Bilateral Investment Treaties and Foreign Direct Investment: Correlation versus Causation

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Abstract

The rapid and concurrent increase in both foreign investment and government efforts to attract foreign investment at the end of last century makes the question of causality between the two both interesting and challenging. I take up this question for the case of the nearly 2,500 bilateral investment treaties (BITs) that have been signed since 1980. Using data on bilateral investment outflows from OECD countries, I test whether BITs stimulate investment in twenty eight low- and middle-income countries. In contrast to previous studies that have found a strong effect from BIT participation, I explicitly model and empirically account for the endogeneity of BIT adoption. I also test for a signaling effect from BITs. I find that the initially strong correlation between BITs and investment flows is not robust controlling for selection into BIT participation. Furthermore, I find no evidence for the claim that BITs signal a safe investment climate. My results show the importance of accounting for the endogeneity of adoption when assessing the benefits of investment liberalization policies.

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1. Introduction

In the last fifteen years of the 20th century foreign direct investment (FDI) growth outstripped all other global economic measures, with no less than ninety four countries experiencing FDI growth rates in excess of 20% per year (UNCTAD, 2001). At the same time there was a broadening consensus regarding the benefits of FDI to host countries, particularly less industrialized ones. As a result, over 1,100 national policy changes in favor of FDI were introduced worldwide between 1991 and 2000 (UNCTAD, 2001). The rapid and concurrent expansion of FDI and policies to attract FDI make the question of causality between the two both interesting and challenging. This paper addresses this question for bilateral investment treaties (BITs). Specifically, I test whether participation in BITs leads to increased FDI inflows from the treaty partner countries.

By the end of 2005 nearly 2,500 BITs had been signed, most of them after 1990 (UNCTAD, 2006a). The stated intent of the treaties is the "reciprocal promotion and protection of investment" between signatory governments. Among other things, BITs specify rights to invest in accordance with the laws of the host, rights to freely transfer funds and assets, minimum treatment standards, and protection from expropriation. The most economically important aspect of BITs, however, is the direct investor-state dispute mechanisms which allow investors to bring claims of treaty violations to arbitration tribunals outside of the host state. For example, if a host raises taxes levied on a foreign firm's profits above levels agreed at the time of investment, the foreign investor may be able to take an expropriation claim to arbitration under the BIT. The incorporation of an international dispute resolution mechanism distinguishes BITs from domestic policy statements and makes them a potentially effective commitment device.[1]

Existing studies have found contradictory evidence regarding the impact of BITs on FDI. Hallward-Driemeier (2003) and Tobin and Rose-Ackerman (2004) find either no impact or a negative impact of BITs, while Neumayer and Spess (2005) and Salacuse and Sullivan (2004) find strong positive impacts. Neumayer and Spess attribute the different conclusions of the various studies to differences in sample, and in the case of Hallward-Driemeier (2003), the inability of her methodology to capture signaling effects. I explain the different findings of these studies in terms of methodological issues, many of which are common to the broader literature on the impacts of FDI and trade promotion policies. I illustrate these general

[1] I discuss the evidence on the limits to the effectiveness of BITs are as a commitment device in Section 2.

empirical issues using panel data of FDI outflows from OECD countries to twenty eight low- and middle-income countries. I suggest several simple specification improvements to address these issues, and show that the omission of any one of these improvements (as is usually the case in the existing empirical FDI literature) can lead to serious errors in inference.

One empirical issue turns out to be less of a concern than expected. I find that selection bias, which has received some attention in the recent trade and investment literature , is effectively eliminated by the inclusion of country-pair fixed effects in the specification ((Razin, Rubinstein and Sadka, 2003), (Helpman, Melitz and Rubinstein, 2005), (Razin, Sadka and Tong, 2005)).

Although accounting for data-related empirical issues is important, the primary problem for researchers wishing to assess the impacts of policies to promote FDI is that policy adoption is endogenously determined. In the case of BITs, there is potential endogeneity due to both reverse causality and omitted variables. For example, increased FDI flows in one year may cause a BIT to be signed in the next, or an improvement in the investment climate of the host may cause a simultaneous increase in both FDI and BIT participation. I show the potential for both these forms of endogeneity by modeling a simple game between a host government deciding whether to participate in a BIT and a representative foreign firm deciding whether to invest in the host.

The starting point for my empirical analysis of the impact of BITs is to test the robustness of the BIT indicator to the set of specification improvements discussed earlier. I find that the BIT indicator is positive and significant, even in my preferred (most conservative) specification. Robust positive correlation between BITs and FDI is one of the empirical predictions of my model. However, this prediction is based on a combination of the causal effect of BITs and the endogeneity of BIT formation. Thus it would be a mistake to conclude from these results that BITs have a significant positive impact on bilateral FDI flows. Further evidence that the observed correlation between BITs and FDI flows is not predominantly attributable to a causal effect of BITs is provided by the magnitude of the BIT coefficient. The point estimate implies that BIT participation is associated with an over 50% increase in bilateral FDI flow. Not even the most enthusiastic proponent of BITs would feel comfortable atttributing such an increase to the causal impact of BITs.

The standard approach to deal with the endogeneity of right hand side variables is to use an instrumental variable. Unfortunately, a suitable instrument for BITs is not available. However, BITs themselves are exogenous *ex post*, that is, once in place, a BIT remains in place for a minimum of 10 years. This characteristic of BITs means that it is possible to overcome the lack of an instrument if we can satisfactorily control for BIT adoption.[2] The use of bilateral data provides a great deal of potential in this regard which has not been exploited by previous studies. I find that when I include either proxies for the underlying growth rate of bilateral FDI between countries[3] or host- and source-year effects[4], the magnitude of the BIT coefficient drops and becomes statistically insignificant. These findings suggest that the strong correlation previously identified between BITs and FDI is substantially caused by the endogeneity of BIT adoption.

There are two issues which need to be addressed before concluding from these results that BITs have no significant impact on FDI flows. The first is that the controls used to reduce the endogeneity bias may also have disguised a signaling effect of BITs. Signaling a safe investment climate has been suggested by other authors as potentially the primary function of BITs ((Hallward-Driemeier, 2003), (Neumayer and Spess, 2005)). The use of bilateral data allows me to explicitly test for a signaling effect by replacing the BIT dummy in my base specification with the number of BITs that the host has signed with other OECD countries. If BITs have a signaling effect, participation by the host in BITs with other OECD countries should lead to an increase in FDI received. I find no evidence of such an effect.

A second potential concern is that my efforts to control for endogeneity may have left too little variation in the data with which to identify the effects of BIT participation. It is not possible to completely rule this out. However, it is possible to show that much of the correlation identified in the base specification is due to the endogeneity of BITs. To do this I use a graphical event study analysis to show that BITs are signed when FDI flows are already increasing. I also use Granger-type analysis of the relationship between BITs and expropriation risk to show that BITs are ratified when expropriation risk falls, but the ratification of BITs does not lead to further decreases in expropriation risk.

The rest of this paper is organized as follows. I begin in Section 2 with a short overview of the basic theory and case evidence on the potential of BITs to function as a commitment device for the host. Section 3 presents a theoretical model of BIT function and the decision of a host country to participate in one. Section 4 provides a summary of the data and general specification issues, which are addressed in detail in Appendix A. Section 4 also

[2]This approach is common in the program evaluation literature, where the identifying assumption is often referred to as the 'ignorability of treatment' following Rosenbaum and Rubin (1983).

[3]Specifically I include individual linear time trends for each source-host country-pair.

[4]Host-year effects are a set of dummies for each host in all but one year. Source-year effects are analogously defined.

introduces and motivates my empirical approach to the endogeneity of BIT participation and shows that selection bias is not a concern in my specifications. Section 5 presents the results of the regression analysis, followed by the graphical event study of BIT participation. The final subsection of results shows that BITs do not attract investment from non-partner countries through signaling. Section 6 uses a simple Granger-type analysis to show that BIT participation follows improvements in the host investment climate, but that improvements in the investment climate do not follow BIT participation. Finally, Section 7 concludes and suggests directions for future research.

2. BITs in Practice

The primary economic function of BITs is to act as a commitment device for the host government. BITs are designed to achieve this function through direct investor-state dispute resolution mechanisms which are constituted outside of the host state. If an investor from the partner country feels that the host government has violated their rights under the BIT, for example by expropriating the investment, they may bring a compensation claim to an international tribunal for arbitration. Most arbitration cases are run by either the International Center for the Settlement of Investment Disputes (ICSID), which is a part of the World Bank Group, or under the United Nations Commission on International Trade Laws (UNCITRAL) Arbitration Rules. As of 2005 there have been 225 known arbitration cases brought by foreign investors against host governments under an international investment treaty (UNCTAD, 2006b). Examples of host actions which have resulted in the investor bringing a compensation case under a BIT include the removal of tax breaks, failure to increase tariffs paid to the investor as agreed in contract, expropriation of land for incorporation into a national park, and denial of license renewal for a hazardous waste landfill.[5]

The need for an externally supported commitment device is motivated by the presence of sunk costs of investment which can lead to dynamic inconsistency of optimal policy for the host. Before the investor makes the investment, the host's optimal policy is to promise good conditions such as low taxes. After the investment takes place and costs are sunk, the optimal policy for the host is to extract rents up to the value of the sunk costs, that is, to directly or indirectly expropriate the investment. The result is a classic hold-up problem leading to underinvestment. BITs can solve the problem because they provide extra-national

[5] All these cases can be found on the ISCID website, http://www.worldbank.org/icsid/cases/awards.htm#awardARB0112 The case numbers for the examples are in order ARB/95/3, ARB/97/3, ARB/96/1, and ARB(AF)/00/2

arbitration of investor compensation claims and thereby help the host to credibly commit not to change its policy toward the investment.

Although the basic commitment device view leads to clear predictions regarding the investment promoting impacts of BITs, there are a number of reasons that we may not observe the effect empirically. To begin with, host governments do not necessarily have a commitment problem in the absence of a BIT. A substantial literature is devoted to showing how investor-state commitment problems may be overcome in the presence of repeated interactions, reputation effects, or through the use of financial mechanisms such as up-front subsidies (Doyle and van Wijnbergen, 1994), (Janeba, 2002). There are also alternative legal mechanisms which in some cases may be close substitutes for BITs as a means of protection from expropriation. For example, US firms may stipulate in their contracts with host governments that disputes be referred to US commercial courts (Pistor, 2002). Finally, firms may purchase political risk insurance that is offered by private firms, source governments, host governments, and the Multilateral Investment Guarantee Agency of the World Bank group. Thus, the investment-promoting impact of BITs will depend on how efficient they are in comparison to a variety of alternative means of reducing transaction costs between investors and host governments.

Independent of how efficient they are in comparison to alternative solutions to the hold-up problem, it is also reasonable to question how effective BITs actually are as a commitment device. In particular, the power of investor-state arbitration is limited by the lack of a world government to enforce the decisions of the tribunals. The extra-national arbitration process derives most of its power from raising the reputation costs of refusing to compensate an investor (Guzman, 2005). Anecdotal evidence from the investor-state dispute case history suggests that the enhanced reputation effect is present. For example, over half of the 110 completed cases listed on the ICSID website[6] ended in settlement between the parties. Furthermore, both investors and defending states invest significant sums in bringing and defending cases to arbitration tribunals. Both parties have average legal costs plus arbitration fees of around $1.5 to 2.5 million (UNCTAD, 2005). The confidence of investors in the mechanism is further suggested by the fact that despite the high expected legal costs, the rate of submission of disputes is rising rapidly. In 2005 alone, 50 of the total 226 investor-state cases brought under BITs were filed (UNCTAD, 2006a).

[6] Available at http://www.worldbank.org/icsid/cases/conclude.htm

3. Modeling the Economic Function of BITs

In this section I model a host government's decision whether to participate in a BIT and a foreign investor's decision whether to invest in the host. The model is intentionally simple as its primary purpose is to motivate my empirical strategy.

3.1 Description and Payoffs

The model consists of a simple dynamic game between a monopolist foreign investor and a single potential host government. The potential host government must decide whether to sign a BIT with the investor's home country in order to help attract the investor. In deciding, the host must weigh up the benefit of the potential new investment against the costs of signing a BIT. The host has existing investments from the investor's home country of magnitude S, on which it levies a tax of τ. If it signs a BIT with the home country, it must compensate both the new investor and any of the existing investors in the event that it expropriates their assets. In the first period the host chooses whether or not to participate in the BIT and the tax rate, t, which the new investor must pay if they choose to invest.

In the second period, the investor decides whether to make the investment. The activity will generate one unit of revenue and requires an investment of $K < 1$, which cannot be recovered.

