Beyond the Unobservable: Inferred Openness to Foreign Direct Investment and Migration[*]

Christian Gormsen[†]

February, 2010
Work in progress

Abstract:
Using a method commonly used to infer trade costs for goods, I construct bilateral openness measures to foreign direct investment (FDI) and to migration for OECD country pairs. For FDI, barriers are reduced the most for three emerging hubs, the UK, the Netherlands and Switzerland. The impact of geography on FDI changes, with a growing effect of distance and decreasing effect of a common border. Little happens to the bilateral openness to migration, but across country pairs, FDI and migration openness are correlated.

I also infer a country's overall barriers to FDI in OECD countries. These barriers decline over time, a fact which must be corrected for in bilateral FDI regressions to avoid misspecification. Based on the inferred barriers, I propose to add country-specific trends.

By decomposing the growth in bilateral FDI, I show that for EU pairs, FDI grows mostly due to reduced barriers (63%-70%), whereas economic growth explains most of the increased FDI between the US and Canada (68%).

Keywords: Foreign direct investment, migration, economic integration, EU single market

JEL-codes: F13, F15, F21, F22

[*] This paper is deeply indebted to Thierry Mayer. I am grateful to Mariola Pytlikova for kindly providing data. I also thank Eckhardt Bode, Holger Görg and Frederic Warczynski as well as my supervisors Philipp Schröder and Jørgen Ulff-Møller Nielsen. I acknowledge financial support from the Danish Social Sciences Research Council (grant no. 275-06-0025).
[†] chgs@asb.dk; Department of Economics, Aarhus School of Business – Aarhus University, Hermodsvej 22, 8230 Aabyhoej, Denmark; http://www.asb.dk/staff/chgs

1 Introduction

Inferred trade barriers is a well-established and valuable tool for measuring trade costs comprehensively and for tracking the up- and downturns of globalization (Head and Mayer (2004), Jacks, Meissner and Novy (2008), Novy (2008), Novy and Chen (2009)). To get a full picture of international economic integration, it is important, however, to examine other channels than trade in goods, such as cross-border movements of capital and people, especially with the surge in foreign direct investments (FDI) of recent decades. Yet, measures of FDI barriers or migration barriers are not readily provided by the existing economic apparatus.

This paper shows how the method of inferring bilateral barriers can be extended from trade in goods to FDI and to migration. The resultant measures of bilateral openness to FDI and to migration are based solely on observed data and can easily be compared across country pairs and over time. The theoretical interpretation of the measures is the "inverse of the net costs" of doing FDI, respectively migrating, between two countries, with the great advantage that all unobservable costs and benefits of FDI or migrating are included.[1] For FDI, I also infer a measure of a country's overall barriers to FDI, inspection of these measures raises concerns of misspecification in earlier studies of the cross-country determinants of FDI.

I compute the bilateral openness measures for FDI and migration for OECD country pairs, over the period 1990-2007 (FDI) and 1986-2006 (migration). Openness to FDI increases for most country pairs, especially for those involving the Netherlands, the UK and Switzerland, three countries that emerge as hubs to FDI. Closer countries also experience larger increases in bilateral FDI openness; regression analysis reveal a more complicated pattern: although geographic distance is an increasingly important determinant of FDI, a common border becomes less expedient to bilateral investments over the sample period. A potential explanation is a growing role of vertical FDI.

For migration, there is a small overall increase in bilateral openness, not visible through graphical inspection; only the net costs of migrating between Northern and Southern Europe and between Eastern and Western Europe fall at any substantial rate. The inferred openness to FDI and migration are highly interdependent (partial R^2 of 0.441) even after controlling for distance, common languages, colonial ties and country fixed effects. The relation seems to come from unobserved variables like cultural barriers influencing both openness measures rather than from a direct causal relation. This evidence of important unobservables in aggregate costs of FDI and migration illustrates the usefulness of inferring barriers as an alternative to compiling observable costs.

