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The Declining Barriers to Foreign Direct Investments and How to See Them [*]

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Abstract:
Although Foreign Direct Investments (FDI) are as important to the world economy as exports, the extensive literature on trade costs has no strong parallel for FDI. Data are hard to come by, and many of the barriers to FDI are unobservable. This paper circumvents the problem by inferring the barriers to FDI that are consistent with observed FDI data. I describe the distribution and evolution of these barriers to FDI between pairs of 28 OECD countries from 1985 to 2008. On average, barriers to FDI were halved every 4.8 years. Geography is a key determinant, but GDP per capita also plays a leading role. Decomposing the growth in FDI, I show that it has mainly been driven by lower bilateral barriers (75%), not by economic growth, and that bilateral FDI stocks will tend to crowd each other out, lowering their yearly growth by -3%.

Keywords: Foreign direct investment, economic integration, gravity

JEL-codes: F15, F21, F23

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1 Introduction

The last few decades have seen a surge in Foreign Direct Investments (FDI). For the average OECD country, inward FDI stocks amount to 49% of GDP in 2009, up from 14% in 1980. Total sales from the foreign affiliates set up through FDI have nearly twice the value of world exports. Foreign direct investments (FDI) have in sum become as important to the global economy as trade in goods.[1] Despite this large and growing importance, the extensive literature on trade costs has no strong parallel for FDI. The reason for this gap in our knowledge is that many of the costs of doing FDI are difficult to observe or quantify: costs of coordinating with foreign affiliates, complex laws on foreign ownership and cultural barriers, just to name a few.

This paper circumvents the problem of unobservability and is the first to provide data on the barriers to FDI between pairs of OECD countries from 1985 to 2008. Rather than trying to compile data on FDI barriers, I infer from observed FDI stocks at what level the barriers must be, by imposing a minimal structure with broad empirical and theoretical support, the gravity equation. I describe the magnitude and variation of FDI barriers across country pairs and their decline over time and examine how much of the barriers to FDI we can account for with previously used proxies like distance or GDP per capita. I show how declining barriers can explain 75% of the growth in FDI from 1985 to 2008, an intriguing contrast to a corresponding study by Jacks, Meissner and Novy (2008) showing that only 33% of the growth in goods trade from 1950 to 2000 is attributable to falling trade costs. As a final contribution, I show that bilateral FDI stocks tend to crowd each other out, on average depressing their yearly growth by 3% (log). This crowding out, which arises because a country only has a limited stock of suitable targets that foreign firms can acquire, raises concerns of misspecification in previous FDI studies.[2]

The inference procedure used to compute the FDI barriers is presented in section 1.2. The inference relies on the gravity equation, one of the strongest empirical regularities in economics, stating that bilateral stocks of FDI (like trade flows) can be described by a log-linear relationship involving sender and receiver-specific variables (GDP per capita, population etc.), and bilateral variables (distance, whether two countries speak a common language, etc.).[3] The method works regardless of what theoretical foundation one believes is behind the gravity equation. I use the theory developed in Head and Ries (2008) to make the exposition clearer; using the alternative theories presented in Kleinert and Toubal (2010) would give the same interpretation of the measure.

The inferred measures, denoted ϕ_{ijt}^{FDI}, are the pair-wise aggregate barriers that are consistent with how much FDI that actually takes place between the two countries i and j at

[1] The FDI shares of GDP come from the UNCTAD database. Among others, Mariscal (2010) documents and examines the ratio of affiliate sales to exports.

[2] Example: A Spanish firm wishes to acquire a firm in The UK. In 2007, the UK is more open to FDI (and therefore acquisitions) from third-countries than in 1988, and the Spanish firm therefore has a lower chance of actually winning the bid for the UK firm in 2007. In this way, the Spanish stock of FDI in the UK is depressed. If this effect is not controlled for, the FDI-depressing effect of e.g. distance will be over-estimated.

[3] In the references cited at the end of the introduction, the overall fit (R^2) of a gravity equation for FDI is between 0.6 and 0.9.

time *t*. The measured FDI barriers are therefore net barriers, if two countries have strong strategic complementarities, it will count as a lower barrier to FDI.

For easier comparison and to account for barriers that are so high that no FDI takes place, I use an inverse measure, giving the attractiveness of owning an affiliate in the other country relative to owning a domestic firm. If $\phi_{ijt}^{FDI} = 0.05$, foreign firms in the pair are on net 0.05 times as attractive to own as domestic firms. As the wording suggests, the bilateral FDI barrier is measured relative to a domestic barrier; without imposing additional structure, barriers to FDI are inseparable from a domestic bias in firm ownership. The measure is symmetric, ϕ_{ijt}^{FDI} is the geometric average of country *i*'s barrier to *j* and *j*'s to *i*. The symmetry, along with data availability, is the reason for constricting the analysis to OECD countries.

The descriptive results in section 1.3.1 show that in 2008, barriers to FDI were lowest between the Netherlands and the UK, $\phi_{ijt}^{FDI} = 0.14$. The median barrier in 2008 was between France and Turkey, at $\phi_{ijt}^{FDI} = 0.0015$. On average, bilateral barriers to FDI decline by 14% per year (logarithmic rate), so that the barrier is halved every 4.8 years. It is hardly surprising that there are “improbable” pairs of countries, with very high FDI barriers. For example, in 2008, the OECD's highest finite FDI barrier is between Iceland and South Korea, $\phi_{ijt}^{FDI} = 6.44 \times 10^{-7}$. Firms in South Korea clearly see very little benefit in investing in Iceland, and vice versa. But this is precisely the strength of the inference methodology: It can point out the country pairs where firms surprisingly do carry out FDI, despite being far apart, not speaking the same language, etc., and suggest which variables we might have omitted. For example, why is the FDI barrier between Denmark and Portugal a thousand times lower than it is between Sweden and Portugal?

Using my inferred barriers as a dependent variable, section 1.4 examines how well observable variables like distance, common language and GDP can explain the barriers to FDI; I also experiment with a proxy for whether countries have similar industrial structures. The variables are all significant and have the expected signs. The R^2 of such a regression is 0.84, but the fit drops markedly without country fixed effects. The estimated country fixed effects suggest that a country has lower domestic bias in firm ownership (or equivalently, lower average barriers to FDI), if it has low corporate taxes, high GDP per capita or English as main language.

As a compliment to the bilateral FDI barriers, section 1.5 presents an inferred measure of a country's aggregate inward barriers to FDI. Building on Head and Ries (2008), this measure, denoted Φ_{it}^{FDI}, can be interpreted as how difficult foreign firm ownership is relative to domestic firm ownership in country *i*. It is the dramatic decline in this measure that suggest that FDI crowding out is an issue that must be accounted for; in a gravity equation with bilateral FDI stocks, a possibility is country-year fixed effects or country-specific trends. A decomposition in section 1.6 reveals that on average, the 41% yearly log-growth in bilateral FDI stocks consists of a 31% decline in FDI barriers, a 13% growth in domestic capital, and a -3% crowding-out effect.

The inference method, which this paper is the first to apply to FDI, has frequently been used to measure trade costs. Inferred trade costs were first introduced by Head and Ries (2001), subsequent applications include: Describing the distribution and evolution of trade costs geographically, historically or across industries (Eaton and Kortum (2005), Novy (2008), Jacks, Meissner, and Novy (2008, 2010, 2011), Novy and Chen (2011) and McGowan and Milner (2011)) and calibrating models in economic geography (Head and Mayer (2004), Combes, Mayer and Thisse (2008)) and in international trade (Eaton, Kortum, Neiman and Romalis (2010)). Costs of FDI are arguably even harder to observe than trade costs, so indirect measurement is likely to be as enlightening as it has been for trade in goods.

Burstein and Monge-Naranjo (2009) carry out an inference procedure similar in spirit to the present paper. They examine country-level barriers to foreign firm ownership in developing countries, and how removing these barriers may bring growth and welfare gains because foreign management know-how can make more productive use of a developing country's assets. To infer these gains from foreign firm ownership, they calculate the ratio of net FDI stocks over capital (a measure somewhat similar to Φ_{it}^{FDI}) and estimate that foreign firm ownership brings developing countries 2% closer to developed countries' output; removing barriers to firm ownership would further increase welfare with 5%. Although the paper shares the idea of inferring FDI barriers with the present paper, the focuses and methodologies are different: Burstein and Monge-Naranjo (2009) examine country-level barriers in developing countries, not pair-wise barriers between OECD countries. And to infer growth and welfare effects, Burstein and Monge-Naranjo must rely on a more elaborate (and restrictive) model than simply the empirical regularity of the gravity equation.