In the third period, the residual values r and ρ are revealed, which the host gains if it expropriates the new and existing investments respectively. The random variables r and ρ are drawn from a distribution $g(\cdot)$ which is known in advance by both host and investor. For simplicity, I assume that the distribution $g(\cdot)$ is uniform with a support between zero and an upper bound, R: $g(\cdot)\ U[0, R]$. Based on the revealed residual values, the host decides whether or not to expropriate any of the investments in its territory. If the host does not expropriate the new investment, the new investor receives $1 - t - K$ and the host receives t. Similarly, if the host does not expropriate the existing stock of investment, it receives tax revenues $S\tau$. If the host does expropriate an investment, the payoffs depend on whether the host has ratified a BIT with the investors' home country. If the host has not ratified a BIT with the home country and it expropriates an investment, it gains the residual value of the expropriated investment, r or ρ respectively. If, on the other hand, the host has ratified a BIT with the home country and expropriates an investment, it must fully compensate the affected investor for its losses. Thus, if a BIT has been ratified and the host expropriates the new investment, it receives $r-(1-t)$, while the new investor receives $1-t-K$. If it expropriates the existing stock, it receives $\rho-(1-\tau)$.

Working backwards from period 3, it is clear that if they have not signed a BIT, the host will expropriate the new investment whenever $r>t$. Thus, given $r\ U[0,R]$, the probability of the host not expropriating is:

$$p_N = \begin{cases} \frac{t}{R} & for \quad t<R \\ 1 & for \quad t \geq R \end{cases} \tag{1}$$

An analogous expression describes the probability of expropriating the existing stock of investment. The expected payoff for a host which receives the new investment despite not ratifying a BIT with the investor's home country is given by:[7]

$$\begin{aligned} \widehat{U}_{NI} &= \int_t^0 t\ g(r)dr + \int_R^t r\ g(r)dr + S\left(\int_\tau^0 \tau\ g(r)dr + \int_R^\tau r\ g(r)dr\right) \\ &= \tfrac{1}{2R}\left(R^2+t^2+S(R^2+\tau^2)\right) \end{aligned}$$

and the payoff to a host that does not ratify the BIT and consequently does not receive the new investment is:

$$\widehat{U}_{NO} = \frac{S}{2R}\left(R^2+\tau^2\right)$$

The new investor's expected payoff to investment is:

$$\widehat{V}_{NI} = \frac{t(1-t)}{R} - K$$

The maximum expected investor payoff is at $t=\frac{1}{2}$ and is given by:

$$\widehat{V}_{NI}^{max} = \frac{1}{4R} - K \tag{2}$$

I assume that the residual value of an investment is always less than the total revenue it generates when still in the hands of the original investor, so that $R<1$. In this case, the full compensation requirement of a BIT will prevent the host from ever expropriating. Thus the payoffs to a host which ratifies an investment agreement with the home country are:

$$\widehat{U}_{BI} = t + S\tau$$

[7] The following assumes $t<R$. If not, the host will never expropriate and its expected payoff is simply the tax revenue, t.

if the host receives the new investment, and

$$\widehat{U}_{BO} = S\tau$$

if they do not.

Since the investor is fully insured against expropriation, its expected payoff to investment is:

$$\widehat{V}_{BI} = 1 - t - K$$

3.2 Host Benefit to BIT Ratification

The host's decision whether or not to ratify a BIT with the home country will depend on the trade-off between the benefit of extra investment gained and the cost of not expropriating the valuable assets of both existing and new investors. A host which knows it will receive the new investment without ratifying the BIT has no incentive to do so, as it means buying into a costly commitment device without getting any increased investment in return. From equation 2 we know that with full information about the host's type (R), the new investor will invest in a host in the absence of a BIT if and only if the host has $R < \underline{R} \equiv \frac{1}{4K}$. For a host with $R > \underline{R}$, the decision to ratify a BIT with home depends on the expected payoff to non-ratification and no new investment, compared to that for ratification and gaining new investment. Thus, the host will ratify if and only if $\widehat{U}_{BI} - \widehat{U}_{NO} > 0$. For $R > max[t, \tau]$ the condition is:

$$\widehat{U}_{BI} - \widehat{U}_{NO} = t + S\tau - \frac{S}{2R}(R^2 + \tau^2) > 0 \tag{3}$$

Once the BIT is signed, the host can set a maximum tax rate of $1 - K$ and still leave the investor indifferent between investing and not investing. I assume the investor invests in this case. Substituting this maximum tax into equation 3 and solving for the maximum R for which a host will be at least as well off after signing the BIT and gaining the new investment gives:

$$\overline{R} = \frac{1}{S}\left(1 - K + S\tau + \sqrt{(1-K)(1-K+2S\tau)}\right) \tag{4}$$

Thus the model allows us to identify three types of host:

- Type A with low expected residual value of expropriated FDI, that is, with $R < \underline{R}$,
- Type B with medium expected residual value of expropriated FDI, that is, with $\underline{R} < R < \overline{R}$, and
- Type C with high expected residual value of expropriated FDI, that is, with $R > \overline{R}$.

For Type A, the expected benefits and associated probability of expropriation, are so low that they can induce investment without signing a BIT. For Type B, the incentive to expropriate is high enough that in the absence of the insurance provided by a BIT, investors will not invest regardless of the tax rate. For Type C, the benefits to expropriation are so high that committing to not expropriating by ratifying a BIT is not worthwhile, even if it does allow them to attract new investment. Thus we would expect Type B hosts with intermediate probability of expropriation to be the most likely to participate in BITs.

3.3 Empirical Implications of the Model

In order to draw empirical implications from the model, I first need to briefly translate a couple of important model parameters into empirical concepts. A key component of the model is the decision by a single representative investor whether or not to invest in the host country. The model is normalized by the amount of revenue that would be generated if the investor chooses to invest. I will refer to the empirical application of this concept as the 'potential new investment' or the 'investment response' to the BIT. The potential new investment usually appears in the model relative to the existing stock of investment (measured equivalently), S.

The other important parameter which needs translating into an empirical concept is the upper bound of the distribution of possible residual values that the host obtains if it expropriates an investment, 'R'. The parameter, R, essentially defines the host's type and, all other things being equal, the probability that the host will expropriate a given investment. In the discussion which follows, I will treat R as if it were a measure whether the host has a 'good' or 'investor friendly' investment climate, or alternatively whether the host is a high or low probability of expropriating investments.

The size of the potential new investment relative to the existing stock and the host's probability of expropriating are the two main determinants of the benefit to the host of participating in a BIT with the home country. Empirically, I equate increases in the expected benefit to the host of participating to increases in the probability that the host will participate in a BIT. Thus the key empirical implications of the model are that:

- Conditional on the existing stock of investment, increasing the size of the potential new investment increases the probability that the host will participate in a BIT with the home country.
- Changes in the host's investment climate will change the probability that the host participates in BITs.

The first implication highlights the potential for overestimating the magnitude of the effect of BITs on FDI if reverse causality is ignored - the bigger the likely increase in FDI, the more likely a BIT is to be ratified. Notice that we are not able to sign the second empirical implication. As I show on page 9 there is a range of expropriation risks over which the host's benefits to BIT participation increase with decreasing risk, and a range over which they actually decrease. Since there is no way of determining which range a given country is in - particularly relative to investments from a given source - it is not possible to control for this implication by inclusion of a specific variable. The second implication highlights the need to address bias due to omitted variables about the investment climate in the host.

I return to the issues of reverse causality and omitted variable bias, and explain how my empirical approach addresses them, in Section 4.1. Before that, however, I introduce the data and discusses econometric issues common to empirical analyses using this type of data.

4. Data and Empirical Strategy

There are a large number of econometric and data concerns that should be addressed by any researcher interested in empirically studying the short-run determinants of FDI. I address these issues in detail and derive my chosen regression specification in the appendix. The discussion of specification includes the advantages and disadvantages of different dependent variables for the regressions (e.g. FDI stocks, affiliate sales, log FDI flow) and motivates the choice of log bilateral FDI flow due to its relatively good time series properties and low susceptibility to influential data points. The appendix also discusses the choice of control variables. Based on empirical performance, I adopt a set of controls which combine some of those suggested by Carr, Markusen and Maskus (2001)(namely share of trade in GDP for source- and host-, and the difference in factor endowments as proxied by differences in average years education), with others which are motivated both by the empirical trade literature and by recent theoretical FDI work by Helpman, Melitz and Yeaple (2004) (namely log source- and host- GDP and population).

Given the potential for omitted variable bias on my BIT coefficient, I also include a number of proxies in the specification. The proxy variables include country-pair fixed effects to control for unobservable determinants of the strength of the bilateral FDI relationship. Year effects are included to control for global shocks (such as business cycles) and trends in world FDI. I also reduce simultaneity by lagging the explanatory variables, and address heterogeneity by correcting the standard errors for clustering of residuals by country-pair. The resulting base specification is given in equation 5. Though all of these specification improvements should be routine when working with country-level panel data, they are remarkably inconsistently applied in the empirical FDI literature. This is a concern for many of the findings of the current literature, as is highlighted in the appendix by Tables 12 and 13 which show the impact of the stepwise addition of the specification improvements.

$$lnfdi_{ijt+1} = \varphi BIT_{ijt} + \alpha_I X_{it} + \alpha_J X_{jt} + \beta Z_{ijt} + \gamma_{ij} + \eta_t + \epsilon_{ijt} \quad (5)$$

where $lnfdi_{ijt+1}$ is the log flow of FDI from OECD source country to low- or middle-income host country (a.k.a. bilateral FDI),

BIT is a dummy which is zero in years before a BIT between host i and source j has been ratified, and 1 otherwise,

X_{kt}, $k = (i, j)$ is host (i) and source (j) log GDP, log population, and trade share in GDP,

Z_{ijt} is the skill gap, the product of skill gap and GDP difference, and product of skill gap and host trade share in GDP,

γ_{ij} is a country-pair specific fixed effect, and

η_t are year effects and

ϵ_{ijt} are idiosyncratic errors which I assume are clustered by country-pair.

My main data source is an unbalanced panel of bilateral FDI outflows reported by 24 OECD member countries to 28 recipient low- and middle-income countries for the period 1980-99. Although the panel has a potential for 24x28=672 observations per year, missing data means that the actual observations per year is far less. In 1982 - the first year for which I have a complete set of data (including all controls) - there are only thirty nine reporting country-pairs.[8] Tables 1 and 2 provide summary statistics for both the FDI data and control variables at the start and end of the study period. Data are discussed further in the appendix.

Table 1: Summary Statistics for 1982

Variable	Mean	Std. Dev.	Min.	Max.	N
Bilateral FDI flow	191.987	446.165	-36.87	2434.994	39
Lagged BIT ratification	0.051	0.223	0	1	39
Host GDP (Mill. $US)	0.233	0.24	0.046	0.948	39
Host GDP per capita ('000 $US)	3.559	1.598	0.908	6.467	39
Host Population (Mill.)	126.334	249.564	11.147	981.24	39
Host Trade Share in GDP (%)	37.136	24.286	14.29	110.86	39
Source GDP (Mill. $US)	0.672	0.403	0.057	1.212	39
Source GDP per capita ('000 $US)	10.085	1.231	7.239	11.746	39
Source Population (Mill.)	66.038	37.627	5.123	116.78	39
Source Trade Share in GDP (%)	46.936	21.211	28.65	126.35	39
Skill Gap (Years Education)	3.074	2.538	-3.5	7.543	39
Sum of GDPs (Mill. $US)	0.904	0.482	0.109	2.16	39
Squared Diff. GDPs	0.396	0.473	0	1.36	39
Skill_gap*GDP_diff.	-1.357	2.041	-7.678	3.525	39
Host_trade*Skill_gap^2	620.38	843.268	7.558	3722.36	39

4.1 Endogeneity of BIT Adoption

Although the general specification issues discussed in the appendix are all important for my analysis, the major econometric issue specific to my research question is the endogeneity of the decision to form a BIT. The model in Section 3 motivates the need to address both the potential for reverse causality (in the sense that increasing FDI flows increase the probability of a BIT being formed) and omitted variables (such as the host's investment climate).

Figures 1 and 2 supplement the theoretical motivation for attention to endogeneity issues with an empirical motivation. The figures also preview the conclusions of the regression analysis that will be presented in the next section. Figure 1 shows the strongly increasing trends in both total reported FDI flows and number of BIT ratified by country-pairs in the data. FDI and BITs are clearly highly correlated over time.

Figure 2 suggests the importance of addressing the potential endogeneity of BIT formation rather than relying on simple correlations of the type depicted in Figure 1. Figure 2

[8]The potential selection bias introduced by the missing data is discussed in Section 4.2.