The method of inferring barriers consists of solving the gravity-like relations, which have been found empirically to fit FDI and migration patterns well[2], for the cost of doing FDI or migrating. In this manner, the cost of doing FDI, respectively migrating, is expressed as a function of observed bilateral and intra-country stocks. The underlying intuition is that by dividing bilateral stocks of FDI or migration with a country's stock of FDI or migration "with itself", country-specific spurs or impediments cancel out, leaving only bilateral factors as an inverse measure of the "net cost" of doing FDI or migrating.

[1] An example of unobsevable determinants of FDI is costs of monitoring or coordinating with foreign divisions; migration choices presumably depend on unobservable individual preferences. Legal restrictions and cultural differences make both migration and foreign direct investment (FDI) costlier, but are hard to quantify.

[2] For FDI, see for instance Eaton and Tamura (1994), Wei (2000), Bénassy-Quéré, Fontagné and Lahrèche-Révil (2001) and Bénassy-Quéré, Coupet and Mayer (2007). For migration, see for example Zavodny (1997) or Lewer and van den Berg (2008).

For FDI, the underlying theory, due to Head and Ries (2008), also allows the inference of a country's overall barriers, the FDI counterpart of the 'multilateral resistance' introduced by Anderson and van Wincoop (2003) for trade in goods. Overall barriers to FDI generally show substantial declines over the examined time period (1990-2007). European countries experience the largest openings, the evolution is strongest for the aforementioned hubs (UK, Netherlands, Switzerland), for Ireland and for the Central European EU members. Japan and Korea remain hermetically closed to FDI.

My finding that the inferred overall barriers to FDI differ across countries and fall over time raises a misspecification issue in existing studies of determinants of bilateral FDI stocks. The problem is similar to that of failing to correct for multilateral resistance when estimating bilateral trade in goods, as Anderson and van Wincoop (2003) show. If a country is more open to FDI, its FDI inflows from individual partners will be suppressed, as competition for the assets in the country increases. This crowding-out effect must be accounted for in regressions, even the country fixed effects employed by Head and Ries (2008) are insufficient. Based on inspection of the inferred overall barriers, I suggest adding country-specific trends.

The time series for bilateral openness and overall barriers allow for a decomposition of the growth of bilateral FDI, determining the relative importance of reductions in net bilateral barriers, economic growth and third-country crowding out effects. I find that for European countries, bilateral reductions explain a larger share of the growth in FDI (50-60%) than for the US and Canada (40%). Moreover, bilateral FDI is indeed depressed by increased overall openness to FDI, the magnitude is around 7-11%.

The following section presents the methodology of inferring bilateral barriers to FDI and to migration, as well as the used for computation. Section 3 presents results, beginning with graphical inspection of the openness to FDI then to migration. The graphical analysis suggests hypotheses that are tested in subsection 3.3. Overall barriers to FDI are computed in subsection 3.4, and subsection 3.5 provides a decomposition of the growth in FDI using the inferred measures. Section 4 concludes.

2 Inferring the Barriers to FDI and Migration

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

$$F_{ij} = \exp\left(\mu_i/\sigma - \mathbf{D}_{ij}\boldsymbol{\theta}\right) s_i^m K_j B_j^{-1}. \tag{1}$$

μ_i is the average valuation that firms in country i put on *any* asset, a higher average valuations means that firms will be willing to pay more for assets, increasing their expected stock of FDI in any country; the variance of the valuations is denoted by σ. These valuations are affected by $\mathbf{D}_{ij}\boldsymbol{\theta}$, a vector of bilateral factors $\mathbf{D}_{ij}$ weighted with their coefficients $\boldsymbol{\theta}$. 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 multilateral resistance, introduced by Anderson and van Wincoop (2003) for trade in goods, it is an aggregate of country j's barriers: $B_j^{-1} = \sum_{h=1}^{M} \exp\left(\mu_h/\sigma - \mathbf{D}_{jh}\boldsymbol{\theta}\right) s_h^m$.[3]

The method of inferring the bilateral factors $\mathbf{D}_{ij}\boldsymbol{\theta}$ 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

$$F_{ii} = \exp\left(\mu_i/\sigma - \mathbf{D}_{ii}\boldsymbol{\theta}\right) s_i^m K_i B_i^{-1}. \tag{2}$$

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 $\mathbf{D}_{ii}\boldsymbol{\theta}$.

