.184	0.196	0	0.687

Variable	Observations	Frequency	Percentage (%)
$FDI^{F,BIRTH}$	32,275	3,915	12.1
$FDI^{F,DEATH}$	32,275	983	3.0
$FDI^{S,BIRTH}$	32,275	3,662	11.3
$FDI^{S,DEATH}$	32,275	479	1.5
PTA_{ij}	32,289	1,701	5.3
$NewBIT_{ij}$	32,338	805	2.5
$Contig_{ij}$	32,289	100	0.3
$Comlang_{ij}$	32,289	3,853	11.9
$Colony_{ij}$	32,289	807	2.5

Notes: Descriptive statistics are based upon the final data used for the difference-in-difference analysis. $PAFDI$ and $SAFDI$ are reported in thousands of US\$. Superscript $F(S)$ refers to FDI Flows (Stocks), with $IM(EM)$ referring to the intensive (extensive) margin, and $BIRTH$ ($DEATH$) referring the birth (death) of FDI relationships between time periods.

Table 4 reports the mean (and standard deviation) of our different FDI flow and stock variables for all observations, and separately for country-pairs that formed BITs and those that did not. Also reported is the difference in mean values between BIT and non-BIT country-pairs and results of a simple t-test for significant differences between the two means. The mean values (and standard deviations) of all variables in the Table are larger for new BIT pairs than for non-BIT pairs. While these differences are significant overall and for the extensive margin for FDI flows, they are not significantly different in the case of the intensive margin. In the case of FDI stocks we observe that all differences are highly significant.

Table 4: Comparison of BIT and non-BIT Country-Pairs

	All	NewBIT = 0	NewBIT = 1	Difference	t-test (p-value)
$\Delta \ln FDI^{F}$	0.793 (0.017)	0.762 (0.017)	1.999 (0.156)	1.237	0.000***
$\Delta \ln FDI^{F,IM}$	-0.117 (0.052)	-0.119 (0.008)	-0.047 (0.081)	0.073	0.163
$\Delta lnFDI^{F,EM}$	0.910 (0.015)	0.881 (0.015)	2.045 (0.133)	1.164	0.000***
$\Delta \ln FDI^{S}$	1.017 (0.018)	0.981 (0.018)	2.438 (0.153)	1.457	0.000***
$\Delta \ln FDI^{S,IM}$	0.003 (0.007)	-0.002 (0.007)	0.219 (0.049)	0.221	0.000***
$\Delta FDI^{S,EM}$	1.014 (0.017)	0.983 (0.016)	2.219 (0.149)	1.236	0.000***

Notes: This table reports the mean value of (changes in) the FDI variables (with standard errors in brackets) for all observations, for non-BIT country-pairs and for new BIT country-pairs. Also reported is the difference in the mean between new and non-BIT members and the p-value of a simple t-test of significant differences in these variables between new and non-BIT pairs.

Tables 5 and 6 report our main difference-in-difference estimates of the effects of BITs on FDI flows and stocks respectively. Results are reported for changes in FDI for all observations, and decomposed into the intensive and extensive margins, for the ATT, ATE and ATU. The upper part of the table reports results using the unmatched data with the lower part reporting results when using the matched data. In the case of the unmatched sample, results are reported when excluding and including year fixed effects, and when including the additional control variables (i.e. the set of explanatory variables described above and the variables used to control for multilateral resistance).[27]

The results for the unmatched sample in Table 5 are similar to those reported in Table 1. They suggest an increase in FDI flows following BIT formation of between 96% and 253%, with the significant effects of BIT formation working along the extensive margin. Coefficients on the BIT

[27] Note, that the differencing procedure will remove the country-pair fixed effects, so these are not controlled for in any of the specifications.

dummy at the intensive margin tend to be positive, but small and not significant, while at the extensive margin we find coefficients that are large, positive and significant.

Turning to the matching results, we observe an ATT[28] of between 0.348 and 1.091 when looking at all FDI flows, with the lower estimate being insignificant. These estimates suggest an increase in FDI flows due to BIT membership of between 41% and 198%. The mean estimate of the ATT is around 0.70, which is similar to the smallest estimate using the unmatched sample, and suggests an increase in FDI flows of around 102%. The ATT along the intensive margin is found to be small, insignificant, and occasionally negative. Along the extensive margin however, we find an ATT that is positive and significant across all the different matching estimators.

The results for FDI stocks in Table 6 are broadly similar, with the estimated effects of BIT formation being to increase FDI stocks by between 109% and 330% for the full unmatched sample of observations. When looking at results along the intensive and extensive margins, we find coefficients on the BIT dummy that are positive and significant along both dimensions, though the coefficients tend to be considerably larger in the case of the extensive margin. For the intensive margin we find estimated average increases of between 14% and 25%. When using the matched sample, we find an estimated ATT of between 0.21 and 1.29, implying an increase in FDI stocks due to BIT formation of between 23% and 262%. The mean value of the estimates is similar to the lower estimates from the unmatched sample, and suggests an increase in FDI stocks of around 109% following BIT formation. We find a significant ATT in four cases for both the intensive and extensive margins, with the estimated effects being larger at the extensive margin in each case.