Table 2: Summary Statistics for 1998

Variable	Mean	Std. Dev.	Min.	Max.	N
Bilateral FDI flow	419.526	1323.204	-491.667	12106	186
Lagged BIT ratification	0.392	0.501	0	2	186
Host GDP Mill. US Dollars	0.624	0.924	0.01	3.129	186
Host GDP per capita	4.331	1.921	1.678	7.16	186
Host Population (Mill.)	238.161	410.234	2.719	1227.2	186
Host Trade Share in GDP	60.526	50.005	16.7	221.54	186
Source GDP Mill. US Dollars	0.879	1.502	0.004	5.528	186
Source GDP per capita	14.581	3.022	5.299	20.647	186
Source Population (Mill.)	52.03	72.994	0.272	267.74	186
Source Trade Share in GDP	73.814	30.338	25.63	141.7	186
Skill Gap	2.751	2.482	-5.041	7.767	186
Sum of GDPs	1.503	1.724	0.081	8.657	186
Squared Diff. GDPs	3.297	7.636	0	30.448	186
Skill_gap*GDP_diff.	-1.344	9.561	-42.035	18.812	186
Host_trade*Skill_gap^2	646.864	721.078	0.324	4305.1	186

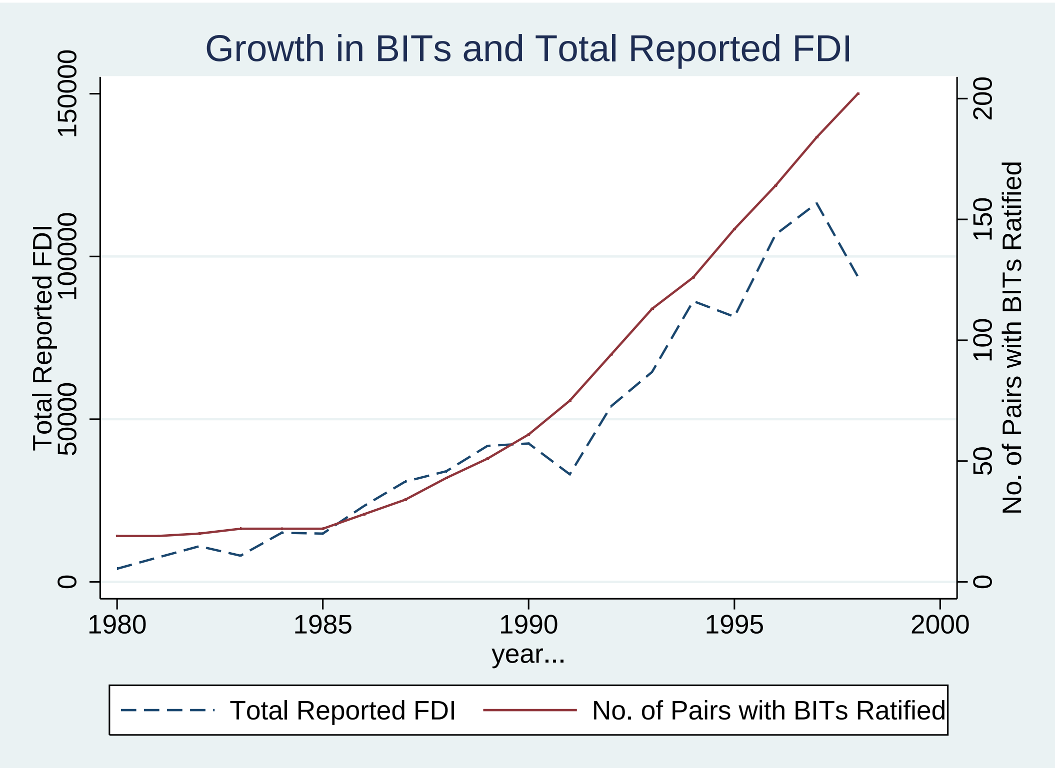

Figure 1: Total Reported FDI and Total BITs Ratified in the Data

shows three lines: the mean FDI flow between country pairs who never sign a BIT during the sample period; the mean FDI flow between country pairs who do sign a BIT during the sample period; and the number of BITs ratified by country pairs in my data. The first half of the graph shows that BITs begin to take off around 1985, a couple of years *after* mean FDI between signing pairs takes off. The second half of the graph shows that in the 1990s, when the rate of increase in BIT formation was highest, the mean FDI flow between signing pairs was growing slowly relative to both its own growth earlier in the period, and relative to flows between non-signing pairs. Thus the first half of Figure 2 is consistent with the explanation that BIT participation is driven by initial increases in bilateral FDI flows, and the second half of Figure 2 is consistent with the explanation that BIT participation is driven by variables that increase both FDI flows and BIT formation.

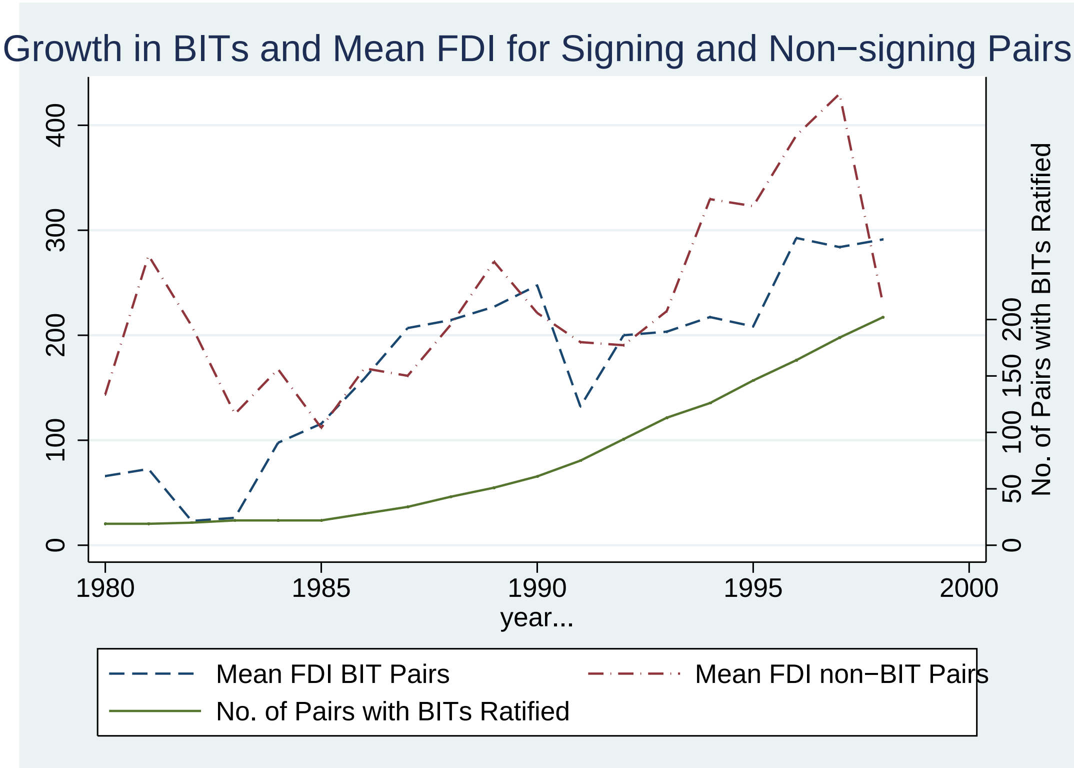

Figure 2: Mean FDI for Signing and Non-signing Pairs and Total BITs Ratified

In general, the preferred approach to addressing endogeneity is to use an exogenous instrument. In the case of BITs and FDI, however, it is very hard to identify a good instrument. Thankfully BITs themselves are exogenous *ex post*. That is, once a BIT is in place, it cannot become more or less in place for at least ten years. This means that, as is commonly done in the program evaluation literature, I can address endogeneity by fully controlling for adoption of BITs.

The three dimensional (host, source, year) nature of the OECD FDI data allows me to construct three sets of controls for the adoption of BITs: host-year dummies, source-year dummies, and host-source (i.e. country-pair) time trends. Host-year dummies mean that there is a separate dummy variable for all but one host country and every year. Source-year dummies are analogously defined. The motivation for including these variables is to control for any unobserved or imperfectly observed features of the investment climate in host or source in each year. In particular, these dummies control for changes in exchange rates, changes in host domestic policies toward FDI, changes in host expropriation probability, elections, etc. Thus host-year dummies in particular address the concern that the coefficient on BIT ratification is driven by the omission of changes in host country investment climate which lead to an increase in both FDI flows and BIT participation. Country-year dummies have also been recently recommended in the context of trade gravity models by Baldwin and Taglioni (2006).

The addition of country-pair specific time trends to the base specification helps to control for adoption of BITs driven by reverse causality from FDI flows. The model in Section 3 shows that, conditional on the existing stock of FDI, a higher bilateral flow of FDI will lead to a higher probability of BIT formation. This means that conditional on fixed effects (which control for the existing bilateral stock of FDI), country-pairs with higher bilateral FDI growth rates are more likely to form BITs.

A final way to reduce the bias in the BIT coefficient due to the endogeneity of BIT adoption is to correct for autocorrelation. Although the presence of autocorrelation does not lead to inconsistent estimates under the standard assumption of strict exogeneity of right hand side variables, it can exacerbate existing bias when strict exogeneity is violated. Intuitively, if there is feedback from higher FDI flows to BIT formation, a positive shock to FDI flows in one year increases the probability that a BIT is formed by the following year. Thus, if autocorrelation is not corrected for, the BIT dummy may capture the omitted effect of the serial correlation in the disturbance term. I test for first order autocorrelation using the Bhargava, Franzini and Narendranathan (1992) modified Durbin-Watson statistic for unbalanced panel data. I then correct for it by estimating the regression using Baltagi and Wu's (1999) feasible generalized least squares (FGLS) estimator for unbalanced panels with fixed effects in the presence of first order autocorrelation. Having established the presence of serial correlation, I report results for both the FGLS and the ordinary least squares with fixed effects for the remainder of the different specifications for addressing endogeneity and robustness checks.

4.2 Selection Bias

Before moving onto the results, there is one final potential econometric concern that needs to be addressed, that is, the large number of missing values in the OECD bilateral FDI dataset. There are two causes of missing observations in the data. The first is simply that different OECD members started reporting their FDI outflows at different times during the period of study. The first reporting year for each source country is reported in Table 14 in the appendix. Secondly, countries only report investment outflows over a particular size, where the threshold varies with the reporting country. Since bilateral FDI flows have been generally increasing since the 1980s, the number of reporting pairs has also increased. Figure 3 plots the increases in reporting source countries, reported host countries, and mean bilateral FDI over the study period.

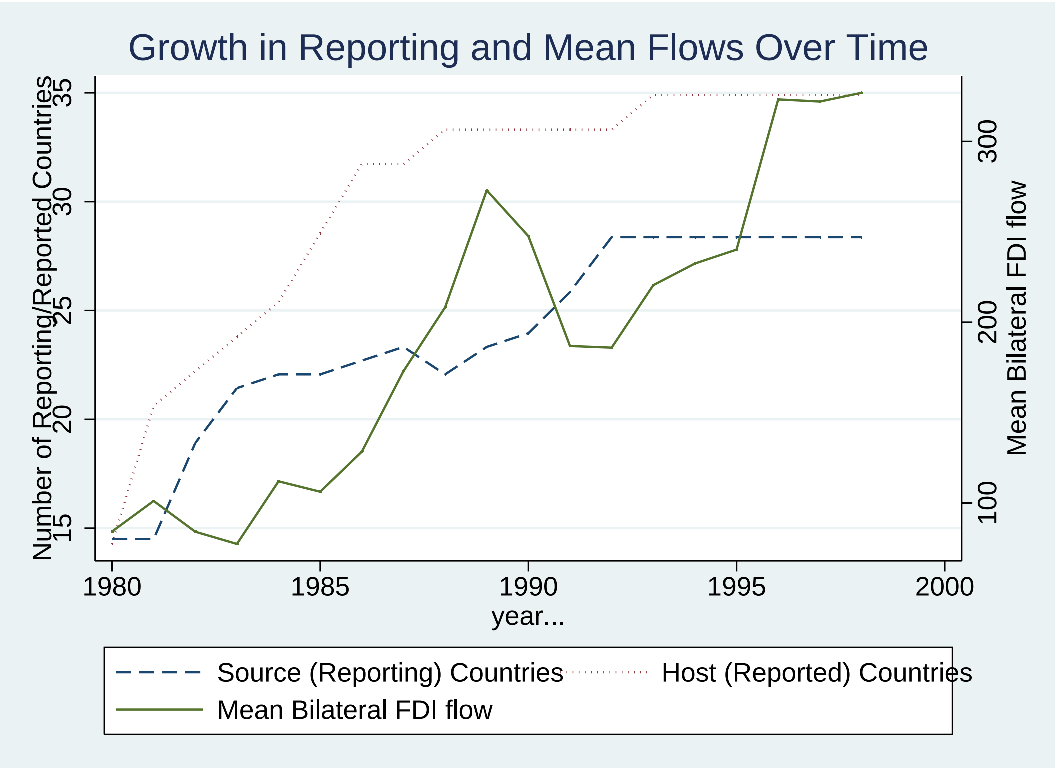

Figure 3: Mean FDI and number of source (host) countries reporting (reported) at least one bilateral FDI flow

Non-random missing data is a potential concern for my estimation. Indeed, several papers have highlighted this issue for either FDI or trade data and demonstrated the importance of jointly estimating participation and flow equations to correct selection bias ((Razin et al., 2003), (Helpman et al., 2005), (Razin et al., 2005)). Joint estimation of participation and flow equations, however, requires exclusion restrictions on the flow equation in order to be well identified (Wooldridge, 2002). In the absence of a structural model, I have little basis for exclusion restrictions. An alternative approach may be to treat the issue as one of truncation and use a Tobit framework. However, this would preclude the use of a fixed effects estimator, which is clearly unsatisfactory.[9]

The above discussion assumes, however, that selection bias is a problem for my estimates. It turns out that this is not the case, precisely because my preferred specification includes country-pair fixed effects.[10] Table 3 reports the results of a test for selection bias in different specifications of the bilateral FDI relationship. The test is based on the method of Nijman and Verbeek (1982) for a random effects context, applied to fixed effects as suggested by Wooldridge (2002, p.581). It simply involves the inclusion of a lagged indicator for missing FDI data in the regression equation. The test for selection bias amounts to a t-test of whether the coefficient on the lagged missing indicator is different from zero.[11]

The results of the test for selection bias in my preferred policy specification are shown in column 3 of Table 3. The lagged missing indicator is completely insignificant, suggesting that selection bias is not a problem in this specification. Columns 1 and 2 of Table 3 explain the apparent contradiction between my finding and the results of some other authors. Column 1 reports the results for a regression which includes year effects but no country or country-pair effects. This is consistent with the specification used by Razin et al. (2003). Column 2 reports the results for a regression which includes year effects and individual host and source effects, but not country-pair effects. This is consistent with the specification used by Helpman et al. (2005) and Razin et al. (2005). In both cases the lagged missing indicator

[9] The problem with this approach is that Tobit regressions with fixed effects are known to be biased. Using Monte Carlo studies, Greene (2003) shows that the coefficients estimates have very low bias, especially for relatively long panels such as the one used here. However, Greene found that the estimated variance is substantially biased, leading to an underestimation of standard errors. He concludes that when interested in a dummy variable such as a treatment effect, a random effects or pooled specification is preferred to the fixed effect model. Given the earlier analysis, the omission of fixed effects would be a serious limitation.