Multiple studies have used gravity-type regressions to look for determinants of bilateral FDI. Examples include Eaton and Tamura's (1994) study of factor endowments and region-specific effects, Wei (2000)'s analysis of corruption, information proxies as in Loungani, Mody, Razin and Sadka (2003), Mutti and Grubert's (2004) study of the effects of taxes and wages, and institutional factors in Bénassy-Quéré, Coupet and Mayer (2007). Distance, common borders, common languages and past colonial ties are included throughout the literature; Head and Ries (2008) argue that distance proxies for monitoring costs, and Crozet, Mayer and Mucchielli (2004) show how firms often set up affiliates just on the other side of a common border. My extension of the gravity equation methodology provides a complement to these studies by allowing an examination of the aggregate barriers to FDI, rather than considering each barrier separately, and by allowing some FDI barriers to be unobservable.

2 Inferring the Barriers to FDI

The method of inferring bilateral barriers relies on the gravity equation, one of the most well-established empirical regularities in economics. The inference procedure does not rely on any particular theory for why the gravity equation holds for FDI, but with a theoretical framework the mechanisms and properties of the openness measures are more clearly exposed. Subsections 1.2.1 and 1.2.2 describe the theoretical framework and subsection 1.2.3 describes how the inference procedure is taken to the data.

2.1 A Theoretical Framework

Consider the gravity equation for FDI derived in Head and Ries (2008). Their underlying model concerns mergers and acquisitions (M&A), which is the bulk of FDI flows, especially among developed countries. A firm in country *i* wishes to acquire a firm in country *j*, it makes a bid for the firm, and if the offer is good enough, the firm in *i* purchases (or merges with) the firm in *j*. In the aggregate, a gravity equation emerges: The predicted stock of FDI that firms in *i* own in *j*, F_{ij}, is

$$F_{ij} = \exp\left(\mu_i / \sigma - D_{ij}\theta\right) s_i^m K_j B_j^{-1} \qquad (1.1)$$

μ_i is the average valuation that firms in country *i* put on any asset, a higher average valuation (for instance if the country is rich) means that firms will be willing to pay more for all assets, increasing their expected stock of FDI in any country. The variance of the valuations is denoted by σ. These valuations are affected by $D_{ij}\theta$, a vector of bilateral factors D_{ij} weighted with their coefficients θ. Bilateral factors include both observables such as distance and language barriers, and unobservables like cultural barriers or monitoring costs.

If more of the world's firms are located in *i*, *i* will also win bids more often and own more assets in any country, this effect is captured by s_i^m, the share of the world's firms located in *i*. K_j is the capital stock in *j*, all else being equal, the more firms there are to buy in *j*, the higher will be the (absolute) value of firms owned by foreigners. The term B_j^{-1}, "bidder competition", captures third country effects: If firms from other countries bid intensively for firms in *j*, firms in *i* will have a harder time winning the bids, lowering F_{ij}. Bidder competition is the FDI counterpart to inward multilateral resistance introduced by Anderson and van Wincoop (2003) for trade in goods. It is an aggregate of country *j*'s barriers: $B_j = \sum_{h=1}^{M} \exp\left(\mu_h / \sigma - D_{jh}\theta\right) s_h^m$.

The method of inferring the bilateral factors $D_{ij}\theta$ from observed stocks of FDI (F_{ij}) relies on the fact that the theory also has a prediction of country *i*'s "stock of FDI in itself". That is, how much of the capital stock is still on domestic hands, after both foreign and domestic firms have made their bids for firms in *i*. Domestically owned capital stock, F_{ii}, will be given by

$$F_{ii} = \exp\left(\mu_i / \sigma - D_{ij}\theta\right) s_i^m K_j B_j^{-1} \qquad (1.2)$$

The same factors affect F_{ii} and F_{ij}. There might be country-specific reasons why firms in *i* place particular value on domestic assets, captured by $D_{ii}\theta$. These "home ownership biases" turn out to be quantitatively important.

Consider the measure

$$\phi_{ij}^{FDI} = \sqrt{\frac{F_{ij} F_{ji}}{F_{ii} F_{jj}}}$$

The domestically and foreignly owned capital stocks are determined by the same variables, which all enter multiplicatively. The index therefore simplifies to

$$\phi_{ij}^{FDI} = \sqrt{\frac{\exp(D_{ii}\theta)\exp(D_{jj}\theta)}{\exp(D_{ij}\theta)\exp(D_{ji}\theta)}}$$

With the theoretical framework, the key properties of the inferred openness measure become apparent. First of all, country-specific variables have cancelled out, and we are left with the bilateral factors that make up the net barriers between *i* and *j*. More precisely, ϕ_{ijt}^{FDI} measures the inverse of the net cost of holding foreign capital between country *i* and country *j*. If $\phi_{ijt}^{FDI} = 0.10$, then residents in country *i* consider owning firms in country *j* 0.10 times as attractive as owning firms at home, and vice versa. To express the number as a barrier, take the inverse, it is on net $(0.10)^{-1}=10$ times more costly to own firms abroad in the pair than owning firms at home. (The inverse measure is chosen in line with most work on inferred trade barriers and facilitates comparison across country pairs).

The cancelling out of country-specific factors is the basic idea behind the inference method. The method works whenever the country-specific factors enter multiplicatively, as they do in a gravity equation. The validity of the procedure relies on the empirical fit of the gravity equation for FDI; whether the particular theory used here is valid or not is not crucial.

A second property of the inferred measure is suggested by the phrasing in the example: an international barrier is always measured relative to a domestic one. Bilateral barriers cannot (and perhaps should not) be distinguished from a home bias in firm ownership ($D_{ii}\theta$ and $D_{jj}\theta$). As an example, Poland turns out to have high barriers to FDI, or high home bias. Reasons may be that Polish capital is unattractive to foreigners or that Polish firms face liquidity constraints when seeking to set up or acquire firms abroad. This paper considers these impediments part of the barrier to FDI. Nevertheless, as outlined below, aggregate domestic bias (outward and inward combined) can be separated from purely bilateral barriers by regressing ϕ_{ijt}^{FDI} on country fixed effects.

A third and more problematic property is that the inferred openness between *i* and *j*, will be the geometric mean of how open country *i* is to country *j* and how open country *j* is to country *i*. If the two countries have similar openness, the average is a good measure, it will be less informative for country pairs with asymmetric barriers. That, along with data limitations, is the reason for restricting the current study to OECD countries.

Fourth, ϕ_{ijt}^{FDI} measures aggregate net openness; all bilateral costs or benefits of FDI, whether observable or not, are included and weighted with their coefficients:

$$D_{ij}\theta = \theta_1 d_{1ij} + \theta_2 d_{2ij} + \theta_3 d_{3ij} + \ldots$$

The advantage of inferring the FDI costs rather than compiling observable costs are clear: It gives an easy to compute measure of the overall net openness to FDI, which is what matters for investment decisions (a tautological statement, because the measure is calculated from actual investments). It includes the impact of unobservable barriers or benefits. The measure is comparable across country pairs and over time.[4]

The static model in the theoretical exposition conceals a fifth property of the inferred barriers: ϕ_{ijt}^{FDI} is calculated on the basis of FDI stocks, and if these stocks take time to adjust to changes in FDI barriers, ϕ_{ijt}^{FDI} will measure the barrier with a lag. It is unclear, however, whether FDI stocks actually do take time to adjust; annual fluctuations in FDI stocks can be very large.

2.2 Inferring Country-level Inward Barriers to FDI

The theoretical model in Head and Ries (2008) suggests a compliment to the bilateral measures, a country's aggregate inward barriers to FDI. Consider the fraction of a country's total capital stock which is on domestic hands:

$$\Phi_i^{FDI} = \frac{F_{ii}}{K_i}$$

The share of a country's capital which is domestically owned is a quite intuitive way of measuring a country's inward FDI barriers. If capital is acquired by foreigners through acquisitions, F_{ii} falls, if new capital is constructed through greenfield FDI, K_i rises, with F_{ii} unchanged.