In general, the results in Tables 5 and 6 suggest that not matching leads to inflated estimates of the effect of BITs on FDI, with the lower (upper) unmatched estimate being 94% (16%) higher

[28] For completeness we also report the estimated the average treatment effect (ATE) and the hypothetical treatment effect on the sample of non-treated individuals (ATU). Standard errors in these two cases are bootstrapped. For reasons of brevity we concentrate on the ATT in our discussion of the results.

than the lower (upper) estimate when matching in the case of FDI flows. For FDI stocks, the lower (upper) unmatched estimate is around 251% (13%) higher. Not controlling for self-selection appears to overestimate the effects of BIT formation on FDI flows and stocks.[29]

These results further suggest that the extensive margin is important in the effects of BIT formation on FDI flows and stocks. Indeed we find no significant increase in FDI flows for those country-pairs for which FDI flows were already positive in the period prior to BIT formation. For FDI stocks we find that BIT formation works along both margins, with the estimated effects at the extensive margin tending to be larger, however. Converting these effects into estimated quantities is complicated here, because the usual proportional or percentage change interpretation cannot be directly applied at the extensive margin whose base value (i.e. pre-treatment FDI flow or stock) is zero by definition. However, when we recognise that the treatment effects are capturing changes in the FDI flows and stocks of the treated relative to the untreated in the post-BIT-formation period, and we observe that even the untreated country pairs on the extensive margin had positive FDI flows and stocks on average in this period, we see that the post-treatment-period averages for the untreated country pairs gives us a valid base to work from. If our matching has been valid, this is what the average FDI flows and stocks of the treated country pairs would have been had they not been treated.

Following this approach (see Appendix B for fuller details), our estimated average change in FDI (flows or stocks) due to BIT formation at the extensive margin is given by

$$[e^{\hat{\beta}_{BIT}} - 1]SAFDI^{EM}(BIT = 0)$$

[29] The matching results also show a tendency to be larger for radius and kernel matching than for nearest neighbour and five nearest neighbour matching. The former two weighting mechanisms involve using more untreated country-pairs as matches than the latter two, The nearest neighbour weighting, for example, simply uses the single country-pair with a value of the propensity score closest to the treated country-pair, while the kernel method uses all non-treated country-pairs as a match, albeit with smaller weights for more distant country-pairs. This use of more distant matches may help explain why the ATTs tend to be more similar to the unmatched results when using radius and kernel matching.

where $\hat{\beta}_{BIT}$ is the coefficient on the BIT dummy in the case of the unmatched sample and the estimated ATT in the case of matching, and $SAFDI^{EM}(BIT = 0)$ is the average value of the FDI (stocks or flows) for the untreated country pairs at the extensive margin in the post-treatment period. The corresponding formula for the estimates at the intensive margin involves an adjustment because, unlike the extensive margin, at the intensive margin the treated and untreated country pairs had different averages in the pre-treatment period. Our estimated average change in FDI (flow or stock) due to BIT formation at the intensive margin is

$$[e^{\hat{\beta}_{BIT}} - 1]\left\{\frac{PAFDI^{IM}(BIT = 1)}{PAFDI^{IM}(BIT = 0)} \times SAFDI^{IM}(BIT = 0)\right\}$$

where $PAFDI^{IM}(BIT = 0)$ and $PAFDI^{IM}(BIT = 1)$ are the average values of FDI flows or stocks in the pre-treatment period for untreated and treated country pairs at the intensive margin respectively. The second term in this expression estimates what the average FDI (flow or stock) of the treated would have been in the post-treatment period, had they not been treated.

Applying these formulae[30] to FDI flows we find, for the unmatched sample, estimated effects of BIT formation on the intensive margin ranging from \$5.9 million to \$7.3 million, while those along the extensive margin range from \$3.5 million to \$9.8 million. For the matched sample the numbers are smaller, ranging from of \$-2.6 million to \$6.6 million along the intensive margin and \$1.9 million to \$7.9 million along the extensive margin. Although these estimated effects at the two margins are of similar orders of magnitude, recall that the estimated coefficients at the intensive margin are not statistically significant. Turning to FDI stocks, we would expect the estimated short-run (five year) changes at the extensive margin to be much smaller than those at the intensive margin simply because of the large difference in the average stocks at the two margins in the pre-treatment period. This expectation is confirmed. In the matched sample, for example, we find estimated effects along the intensive margin between \$50.4 million and \$188

[30] Details of the following calculations are provided in Appendix Table A2.

million, while the range along the extensive margin is only $2.2 million to $29 million. Similar results are found when using the unmatched sample, though the estimated effects tend to be considerably larger.