[10] It would be more technically correct to say that attrition bias - that is, bias due to country pairs which appear in some but not all years - is not a problem. It remains true that the sample is not a random cross-section of country-pairs. To be precise, only 711 of the potential 1,334 potential country-pairs report flows for at least one year in the sample period. However, given the potential sample covered by the OECD dataset only ever included the largest source and recipient countries, this is nothing new. Rather, the findings should be qualified by acknowledging that they represent the effect of BITs on FDI from major source countries to their major recipient countries.

[11] The more sophisticated test suggested by Wooldridge (2002, p. 581) is not applicable here as it also relies on exclusion restrictions from the flow equation.

is significant at the 1% level, suggesting selection bias can be a real concern if country-pair fixed effects are not used.

5. Results of Analysis of Bilateral FDI Data

This section presents the results of the empirical analysis of the relationship between FDI and BITs. I begin by examining the robustness of the BIT coefficient to the range of specifications improvements discussed in Appendix A. I find a strong positive correlation between FDI and BITs in all these specifications. This shows that my dataset is capable of reproducing the findings of Neumayer and Spess (2005) and Salacuse and Sullivan (2004), who both conclude that BITs have a strong positive impact on FDI. I then show that this finding is not robust to addressing the endogeneity of BIT participation by controlling for country-level characteristics at the time of ratification, or controlling for the underlying trends in bilateral FDI between country-pairs. I also show that correcting for autocorrelation using Baltagi and Wu's (1999) feasible generalized least squares (FGLS) estimator lowers the point estimate of the BIT dummy. The effect from correcting for autocorrelation is what we would expect if there is feedback from higher FDI in one year to increased probability of BIT formation in the next.

The second results subsection supplements the regression analysis with graphical event-study analysis. Consistent with the regression findings, the graphical analysis shows that BITs occur during times of increasing bilateral FDI, but shows no evidence that BITs cause an increase in FDI.

In the final subsection, I construct a measure of BIT participation with OECD countries other than the source and find no evidence that BITs attract FDI by acting as a signal of a safe or productive investment environment.

5.1 Main Results

I begin the analysis of the relationship between BITs and FDI by showing the robustness of the BIT coefficient to a range of specification improvements that are commonly used in the literature to reduce omitted variable and simultaneity bias, and correct for heteroskedasticity. These specification improvements are discussed in detail in the appendix. The results of this exercise are presented in Table 4. The BIT dummy is robustly and economically

Table 3: A simple test shows that selection bias due to missing data is not a concern when country-pair fixed effects are used. Log FDI is regressed on indicator of missing data plus other controls. Missing data indicator is insignificant when country-pair fixed effects are used.

COEFFICIENT	LABELS	OLS	Source/Host FE	Country-pair FE
fdiD	Missing Data Indicator[a]	-1.505***	-0.695***	-0.0621
		(0.19)	(0.14)	(0.10)
lnJgdp	Source Log GDP	8.512***	0.828	1.957***
		(0.64)	(0.59)	(0.56)
lnJpop	Source Log Population	-8.054***	-3.283	-7.354**
		(0.61)	(3.19)	(3.25)
lnIgdp	Host Log GDP	0.776*	-0.293	0.340
		(0.43)	(0.38)	(0.38)
lnIpop	Host Log Population	-0.681*	-0.425	-1.828
		(0.37)	(1.45)	(1.76)
edgap	Skill Gap	0.247***	-0.102	-0.289***
		(0.087)	(0.090)	(0.083)
Itragdp	Host Trade Share in GDP	-0.00801	-0.00953**	-0.0136***
		(0.0062)	(0.0046)	(0.0045)
Jtragdp	Source Trade Share in GDP	-0.00819	0.0136	0.0247**
		(0.0069)	(0.011)	(0.011)
edgapgdpdiff	Skill_gap*GDP_diff.	0.0565***	0.0454**	-0.0343
		(0.021)	(0.020)	(0.027)
Itragedgapsw	Host_trade*Skill_gap^2	0.000165	0.0000795	0.000280**
		(0.00019)	(0.000100)	(0.00014)
Source/host effects		No	Yes	No
Country-pair effects		No	No	Yes
Year effects		Yes	Yes	Yes
Observations		2317	2317	2317

[a] Indicator equals 1 if data for the country pair were missing in previous year, zero otherwise.
Robust(clustered) standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

and statistically significant. BITs, source GDP, and the host trade share in GDP are the only variables which remain significant and of the same sign across specifications. Furthermore, even in the most conservative specification (column 5) the magnitude of the coefficient suggests BITs are associated with an increase in bilateral FDI of over 50%.

The strong correlation of FDI and BITs even when conditioning on all the factors usually applied in the literature suggests two things. Firstly, BITs and FDI are closely related economic phenomena. That is, we would be surprised to see such robust correlation if BITs were merely a political or diplomatic tool with no economic policy relevance. Secondly, the coefficient on the BIT almost certainly does not represent the causal effect of BITs on FDI. Even the most enthusiastic proponent of BITs would not claim that they increase FDI flows by an average of over 50%. Rather, the results in Table 4 are entirely consistent with the endogeneity of BITs predicted by my model in Section 3.

I next demonstrate the effect of controlling for the endogeneity of BIT participation in a number of ways. Each of these controls take as a base specification the regression reported in column 5 of Table 4, and given in equation 5.

I first focus on reverse causality as a source of endogeneity of BITs. As discussed on page 13, two potential ways to reduce the bias on the estimated BIT coefficient caused by reverse causality are to correct for autocorrelation and to include country-pair specific time trends. I first confirm the presence of first order autocorrelation in the residuals from the base specification using Bhargava et al's modified Durbin-Watson test for serial correlation in an unbalanced panel (Bhargava et al., 1992). This test easily rejects the null of no serial correlation at the 5% level.[12] I, therefore, correct for first order autocorrelation using Baltagi and Wu's (1999) feasible generalized least squares (FGLS) estimator for unbalanced panels with fixed effects.

Columns 1-3 of Table 5 report respectively the OLS base specification (identical to column 5 of Table 4), the base specification estimated correcting for autocorrelation using FGLS, and the OLS base specification plus country-pair specific time trends.[13] The results show that reducing the influence of reverse causality through either method reduces the estimated coefficient on BITs. In column 2 the coefficient remains barely significant at the 10% level, while in column 3 it is not significant even at that level.

The insignificance of the BIT coefficient in column 3 needs to be understood in the

[12]Based on comparison of the test statistic with the 5% significance Tables in Bhargava et al., p.537

[13]The autocorrelation coefficient for the results in column 2 is 0.36, and the country-pair time trends are jointly highly significant.

Table 4: BIT participation robustly correlated with FDI. Log bilateral FDI regressed on indicator of BIT ratification plus other controls. Specifications are increasingly conservative moving left to right.

COEFFICIENT	LABELS	(1) lnfdi	(2) lnfdi	(3) lnfdi	(4) lnfdi	(5) F.lnfdi
R	BIT ratification indicator	0.799**	0.717***	0.467***	0.467***	0.444***
		(0.35)	(0.11)	(0.12)	(0.15)	(0.17)
lnJgdp	Source Log GDP	8.156***	2.272***	1.861***	1.861***	1.861***
		(0.69)	(0.40)	(0.43)	(0.57)	(0.56)
lnJpop	Source Log Population	-7.267***	2.936	-4.152*	-4.152	-6.905**
		(0.68)	(2.05)	(2.18)	(3.23)	(3.24)
lnIgdp	Host Log GDP	0.958**	0.599**	0.217	0.217	0.279
		(0.42)	(0.26)	(0.26)	(0.40)	(0.37)
lnIpop	Host Log Population	-0.969**	2.161***	-1.470	-1.470	-0.684
		(0.38)	(0.77)	(1.02)	(1.67)	(1.73)
edgap	Skill Gap	0.305***	-0.226***	-0.220***	-0.220***	-0.283***
		(0.100)	(0.072)	(0.072)	(0.075)	(0.081)
Itragdp	Host Trade Share in GDP	-0.0196***	-0.00895***	-0.00923***	-0.00923**	-0.0137***
		(0.0065)	(0.0035)	(0.0035)	(0.0041)	(0.0044)
Jtragdp	Source Trade Share in GDP	0.0220**	0.00537	0.000728	0.000728	0.0234**
		(0.0099)	(0.0062)	(0.0080)	(0.011)	(0.011)
edgapgdpdiff	Skill_gap*GDP_diff.	0.0429*	-0.0193	-0.0343	-0.0343	-0.0427
		(0.024)	(0.022)	(0.022)	(0.028)	(0.026)
Itragedgapsw	Host_trade*Skill_gap^2	0.000202	0.000285***	0.000252**	0.000252*	0.000276**
		(0.00021)	(0.00011)	(0.00011)	(0.00014)	(0.00014)
Constant		40.75***	-13.34*	24.28***	24.28*	29.58**
		(3.97)	(7.39)	(8.74)	(12.8)	(13.8)
Country-pair FE		No	Yes	Yes	Yes	Yes
Year effects		No	No	Yes	Yes	Yes
Cluster robust errors		No	No	No	Yes	Yes
Lagged controls		No	No	No	No	Yes
Observations		2098	2208	2208	2208	2317
R-squared		0.51	0.28	0.32	0.32	0.35
Number of country-pairs			281	281	281	287

Time-invariant controls included for column 1 but not reported are: number landlocked, number of islands, land border, colonial relationship and distance. Taken from Andrew Rose's website and defined as in Rose (2004)

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

context of the other coefficients in the regression. It is the case that none of the coefficients in column 3 are significant and of the theoretically predicted sign. However, the two other previously robust coefficients, source GDP and host trade share in GDP, are insignificant in column 3 of Table 5 because of a large increase in standard error, while the coefficient on the BIT has become insignificant mainly because the point estimate is less than half that in column 1.

Table 5: Significance of BITs not robust to controlling for country-pair trends. From left to right: Log bilateral FDI regressed on base specification; with correction for autocorrelation; and with addition of country-pair time trends.

COEFFICIENT	LABELS	(1) F.lnfdi	(2) F.lnfdi	(3) F.lnfdi
R	BIT ratification indicator	0.437***	0.245*	0.204
		(0.15)	(0.15)	(0.19)
lnJgdp	Source Log GDP	1.839***	1.030**	1.854
		(0.55)	(0.49)	(1.76)
lnJpop	Source Log Population	-6.811**	-0.0765	-9.521
		(3.26)	(0.49)	(12.7)
lnIgdp	Host Log GDP	0.272	0.122	0.624
		(0.38)	(0.34)	(0.60)
lnIpop	Host Log Population	-0.732	0.246	12.96
		(1.76)	(0.34)	(8.09)
edgap	Skill Gap	-0.287***	0.00180	-0.343***
		(0.082)	(0.082)	(0.093)
Itragdp	Host Trade Share in GDP	-0.0135***	-0.0117**	-0.0119
		(0.0044)	(0.0045)	(0.0074)
Jtragdp	Source Trade Share in GDP	0.0235**	-0.00112	0.0205
		(0.011)	(0.0091)	(0.013)
edgapgdpdiff	Skill_gap*GDP_diff.	-0.0391	-0.0119	-0.0363
		(0.027)	(0.028)	(0.047)
Itragedgapsw	Host_trade*Skill_gap^2	0.000282**	0.0000445	0.000420***
		(0.00014)	(0.00014)	(0.00014)
Country-pair FE		Yes	Yes	Yes
Year effects		Yes	Yes	Yes
FGLS/autocorrelation		No	Yes	No
Country-pair time trends		No	No	Yes
Observations		2317	2030	2317
Number of country-pairs		287	258	287

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

It is also worth noticing a number of other appealing features of the FGLS estimates. Firstly, the unrealistically large negative coefficient on source population is now much smaller and much more the magnitude we would expect. It now suggests that FDI is increasing in both the GDP and GDP per capita of the source. Secondly, two of the coefficients that were significant with the opposite sign to that predicted by the knowledge-capital model of FDI - that is, the skill gap and the interaction of the squared skill gap with host trade share - are now insignificant. In fact, the only three coefficients which are significant in the FGLS regression are the same three coefficients (BITs, source GDP and host trade share in GDP) which remained significant and of consistent sign across specifications in Table 4. Overall, the FGLS estimates are preferred to the OLS estimates. I therefore report the results of both estimators for the remaining regressions.