The measure also has a theoretical interpretation. Using (1.2) above, Φ_i^{FDI} can be written as

$$\Phi_i^{FDI} = \frac{\exp\left(\mu_i / \sigma - D_{ii}\theta\right)s_i^m}{\sum_{h=1}^{M}\exp\left(\mu_h / \sigma - D_{jh}\theta\right)s_h^m} = \frac{b_{ii}}{B_i}, \tag{1.3}$$

where $b_{ii} = \exp\left(\mu_i / \sigma - D_{ii}\theta\right)s_i^m$ summarizes the strength of domestic bids, and B_i is the "bidder competition". $\Phi_i^{FDI} \in [0,1]$ is therefore a measure of the relative strength of domestic bidders, the higher Φ_i^{FDI} the higher their advantage over foreign bidders when wanting to acquire domestic firms. If a country has high inward barriers to FDI ($D_{ii}\theta$ is lower than $D_{ih}\theta$ $h \neq i$), domestic bidders will be favored. In this manner, Φ_i^{FDI} is an aggregate of the country's barriers to FDI. The measure is not entirely neutral to size or

[4] Because the inferred barrier is an aggregate, it does not have a meaningful counterfactual. We can compare the aggregate barrier to FDI between Portugal and Spain to the one between Australia and New Zealand, we can use regression analysis to examine how much distance can explain of the aggregate barriers, but it does not make sense to ask what happens if we remove the aggregate barrier to FDI.

wealth, however. If a country is rich (implying higher average valuations, μ_i) or has relatively many firms (high s_i^m), Φ_i^{FDI} will increase as well.[5]

2.3 Implementing the Inference Procedure

Data on bilateral FDI stocks, F_{ij}, are readily available, F_{ii} is more problematic. The precision of inferred openness depends on how well a country's investment stock in itself, F_{ii}, is measured. The model of Head and Ries (2008) suggests computing a country's FDI with itself as a residual: the amount of capital in country *i*, which is still on domestic hands after all foreign firms have acquired firms in *i*. Following Head and Ries (2008) and Burstein and Monge-Naranjo (2009), I calculate a measure of a country's capital stock, $\tilde{K}_i$, in the standard way, by compiling investments from the national accounts using a perpetual inventory method. Investment data is taken from the OECD database (gross fixed capital formation); I subtract investments in dwellings to get rid of the most obvious non-business investments.

The depreciation rate is set to $d = 0.07$, and as an initial guess of a country's capital stock for the first year, I use an inverted production function: $K_{i0} = (Pop_{i0})^{1.022} (Y_{i0}/\text{Pop}_{i0})^{0.964}$, where Y_{i0} is GDP at the date from which investment data is available. The guess is based on Head and Ries (2008)'s finding that 93% of the variation in their measure of capital stock can be explained with a log-log regression yielding the relation above. I use real investments and then inflate the capital measures each year, using the ratio of nominal to real investments, to have measures comparable to the nominal FDI stocks.

Because foreign firms have merged with or acquired firms in country *i*, some of this capital stock will not be domestically owned. To get to domestically owned capital, we must subtract the stock of inward mergers and acquisitions (M&A) in *i*; if a share $\eta_i^{M\&A}$ of the stock of inward FDI in *i* come in the form of mergers and acquisitions, we can compute F_{ii} as:

$$F_{ii} = \tilde{K}_i - \eta_i^{M\&A} \sum_{j \neq i} F_{ji}$$

As an estimate of $\eta_i^{M\&A}$ I use the average share of M&A in FDI inflows to country *i* from 1988 to 2006.

The total capital stock in *i*, disregarding ownership and including what comes in as greenfield FDI, is given by

[5] The way the total capital measure is constructed, Greenfield FDI is counted as an increase in K_i. With this construction, a country with a large inflow of Greenfield FDI is classified as having fiercer bidder competition (but also as having a larger stock of total capital). The rationale is that with the addition of new foreign-owned capital from a given country, each of the inward bilateral FDI stocks from other countries makes up a lower share of total capital.

$$K_i = F_{ii} + \sum_{j \neq i} F_{ji} \; .$$

It is this total capital measure that is used to infer a country's overall barriers to inward FDI defined in (1.3).

3 Data and Descriptive Results

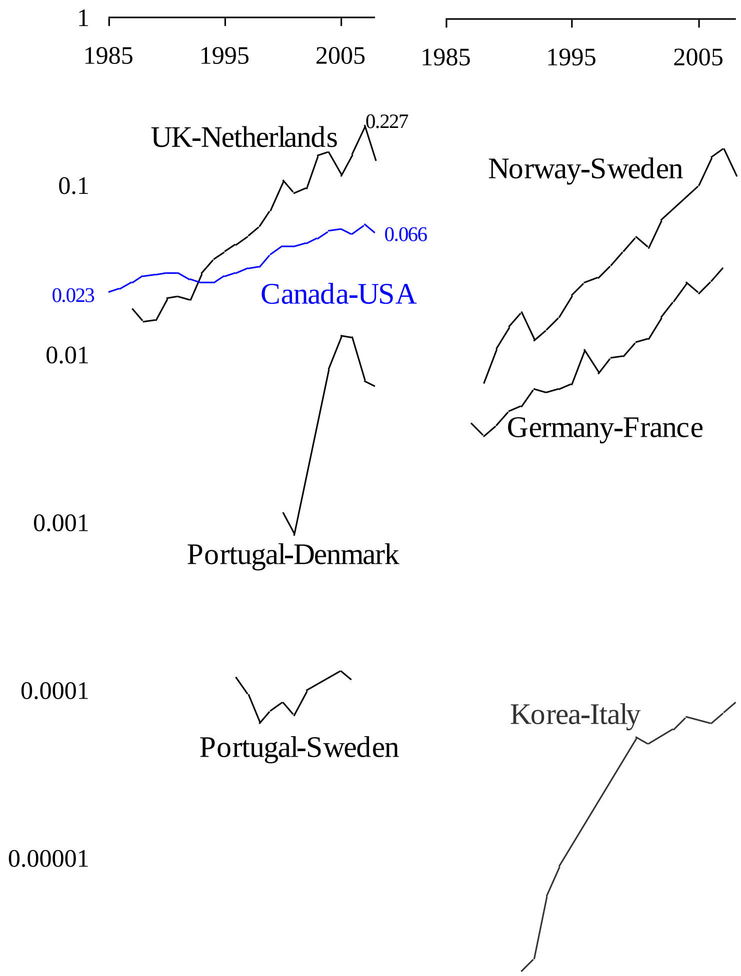
Data on bilateral FDI stocks F_{ij} are taken from the OECD online database. The time period is 1985-2008 with some holes due to lack of data. To maximize data coverage I use both inward and outward FDI data. Due to the difficulties of dealing with countries with asymmetric barriers, the analysis is confined to OECD members, data for Belgium, Luxembourg, Chile, Slovenia, Israel and Estonia are unavailable. The sample consists of pairs of these 28 countries: Australia, Austria, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea (South), Mexico, The Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey, the UK, the USA. Available data allow the construction of ϕ_{ijt}^{FDI} for 324 pairs with varying time series length for a total of 4727 observations (out of 9072 possible observations for 378 possible pairs).

Domestic investments used to construct domestic capitals also come from the OECD database, "gross domestic capital formation" minus the subcategory "dwellings", which should not count as business sector capital. Population and GDP per capita data used to construct the initial capital guess are from the same database, GDP per capita is in US$ constant prices, constant PPPs (2000 is the OECD base year). M&A and FDI flow data used to estimate the share of M&A in FDI stocks come from the UNCTAD database, the time coverage is from 1987 to 2006.

3.1 The Size and Evolution of FDI Barriers

Figure 1 plots ϕ_{ijt}^{FDI} for 7 country pairs. In 1985, Canada-USA was the most integrated pair in the world, owning foreign affiliates in the other country was $\phi_{Can,US,85}^{FDI} = 0.023$ as attractive as owning domestic firms. As seen, however, FDI barriers have declined more quickly for several other pairs. By 1995 both Norway-Sweden and the UK-Nethelands were more integrated, with the latter pair setting the world record for low FDI barriers in 2007: $\phi_{NL,UK,07}^{FDI} = 0.227$.

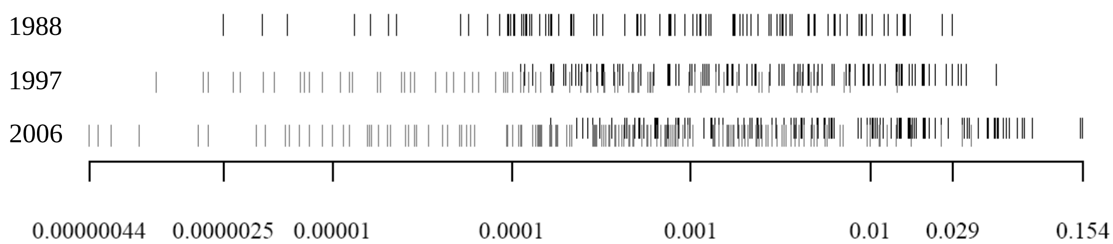
Figure 1: Bilateral openenss to FDI, selected pairs



The FDI barrier between Portugal and Sweden is almost a thousand times higher than the one between Portugal and Denmark. This difference is striking and highlights the usefulness of inferring FDI barriers, rather than trying to collect observable data or run gravity regressions: we would hardly have expected or discovered such a large discrepancy. The difference is likely driven by some unobservable or hitherto unstudied variable. A guess could be that Danish manufacturing firms to a very large degree used to operate in industries, where it has been attractive to relocate production to Portugal.