Table 5: Difference-in-Difference Results for FDI Flows

	$\Delta \ln FDI^{F}$			$\Delta \ln FDI^{F,IM}$			$\Delta \ln FDI^{F,EM}$		
Unmatched	1.237***	1.262***	0.674***	0.0726	0.0857	0.0904	1.164***	1.177***	0.584***
	(0.157)	(0.156)	(0.157)	(0.0802)	(0.0799)	(0.0819)	(0.133)	(0.133)	(0.134)
Year FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Additional controls	No	No	Yes	No	No	Yes	No	No	Yes
	ATT	ATU	ATE	ATT	ATU	ATE	ATT	ATU	ATE
Mahalanobis Distance Metric (Bias Adjusted)									
One to One Matching	0.3479	0.1895*	0.1876	-0.0034	-0.0769	-0.0716	0.3513*	0.2664***	0.2592**
	(0.2181)	(0.1039)	(0.1435)	(0.1115)	(0.1033)	(0.0545)	(0.1853)	(0.1027)	(0.1072)
Five Nearest Neighbour Matching	0.4926***	0.3656***	0.3641***	0.0811	-0.0479	-0.0455	0.4114***	0.4134***	0.4096***
	(0.1750)	(0.1164)	(0.1155)	(0.0902)	(0.0832)	(0.0565)	(0.1482)	(0.1331)	(0.0841)
Propensity Score Metric									
One to One Matching	0.6443***	0.5897**	0.5911***	-0.0338	-0.0808	-0.0796	0.6781***	0.6704***	0.6707***
	(0.2135)	(0.2380)	(0.1824)	(0.1108)	(0.0813)	(0.0891)	(0.1787)	(0.1620)	(0.1924)
Five Nearest Neighbour Matching	0.7134***	0.4780***	0.4841**	0.0089	-0.1218	-0.1185	0.7045***	0.5998***	0.6025***
	(0.1700)	(0.1395)	(0.2347)	(0.0892)	(0.2287)	(0.0818)	(0.1445)	(0.1417)	(0.1985)
Radius Matching (radius = 0.01)	1.0909***	1.1033***	1.1030***	0.0648	-0.0241	-0.0218	1.0261***	1.1274***	1.1248***
	(0.1585)	(0.1654)	(0.1480)	(0.0822)	(0.0815)	(0.0661)	(0.1343)	(0.1068)	(0.1364)
Kernel Matching (Epanechnikov kernel,	0.9273***	0.8855***	0.8865***	0.0622	-0.0809	-0.0772	0.8650***	0.9664***	0.9637***
bandwidth = 0.06)	(0.1589)	(0.1304)	(0.1516)	(0.0824)	(0.0868)	(0.0683)	(0.1347)	(0.1281)	(0.1522)

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. The top half of this table reports the coefficient on a BIT dummy from a difference-in-difference regression. The lower half of the table reports various treatment effects from BIT membership on North-South FDI flows. ATT, ATU and ATE refer to the Average Treatment Effect on the Treated, the Average Treatment Effect on the Untreated and the Average Treatment Effect respectively. Standard errors for the ATU and ATE are bootstrapped.

Table 6: Difference-in-Difference Results for FDI Stocks

	$\Delta \ln FDI^{S}$			$\Delta \ln FDI^{S,IM}$			$\Delta \ln FDI^{S,EM}$		
Unmatched	1.457***	1.433***	0.738***	0.221***	0.224***	0.139***	1.236***	1.208***	0.599***
	(0.153)	(0.153)	(0.151)	(0.0494)	(0.0498)	(0.0534)	(0.149)	(0.148)	(0.148)
Year FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Additional controls	No	No	Yes	No	No	Yes	No	No	Yes
	ATT	ATU	ATE	ATT	ATU	ATE	ATT	ATU	ATE
Mahalanobis Distance Metric (Bias Adjusted)									
One to One Matching	0.2105	0.4179**	0.4101***	0.0766	-0.0665	-0.0630	0.1339	0.4843***	0.4731***
	(0.2220)	(0.2046)	(0.1182)	(0.0733)	(0.0453)	(0.0530)	(0.2143)	(0.1761)	(0.1487)
Five Nearest Neighbour Matching	0.3273**	0.6789***	0.6679***	0.0671	0.0380	0.0389	0.2603	0.6409***	0.6291***
	(0.1731)	(0.2042)	(0.1289)	(0.0573)	(0.0335)	(0.0728)	(0.1677)	(0.2622)	(0.1936)
Propensity Score Metric									
One to One Matching	0.7630***	0.3467	0.3575	0.2298***	-0.1778	-0.1668	0.5332***	0.5240***	0.5242**
	(0.2163)	(0.2625)	(0.2501)	(0.0789)	(0.1606)	(0.1397)	(0.2055)	(0.1969)	(0.2466)
Five Nearest Neighbour Matching	0.7837***	0.3264*	0.3382	0.1628***	-0.1908*	-0.1816	0.6209***	0.5172***	0.5198***
	(0.1684)	(0.1886)	(0.2223)	(0.0579)	(0.0977)	(0.1478)	(0.1638)	(0.1795)	(0.1505)
Radius Matching (radius = 0.01)	1.2871***	1.2313***	1.2327***	0.2087***	0.1656**	0.1667***	1.0784***	1.0658***	1.0661***
	(0.1548)	(0.1687)	(0.1418)	(0.0504)	(0.0669)	(0.0440)	(0.1505)	(0.1460)	(0.1083)
Kernel Matching (Epanechnikov kernel,	1.0499***	0.9857***	0.9873***	0.1720***	0.0805	0.0829	0.8779***	0.9052***	0.9045***
bandwidth = 0.06)	(0.1552)	(0.1152)	(0.1458)	(0.0507)	(0.0479)	(0.0635)	(0.1509)	(0.1384)	(0.2002)

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. The top half of this table reports the coefficient on a BIT dummy from a difference-in-difference regression. The lower half of the table reports various treatment effects from BIT membership on North-South FDI flows. ATT, ATU and ATE refer to the Average Treatment Effect on the Treated, the Average Treatment Effect on the Untreated and the Average Treatment Effect respectively. Standard errors for the ATU and ATE are bootstrapped.