The second source of endogeneity bias for BITs suggested by the model in Section 3 is omitted variables. As discussed on page 13, the bilateral panel data I use provides a particularly useful means of controlling for omitted variables which are hard to measure. Specifically, I construct two sets of interaction terms: host-year dummies and source-year dummies. The results of including these interactions both individually and together are reported in Table 6. OLS estimates with errors corrected for clustering are in columns 1-3 and FGLS estimates correcting for autocorrelation are in columns 4-6.

Columns 1 and 3 have host-year dummies in place of the year dummies in columns 1 and 2 of Table 5. The inclusion of host-year dummies causes the point estimate of the BIT effect to fall under the clustered error assumption and rise slightly for the autocorrelation case. Columns 2 and 4 have source-year dummies in place of the year dummies. In comparison to columns 1 and 2 of Table 5 the inclusion of source-year dummies decreases the point estimate of the BIT dummy. This suggests that omitted source country conditions are at least as important as omitted host country factors in biasing the BIT coefficient upward in the base specification. Finally, columns 3 and 6 show the results of including both host and source-year dummy sets. The BIT coefficient reduces further and is now insignificantly different from zero at the 10% significance level for both OLS and FGLS estimators.

Note that estimates in Table 6 are not reported for some variables because they are colinear with the sets of county-year dummies.

Of course, the inclusion of such a large set of dummy variables could reduce the statistical significance of the BIT variable for two reasons: either it simply reduces the degrees of freedom and power of the regression, or it effectively controls for important variables that

Table 6: Significance of BITs not robust to controlling for host-year and source-year effects. Log bilateral FDI regressed on base specification plus host-year and/or source-year effects. Left columns OLS, right column FGLS correcting autocorrelation. Non-reported coefficients are for variables colinear with country-year controls.

COEFFICIENT	LABELS	(1) F.lnfdi	(2) F.lnfdi	(3) F.lnfdi	(4) F.lnfdi	(5) F.lnfdi	(6) F.lnfdi
R	BIT ratification indicator	0.396***	0.273*	0.210	0.310*	0.157	0.108
		(0.15)	(0.15)	(0.15)	(0.16)	(0.15)	(0.17)
lnJgdp	Source Log GDP	1.719***	.	.	1.747***	.	.
		(0.61)			(0.56)		
lnJpop	Source Log Population	-5.527*	.	.	-0.735	.	.
		(3.28)			(0.69)		
lnIgdp	Host Log GDP	.	0.326	.	.	0.440	.
			(0.34)			(0.37)	
lnIpop	Host Log Population	.	-1.094	.	.	-0.285	.
			(1.80)			(0.42)	
edgap	Skill Gap	-0.160	-0.274**	.	0.116	-0.208**	.
		(0.10)	(0.12)		(0.11)	(0.11)	
Itragdp	Host Trade Share in GDP	.	-0.0124**	.	.	-0.0110**	.
			(0.0051)			(0.0045)	
Jtragdp	Source Trade Share in GDP	0.0214**	.	.	0.00108	.	.
		(0.010)			(0.0091)		
edgapgdpdiff	Skill_gap*GDP_diff.	-0.0515	-0.0101	.	-0.0338	0.0122	.
		(0.037)	(0.035)		(0.033)	(0.041)	
Itragedgapsw	Host_trade*Skill_gap^2	0.0000584	0.000332**	.	-0.000326*	0.000225*	.
		(0.00018)	(0.00015)		(0.00018)	(0.00014)	
Country-pair FE		Yes	Yes	Yes	Yes	Yes	Yes
Year effects		Yes	Yes	Yes	Yes	Yes	Yes
FGLS/autocorrelation		No	No	No	Yes	Yes	Yes
Host-year effects		Yes	No	Yes	Yes	No	Yes
Source-year effects		No	Yes	Yes	No	Yes	Yes
Observations		2317	2317	2317	2030	2030	2030
Number of country-pairs		287	287	287	258	258	258

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

were previously omitted. Two factors point to the latter interpretation. Firstly, a joint test of the significance of the dummy variables is highly significant. Secondly, the loss of significance of the BIT dummy is driven by a fall in magnitude of the point estimate. There is very little increase in the standard error of the BIT coefficient with the addition of the country-year interactions using either OLS or FGLS.

5.2 Graphical Analysis

An alternative means of illustrating the lack of evidence of causal impact of BITs is to literally illustrate the trends in FDI around the time of BIT ratification. I do this for both unconditional and conditional FDI flows in Figure 4.

Graph 1 in Figure 4 plots the unconditional mean log bilateral FDI flow from three years prior to ratification through to three years post ratification of a BIT.[14] The remaining graphs in Figure 4 are the corresponding plots for conditional FDI flows. In graph 2 log FDI is conditioned on the base specification given in equation 5[15] with the omission of the BIT dummy. In graph 3 the conditioning set is the base specification minus the BIT dummy, plus country-pair time trends (analogous to the results in column 3 of Table 5), while in graph 4 the set is the base specification minus BIT dummy plus host-year and source-year dummies (compare with column 3 of Table 6).

The evidence presented in Figure 4 supports the conclusion that the positive and significant coefficient on BIT ratification in my base specification is due to not fully controlling for the endogeneity of BIT participation in that specification. The residual FDI in graph 4, in particular, is indistinguishable from white noise.

5.3 BITs as Signaling Device

Previous authors have suggested that the main function of BITs in attracting FDI may be not to actually provide increased investor protections, but to signal that the host already provides a low-risk investment environment (Hallward-Driemeier, 2003), (Neumayer and Spess, 2005). If this is the case, then BITs should increase FDI received from all sources, not just the BIT partner.

[14] The choice of three years before and after BIT ratification was the optimal trade-off between length of study period and number of country-pairs for which there was data available. The mean is calculated based only on the 25 country pairs for which there was data for all seven years in the event study window.

[15] The results are reported in Column 1 of Table 5.

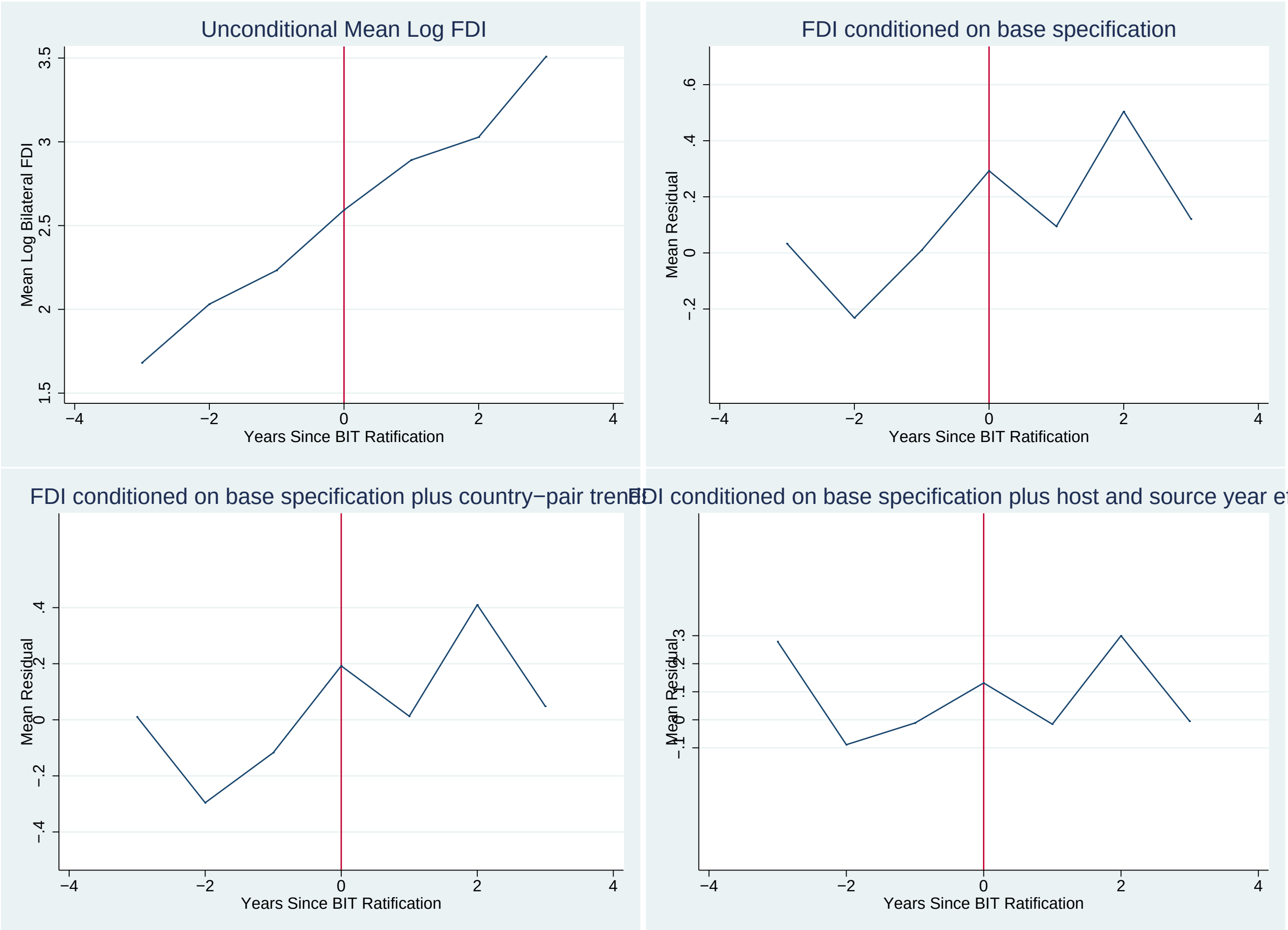

Figure 4: Event study graphs support the conclusion that correlation between BITs and FDI is driven by endogeneity of BIT adoption. Change in conditional and unconditional log FDI round the time of BIT ratification. Top-left graph (unconditional FDI flows) highlights the endogeneity of BIT adoption. Other graphs show the impact of progressively adding controls for BIT adoption.

To test this possible explanation, I return to the base specification and replace the BIT dummy with the number of BITs that the host has signed with OECD countries other than the source. If BITs act as a signal of a safe investment climate, then source FDI should respond to participation by the host in BITs with other source countries. The results in Table 7 suggest that signaling is not the cause of the strong correlation between FDI and BITs in the base specification in Table 4. BITs ratified with other source countries are not a significant predictor of FDI at the 10% level.

6. BITs and Expropriation Risk

The empirical part of this paper has thus far focused on the relationship between BITs and FDI, with the major conclusion that the correlation between the two which was apparent in my base specification was predominately caused by the endogeneity of BIT participation. This section provides further evidence in support of this conclusion by examining the relationship between BIT formation and host country expropriation risk. In particular, I test whether BIT participation is caused in a Granger sense by improvements in the host country investment climate, and vice versa.

The specification used to test the first direction of causality is given in equation 6.[16] The equation is run in differences, with lagged differences used as instruments for endogenous right hand side variables.

$$\Delta OBIT_{it} = \alpha + \beta_1 \Delta E_{it-2} + \beta_2 \Delta GDP_{it-2} + \beta_3 \Delta tradeGDP_{it-2} + \beta_4 \Delta OBIT_{it-2} + \Delta \eta_{it} \quad (6)$$

The dependent variable in equation 6 is the change in the cumulative number of BITs with OECD partners which a country has in force[17] at a given time, $OBIT_{it}$.

The explanatory variable of relevance to my hypothesis tests is E_{it-1}, an index of the risk of expropriation of private investment.[18] The index is on a scale of one to ten with

[16]In regressions not reported here the specification in equation 6 was also estimated using a Zero Inflated Poisson model which is appropriate to the count data nature of the change in the number of BITs per year. The qualitative conclusions were the same as those using the linear model reported here.

[17]Entry into force of a treaty occurs only after both partners have ratified the treaty. Since major source countries have nothing to lose from BIT ratification with hosts that have very little reciprocal investment, I assume that the host country is the latter to ratify the agreement.

[18]According to the documentation, this variables evaluates the risk "outright confiscation and forced nationalization" of property. Lower ratings "are given to countries where expropriation of private foreign

Table 7: No evidence that BITs increase FDI through signaling a good investment climate. Log bilateral FDI flow regressed on base specification with indicator of ratification of BIT between host and source replaced by number of BITs ratified by host with OECD countries other than the source.