Figure 2 gives an overview of the distribution of ϕ_{ijt}^{FDI} in 1988, 1997 and 2006 on a common log scale; black bars represent pairs for which there is data in all three years.

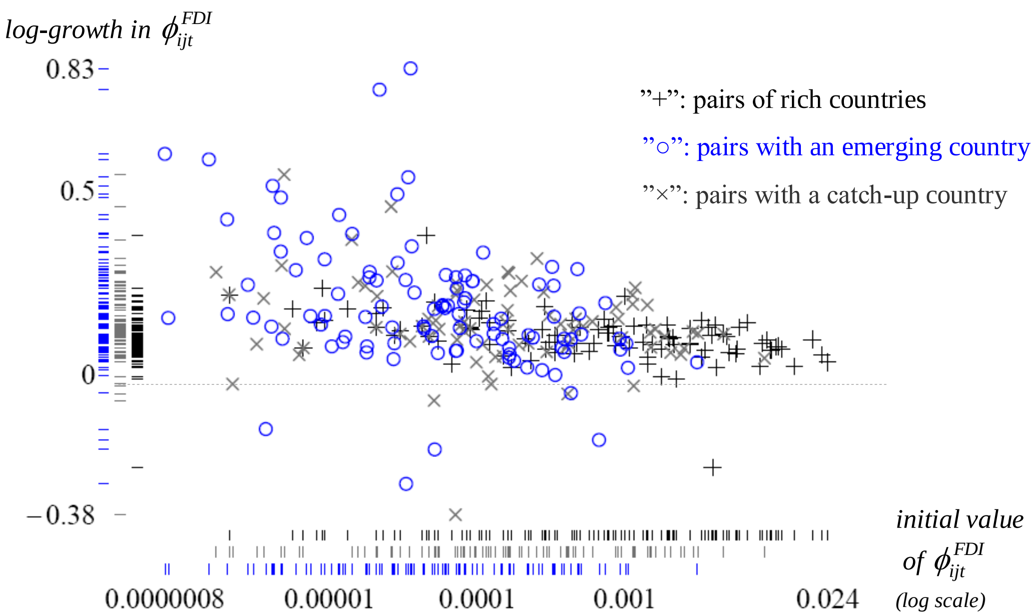
Figure 2: Cross-sections of ϕ_{ijt}^{FDI}



The three bars show the cross-sections of ϕ_{ijt}^{FDI} in 1988, 1997 and 2006 on a common axis. Black observations are pairs for which there is data in all three years. The grey observations do not represent the same pairs. In 1997 and 2006 there were also 16 and 41 observed zeroes, respectively.

The distributions have their masses in the middle and upper end, with a long tail of pairs with very high barriers. In 2006, there is also a substantial number of observed zero values, corresponding to a barrier so large that no investments are worthwhile. It is hardly surprising that there are "improbable" pairs with very high barriers, (1988's lowest ϕ_{ijt}^{FDI} is Austria-Finland and 2006's is Iceland-Korea), but it is noteworthy that these pairs are the exception in the OECD.

Figure 3: Convergence or divergence in FDI barriers?



"Initial value" on the x-axis is the value of ϕ_{ijt}^{FDI} in the first year for which data is available for the *ij*-pair. The y-axis then gives the average annual log-growth rate in ϕ_{ijt}^{FDI} for the pair. Next to the axes are plotted univariate distributions for ϕ_{ijt}^{FDI} and the growth rates.

Let us examine in more detail how FDI barriers evolve over time. Figure 3 is a type of figure often used for convergence analyses. It helps us determine how much FDI barriers decline across country pairs, whether the declines vary with the countries' income, and whether the initial level of FDI barriers matters for how quickly FDI barriers decline.

The annualized log growth rates of ϕ_{ijt}^{FDI} are displayed on the y-axis. The x-axis shows the value of ϕ_{ijt}^{FDI} for the first year for which data is available for the *ij*-pair, (e.g. 1985 for Canada-USA and 2000 for Slovakia-Spain). Country pairs are divided into 3 groups, according to the countries' GDP per capita: If one of the countries in a pair is either Czech Rep., Slovak Rep., Hungary, Poland, Greece, Turkey or Mexico ("emerging countries"), the pair is marked with a "○".Of the remaining pairs, if one of the countries is either Finland, Iceland, Ireland, Portugal, Korea or Spain ("catch-up countries"), they are marked with an "×". Otherwise the pair is marked with a "+", indicating that both countries are wealthy throughout the sample period ("rich countries").

If pairwise FDI barriers converge towards the same level, there should be a downward-sloping relationship in Figure 3, if there is divergence (meaning that already integrated countries keep integrating faster than the rest), the relationship should be positive. If anything, the graph indicates convergence (the correlation between initial levels and growth rates is -0.21), but the dominant picture is one of more variance for lower initial levels of ϕ_{ijt}^{FDI} , it is easier to have large variations in growth rates for low initial levels. On average, pairs where one of the countries is a "catch-up" or "emerging" country have seen larger declines in FDI barriers than the richer countries, as is seen when comparing the marginal distributions of growth rates (y-axis on Figure 3) or looking at the summary statistics in Table 1:[6]

Table 1: Summary statistics of log growth rates in ϕ_{ijt}^{FDI}

	average	(std. dev.)	Half-life
Rich countries (+)	0.104	(0.066)	6.7 years
Catch-up countries (o)	0.141	(0.119)	4.9 years
Emerging countries (×)	0.187	(0.176)	3.7 years

Half-life is the average time it takes for FDI barriers to fall by 50%.
Symbols refer to Figure 3.

In sum, the decline in FDI barriers in the OECD has been quite dramatic, with barriers on average halving every 4.8 years. Although there is variation across pairs, the dominant picture is a universal decline in FDI barriers, likely because of technological developments or policy liberalizations that are common across the OECD. There is some tendency for

[6] The differences between the means are not statistically significant.

more peripheral countries to have a faster decline in their FDI barriers, catching up with the richest.

4 Observable and Unobservable FDI Barriers

From countries shown in Figure 1, the conclusion from the existing empirical literature on FDI barriers seems valid: distance, languages, and GDP are important determinants of the barriers to FDI. On the other hand, it is also clear that these variables do not tell the entire story; they can hardly explain the rapid decline in FDI barriers, or curious outliers like Denmark-Portugal. This section examines how much of the barriers to FDI we can relate to observable barriers or proxies emphasized by the previous literature. First, section 1.4.1 gives a presentation of the estimation strategy and relevant variables, results follow in section 1.4.2. Home biases in firm ownership receive particular attention in section 1.4.3.

4.1 Estimation Strategy

Maintaining the assumption that the components of FDI barriers enter multiplicatively (in line with the derivations in section 1.2.1 and with estimation of gravity equations in general),

$$\phi_{ij}^{FDI} = \sqrt{\frac{\exp(D_{ii}\theta)\exp(D_{jj}\theta)}{\exp(D_{ij}\theta)\exp(D_{ji}\theta)}},$$

I split the bilateral FDI openness into observable and unobservable variables:

$$\begin{aligned}\phi_{ij}^{FDI} &= dist_{ij}^{\ \theta_1} \exp(\theta_2 neigh_{ij})\exp(\theta_2 lang_{ij})\exp(\theta_3 colony_{ij}) \\ &\quad \times (GDP_{it} GDP_{jt})^{\theta_7} \exp(\gamma_t)\eta_{ijt}.\end{aligned} \tag{1.4}$$

Based on previous studies (see the introduction), I use the following observable variables: $dist_{ij}$, the great arc distance in kilometers between the capitals in country i and country j; $neigh_{ij}$, $lang_{ij}$ and $colony_{ij}$ are dummy variables indicating, respectively, whether countries i and j are neighbors (sharing a border or having only a small body of water between them), share a main language, and whether the two countries have been one in the past or whether one was a colony of the other. These variables are taken from the CEPII database, note that they are all symmetric, $x_{ij} = x_{ji}$. Countries i and j's GDP, GDP_{it} and GDP_{jt}, are taken from the OECD database and measured at constant PPPs and prices (base year 2000).

Because ϕ_{ijt}^{FDI} is symmetric $\phi_{ijt}^{FDI} = \phi_{jit}^{FDI}$, we would expect i and j's per GDPs to enter with the same coefficient, as imposed. In some specifications, I split GDPs into per capita GDPs and populations at their 1985 levels, both are taken from the OECD database.

Year dummies γ_t capture the overall positive trend in ϕ_{ijt}^{FDI}. The "non-trend" unobservable barriers, η_{ijt}, are lumped together in an error term. [7]

A widespread econometric approach to estimating a relationship like (1.4) is to take logs on both sides and run a linear regression. In an influential recent paper Santos Silva and Tenreyro (2006) lay out the extreme regularity conditions that this procedure requires to be valid: All conditional moments of η_{ijt} must be independent of the explanatory variables, otherwise the estimates from the log-log model will not be consistent estimates of the parameters of the multiplicative relationship above. Of particular concern is heteroskedasticity in η_{ijt}.