Consider the measure

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

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

$$\phi_{ij}^{FDI} = \sqrt{\frac{\exp\left(\mathbf{D}_{ii}\boldsymbol{\theta}\right)\exp\left(\mathbf{D}_{jj}\boldsymbol{\theta}\right)}{\exp\left(\mathbf{D}_{ij}\boldsymbol{\theta}\right)\exp\left(\mathbf{D}_{ji}\boldsymbol{\theta}\right)}}.$$

Country-specific variables have cancelled out, and we are left with the bilateral factors that make up the net barriers between i and j. To be precise, ϕ_{ij}^{FDI} measures the inverse of the net cost of holding foreign capital between country i and country j (the inverse measure is chosen for easier comparison across country pairs).

Bilateral barriers cannot (and perhaps should not) be distinguished from a "domestic bias" in capital holdings ($\mathbf{D}_{ii}\boldsymbol{\theta}$), an international barrier is always measured as relative to a domestic one. More problematically, ϕ_{ij}^{FDI}, the inferred openness between i and j, is 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.

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

$$\mathbf{D}_{ij}\boldsymbol{\theta} = \theta_1 d_{1ij} + \theta_2 d_{2ij} + \theta_3 d_{3ij} + ...$$

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, including the impact of unobservable barriers or benefits. The measure is comparable across country

[3] There is one important difference between bidder competition and multilateral resistance: Multilateral resistance is a general equilibrium phenomenon. When the trade cost between, say, Germany and Poland goes down, German firms do not immediately shift their exports from France to Poland. Instead, they may choose to export to both countries. However, competition will increase and economic activity will reallocate, causing exports from France to Germany to go down, presumably a long run effect. For bidder competition, in contrast, the effect is immediate: As soon as a barrier to investment falls and Polish firms can start buying firms in Germany, French firms will win fewer bids, lowering France's FDI stock in Germany.

pairs and through time. Its downside is that whereas this variation can be clearly observed, its causes cannot: Determining whether increased openness is caused by better communication technology, legal liberalizations or changing factor prices requires further analysis. Such analysis is straightforward, however, results are presented in section 3.5.

For migration, bilateral openness between i and j, ϕ_{ij}^{Mig}, can be inferred in the same way:

$$\phi_{ij}^{Mig} = \sqrt{\frac{M_{ij}M_{ji}}{M_{ii}M_{jj}}}.$$

M_{ij} is the stock of migrants from country i in country j. M_{ii} is "a country's migrant stock in itself", that is, how much of a country's population that chose not to migrate. I compute M_{ii} as a country's population minus its stock of foreign migrants, $M_{ii} = Pop_i - \sum_{h \neq i} M_{hi}$.

There is little theorizing on why migration patterns are well described by gravity equations. The inferred migration openness ϕ_{ij}^{Mig} therefore has no direct theoretical underpinnings. Nevertheless, as long as the true relationship is multiplicative (like gravity equations are), country-specific variables cancel out: Factors common to why Germans want to migrate to France and why Frenchmen want to stay at home (good job opportunities, for example) will cancel out, as will size effects. What is left is bilateral factors, just as for FDI. The inferred migration openness measure has the same strengths and limitations as the FDI openness measure.

2.1 Data

Data on bilateral FDI stocks F_{ij}, are taken from the OECD online database (outward FDI positions). The time period is 1990-2007 with some holes due to lack of data. Due to the difficulties of dealing with countries with asymmetric barriers, the samples for both FDI and migration are confined to OECD members. Data on bilateral migration stocks have been kindly provided by Mariola Pytlikova. A thorough description of this extensive migration data set can be found in Pedersen, Pytlikova and Smith (2008); its time period is 1986-2006, again with missing data for some country pair years.