5. Heterogeneous Effects of BITs

Apart from distinguishing between the intensive and extensive margins, our approach so far has imposed the condition that the effects of BIT formation on FDI stocks and flows are the same across country-pairs. But in general we may expect that these effects will depend on the same explanatory variables as determine the FDI flows and stocks themselves. In particular, based on the literature we anticipate a heterogeneous impact of BITs depending on policy stability in the host, with existing evidence suggesting that BITs and institutions could be substitutes or complements. Increasingly PTAs include provisions related to FDI, so it is also of interest to examine whether there are differences in the effects of BITs on FDI flows and stocks if country-pairs already have a PTA in force.

Wooldridge (2002) discusses a regression based approach that allows for interactions of the treatment variable and explanatory variables that can be extended to our matched difference-in-difference setting. This approach involves regressing the measure of FDI on the treatment status variable (i.e. the BIT dummy), the set of explanatory variables and the demeaned explanatory variables interacted with the treatment dummy. In adopting this approach, we begin by matching using the propensity score and then estimate the treatment effects using weighted least squares (WLS), including in the WLS regression our set of explanatory variables and the demeaned explanatory variables interacted with the treatment dummy. Table 7 (8) reports results for the FDI flows (stocks), for all observations and separately for the intensive and extensive margins. In our discussion, we concentrate on the sign and significance of the coefficients on the interactions to give some indication on the extent and direction of any heterogeneity.

Since we have no reason a priori to expect the interaction effects for flows and stocks to differ in sign and significance, our main interest is in results that are robust across both flows and stocks and a range of matching methods. The positive and significant coefficients on combined market size and GDP similarity appear to meet this criterion. Larger and more similar sized markets also appear to strengthen the effects of BITs at both the intensive and extensive margins. Otherwise, there is some evidence (from the stock equations at least) that increased distance reduces a BITs effectiveness, while a common language increases it. The stock equation also suggests that a former colonial relationship may reduce the effectiveness of a BIT, primarily through the extensive margin. The coefficients on the common border interaction are sometimes significant, but their signs offer no consistent pattern. Of the two variables mentioned at the start of this section, we find no robust evidence that an existing PTA affects the impact of a new BIT, and slight evidence that policy constraints are complementary to BIT formation. This suggestion of complementarity between BITs and domestic institutions is consistent with the other work using bilateral FDI data reviewed earlier,