Examinations of actual values vs. fitted values from log-log regressions make it clear that these regularity conditions are not met when estimating (1.4) in log-log. I therefore use the alternative estimation procedure that Santos Silva and Tenreyro (2006) suggest, Poisson pseudo-maximum-likelihood (PPML) using (1.4) in its multiplicative form. Appendix 1 provides more details on the bias that arises when estimating (1.4) in logs.

The domestic biases in capital ownership, $D_{ii}\theta$ and $D_{jj}\theta$, are part of the inferred barriers to FDI. As argued above, distinguishing a high domestic bias in capital holdings from a high average barrier to FDI is conceptually difficult and practically impossible without imposing a lot of structure. I treat domestic biases in two ways, with different implications for the identification of the estimated coefficients. Table 2a in the next subsection presents the results.

It could be that a country's domestic bias (or average FDI barrier) is well explained by its geography, how widespread its main languages are and how wealthy and large it is. That is the assumption behind specifications (1) and (3) in Table 2a. In specifications (2) and (4), the error term is specified as $\eta_{ijt}=\exp(c_i)\exp(c_j)v_{ijt}$, c_i and c_j being country dummies that cancel out the domestic biases. With country fixed effects included in this manner, the estimation identifies parameters using only the distribution of bilateral FDI openness, conditional on each country's average bilateral FDI openness.

[7] The symmetric structure of ϕ_{ijt}^{FDI} means that some asymmetric variables such as tax differences or relative technology levels between countries i and j are cumbersome to include. I have chosen to let country fixed effects account for these variables instead, see the discussion below and section 1.4.3. Using country fixed effects also precludes the use of country-specific variables with little time variation, such as R&D-intensity.

4.2 Observable FDI Barriers

Table 2a. The components of bilateral barriers to FDI. Dependent variable: ϕ_{ijt}^{FDI}

Specification	(1)		(2, FE)		(3)		(4, FE)	
	coeff. (std. error)	%-effect [z-stat]	coeff. (std. error)	%-effect [z-stat]	coeff. (std. error)	%-effect [z-stat]	coeff. (std. error)	%-effect [z-stat]
Distance$_{ij}$	-0.69 (0.03)^a	 [-21.8]	-0.47 (0.03)^a	 [-18.5]	-0.74 (0.04)^a	 [-22.7]	-0.47 (0.03)^a	 [-19.0]
Neighbors$_{ij}$ (0,1)	-0.07 (0.09)	 [-0.8]	0.40 (0.04)^a	49% [10.6]	-0.06 (0.09)	 [-0.8]	0.39 (0.05)^a	48% [10.5]
Common language$_{ij}$ (0,1)	1.16 (0.08)^a	218% [14.2]	0.49 (0.06)^a	63% [8.8]	0.35 (0.09)^a	46% [4.9]	0.49 (0.06)^a	64% [8.8]
Colonial past$_{ij}$ (0,1)	0.29 (0.11)^a	34% [2.6]	1.21 (0.07)^a	235% [17.1]	0.55 (0.08)^a	73% [6.7]	1.21 (0.09)^a	236% [17.3]
$GDP_{it} \times GDP_{jt}$	0.37 (0.02)^a	 [23.2]	0.44 (0.15)^a	 [3.6]				
(Per capita GDP_{it}) × (Per capita GDP_{jt})					3.20 (0.12)^a	 [31.1]	1.14 (0.14)^a	 [8.3]
(Population in 1985$_i$) × (Population in 1985$_j$)					0.31 (0.02)^a	 [21.8]	0.41 (0.03)^a	 [12.9]
Year dummies (γ_t)	Yes [sum 74.7]		Yes [sum 101.8]		Yes [sum 46.6]		Yes [sum 79.5]	
Country fixed effects (c_i and c_j).	No		Yes [sum 277.6]		No		Yes [sum 494.7]	
R^2	0.254		0.837		0.432		0.839	

4727 observations. %-effect: Percentage change in ϕ_{ijt}^{FDI} when independent variable goes from 0 to 1, calculated as exp(b) – 1. Estimation method: Poisson pseudo-maximum-likelihood, estimated coefficients are elasticities. Robust standard errors in parentheses. Square parentheses t-statistics, corresponding to the explanatory variables' importance in explaining the variation in the dependent variable. ^{a}: significant at the 1% level

Table 2a shows four different specifications for estimating (1.4), specification (4) is my preferred. The fit of the regression is dramatically improved when controlling for countries' home bias in firm ownership (the R² is computed as $corr\left(\phi_{ijt}^{FDI}, \hat{\phi}_{ijt}^{FDI}\right)^2$. Distance increases the barriers to FDI; although an elasticity of 0.47 is perhaps not dramatically large, the explanatory power of distance is consistently large across specifications. On top of the distance effect, two countries that are neighbors have half the FDI barrier of other pairs;

when country-specific spurs and barriers to FDI are cancelled out, Crozet, Mayer and Mucchielli (2004)'s discovery that affiliates tend to cluster just across the border is quantitatively quite important.

A very large reduction in FDI barriers comes with a past as a common country, the effect seems to be highly dependent on controlling for home bias. Including the Austro-Hungarian empire and the Nordic countries, only 16 country pairs have colonial or common country pasts in the OECD, so it is remarkable that the variable is so important in explaining ϕ_{ijt}^{FDI}. The common language coefficient changes dramatically across specifications, but an intuitive story fits the pattern: Controlling for population sizes but not for country fixed effects gives the lowest coefficient. A country with a widespread language has lower domestic bias in firm ownership.

The idea behind separating GDP into per capita GDP and population is that they are likely to have distinct effects. A large market may allow more firms to recoup fixed costs of owning an affiliate there, as emphasized in the literature on proximity-concentration trade-offs, see for instance Helpman, Melitz and Yeaple (2004). The population variable tries to capture this idea, although GDP per capita may still contain market size effects. In order to keep out effects correlated with population growth, populations are kept fixed at their 1985 level. GDP per capita may also relate to the quality of a country's institutions, lowering the costs of having an affiliate there, see Wei (2000) and Bénassy-Quéré, Coupet and Mayer (2007). Also, firms in rich countries may simply own assets that are more attractive to foreigners, and firms in poorer countries may have problems raising enough funds for international acquisitions or greenfield investments. As a counterbalancing effect, wages are higher in rich countries, increasing the costs (both marginal and fixed) of serving them through local affiliates.

Controlling for their effect on home bias, a subject which will be treated below, per capita GDP and population remain noteworthy determinants of the distribution of FDI barriers. Given their average barrier, countries tend to have 1.1% lower FDI barriers towards wealthier countries, the negative wealth effects from higher wages appear to be outweighed. And a larger market is more attractive, something which traditional gravity-based studies of FDI determinants have a harder time identifying, because larger countries also “mechanically” attract more FDI to satisfy their greater demand.

In addition to the lower fit, the estimated coefficients also differ without country-fixed effects. With some caution, because cross-coefficient effects may play a role, we can learn about the home biases by examining these changes. In addition to the language effect described just above, the most striking difference is in GDP per capita. Its large z-statistic and high positive elasticity in specification (3) suggest that it is an important determinant of home bias. Population also has a much higher z-statistic, but the coefficient is slightly lower without fixed effects. It is plausible that a large market reduces domestic bias, but that the effect comes from adding up the “by pair”-effects that specification (4) identifies: no matter the size of their origin country, firms prefer investing in a foreign market if it is large, large markets therefore have their average barriers to FDI reduced. Note also that the fit of specification (3) with separate wealth and market size effects is much higher than that of specification (1).

The stronger distance effects in specifications (1) and (3) might pick up a remoteness effect: A country like Japan could suffer an additional increase in its FDI barriers, because its isolated location, far from most OECD countries, makes it an unattractive FDI partner, adding to the already large distance-related barriers with each individual country. The coefficient change may also reflect the vanished neighbor effect.

The way ϕ_{ijt}^{FDI} is constructed, a concern may be that a positive shock to domestic investments in a given year, without a corresponding increased inflow of FDI, will translate into higher FDI barriers with all the country's partners in that year. The inference procedure considers this shock to be part of the FDI barrier, but an obvious alternative way of dealing with the problem is to replace the country dummies with country-year dummies, *i*.e. to specify the error term and time trend as $\exp(\gamma_t)\eta_{ijt} = \exp(c_{it})\exp(c_{jt})\zeta_{ijt}$. Unfortunately, the Poisson estimation will not converge with the larger set of dummies. In Appendix 1, I do the log-log regression with country-year dummies also. The estimated coefficients do not change, except a dramatic increase in the population coefficient, although the variable has little explanatory power.