The precision of inferred openness depends on how well a country's invesment or migration stock in itself (F_{ii} and M_{ii}, respectively) is measured. Computing M_{ii} is straightforward, finding or constructing a good measure of F_{ii} is more cumbersome. At the moment, I compile OECD data on investments (Gross fixed capital formation minus dwellings) using a perpetual inventory method.[4] An alternative measure of F_{ii} would be to use stock market capitalization, the total value of country i's stock market. Alas, the stock market bubble and crash of recent years dwarfs changes in bilateral FDI. Although this finding is somewhat interesting, it does render a FDI openness measure based on stock markets rather useless. I have not yet found a suitable way to clean the capitalization time series for stock market bubbles.[5]

[4] Discount rate $d = 0.07$ and initial guess $K_{i0} = (Pop_{i0})^{1.022} (Y_{i0}/Pop_{i0})^{0.964}$, where Y_{i0} is GDP at the date from which investment data is available.

[5] It seems a little surprising that no one would keep track of the fraction of countries' capital stock which is domestically owned. At the moment of writing this, I am verifying whether such data exist or not.

3 Results

3.1 Bilateral Openness to FDI

Figure 1. Bilateral openness to FDI.

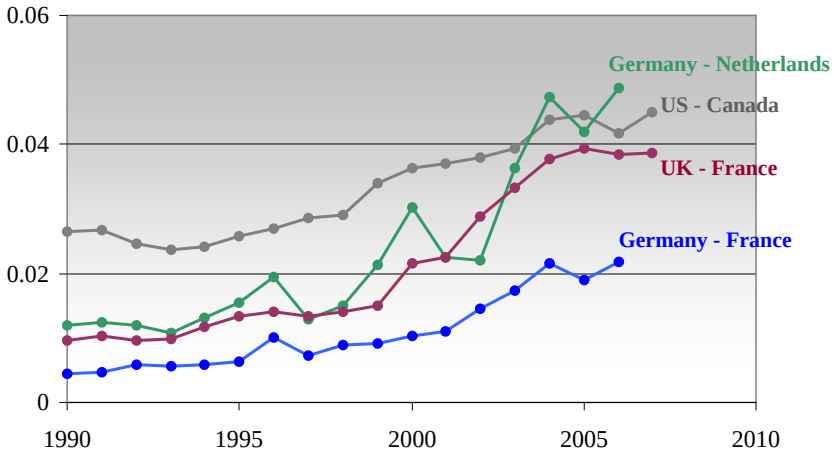
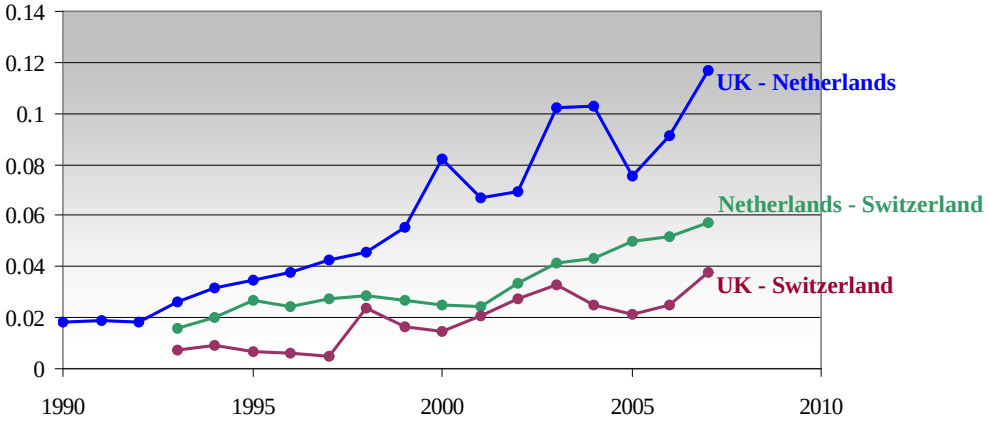