Table 7: Heterogeneous Treatment Effects of BIT Membership on FDI Flows

	$\Delta \ln FDI^{F}$				$\Delta \ln FDI^{F,IM}$				$\Delta \ln FDI^{F,EM}$			
	NN	5NN	Radius	Kernel	NN	5NN	Radius	Kernel	NN	5NN	Radius	Kernel
Main effect of new BIT	0.332*	0.290	**0.434*****	**0.381****	**-0.173***	-0.0923	**-0.171****	-0.127	**0.504*****	**0.382****	**0.606*****	**0.508*****
	(0.183)	(0.188)	(0.157)	(0.165)	(0.0889)	(0.0955)	(0.0827)	(0.0855)	(0.159)	(0.157)	(0.132)	(0.137)
Interaction terms with:												
$\ln Dist_{ij}$	0.315	-0.170	-0.298	-0.289	0.0802	0.0186	-0.118	-0.111	0.234	-0.189	-0.180	-0.178
	(0.200)	(0.201)	(0.252)	(0.226)	(0.0969)	(0.102)	(0.133)	(0.117)	(0.173)	(0.168)	(0.212)	(0.189)
$\ln(GDP_{it} + GDP_{jt})$	**0.822*****	**0.730*****	**0.269***	**0.478*****	**0.248*****	0.102	**0.127***	0.0930	**0.574*****	**0.627*****	0.142	**0.385*****
	(0.130)	(0.132)	(0.142)	(0.137)	(0.0628)	(0.0671)	(0.0750)	(0.0713)	(0.112)	(0.110)	(0.119)	(0.115)
$GDPsim_{ijt}$	**0.443*****	**0.395*****	0.0672	**0.230****	**0.143*****	0.0667	**0.113****	**0.106****	**0.301*****	**0.329*****	-0.0458	0.125
	(0.102)	(0.103)	(0.105)	(0.102)	(0.0492)	(0.0521)	(0.0551)	(0.0531)	(0.0879)	(0.0858)	(0.0878)	(0.0854)
$Contig_{ij}$	**5.353*****	**3.993****	1.587	2.965	0.397	0.518	0.439	0.720	**4.956*****	**3.476*****	1.148	2.245
	(1.381)	(1.580)	(2.455)	(1.868)	(0.669)	(0.804)	(1.294)	(0.970)	(1.195)	(1.322)	(2.061)	(1.559)
$Comlang_{ij}$	1.026	0.712	0.865	0.605	**0.637****	0.236	0.0102	-0.0425	0.389	0.475	0.855*	0.647
	(0.642)	(0.655)	(0.545)	(0.579)	(0.311)	(0.333)	(0.287)	(0.300)	(0.555)	(0.548)	(0.458)	(0.483)
$Colony_{ij}$	-0.994	-0.757	-0.251	-0.815	-0.156	-0.0859	0.668	0.479	-0.838	-0.671	-0.919	**-1.293***
	(0.809)	(0.775)	(0.939)	(0.847)	(0.392)	(0.394)	(0.495)	(0.439)	(0.700)	(0.649)	(0.788)	(0.707)
$K_{it}/(K_{it} + K_{jt})$	0.321	0.676	-0.258	-0.0562	-0.182	-0.229	-0.111	-0.0834	0.503	0.905**	-0.147	0.0272
	(0.490)	(0.483)	(0.479)	(0.488)	(0.237)	(0.246)	(0.252)	(0.254)	(0.424)	(0.404)	(0.402)	(0.408)
$POLCON_{jt}$	**1.662****	**1.734****	1.193	0.901	-0.263	0.152	0.128	-0.0966	**1.924*****	**1.581*****	1.064	0.998
	(0.725)	(0.724)	(0.837)	(0.813)	(0.351)	(0.368)	(0.441)	(0.422)	(0.627)	(0.606)	(0.703)	(0.679)
PTA_{ijt}	**0.842***	0.267	0.251	0.194	-0.0478	-0.121	-0.149	-0.380	**0.890****	0.388	0.400	0.573
	(0.510)	(0.499)	(0.692)	(0.611)	(0.247)	(0.254)	(0.365)	(0.317)	(0.442)	(0.418)	(0.581)	(0.510)

Notes: Robust standard errors reported in parentheses; *** p<0.01, ** p<0.05, * p<0.1; NN and 5N refer to nearest neighbour and five nearest neighbour matching respectively.

Table 8: Heterogeneous Treatment Effects of BIT Membership on FDI Stocks

	$\Delta \ln FDI^{S}$				$\Delta \ln FDI^{S,IM}$				$\Delta \ln FDI^{S,EM}$			
	NN	5NN	Radius	Kernel	NN	5NN	Radius	Kernel	NN	5NN	Radius	Kernel
Main effect of new BIT	0.00142	0.0218	0.186	0.170	-0.111	-0.182**	-0.175***	-0.164***	0.112	0.204	0.362***	0.334**
	(0.176)	(0.177)	(0.143)	(0.152)	(0.0800)	(0.0802)	(0.0490)	(0.0562)	(0.162)	(0.165)	(0.140)	(0.146)
Interaction terms with:												
$\ln Dist_{ij}$	-0.196	-0.741***	-0.432*	-0.380*	0.00215	-0.108	-0.111	-0.146*	-0.198	-0.633***	-0.321	-0.233
	(0.192)	(0.190)	(0.230)	(0.209)	(0.0872)	(0.0860)	(0.0787)	(0.0772)	(0.177)	(0.177)	(0.225)	(0.200)
$\ln(GDP_{it} + GDP_{jt})$	1.242***	1.259***	0.919***	1.094***	0.318***	0.344***	0.287***	0.295***	0.924***	0.915***	0.632***	0.798***
	(0.124)	(0.125)	(0.130)	(0.127)	(0.0565)	(0.0563)	(0.0444)	(0.0469)	(0.114)	(0.116)	(0.127)	(0.122)
$GDPsim_{ijt}$	0.547***	0.612***	0.290***	0.404***	0.225***	0.236***	0.161***	0.177***	0.323***	0.376***	0.129	0.227**
	(0.0975)	(0.0968)	(0.0953)	(0.0944)	(0.0443)	(0.0438)	(0.0327)	(0.0350)	(0.0898)	(0.0899)	(0.0934)	(0.0907)
$Contig_{ij}$	-2.890**	-0.0469	-1.107	-0.830	1.767***	1.048	1.049	1.399**	-4.657***	-1.095	-2.156	-2.229
	(1.324)	(1.492)	(2.237)	(1.723)	(0.602)	(0.675)	(0.767)	(0.638)	(1.220)	(1.386)	(2.192)	(1.655)
$Comlang_{ij}$	1.389**	2.231***	1.152**	1.479***	0.566**	0.416	0.0795	0.170	0.823	1.815***	1.073**	1.309**
	(0.616)	(0.619)	(0.497)	(0.534)	(0.280)	(0.280)	(0.170)	(0.198)	(0.567)	(0.574)	(0.487)	(0.513)
$Colony_{ij}$	-0.852	-2.263***	-0.929	-1.496*	-0.530	-0.491	-0.121	-0.142	-0.323	-1.772***	-0.808	-1.354*
	(0.776)	(0.732)	(0.856)	(0.781)	(0.353)	(0.331)	(0.293)	(0.289)	(0.715)	(0.680)	(0.838)	(0.750)
$K_{it}/(K_{it} + K_{jt})$	1.668***	1.170**	0.305	0.757*	-0.321	-0.415**	-0.0925	-0.0835	1.989***	1.585***	0.397	0.841*
	(0.470)	(0.456)	(0.436)	(0.450)	(0.214)	(0.206)	(0.150)	(0.167)	(0.433)	(0.424)	(0.428)	(0.433)
$POLCON_{jt}$	-0.260	-0.202	-0.0371	-0.0671	0.728**	0.510*	0.305	0.278	-0.987	-0.712	-0.342	-0.345
	(0.695)	(0.684)	(0.763)	(0.750)	(0.316)	(0.309)	(0.261)	(0.278)	(0.641)	(0.635)	(0.748)	(0.720)
PTA_{ijt}	-0.140	-0.558	0.444	0.370	-0.0790	-0.270	0.0280	0.101	-0.0614	-0.288	0.416	0.269
	(0.489)	(0.472)	(0.631)	(0.564)	(0.223)	(0.213)	(0.216)	(0.209)	(0.451)	(0.438)	(0.618)	(0.542)