The variables included in Table 2a do not capture if firms in a country have specific strategic interests in another country (at least for reasons unrelated to distance or wealth). At the cost of losing pairs involving Australia and Turkey (450 observations in total), I have constructed a proxy of these strategic interests, by looking at similarity in industry structure. Table 2b presents the results. The new dummy variable "similar industry" takes the value 1 if two countries have one or more of their three largest industries in common. I use data on gross industry output from the STAN database to construct the variable. 58% of all OECD country pairs have a similar industrial structure, if it is defined in this manner.[8]

Table 2b. Industry similarity and bilateral FDI barriers. Dependent variable: ϕ_{ijt}^{FDI}

Specification	(5)		(6, FE)	
	coeff. (std. error)	%-effect [z-stat]	coeff. (std. error)	%-effect [z-stat]
Similar industries$_{ij}$ (0,1)	-0.02 (0.06)	[-0.34]	0.23 (0.05)^{a}	26% [5.02]
All variables from table 4, reg.3-4				
Year dummies (γ_t)	Yes		Yes	
Country fixed effects (c_i and c_j).	No		Yes	
R^2	0.521		0.904	

Regressions (3) and (4) from Table 2a, with an additional variable that proxies for industry similarity. 4277 observations. %-effect: Percentage change in ϕ_{ijt}^{FDI} when independent variable goes from 0 to 1, calculated as $\exp(b) - 1$.
Estimation method: Poisson pseudo-maximum-likelihood, estimated coefficients are elasticities. ^{a}: significant at the 1% level.

When controlling for country fixed effects in specification (6), the proxy for industry similarity is significant, ϕ_{ijt}^{FDI} rises with 23% if countries have one or

[8] A number of industries have to be excluded, because they are common across too many countries. These are food products and beverages, construction, retailing and wholesale, real estate activities, health, and education. None of these industries have any separate effect on FDI barriers, if they are in top 3 in both countries in a pair. Finally, agriculture is excluded, otherwise the variable becomes insignificant.

more of their top 3 industries in common. Including the proxy for industry similarity does not affect the coefficients of the other explanatory variables (the distance coefficient does change, compared to Table 2a, however, because the many observations involving Australia are dropped).

The results suggest that strategic complimentarities do reduce net FDI barriers. From this preliminary analysis, it is hard to determine how important strategic complimentarities are relative to distance or GDP per capita. Trying to generate better measures of industry similarity, perhaps from input-output tables, seems like a worthwhile endeavor. To the best of my knowledge there are no existing empirical studies of how strategic complimentarities shape aggregate FDI flows, save perhaps the appendix in Mariscal (2010).

4.3 Country-Specific FDI Barriers

The previous subsection established that the main determinants of the inferred barriers to FDI were country-specific factors; adding country fixed effects greatly improved the fit of the estimations in Table 2a. The estimated country fixed effects from the preferred specification (4) can be used to compute how much each country's average FDI barrier deviates from its expected value of 1. (Because the added variable for industry similarity is just a proxy, and including it requires dropping two countries, I use estimations from specification 4, not 6). The results are reported in Table 3, and they allow an assessment of how the variables that the previous subsection suggested were determinants of the country-specific factors (per capita GDP, a country's geographical position and the prevalence of its language) aggregate up, and of what other factors may play a role:

Table 3: Countries’ barriers to FDI, deviations from expected value

Netherlands	-84%	UK	-53%	Germany	-3%	Mexico	193%
Ireland	-76%	USA	-45%	Spain	2%	Poland	225%
Switzerland	-74%	Denmark	-39%	Italy	17%	Turkey	288%
New Zealand	-74%	France	-37%	Hungary	64%	Czech Rep.	304%
Sweden	-65%	Portugal	-27%	Austria	102%	Slovak Rep.	391%
Australia	-60%	Canada	-16%	Finland	107%	Korea	488%
Norway	-54%	Iceland	-8%	Japan	115%	Greece	541%

Deviations calculated using the country fixed effects in Table 2a, specification (4). A country’s expected value of FDI barriers (both inward and outward) is based on its geographical position, relative wealth and population, and whether it shares a language or a colonial past with other countries.

The three countries with the lowest barriers to FDI are all known for their lenient corporate taxes, having the lowest corporate taxes seems to be an important attractor of

FDI. Increasing abilities for companies to arbitrage tax payments across countries may drive part of the decline in aggregate FDI barriers.[9]

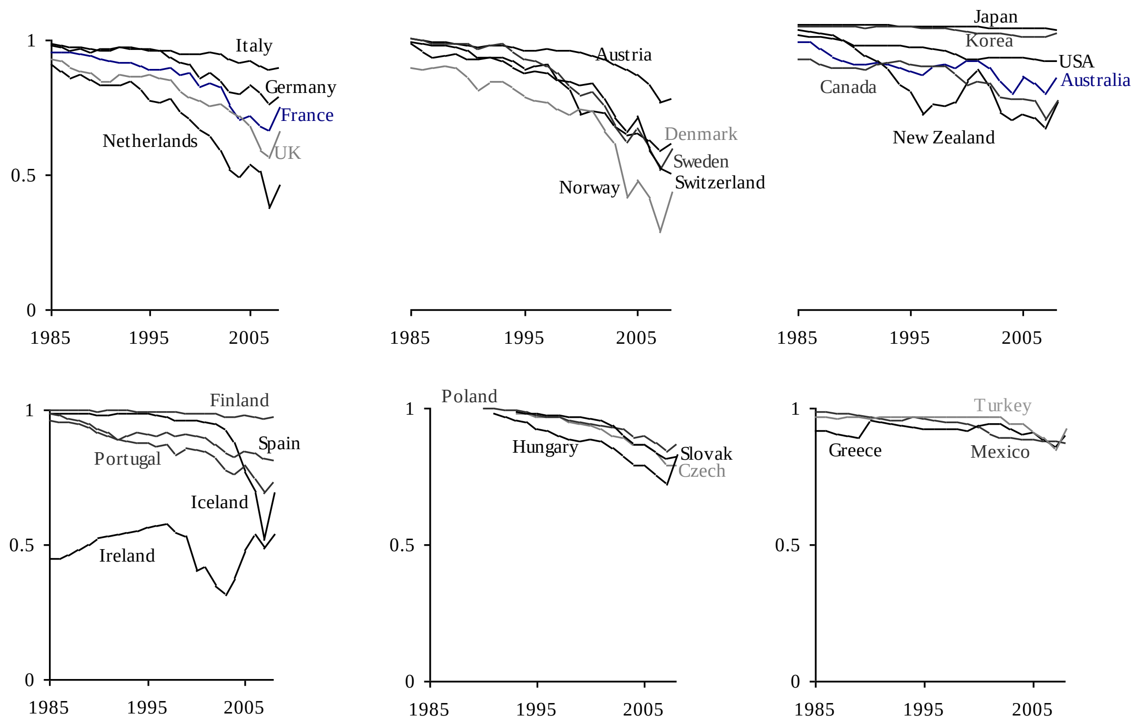
GDP per capita does seem to be an important determinant of the percentage deviations, but it is far from the only factor. The relatively high ranks for Portugal and Spain might relate to their low wages (and hence low GDP per capita). English-speaking countries are well represented at the top; it seems that the benefits of speaking a global language compensates for a remote location for Australia and New Zealand. Remoteness hits much harder on Japan and South Korea, the low ranks of Finland and Greece could also be due to their location at the "corners" of Europe.

5 Increasing Crowding Out of FDI

A disadvantage of the analysis so far has been that the inference procedure for bilateral barriers to FDI lumps together inward and outward barriers. As outlined in section 1.2.2, a complimentary measure infers a country's overall inward barriers to FDI, it is calculated as the fraction of a country's capital stock, which is still domestically owned: $\Phi_{it}^{FDI} = F_{iit} / K_{it}$. Figure 5 depicts Φ_{it}^{FDI} for the 27 countries.

[9] Regarding computation of the deviations in Table 3: Depending on the country-pair observation, a country may enter as *i* or *j* in the regressions. Because ϕ_{ijt}^{FDI} is symmetric, the distinction is arbitrary, but it gives rise to two estimated country fixed effects for each country *h*, call these, with a slight abuse of notation, ci_h and cj_h These estimates should be mean-corrected (because the estimation may arbitrarily attribute the regression's constant to either *i*-dummies, *j*-dummies, year dummies or the constant term), and weighted according to how often a country appears as *i* or *j* in a pair. Country *h*'s total fixed effect, FE_h, is calculated as $FE_h = a_h(ci_h - \bar{c}i) + (1 - a_h)(cj_h - \bar{c}j)$, where a_h weights how frequently country *h* appears as *i*, and where $\bar{c}i$ and $\bar{c}j$ are the means across all ci_h and cj_h estimates, respectively. The percentage deviation is then calculated as $\exp(-FE_h) - 1$.