Figure 1 depicts the inferred bilateral openness to FDI for US - Canada and three European country pairs. In 1990, US-Canada was the most integrated country pair (in the world, in fact), the openness value of $\phi_{ij}^{FDI} = 0.027$ implies that at that time owning domestic capital in the US or Canada was $1/0.027 = 37.5$ times more attractive than owning it in the other country. Net costs of bilateral investments have fallen so that in 2007, foreign assets were $1/0.045 = 22$ less attractive The increase in bilateral openness is even larger for UK - France and Germany - Netherlands, with the latter pair reaching a higher level of integration than the US and Canada.

Openness to FDI increases between virtually all OECD country pairs, but the increases are rather unevenly distributed. During the examined time period, the Netherlands, the UK and (to a somewhat lower degree) Switzerland emerge as hubs to FDI, becoming important partners to most other OECD countries.

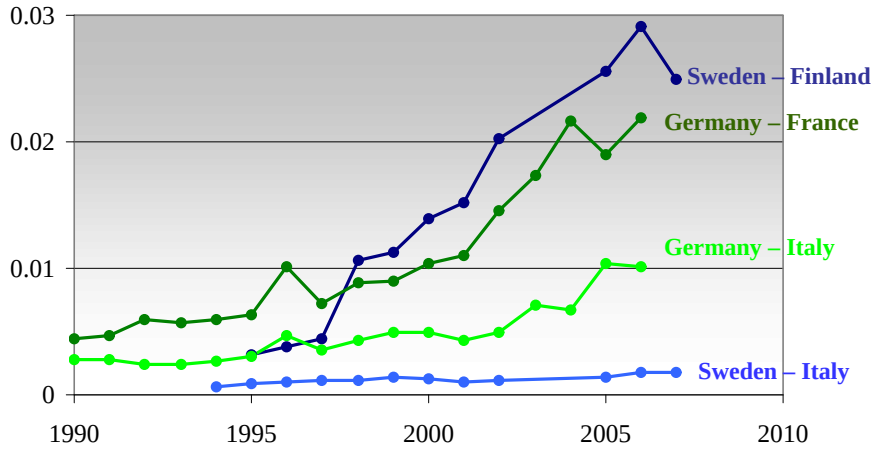
Figure 2: Bilateral FDI Openness, Hubs.



Integration between the three hubs also increases, as illustrated in figure 2, with the UK - Netherlands becoming the world's most integrated country pair

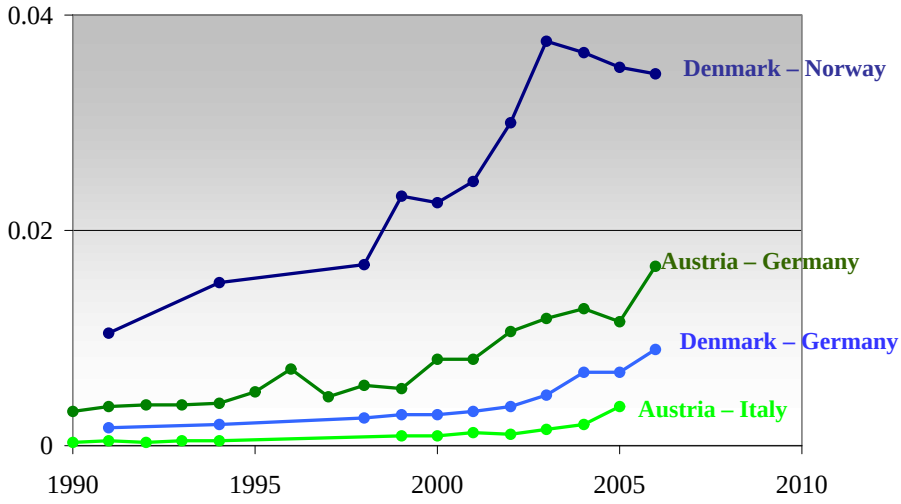
by a considerable margin. In 2007, bilateral barriers to asset holdings between the UK and the Netherlands are only $1/0.12 = 8.5$ higher than those to domestic owning assets.