Notes: Robust standard errors reported in parentheses; *** p<0.01, ** p<0.05, * p<0.1; NN and 5N refer to nearest neighbour and five nearest neighbour matching respectively.

6. Conclusions

This paper uses a matched difference-in-difference methodology to estimate the causal effects of BIT formation on FDI flows and stocks from OECD source countries to a large sample of host countries. We find that BIT formation has a positive and significant impact on FDI flows and stocks, with the estimated effects found to be substantially lower after controlling for self-selection through matching. Our mean estimates suggest an approximate doubling of bilateral FDI flows and stocks after BIT formation, though there is considerable variation in estimates across matching methods. The development of new FDI relationships was found to be an important component of these effects. Indeed, for FDI flows BIT formation only had a statistically significant effect at the extensive margin. For FDI stocks, the effects for existing FDI relationships were estimated to be quantitatively much larger.

There is some evidence that the effects of BIT formation are heterogeneous, depending on combined market size and similarity in particular. The effects may be smaller for country-pairs that are more distant, or have a prior colonial relationship, and may be larger for country-pairs that share a common language. While an existing PTA may have a positive impact on FDI flows and stocks and the probability that two countries sign a BIT, we find little evidence that an existing PTA makes a new BIT more effective. The suggestion that institutional quality might be complementary to BIT formation was consistent with existing results, and does not provide support for the view that BITs can act as an alternative to appropriate domestic institutions for protecting the rights of foreign investors.

In terms of future work, the inclusion of investment provisions in recent attempts at deep trade agreements among advanced nations, suggests a similar examination of the effects of BIT agreements on North-North investment might be useful. Likewise, before we use our and others' results to proclaim the 'FDI creating' benefits of BITs it would be useful to know the extent to which these estimates of the effects of BIT formation in promoting bilateral FDI actually represent 'FDI diversion'. It is not unlikely that at least some of this FDI would otherwise have gone to third parties.

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Appendix A: Country Sample

The North (reporter countries) are: Australia, Austria, Belgium, Canada, Switzerland, Germany, Denmark, Spain, Finland, France, the United Kingdom, Greece, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Sweden and the United States of America.