Figure 5: Inferred aggregate barriers to FDI for OECD countries



The overall picture is one of significant declines in Φ_{it}^{FDI}, the advantage that domestic buyers have over foreign buyers has fallen. There are exceptions, however: Inward barriers in Japan, Korea and Finland remain high, and Ireland has no downward tendency in its already low aggregate barrier.

An important implication follows from Figure 5. The model of Head and Ries (2008) points out the necessity of correcting for country differences in bidder competition when estimating gravity equations for bilateral FDI stocks. Otherwise, regressions will suffer from omitted variables bias, as higher overall openness will tend to depress bilateral FDI stocks. Figure 5 shows that the solution applied by Head and Ries (2008), country fixed effects, is insufficient: Φ_{it}^{FDI}, which is closely related to bidder competition, can change quite dramatically, even over relatively short time periods, and the rates of change clearly differ across countries. As we shall see in the next section, the growth in FDI stocks has been notably lower due to increased bidder competition.

The problem is similar to the one pointed out in Novy (2008): When estimating gravity equations for trade in goods, it is necessary to control for changes in multilateral resistance. For FDI, the problem is accentuated, since the reductions in Φ_{it}^{FDI} are proportionally larger than the changes in inferred multilateral resistance reported by a similar inference procedure in Novy (2008) The debate in the trade literature on how to correct for time-variant multilateral resistance has not yet reached a conclusion. Correcting by including country-year fixed effects solves the problem, but it may require estimating too many parameters. From inspection of the Φ_{it}^{FDI} series, one might suggest the "cheaper" strategy of adding country-specific trends, most of the evolution in a country's overall barriers can be roughly approximated with a negative log-linear trend. In studies with long time periods, it may be necessary to inspect plots of Φ_{it}^{FDI} to check for breaks in the trends.

6 Decomposing the Growth of FDI

Two countries may invest more in each other for three reasons: The bilateral barriers to FDI may fall, the two countries may experience economic growth, raising the nominal value of the desired FDI stock abroad, or finally, the relative attractiveness of mutual investment may increase because the two countries' barriers to the rest of the world have gone up, lowering the competition for assets in the two countries.

FDI activities have indeed grown in recent years. With the time series for the inferred bilateral and overall barriers as well as total capital stocks at hand, it is possible to calculate the relative contributions of each of these three factors. Is the increase in FDI stocks mainly caused by lower costs of investing abroad, or is economic growth, in the form of domestic capital accumulation, driving the increase?

Rewrite the product of the FDI stocks between country *i* and *j* as follows:

$$F_{ijt}F_{jit} = \frac{F_{ijt}F_{jit}}{F_{iit}F_{jjt}}\frac{F_{jjt}F_{iit}}{K_{it}K_{jt}}K_{it}K_{jt}$$

The product of bilateral FDI stocks can then be expressed as

$$F_{ijt}F_{jit} = \left(\phi_{ijt}^{FDI}\right)^2 \Phi_{it}^{FDI}\Phi_{jt}^{FDI}K_{it}K_{jt},$$

that is, the two countries' domestic capital stock times the two countries' aggregate inward barriers to FDI times the bilateral openness squared. To get the contributions of each of these factors over time, take logs and difference with the desired time period:

$$\Delta\log\left(F_{ijt}F_{jit}\right) = 2\Delta\log\left(\phi_{ijt}^{FDI}\right)\Delta\log\left(\Phi_{it}^{FDI}\Phi_{jt}^{FDI}\right) + \Delta\log\left(K_{it}K_{jt}\right) \qquad (1.5)$$

Table 4: Decomposing the annual growth of FDI, 1985-2008							
	Annual growth in FDI stocks		Contribution, change in FDI openness		Contribution, growth in capital stocks		Contribution, change in third-country barriers, bidder competition
OECD average	41%	=	31% (75%)	+	13% (32%)	+	-3% (-7%)
America	29%	=	19% (66%)	+	12% (41%)	+	-2% (-7%)
Mexico	33%	=	23% (69%)	+	12% (37%)	+	-2% (-6%)
Canada	26%	=	17% (66%)	+	11% (43%)	+	-2% (-9%)
USA	28%	=	17% (62%)	+	12% (43%)	+	-2% (-6%)
Oceania and South-East Asia	31%	=	21% (67%)	+	12% (37%)	+	-2% (-5%)
Korea	47%	=	33% (70%)	+	15% (33%)	+	-1% (-3%)
New Zealand	27%	=	19% (70%)	+	10% (37%)	+	-2% (-7%)
Japan	27%	=	17% (65%)	+	11% (40%)	+	-1% (-5%)
Australia	26%	=	16% (62%)	+	11% (44%)	+	-2% (-6%)
Europe, rich	37%	=	30% (80%)	+	11% (30%)	+	-4% (-10%)
Norway	44%	=	39% (87%)	+	11% (26%)	+	-6% (-13%)
Sweden	39%	=	33% (85%)	+	11% (27%)	+	-5% (-12%)
Austria	46%	=	37% (81%)	+	12% (26%)	+	-3% (-7%)
Switzerland	29%	=	23% (81%)	+	11% (37%)	+	-5% (-18%)
Netherlands	37%	=	29% (79%)	+	13% (34%)	+	-5% (-13%)
Germany	33%	=	26% (78%)	+	10% (30%)	+	-3% (-8%)
Denmark	36%	=	28% (77%)	+	11% (32%)	+	-3% (-9%)
France	42%	=	32% (77%)	+	12% (29%)	+	-2% (-6%)
Italy	39%	=	30% (76%)	+	11% (28%)	+	-2% (-5%)
UK	29%	=	21% (72%)	+	11% (39%)	+	-3% (-11%)
Europe, catch-up	45%	=	33% (75%)	+	14% (31%)	+	-3% (-6%)
Iceland	52%	=	42% (81%)	+	15% (29%)	+	-5% (-10%)
Spain	53%	=	41% (77%)	+	14% (27%)	+	-2% (-4%)
Portugal	39%	=	29% (74%)	+	14% (34%)	+	-3% (-8%)
Finland	35%	=	25% (72%)	+	12% (34%)	+	-2% (-6%)
Ireland	44%	=	30% (67%)	+	15% (33%)	+	-0% (-1%)
Central and Eastern Europe	55%	=	43% (79%)	+	14% (26%)	+	-3% (-5%)
Poland	67%	=	55% (81%)	+	15% (23%)	+	-3% (-4%)
Czech Rep.	49%	=	40% (81%)	+	13% (26%)	+	-4% (-8%)
Slovakia	65%	=	52% (80%)	+	16% (24%)	+	-3% (-4%)
Hungary	49%	=	39% (78%)	+	14% (28%)	+	-3% (-6%)
Turkey	48%	=	36% (76%)	+	14% (29%)	+	-2% (-4%)
Greece	49%	=	37% (75%)	+	15% (30%)		-3% (-6%)

Decomposition, according to equation (1.5), of the growth in the product of bilateral FDI stocks, averaged for each country (unweighted) across country pairs. Shares of total contribution in parentheses. In each group, countries are ordered according to the share of FDI growth that is explained by declining barriers.

Table 4 presents these contributions of bilateral barriers $\left(\phi_{ijt}^{FDI}\right)$, third-country effects $\left(\Phi_{it}^{FDI}\Phi_{jt}^{FDI}\right)$ and capital stocks ($K_{it}K_{jt}$) in the growth of FDI stocks between 1985 and 2008.[10] The growth rates are annualized and averaged across country pairs.

The first observation is the dominance of falling bilateral barriers as drivers of the growth of FDI, they typically explain three quarters of the FDI growth. Jacks, Novy and Meissner (2011) do a similar decomposition for trade flows. For the period 1950-2000, they find that falling trade costs (inferred in the same manner as FDI openness in this paper) explain only 31% of the growth in trade, the rest being attributable to economic growth. Novy (2008) reports similar numbers for specific country pairs involving the US over the period 1970-2000, falling trade costs explain on average 40% of the growth in trade.

In fact, the numbers in table 4 are more in line with what happened to international trade in the period 1870-1913, the so-called first wave of globalization. In this period world trade boomed, and Jacks, Novy and Meissner (20011) show that 60% of that expansion could be attributed to falling trade costs. A policy lesson can be drawn from this analogy: As the collapse in global trade following the First World War and the Great Depression has shown, an expansion in trade or FDI which is driven by reduced bilateral costs is more fragile. Barriers can be re-erected. Although trade costs in the late 19th century fell both for technological and political reasons, the protectionist era of 1921-39 brought trade costs back to their pre-Victorian level (see Jacks, Meissner and Novy (2011)).