Figure 3: Bilateral FDI openness and Distance.



Inspection of the data reveals another pattern, examples are shown in Figure 3: Closer countries not only have lower barriers, integration also increases the most between these countries, suggesting the hypothesis that distance has become more important to FDI. Ample evidence for this hypothesis, along with some nuances, will follow in section 3.2.

Figure 4: Bilateral FDI openness. Common Language



Language barriers are also clearly visible in the inferred openness measures, although there is no obvious evolution in the importance of this barrier, as Figure 4 illustrates. The regression analysis below reveal that higher variance of the language effect, and if anything, its importance is decreasing

3.2 Bilateral Openness to Migration

For migration, the picture is rather different. There is very little movement in the bilateral migration openness ϕ_{ij}^{Mig}, and no clear sign of increased integration, although regressions do reveal a small, but significant positive time trend.

Figure 7: Bilateral Migration Openness, EU pairs

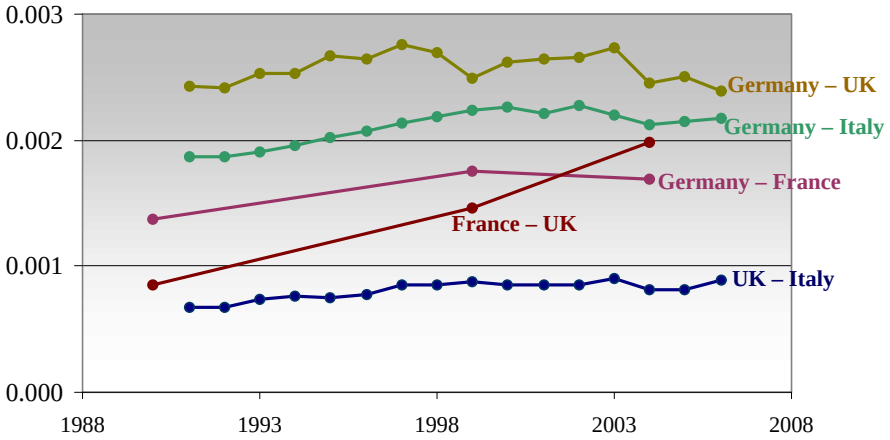
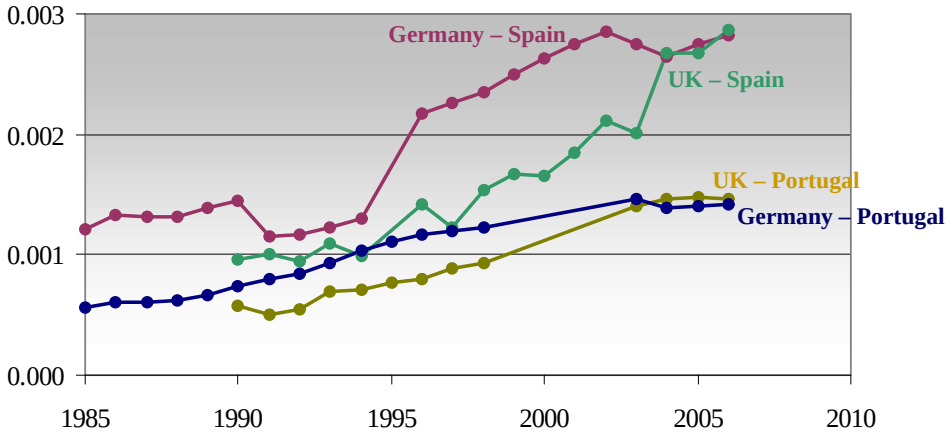


Figure 7 demonstrates this stagnation for pairs of larger EU countries. On the cross-sectional dimension, there are some country pairs that display a high level of integration; in descending order: Australia - New Zealand, Sweden - Finland, Belgium - Netherlands and Australia - UK. With the exception of Australia and New Zealand, the country pairs most open to migration with each other show no increase (or evolution whatsoever) in their openness.