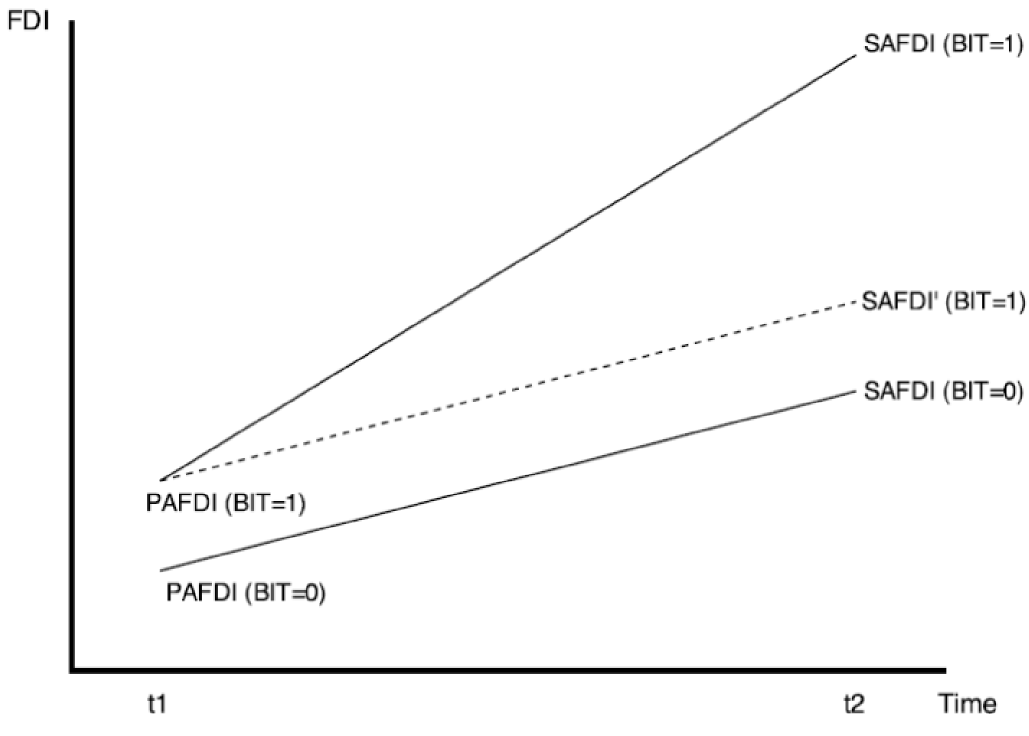
The South (recipient countries) are: Albania, Algeria, Argentina, Armenia, Azerbaijan, Bahamas, Bangladesh, Belarus, Belize, Benin, Bhutan, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Brunei, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, Central African Republic, Chad, Chile, China, Colombia, Comoros, Costa Rica, Cote d'Ivoire, Croatia, Cuba, Cyprus, Czech Republic, Djibouti, Dominican Republic, Ecuador, Egypt, El Salvador, Equatorial Guinea, Eritrea, Estonia, Ethiopia, Gabon, Gambia, Guatemala, Haiti, Honduras, Hong Kong, Hungary, Iceland, India, Indonesia, Iran, Jordan, Kazakhstan, Kenya, Krygzstan, Laos, Latvia, Lebanon, Lesotho, Liberia, Macao, Macedonia, Madagascar, Malawi, Malaysia, Mali, Malta, Mauritania, Mauritius, Mexico, Moldova, Mongolia, Montenegro, Morocco, Mozambique, Namibia, Nepal, Nicaragua, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Republic of Korea, Republic of the Congo, Romania, Russia, Rwanda, Senegal, Serbia, Sierra Leone, Singapore, Slovakia, Slovenia, South Africa, Sri Lanka, Sudan, Swaziland, Syria, Tajikistan, Tanzania, Thailand, Togo, Trinidad and Tobago, Tunisia, Turkey, Turkmenistan, Uganda, Ukraine, United Arab Emirates, Uruguay, Uzbekistan, Venezuela, Vietnam, Zambia.

Appendix B: Estimating the Quantitative Effects of BITs along the Intensive and Extensive Margins

In this appendix, we explain how we calculate comparable estimated quantitative effects of BIT formation on FDI flows and stocks along the intensive and extensive margins. As discussed in the main text, our problem arises because the values of FDI flows (stocks) along the extensive margin are zero by definition in the pre-BIT period (i.e. $PAFDI_{ijt} = 0$), and hence cannot be used as a base to calculate the quantitative effects of BIT formation.

Figure A1 is a graphical illustration of the standard difference-in-difference estimator. In the initial period ($t1$), FDI for the treated and untreated groups are given by $PAFDI(BIT = 1)$ and $PAFDI(BIT = 0)$ respectively. Assuming a common trend, the outcomes in the second period ($t2$) would be given by $SAFDI'(BIT = 1)$ and $SAFDI(BIT = 0)$ for the treated and untreated groups respectively, if the effect of the treatment was zero. In the case pictured, the actual value of FDI in period $t2$ for the treated group is given by $SAFDI(BIT = 1)$, with the distance $SAFDI(BIT = 1) - SAFDI'(BIT = 1)$ then representing the estimated treatment effect.

Figure A1: Difference-In-Difference Estimates



Using Figure A1, we can describe how we obtain our estimate of the quantitative impact of treatment along the intensive and extensive margins. In the case of the extensive margin, the value of FDI in period $t1$ will be the same for the treated and untreated groups, i.e. $PAFDI(BIT = 1) = PAFDI(BIT = 0) = 0$. The estimated treatment effect will therefore be:

$$SAFDI(BIT = 1) - SAFDI'(BIT = 1) = SAFDI(BIT = 1) - SAFDI(BIT = 0)$$

Using the estimated coefficient on the BIT dummy in the unmatched case and the ATT in the case of matching ($\hat{\beta}_{BIT}$) in the analysis above, we can write the quantitative impact of BIT formation on the extensive margin of FDI as:

$$SAFDI(BIT = 1) - SAFDI'(BIT = 1) = [e^{\hat{\beta}_{BIT}} - 1]SAFDI(BIT = 0) \quad \text{(A1)}$$

In the case of the intensive margin, $PAFDI(BIT = 1)$ will generally not be equal to $PAFDI(BIT = 0)$, with $PAFDI(BIT = 1)$ differing from $PAFDI(BIT = 0)$, by the factor:

$$F = \frac{PAFDI(BIT = 1)}{PAFDI(BIT = 0)}$$

In period $t2$ therefore, we can use F to obtain an estimate of $SAFDI'(BIT = 1)$ as:

$$SAFDI'(BIT = 1) = F \times SAFDI(BIT = 0) \quad \text{(A2)}$$

We can then use this information to calculate the quantitative impact of BIT formation on the intensive margin of FDI as:

$$SAFDI(BIT = 1) - SAFDI'(BIT = 1) = [e^{\hat{\beta}_{BIT}} - 1](F \times SAFDI(BIT = 0))$$