Table 4 also reveals that for some countries, falling FDI barriers have played a smaller role. As the regional averages reveal, these countries are non-European, with Ireland as the only exception. Countries that have a contribution share from ϕ_{ijt}^{FDI} below 70% also have lower than average growth in FDI, again Ireland is the exception. The correlation between the growth in FDI stocks and the share explained by ϕ_{ijt}^{FDI} is 0.58. In line with these numbers Jacks, Meissner and Novy (2011) find that within Europe, falling trade costs explain a larger share, 52%, of the growth in trade between 1950 and 2000.

All bilateral investment stocks are suppressed by the decline in third-country barriers, FDI stocks have grown by 1% to 5% less per year because of crowding out. The negative contribution tends to be larger for small open economies.

7 Further Uses of Inferred FDI Barriers

Inferred FDI barriers have uses beyond the direct explorations that are the focus of this paper. In related fields, it can be used as an explanatory or control variable. How do FDI barriers predict trade in goods, migration, or similar cross-border phenomena? Of particular interest here is perhaps the residual from the regressions in section 1.4. Do unexplained barriers to FDI correlate with trade flows or migration stocks?

[10] Following the discussion in footnote 5, an inflow into i of greenfield FDI from a country j will be attributed both to a decline in the bilateral barrier, to an increase in the capital stock in i and to an increase in bidder competition (fall in Φ_{it}^{FDI}), with the latter two exactly offsetting each other. The Greenfield FDI inflow generated more capital in i, but this new capital is owned by country j, and other countries $h \neq j$ therefore own a lower share of the capital in i, mechanically generating more bidder competition for the total capital in i.

Models like Ramondo and Rodríguez-Clare (2010) need barriers to FDI as inputs, and inferred barriers to FDI are an easy and straightforward way to calibrate these models, see Eaton, Kortum, Neuman and Romalis (2010) for a similar application of inferred trade costs.

Finally, the methodology of inferring barriers, applied here to FDI, can be applied elsewhere. The gravity equation describes very well how many economic and social activities propagate across space, examples include migration, traffic, tourism, and social interactions. In principle, we can use the inference procedure to study the barriers to all these phenomena, the only conditions being that we can measure a location's "interaction with itself" meaningfully, and that the locations' interactions are not too unbalanced (an issue for tourism, for example).

We may of course wish for theoretical foundations for why the gravity equation describes a given phenomena before applying the inference procedure, and the above analysis also shows the usefulness of a theoretical framework. On the other hand, social science theory is not formed in isolation from empirical insights, and any theory of, say, social interactions across space that predicts a pattern at odds with an empirical regularity as strong as the gravity equation would be hard to believe.

8 Conclusion

Many barriers to FDI are inherently difficult to observe, but this paper circumvents the problem by inferring the barriers from FDI data. The resulting measure is easy to compute and analyze, and the results presented in this paper are difficult to obtain in any other way. The methodology relies on the gravity equation, one of the strongest and most well-documented empirical relationships in economics, and works whatever theory one believes rationalizes that relationship.

The approach uncovers how barriers to FDI have been declining among virtually all of the 324 OECD country pairs examined. This universal decline suggests either technological explanations, OECD-wide policy liberalizations, or a combination of the two. The decline in FDI barriers has been faster for “catch-up” countries (Finland, Iceland, Ireland, Portugal, Korea and Spain) and “emerging” countries (Czech Rep., Slovak Rep., Hungary, Poland, Greece, Turkey and Mexico).

Regressing the inferred barriers to FDI on variables which the previous literature has found to impede or encourage FDI enables an assessment of the importance of each. The regressions confirm the importance of geography and language; FDI barriers are dramatically lower if two countries used to be one, or if one colonized the other in the past. The hypothesis from the proximity-concentration literature that large markets attract more FDI also receives support. The main determinants of FDI barriers are country-specific, however. Countries with very low corporate taxes are especially successful at attracting FDI, while countries with low GDP per capita tend to have high barriers. The crucial role played by GDP per capita (it is also an important determinant of bilateral barriers) warrants further investigation.

Decomposition reveals that the main driver of the growth in FDI from 1985 to 2008 has been falling barriers, economic growth in the form of capital accumulation is less than half as important. Moreover, the decomposition reveals a crowding-out effect on FDI: Had there been an infinite stock of firms to acquire in each country, bilateral FDI stocks would have grown by 3% more each year. If this crowding-out is not controlled for, estimates of e.g. the FDI-impeding effect of distance will be biased upwards.

In sum, applying the technique of inferred barriers, which is widely used in international trade, to FDI has provided substantial insights into the size, distribution and evolution of the barriers to FDI, as well as the constituents of these barriers. I confirm and nuance results from existing studies of FDI barriers and provide novel results, which are hard to obtain using other methods.

Table A1. The components of bilateral barriers to FDI, log-log regressions. Dependent variable: ϕ_{ijt}^{FDI}

Specification	1		2, (i, j)-FE		3		4, (i, j)-FE		5, (it, jt)-FE	
	coeff. (std. error)	%-effect [t-stat]	coeff. (std. error)	%-effect [z-stat]	coeff. (std. error)	%-effect [z-stat]	coeff. (std. error)	%-effect [z-stat]	coeff. (std. error)	%-effect [z-stat]
$Distance_{ij}$	-0.72 $(0.03)^a$	[-22.7]	-0.71 $(0.03)^a$	[-21.2]	-0.73 $(0.03)^a$	[-27.8]	-0.70 $(0.03)^a$	[-21.2]	-0.69 $(0.03)^a$	[-20.1]
$Neighbors_{ij}$ (0,1)	0.28 $(0.10)^a$	32% [2.8]	0.64 $(0.07)^a$	49% [9.1]	0.37 $(0.07)^a$	45% [4.5]	0.64 $(0.07)^a$	89% [9.2]	0.66 $(0.07)^a$	94% [9.1]
Common $language_{ij}$ (0,1)	2.43 $(0.11)^a$	1031% [23.1]	0.31 $(0.08)^a$	36% [4.0]	1.62 $(0.06)^a$	404% [18.1]	0.32 $(0.08)^a$	37% [4.2]	0.36 $(0.08)^a$	43% [4.4]
Colonial $past_{ij}$ (0,1)	-0.11 (0.14)	[-0.8]	1.43 $(0.10)^a$	319% [14.9]	0.22 $(0.09)^c$	25% [1.9]	1.43 $(0.10)^a$	318% [17.3]	1.40 $(0.10)^a$	307% [14.1]
$GDP_{it} \times GDP_{jt}$	0.50 $(0.02)^a$	[29.4]	1.11 $(0.17)^a$	[6.5]						
(Per capita GDP_{it}) × (Per capita GDP_{jt})					2.89 $(0.06)^a$	[51.5]	1.68 $(0.17)^a$	[9.9]	1.62 $(0.39)^a$	[4.1]
(Population in 1985_i) × (Population in 1985_j)					0.46 $(0.03)^a$	[32.2]	0.61 $(0.03)^a$	[12.4]	2.33 $(0.62)^a$	[3.8]
Year dummies (γ_t)	Yes [sum 57.5]		Yes [sum 62.5]		Yes [sum 31.0]		Yes [sum 56.8]		Country-year dummies, (c_{it}, c_{jt}) [sum 882.1]	
Country fixed effects (c_i and c_j).	No		Yes [sum 321.3]		No		Yes [sum 367.3]			
R^2	0.325		0.778		0.532		0.781		0.832	

4269 observations. %-effect: Percentage change in ϕ_{ijt}^{FDI} when independent variable goes from 0 to 1, calculated as $\exp(-b) - 1$.
Estimation method: Ordinary least squares (with and without fixed effects), estimated coefficients are elasticities.
Robust standard errors in parentheses. Square parentheses contain a t-statistics, corresponding to the explanatory variables' importance in explaining the variation in the dependent variable. ^{a,b,c}: significant at 1%, 5% and 10%-level, respectively.

For comparison, Table A1 reports the results of running the regressions from table 2 in log-log rather than Poisson quasi maximum likelihood. The signs and degree of significance are the same as in Table 2a, except that neighbors is significant now in specification 1. The distance elasticities are larger, and the coefficients for common language and colonial past are implausibly high. It is worth noting that these biases go in the same direction, as what Santos Silvo and Tenreyro (2006) find in gravity equations for trade flows.
There is an additional regression, column 5, here the error term is specified as

$$\exp(\gamma_t)\eta_{ijt} = \exp(c_{it})\exp(c_{jt})\zeta_{ijt}.$$

The only clear change in coefficients when using country-year fixed effects is for population, here there is a markedly higher coefficient (2.33 vs 0.61), but low t-stat.. The other coefficients have roughly the same (biased) values.

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