COEFFICIENT	LABELS	(1) F.lnfdi	(2) F.lnfdi
R1ImJ	BITs signed with other OECD partners	0.0173	0.0177
		(0.016)	(0.013)
lnJgdp	Source Log GDP	1.979***	1.099**
		(0.56)	(0.49)
lnJpop	Source Log Population	-7.406**	-0.124
		(3.28)	(0.50)
lnIgdp	Host Log GDP	0.287	0.108
		(0.38)	(0.35)
lnIpop	Host Log Population	-0.674	0.273
		(2.02)	(0.34)
edgap	Skill Gap	-0.288***	-0.00370
		(0.083)	(0.083)
Itragdp	Host Trade Share in GDP	-0.0143***	-0.0120***
		(0.0047)	(0.0046)
Jtragdp	Source Trade Share in GDP	0.0254**	-0.000135
		(0.011)	(0.0091)
edgapgdpdiff	Skill_gap*GDP_diff.	-0.0395	-0.0139
		(0.027)	(0.028)
Itragedgapsw	Host_trade*Skill_gap^2	0.000284**	0.0000418
		(0.00014)	(0.00014)
Country-pair FE		Yes	Yes
Year effects		Yes	Yes
FGLS/autocorrelation		No	Yes
Observations		2317	2030
Number of country-pairs		287	258

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

higher values indicating *lower* expropriation risk. The annual data for 1982-1997 come from the IRIS-3 File of Data compiled by Stephen Knack and the IRIS Center, University of Maryland, from original monthly International Country Risk Guide data.

As is clear from equation 1 in Section 3, the risk of expropriation is a function of the exogenous residual value, R. Thus expropriation risk is an (admittedly imperfect) observable proxy for the unobservable parameter, R. The prediction from my model, therefore, is that countries with intermediate expropriation risk ratings should be the most likely to participate in BITs. For hosts with moderate to high expropriation risk levels the time series translation of the cross-sectional analysis is that decreases in risk will lead to increases in the propensity to ratify BITs.

Of course, the model in Section 3 also suggests the reverse causality to that modeled in equation 6. The compensation requirements of BITs make expropriation unattractive for hosts, so the probability of expropriation should decrease when BIT participation increases. I test for an improvement in expropriation risk rating following BIT participation by making the first difference of the current period expropriation risk rating the dependent variable.

The summary statistics in Tables 8 and 9 show the rise in both BIT participation and expropriation risk rating (indicating a fall in average risk) which occurred over the study period.

Table 8: Summary Statistics for 1982

Variable	**Mean**	**Std. Dev.**	**Min.**	**Max.**	**N**
BITs ratified with OECD Partners	0.822	1.652	0	10	214
BITs ratified with nonOECD Partners	0.748	3.713	0	37	214
BITs signed with OECD Partners	0.991	1.849	0	10	214
BITs signed with nonOECD Partners	0.958	4.437	0	45	214
Expropriation (Un)Risk	4.996	1.805	1	9.5	70
Host GDP 1985	0.092	0.321	0	3.418	151
Host GDP per capita	4.4	4.59	0.322	25.844	153
Host GDP growth rate	1.408	5.584	-13.2	23.6	156
Trade Share in GDP	76.095	49.963	6.32	402.5	144
Host FDI in GDP	0.937	2.541	-13.093	18.455	126

The results of the base regression specified in equation 6 and its reverse causal equivalent are presented in column 1 of Tables 10 and 11. Columns 2-5 of the two Tables show respectively the robustness of the findings to the removal of the lagged dependent variable,

investment is a likely event."

Table 9: Summary Statistics for 1997

Variable	Mean	Std. Dev.	Min.	Max.	N
BITs ratified with OECD Partners	3.757	5.28	0	27	214
BITs ratified with nonOECD Partners	6.178	12.32	0	74	214
BITs signed with OECD Partners	5.014	6.217	0	32	214
BITs signed with nonOECD Partners	9.463	16.332	0	107	214
Expropriation (Un)Risk	9.013	1.488	3	10	129
Host GDP 1985	0.175	0.576	0	5.317	133
Host GDP per capita	5.195	5.5	0.197	21.974	133
Host GDP growth rate	3.916	6.409	-17.6	71.2	177
Trade Share in GDP	83.323	43.912	2.38	264.17	144
Host FDI in GDP	3.271	4.251	-2.107	28.141	161

controlling for time trends with linear, and quadratic terms, and finally controlling for common trends by including year dummies. All the columns in Table 10 show that decreases in expropriation risk in a given year are strongly correlated with increases in BIT ratification in the following year. As Table 11 shows, however, this correlation disappears when the lags are reversed and expropriation risk is the dependent variable. Increases in BIT ratification in one year are not correlated with decreases in expropriation risk ratings in the subsequent year. BITs do not appear to achieve their primary purpose of making investment climates safer. These results support the conclusion from Section 5.1 that the correlation between BITs and FDI identified in some previous studies and in my base specification is due to the endogeniety of BIT participation, rather than to the effectiveness of BITs.

7. Summary and Conclusion

Bilateral investment treaties are one of the most popular policy initiatives undertaken by low- and middle-income countries in the race to attract a larger share of global FDI. Like most such initiatives, BITs are not without costs. Resources are expended on the design and negotiation of BITs. When ratifying BITs, states sacrifice policy flexibility and risk sizable fines and legal costs if they are sued by an investor. The experience of the United States and Canada under the BIT-like Chapter 11 of NAFTA shows that even well documented actions undertaken by countries which are renowned for their investor protections, and undertaken to protect public health or the environment, may be subjected to claims by investors. Yet the number of BITs and similar agreements embedded in regional trade agreements continues to grow. Countries appear to believe that the FDI-promoting abilities of BITs outweigh these

Table 10: Reduced expropriation risk is followed by increased participation in BITs with OECD partners. Number of BITs ratified per year by each country regressed on lagged BIT ratification, lagged changes in expropriation risk rating and other controls.

	(1)	(2)	(3)	(4)	(5)	
COEFFICIENT		$\Delta OBIT$	$\Delta OBIT$	$\Delta OBIT$	$\Delta OBIT$	$\Delta OBIT$
ΔE	Lagged Δ Expropriation (Un)Risk	0.106***	0.117***	0.0959***	0.0903***	0.0792**
		(0.032)	(0.034)	(0.035)	(0.033)	(0.035)
$\Delta tradeGDP$	Lagged Δ Trade Share in GDP	-0.000400	0.000104	-0.000776	-0.000870	-0.000846
		(0.0024)	(0.0025)	(0.0025)	(0.0024)	(0.0024)
ΔGDP	Lagged Δ Log Host GDP	0.0211**	0.0348***	0.0338***	0.0212**	0.0211**
		(0.0091)	(0.0095)	(0.0095)	(0.0091)	(0.0091)
$\Delta OBIT$	Lagged Δ BITs ratified with OECD	0.321***			0.318***	0.315***
		(0.028)			(0.029)	(0.029)
	Year			0.0163***	0.00741	
				(0.0049)	(0.0047)	
	Year Squared			-0.00225*	-0.00276**	
				(0.0013)	(0.0012)	
Constant		0.290***	0.452***	0.481***	0.339***	0.210*
		(0.065)	(0.067)	(0.071)	(0.069)	(0.11)
Year dummies		No	No	No	No	Yes
Observations		1194	1194	1194	1194	1194
R-squared		0.12	0.02	0.03	0.12	0.14

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 11: Increased participation in BITs with OECD partners is not followed by reduced expropriation risk. Changes in expropriation risk rating (higher score = less risk) regressed on lagged change in expropriation risk rating, lagged number of BITs ratified with OECD partners and other controls.

COEFFICIENT		(1) ΔE	(2) ΔE	(3) ΔE	(4) ΔE	(5) ΔE
$\Delta OBIT$	Δ BITs ratified with OECD	0.0100	0.0169	0.00937	0.0126	0.0161
		(0.028)	(0.026)	(0.026)	(0.028)	(0.026)
$\Delta tradeGDP$	Δ Trade Share in GDP	0.00411*	0.00438**	0.00290	0.00356	0.00615***
		(0.0023)	(0.0022)	(0.0022)	(0.0023)	(0.0022)
ΔGDP	Δ Log Host GDP	-0.00602	-0.00647	-0.00552	-0.00577	-0.00184
		(0.0090)	(0.0083)	(0.0082)	(0.0089)	(0.0083)
ΔE	Δ Expropriation (Un)Risk	0.0145			-0.00306	0.0151
		(0.031)			(0.031)	(0.031)
	Year			-0.00242	-0.00180	
				(0.0052)	(0.0056)	
	Year Squared			-0.00709***	-0.00835***	
				(0.0012)	(0.0016)	
Constant		0.199***	0.179***	0.302***	0.313***	0.196*
		(0.065)	(0.059)	(0.061)	(0.067)	(0.11)
Year dummies		No	No	No	No	Yes
Observations		1011	1124	1124	1011	1011
R-squared		0.00	0.00	0.04	0.03	0.15

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

legal and policy costs. I find no evidence to support this belief. Furthermore, my results suggest that previous findings of a positive impact of BIT participation (Neumayer and Spess (2005) and Salacuse and Sullivan (2004)) are almost certainly due to misspecification and insufficient attention paid to the endogeneity of BIT participation.

Although this paper addresses a specific policy question, the empirical issues it addresses are relevant to the larger literature on the impacts of trade and FDI policy. Due to the relatively poor explanatory power of current theoretically motivated models of FDI, it is important that this literature consider carefully the influence of omitted variables. One advantage of using bilateral panel data is that country-pair fixed effects may be used to control for time-invariant variables affecting the bilateral FDI relationship.

Though panel data has helped to reduce the omitted variables problem of earlier cross-section studies of FDI, it has also brought new challenges that have not always been fully appreciated. Many papers related to FDI are motivated by the observation that global FDI has grown rapidly over the last couple of decades, much more rapidly than common explanatory variables such as GDP and trade. It is ironic, therefore, that so many of these studies neglect to properly account for the time series properties of the data. My findings show the importance of the inclusion of year effects to remove common time trends if spurious correlation is to be avoided. I also argue that it is preferable to use FDI flows rather than FDI stocks as a dependent variable in order to reduce the degree of autocorrelation. Even when using log FDI flow as a dependent variable, I find significant autocorrelation and show that the use of feasible Generalized Least Squares to correct for this improves the estimates in qualitatively important ways. Correcting for autocorrelation is particularly important with endogenous right hand side variables as autocorrelation may exacerbate endogeneity bias. Finally in terms of general methodological issues, I show that the selection bias resulting from the large number of non-random missing values in the bilateral FDI data is eliminated by the inclusion of country-pair fixed effects.

Consideration of the above general specification issues in FDI regressions leads to my preferred base specification which includes country-pair fixed effects, year effects, lagging of dependent variables, and adjusting errors for clustering by country-pair. Using this specification I find that BITs are positively and significantly correlated with FDI flows. This finding is consistent with those obtained by Neumayer and Spess (2005) who apply a similar specification to aggregate host-country FDI inflows. My finding of a strong positive correlation shows that the difference between Hallward-Driemeier (2003) finding of no effect and Newmayer and Spess' finding of a strong effect are not due, as Newmayer and Spess suggest, to the former author's use of the bilateral OECD data and associated restricted sample of countries. Instead Hallward-Driemeier's results are likely to be driven by her use of levels FDI flows rather than log FDI. I show in Appendix A that when logs are not taken, FDI data is highly skewed and prone to influence by extreme observations.

This initial finding of strong correlation between FDI and BITs does not, however, imply that BITs *caused* an increase in FDI. I use a simple model to show that BIT participation is endogenous and may be driven by omitted variables such as a change in the domestic policy environment of the host. My model also shows the potential for reverse causality, where a higher growth rate of FDI leads to increased probability of a BIT being formed. I find that controlling for either of these possibilities eliminates the statistically significant correlation between BIT participation and FDI flows.

It is possible, however, that some of my attempts to deal with endogeneity obscured a potential signaling effect of BITs. Using the bilateral data I am able to explicitly test for signaling by the inclusion of the number of BITs that the host has ratified with other OECD countries in the regression. If participation in BITs does signal a safe or productive investment environment, there should be an increase in bilateral FDI in response to ratification of treaties with other major source countries. I find no evidence of such an effect. Thus the strong correlation between BITs and FDI in the base specification appears to be driven by the endogeneity, rather than either a direct or a signaling effect of the BITs.

The major limitation of my analysis, which I would argue is common to studies of the short-run determinants of FDI, is that once spurious correlation and endogeneity are accounted for, the standard control variables have very little explanatory power. The concern, therefore, is that the finding of no effect of BIT participation on FDI flows is driven by data limitations. In light of this limitation, I do not conclude that BITs are ineffective. Instead, I conclude that there is no evidence of that BITs have an effect, and that previous findings in the literature of a positive impact of BITs were probably due to not proply accounting for the endogeneity of BIT participation and other specification issues.

Aside from my finding of no significant impact once endogeneity is accounted for, there are a number of additional reasons to believe that the initial strong correlation between BITs and FDI was driven by the endogeneity of BITs. Firstly, the magnitude of the BIT coefficient in the base specification implied that the ratification of a BIT brought on average an increase in bilateral FDI inflow of over 50%. This figure is implausibly large. Secondly, the loss of significance of the BIT coefficient when additional controls were introduced to reduce endogeneity bias was caused primarily by a decrease in the magnitude of the point estimate, not by an increase in the standard errors. A large increase in standard errors would be expected if the loss of significance was driven by data limitations. Thirdly, I undertake a graphical event study which shows clearly that BITs are formed during times of increasing bilateral FDI flows, but shows no evidence of an increase in flows after the BIT is ratified. Finally, in a separate set of regressions I find that participation in BITs increases after a country gains an improved expropriation risk rating, but that improvements in expropriation risk rating do not follow increased participation in BITs.