Table A1 reports the average values of $PAFDI$ and $SAFDI$ for the treated and untreated groups. Based upon these data we can calculate $SAFDI'(BIT = 1)$ in the case of the intensive margin for FDI flows and stocks as:

$$SAFDI'(BIT = 1)^{FDI\ Flows} = \frac{45{,}168.2}{134{,}532} \times 232{,}447.4 = 78{,}042.6$$

$$SAFDI'(BIT = 1)^{FDI\ Stocks} = \frac{377{,}986.8}{996{,}154.5} \times 1{,}912{,}717 = 725{,}772.7$$

With this and information from Table A1, along with equations (A1) and (A2), and the estimated treatment effects in Tables 5 and 6 we calculate the range of estimated effects of BIT formation. These are reported in Table A2.

Table A1: Mean Values of $SAFDI$ and $PAFDI$ by Group

		Extensive Margin $lnPAFDI = 0$			Intensive Margin $lnPAFDI \neq 0$		
	BIT	Obs.	Mean	Std. Dev.	Obs.	Mean	Std. Dev.
FDI Flows							
PAFDI	1	547	1	0	253	45,168.19	134,344.1
PAFDI	0	28056	1	0	3433	134,532	534,247.8
SAFDI	1	546	13,190.98	65,779.6	256	121,417.8	311,447.3
SAFDI	0	28050	4,427.292	65,710.02	3469	232,447.4	808,542.8
FDI Stocks							
PAFDI	1	579	1	0	221	377,986.8	1,064,802
PAFDI	0	27433	1	0	4056	996,154.5	3,795,748
SAFDI	1	578	42,537.69	247,554.8	224	868,817.1	2,112,215
SAFDI	0	27427	15,161.51	206,181.7	4092	191,2717	7,078,451

Notes: This table reports the mean and standard deviation of $PAFDI$ and $SAFDI$ (in thousands of US dollars) along the extensive and intensive margin for the treated and untreated groups separately.

Table A2: Range of Estimated Effects of BITs along the Extensive and Intensive Margin

	Sample	Range of Coefficients	Lower Estimate	Upper Estimate
FDI Flows				
Extensive Margin	Unmatched	0.584 – 1.164	$\left(4{,}427.29 \times (e^{0.584} - 1)\right) \times 1{,}000 = \$3{,}511{,}713$	$\left(4{,}427.29 \times (e^{1.164} - 1)\right) \times 1{,}000 = \$9{,}752{,}074$
	Matched	0.3513 – 1.0261	$\left(4{,}427.29 \times (e^{0.3513} - 1)\right) \times 1{,}000 = \$1{,}863{,}506$	$\left(4{,}427.29 \times (e^{1.0261} - 1)\right) \times 1{,}000 = \$7{,}925{,}571$
Intensive Margin	Unmatched	0.0726 – 0.0904	$\left(78{,}042.6 \times (e^{0.0726} - 1)\right) \times 1{,}000 = \$5{,}876{,}664$	$\left(78{,}042.6 \times (e^{0.0904} - 1)\right) \times 1{,}000 = \$7{,}383{,}770$
	Matched	-0.0338 – 0.0811	$\left(78{,}042.6 \times (e^{-0.0338} - 1)\right) \times 1{,}000 = -\$2{,}593{,}758$	$\left(78{,}042.6 \times (e^{0.0811} - 1)\right) \times 1{,}000 = \$6{,}592{,}987$
FDI Stocks				
Extensive Margin	Unmatched	0.599 – 1.236	$(15{,}161.5 \times 0.599) \times 1{,}000 = \$12{,}436{,}942$	$(15{,}161.5 \times 1.236) \times 1{,}000 = \$37{,}021{,}633$
	Matched	0.1339 – 1.0784	$(15{,}161.5 \times 0.1339) \times 1{,}000 = \$2{,}172{,}317$	$(15{,}161.5 \times 1.0784) \times 1{,}000 = \$29{,}412{,}883$
Intensive Margin	Unmatched	0.139 – 0.224	$\left(725{,}772.7 \times (e^{0.139} - 1)\right) \times 1{,}000 = \$108{,}230{,}200$	$\left(725{,}772.7 \times (e^{0.224} - 1)\right) \times 1{,}000 = \$182{,}220{,}492$
	Matched	0.0671 – 0.2298	$(725{,}772.7 \times 0.0671) \times 1{,}000 = \$50{,}370{,}377$	$(725{,}772.7 \times 0.2298) \times 1{,}000 = \$187{,}502{,}154$

Notes: This table reports the range of estimated quantitative effects of BIT formation on the intensive and extensive margin of FDI flows and stocks. Values are multiplied by 1,000 to express the effects in US$ rather than 1,000s of US$.

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