There are a number of potential explanations for the apparent disconnect between the effort states place on signing BITs and the lack of measurable response of investors to these efforts. The first is suggested by my model and related findings. The fact that BIT participation increases when expropriation risk has fallen and when FDI flows are already increasing will make the potentially small effect of the BITs difficult to identify within the larger changes.

In a similar vein, it is possible that BITs are only of relevance for certain sectors, making their impact difficult to identify in aggregate data. Expropriation risk tends to be greatest in natural resource extractive industries, which are an example of vertical or factor seeking FDI. My results, and those of others (Blonigen, Davies and Head, 2003), show that evidence of vertical FDI is hard to identify in aggregate data. Thus future attempts to identify impacts of BITs may want to focus on bilateral FDI data disaggregated by sector or industry.

It is also possible that there is no evidence of an investment response to BITs simply because there was none. It may be the case that while governments have always considered BITs economically significant, investors have not. Evidence that investors have been slow to trust BITs as a commitment device is provided by the very rapid increase in the number of investor-state arbitration cases being brought over the last few years, in a global climate that is generally continuing to become more investor-friendly (UNCTAD, 2006b). It appears that over time, as more disputes brought to arbitration under BITs have been completed and more settlements reached, confidence in the institution of investor-state arbitration may be growing. This means that the positive impacts of BITs on investor confidence have come long after many of the BITs were ratified.

Finally, it is possible that the primary function of BITs is the propagation of good investor treatment norms. In this case we would not expect to see positive FDI impacts associated with the ratification of any particular BIT. However, my findings in Section 6 that BIT participation increases after a country becomes less likely to expropriate investments would be consistent with the hypothesis that states believe signing a BIT condones a norm of strong investor rights. Also, major investment source countries, which have the most to gain by the global adoption of such a norm, may find their BIT promotion efforts more successful in countries that are competing heavily for FDI (which is consistent with the findings of Elkins, Guzman and Simmons (2004)), or to whom they are experiencing a growth in FDI outflow (which is consistent with my findings in Tables 5 and 6).

These possibilities provide ample opportunity for future research on BITs. For now, I conclude that while BITs and FDI appear initially to be highly correlated, this finding is not robust to proper specification to account for the endogeneity of BITs and the time series properties of FDI data. This is important information for countries weighing the costs and benefits of beginning or expanding their participation in BITs and similar international investment agreements, as well as for other researchers undertaking international policy analysis.

References

Baldwin, R. and Taglioni, D.: 2006, Gravity for dummies and dummies for gravity equations. NBER Working Paper 12516.

Baltagi, B. H. and Wu, P. X.: 1999, Unequally spaced panel data regressions with AR(1) disturbances, *Econometric Theory* **15**, 814–823.

Bhargava, A., Franzini, L. and Narendranathan, W.: 1992, Serial correlation and the fixed effects model, *Journal of Applied Econometrics* **7**, 243–257.

Blonigen, B. A.: 2005, A review of the empirical literature on FDI determinants. NBER Working Paper 11299.

Blonigen, B. and Davies, R.: 2004, The effects of bilateral tax treaties on U.S. FDI activity, *International Tax and Public Finance* **11**, 601–622.

Blonigen, B., Davies, R. and Head, K.: 2003, Estimating the knowledge-capital model of the multinational enterprise: Comment, *American Economic Review* **93**, 980–994.

Blonigen, B. and Wang, M.: 2004, Inappropriate pooling of wealthy and poor countries in empirical FDI studies. NBER Working Paper 10378.

Carr, D., Markusen, J. R. and Maskus, K. E.: 2001, Estimating the knowledge-capital model of the multinational enterprise, *American Economic Review* **91**, 693–708.

Doyle, C. and van Wijnbergen, S.: 1994, Taxation of foreign multinationals: a sequential bargaining approach to tax holidays, *International Tax and Public Finance* **1994**(1), 211–225.

Elkins, Z., Guzman, A. and Simmons, B.: 2004, Competing for capital: The diffusion of bilateral investment treaties, 1960-2000. UC Berkeley Public Law Research Paper No. 578961.

Guzman, A.: 2005, The design of international agreements, *European Journal of International Law* **16**(4), 579–612.

Hallward-Driemeier, M.: 2003, Do bilateral investment treaties attract FDI? Only a bit and they could bite. World Bank Policy Research Paper WPS 3121.

Helpman, E., Melitz, M. and Rubinstein, Y.: 2005, Trading partners and trading volumes. Working Paper.

Helpman, E., Melitz, M. and Yeaple, S.: 2004, Export versus FDI with heterogeneous firms, *American Economic Review* **91**(1), 300–316.

Janeba, E.: 2002, Attracting FDI in a politically risky world, *International Economic Review* **43**(4), 1127–1155.

Neumayer, E. and Spess, L.: 2005, Do bilateral investment treaties increase foreign direct investment to developing countries?, *World Development* **33**(10), 1567–1585.

Nijman, T. and Verbeek, M.: 1982, Nonresponse in panel data: the impact on estimates of a life cycle consumtion function, *The Review of Economic Studies* **49**(4), 533–549.

Pistor, K.: 2002, The standardization of law and its effect on developing economies, *The American Journal of Comparative Law* **50**(1), 97–130.

Razin, A., Rubinstein, Y. and Sadka, E.: 2003, Which countries export FDI, and how much? NBER Working Paper 10145.

Razin, A., Sadka, E. and Tong, H.: 2005, Bilateral FDI flows: Threshold barriers and productivity shocks. NBER Working Paper 11639.

Rose, A.: 2001, The determinants of foreign direct investment: sensitivity analyses of cross-country regressions, *Kyklos* **54**, 89–114.

Rosenbaum, P. and Rubin, D.: 1983, The central role of the propensity score in obsrevational studies for causal effects, *Biometrika* **70**, 41–55.

Salacuse, J. and Sullivan, N.: 2004, Do BITs really work? an evaluation of bilateral investment treaties and their grand bargain, *Harvard International Law Journal* **46**(1).

Tobin, J. and Rose-Ackerman, S.: 2004, Foreign direct investment and the business environment in developing countries: The impact of bilateral investment treaties. Yale Law School Center for Law, Economics and Public Policy Research Paper No. 293.

UNCTAD: 2001, *WORLD INVESTMENT REPORT 2001 - Promoting Linkages*, UNCTAD.

UNCTAD: 2005, Recent developments in international investment agreements. IIA Monitor Number 2.

UNCTAD: 2006a, Developments in international investment agreements in 2005. IIA Monitor Number 2 (2006).

UNCTAD: 2006b, *WORLD INVESTMENT REPORT 2006 - FDI from Developing and Transition Economies: Implications for Development*, UNCTAD.

Wooldridge, J. M.: 2002, *Econometric Analysis of Cross Section and Panel Data*, The MIT Press.

A. Specification of Bilateral FDI Regressions

A.1 Choice of Dependent Variable

Researchers wishing to analyze the impact of policies on bilateral FDI flows face an array of alternative empirical specifications, none of which have particularly good explanatory power, and none of which are tightly linked to theory. The theory of the determinants of FDI is at once too immature and too complex to be translated into structural econometric models (Blonigen, 2005). The result is that there is very little consistency in the literature, even in terms of the appropriate dependent variable. It is common to find the use of affiliate sales, FDI stocks, or FDI flows, either in levels or in logs, FDI as a share of GDP, and FDI per capita.

In light of the lack of strong indication from theory, it seems appropriate to base the choice of specification on statistical tests. This paper uses panel data on bilateral FDI flows from 29 OECD reporting countries to 46 partner countries over the period 1980-1998. The OECD database I use has both stocks and flows of inward and outward FDI. I use outward flows for the analysis since my interest is on the impact of BIT participation on lower income countries, not OECD countries. I use flows rather than stocks for two reasons. Firstly, there are significantly more missing values of the stocks. Secondly, stocks display a higher degree of autocorrelation and for many countries are far from stationary. We should be concerned about non-stationarity in FDI particularly because, as is often cited in empirical papers on this topic, world FDI has grown much more rapidly than either trade or GDP since the 1980s. This suggests that FDI is unlikely to be cointegrated with either of these controls, leading to the potential for spurious correlation with policy variables that are introduced over time. An example of the problem with using FDI stocks as the dependent variable is provided by Blonigen and Davies (2004, p.612) who find that:

> While the inclusion of fixed effects means residuals for any group of countries (such as rich ones) are zero on average, differing trends between groups may still remain. Specifically, over the time dimension of our sample, the rich countries average residuals become increasingly positive, while the poor countries average residuals grow increasingly negative.

Having determined to use flows rather than stocks, the next choice is among levels, logs or some normalization of FDI flows. Logs have the disadvantage of losing zero and negative observations from the sample. The advantage of using logs is that the data are much less skewed than levels or normalized levels, meaning that using logs the results are less likely to be driven by a few influential data points. The severity of the skew in the data using levels of FDI flow or FDI normalized by host GDP, and the extent to which it is ameliorated by taking logs is illustrated by the histograms in Figure 5. Though not reported here in order to save space, the histograms for alternative normalizations including FDI per capita and FDI normalized by the product of host and source GDPs look very similar to that for FDI normalized by host GDP. I use logs in the analysis to follow. However, for my sample the qualitative conclusions are essentially unchanged if levels or the share of FDI in GDP or population are used. This is to be contrasted with the results of Hallward-Driemeier (2003) who finds no impact of BITs in specifications very similar to ones in which I do find a strong correlation between BITs and FDI. Hallward-Dreimeier uses a slightly different sub-sample of country-pairs to those I use. A possible explanation for the difference between her results and mine using FDI levels is that, due to the skew of the levels data, the results are highly sensitive to the sample used.

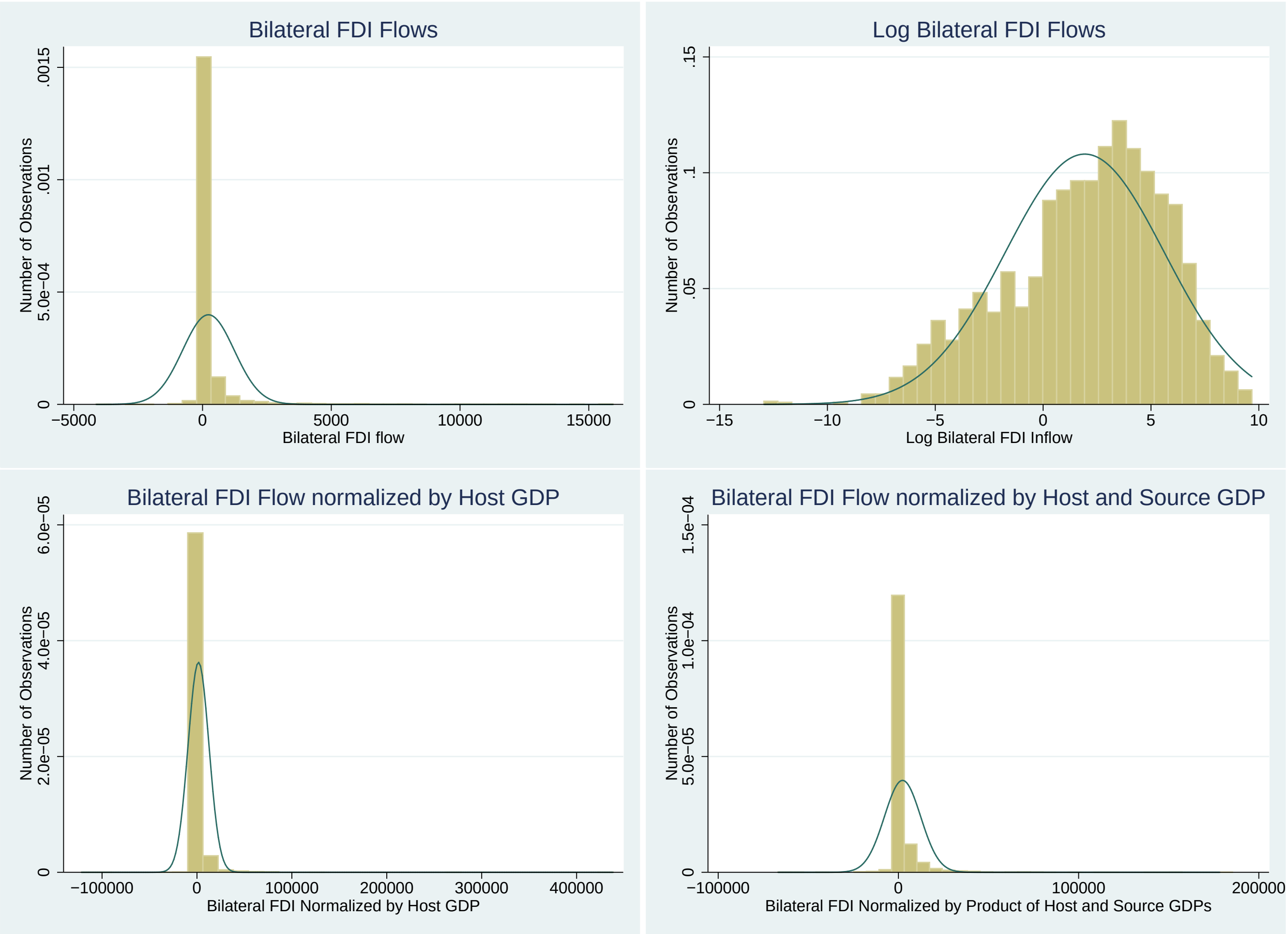

Figure 5: Histograms Showing Skewedness of Alternative FDI Measures

A.2 General Specification for Bilateral FDI

Having chosen a dependent variable, I next consider the appropriate set of controls for the regressions. The state of the art in theory-based empirical specifications for bilateral FDI is that proposed by Carr et al. (2001) and applied to a similar policy question in two papers by Blonigen and Davies (2002,2004). Carr, Markusen and Maskus' (CMM) set of proposed controls includes the sum of host and source GDP, the squared difference between host and source GDP, the skill gap, the product of the difference in GDPs and the skill gap, trade costs for both host and source, the square of the skill gap multiplied by the host trade costs, and a measure of the cost of FDI in the host. In their preferred specifications, Blongien and Davies (BD) add country-pair fixed effects and in some cases rich country interaction terms. The importance of rich country interactions are highlighted by the finding of Blonigen and Wang (2004) that the underlying factors that determine the location of FDI activity across countries vary systematically across LDCs and DCs in a way that is not captured by current empirical models of FDI. Since participation in BITs with OECD partners is mostly a lower income country phenomenon, I remove from the sample any recipient countries classified by the World Bank as high income.[19]

Summary statistics for these controls and others used in later regressions, as well as for bilateral FDI flows, are presented for the start and end years in Tables 1 and 2 respectively. The skill gap variable is proxied by the difference in average years education for adults over 25 years of age, taken from Barro and Lee's (2000) latest dataset.

The specification of BD (2002, Column 2 of Table 5) is reproduced almost exactly in Column 2 of Table 12. Consistent with BD I find that both the sum of host and source GDP and the square of the difference in GDPs are significant at the 1% level and have the expected sign (positive for the former and negative for the latter). In contrast to BD (2002) I find that several other variables are significant. Firstly the skill gap is significant and has the 'wrong' (i.e. negative) sign according to theory. This finding is consistent with Blonigen et al. (2003) and Blonigen and Davies (2004). The interaction of the skill gap with the GDP difference is also negative and significant, which is consistent with the predictions of the CMM knowledge-capital model. Finally host trade share in GDP, which is my proxy for trade openness, is positive and significant. This would seem to support the dominance of export oriented FDI over market seeking FDI.

The inconsistency between the results in column 2 and the theoretical predictions is a cause for concern. However, it is important to recall that the theory is one of long-run equilibrium FDI, and is not designed for policy analysis. If we are interested in to see how well the theory works at predicting long-run relationships, we may focus on the pooled OLS results in Column 1 of Table 12. Here we see that both the sum of the GDPs and the skill gap have the anticipated (positive) sign and are significant at the 1% level. The GDP gap is positive and insigificant, but this is likely to be driven by high correlation with the skill gap. The time varying trade cost measures are also insigificant. However, truely exogenous measures of trade costs are provided by the geographical variables measuring the number of landlocked or island countries in the pair. Both of these are significant and positive as predicted by a theory of market driven FDI.

One interpretation of the results in column 2 of Table 12 and, therefore, of the results of BD is that the inclusion of country-pair fixed effects emphasizes the spurious correlation due to trends in both FDI and some of the control variables. Reference to Tables 1 and 2 shows that the significant coefficients in column 2 are all associated with the variables for which the mean changed the most between the start and end of the sample period. Further evidence that the results in column 2 are driven by spurious time-series correlation is provided by columns 3 and 4 of Table 12 which shows the impact of adding year effects to the regression,

[19] In regressions not reported here high income host countries were left in the sample and there was no qualitative impact on my results.

COEFFICIENT	LABELS	(1) lnfdi	(2) lnfdi	(3) lnfdi	(4) lnfdi	(5) F.lnfdi
IpJgdp	Sum of GDPs	1.101***	1.758***	0.283	0.283	0.138
		(0.27)	(0.16)	(0.17)	(0.22)	(0.25)
ImJgdpsq	Squared Diff. GDPs	0.00427	-0.123***	-0.0288	-0.0288	-0.0560
		(0.064)	(0.034)	(0.032)	(0.042)	(0.044)
edgap	Skill Gap	0.385***	-0.197***	-0.141**	-0.141*	-0.229***
		(0.11)	(0.076)	(0.072)	(0.074)	(0.078)
Itragdp	Host Trade Share in GDP	-0.000205	0.0156***	-0.00861***	-0.00861*	-0.0121***
		(0.0074)	(0.0032)	(0.0033)	(0.0044)	(0.0046)
Jtragdp	Source Trade Share in GDP	0.0147	0.0114*	-0.000740	-0.000740	0.0197*
		(0.012)	(0.0065)	(0.0080)	(0.012)	(0.011)
edgapgdpdiff	Skill_gap*GDP_diff.	-0.000628	-0.0792***	-0.0228	-0.0228	-0.0284
		(0.029)	(0.023)	(0.023)	(0.028)	(0.028)
Itragedgapsw	Host_trade*Skill_gap^2	-0.000230	0.000118	0.000165	0.000165	0.000217
		(0.00024)	(0.00011)	(0.00011)	(0.00015)	(0.00014)
landl	No. Landlocked 0,1,2	0.982**				
		(0.50)				
island	No. Island 0,1,2	1.923***				
		(0.49)				
border	Land Border Dummy	-0.509				
		(0.81)				
colony	Colonial dummy	0.304				
		(0.74)				
ldist	Log of Distance	-0.221				
		(0.35)				
Country-pair FE		.	Yes	Yes	Yes	Yes
Year effects		.	.	Yes	Yes	Yes
Cluster robust errors		.	.	.	Yes	Yes
Lagged controls		.	.	.	.	Yes
Observations		2098	2208	2208	2208	2317
R-squared		0.29	0.18	0.30	0.30	0.33
Number of IJid			281	281	281	287

Time-invariant controls in column 1 from Andrew Rose's
website and defined as in Rose (2004)
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 12: Limits of the Knowledge Capital Specification for Policy Analysis

and then additionally making the standard errors robust to clustering at the country pair level. The only coefficient which remains significant in column 4 is the host share of trade in GDP, and it now has the opposite sign to that in column 2.

Finally in Table 12, column 5 lags the explanatory variables to reduce simultanaiety bias. This is important given the large body of literature which claims to show that FDI drives growth.

An alternative, and in some ways simpler, theory of FDI than the knowledge capital model has been proposed and tested by Helpan, Melitz and Yeaple (2004). Their model is one of horizontal FDI in the context of monopolistic competition in differentiated products, with heterogeneous firms, and fixed costs of entry to the domestic market, additional fixed costs to exporting, and still higher fixed costs to FDI. FDI is driven by the desire to access foreign markets and avoid melting-iceberg trade costs. Helpan, Melitz and Yeaple (HMY) develop and test this model with a focus on the cross-industry implications. As far as cross-country implications they note only that the ratio of FDI to trade will be increasing in variable and fixed trade costs and decreasing in the fixed costs of engaging in FDI. These implications are standard to a model of horizontal FDI.

It is easy to draw a number of other cross-country implications from the intuition of the HMY model. For example, FDI is aimed at supplying differentiated products, and the relative consumption of differentiated products tends to rise with income. Therefore, we would expect FDI to increase with per capita income of the host. Secondly, the most productive firms are the ones which engage in FDI. Since per capita income is a good measure of the average productivity of firms in a country, we may also expect bilateral FDI to increase with source per capita income. Similarly, for a given productivity distribution, a larger pool of firms implies a larger number of firms that will have productivity sufficiently great to be successful in FDI. To the extent that GDP is a measure of the number of firms in a country, we would also expect FDI to be increasing with the GDP of the host. Finally, the profit functions (HMY, 2004, p.302) suggest that profitability of FDI both in absolute terms and relative to exports is increasing with the size of the host market. Thus we would expect bilateral FDI to also be increasing with the size of the host market.

Overall, some implications of the HMY model additional to those already in the CMM model are that the importance of host and source GDPs may not be symmetric, and that per capita incomes will play an important role. This suggests that the standard trade gravity model including the logs of GDP and income may be a good alternative to the sum of GDPs and squared difference in GDPs in the CMM specification. In order to avoid colinearity between GDP and GDP per capita in the log specification, I include a log population term together with log GDP.

It is worth noting one further thing about the classic logarithmic gravity specification. When logs are taken, the ratio of the per capita GDPs is collinear with the product of the per capita incomes. The ratio of per capita incomes is a good proxy for the relative factor endowments that are important to vertical FDI. This means that the logarithmic gravity equation is flexible enough to accommodate vertically motivated FDI as well as horizontal.

Table 13 shows the impact of the same stepwise refinements to the pooled OLS that are illustrated in Table 12 for the CMM model. The results are similar to Table 12 except that now two coefficients, source GDP and host trade share in GDP, are robust in sign and significance across specifications. The gravity model also has the advantage of showing the relative importance of source size and income compared to host characteristics. One concerning feature of the gravity model results in Column 5 of Table 13 is the fact that the magnitude of the negative coefficient on the source population is much larger than the magnitude of the GDP coefficient. This would imply that, conditional on a given GDP per capita, smaller source countries will have larger bilateral FDI flows. These coefficient estimates would suggest, for example, that Australia was a larger FDI source than the US. This is clearly not the case, and I will return to this issue in Section 5 with the introduction of the feasible generalized least squares estimates.

Given the similar fit of the full CMM and gravity version, and the advantages of the gravity specification in terms of separating source and host effects, I will focus on the gravity specification in the analysis of the relationship between BITs and FDI. In the interests of space, the CMM results are not reported as the qualitative conclusions are identical to those I find based on the gravity specification.

COEFFICIENT	LABELS	(1) lnfdi	(2) lnfdi	(3) lnfdi	(4) lnfdi	(5) F.lnfdi
lnJgdp	Source Log GDP	8.458***	2.665***	1.961***	1.961***	1.963***
		(0.67)	(0.40)	(0.43)	(0.59)	(0.56)
lnJpop	Source Log Population	-7.516***	4.075**	-4.356**	-4.356	-7.238**
		(0.66)	(2.06)	(2.19)	(3.26)	(3.24)
lnIgdp	Host Log GDP	0.927**	0.799***	0.264	0.264	0.338
		(0.42)	(0.26)	(0.26)	(0.40)	(0.38)
lnIpop	Host Log Population	-0.872**	1.703**	-2.550**	-2.550	-1.833
		(0.38)	(0.77)	(0.99)	(1.69)	(1.76)
edgap	Skill Gap	0.275***	-0.222***	-0.223***	-0.223***	-0.290***
		(0.098)	(0.072)	(0.072)	(0.075)	(0.083)
Itragdp	Host Trade Share in GDP	-0.0165***	-0.00930***	-0.00914***	-0.00914**	-0.0137***
		(0.0063)	(0.0035)	(0.0035)	(0.0042)	(0.0045)
Jtragdp	Source Trade Share in GDP	0.0248**	0.00920	0.00292	0.00292	0.0249**
		(0.0099)	(0.0063)	(0.0080)	(0.012)	(0.011)
edgapgdpdiff	Skill_gap*GDP_diff.	0.0501**	-0.00200	-0.0263	-0.0263	-0.0336
		(0.024)	(0.022)	(0.022)	(0.027)	(0.027)
Itragedgapsw	Host_trade*Skill_gap^2	0.000215	0.000289***	0.000250**	0.000250*	0.000281**
		(0.00020)	(0.00011)	(0.00011)	(0.00015)	(0.00014)
Country-pair FE		.	Yes	Yes	Yes	Yes
Year effects		.	.	Yes	Yes	Yes
Cluster robust errors		.	.	.	Yes	Yes
Lagged controls		.	.	.	.	Yes
Observations		2098	2208	2208	2208	2317
R-squared		0.50	0.26	0.31	0.31	0.34
Number of country-pairs			281	281	281	287

Time-invariant controls included for column 1 but not reported are: number landlocked, number of islands, land border, colonial relationship and distance. Taken from Andrew Rose's website and defined as in Rose (2004)

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 13: Performance of a gravity model alternative to the CMM knowledge capital specification

Country	**Year**
Australia	1980
Belgium	1980
France	1980
Denmark	1980
France	1980
Japan	1980
Netherlands	1980
Portugal	1980
Spain	1980
United Kingdom	1980
Austria	1981
Finland	1981
Germany	1981
Sweden	1981
Italy	1982
United States	1982
Canada	1983
New Zealand	1984
South Korea	1985
Norway	1986
Switzerland	1986
Iceland	1988
Poland	1993
Hungary	1999
Turkey	1999

Table 14: First Reporting Year for Source Countries