Compared to FDI openness, bilateral openness to migration is on a very different scale, although the values of ϕ_{ij}^{Mig} and ϕ_{ij}^{FDI} cannot be compared to each other directly. For Englishmen and Germans, the net costs of living in the other country were $1/0.0024 = 418$ times higher than that of staying at home.

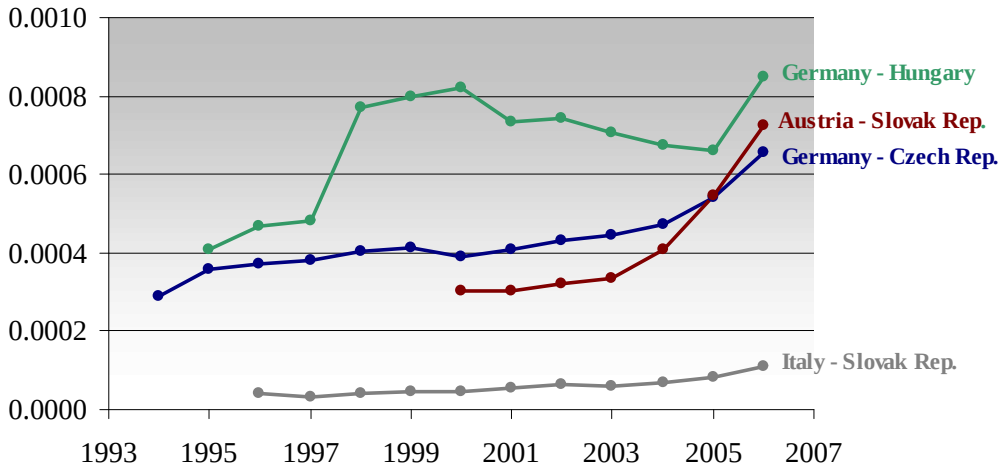
Figure 8: Bilateral Migration Openness. Sunshine Migrants.



One thing does happen in Figure 7, increased integration between France and the UK. This is part of a bigger picture, presented in Figure 8: Lower net costs of migration from rainy to sunny parts of Europe (the changes in inferred

openness are driven by migration from the UK to Spain, not the other way round)..

Figure 9: Migration Openness, EU15 and EEC pairs



The only other clear evolution in the data is the move of migrants from the new Central European EU members to the EU15, depicted in Figure 9. The scale is still low, reflecting that the barriers to migration between Eastern and Western Europe are asymmetric: there are very few people migrating the other way.[6]

It is perhaps surprising that there is very little overall sign of lower barriers to migration within the EU and among OECD countries in general. One caveat with the analysis is the use of stocks rather than flows: Migrant stocks can decline if migrants return home, move elsewhere or achieve citizenship in the resident country; increased outflow of migrants therefore does not necessarily reflect higher barriers. Using migration flows would assess this problem, but this modification would require another measure of internal migration, the best candidate being some measure of how much people move within a given country. I am trying to obtain such data. Another possibility would be to use working permits data, but I would first need to show whether gravity equations fit the international grants of working permits.

Still, it is a noteworthy finding that overall barriers to long-term migration stays have not declined. A potential explanation suggested by the two counterexamples above is that legal barriers to migration indeed have fallen within the EU, enabling Northern Europeans to seek sunshine abroad and Central Europeans to migrate for work opportunities, but that the principal barriers to migration are individual preferences, cultural or language barriers, which are still unchanged.

3.3 The Components of Migration and FDI Barriers

In this section, I dig into the underlying components of the openness measures for FDI and migration. I examine the relative contribution of "the usual suspects", distance (measured as the distance between the countries' capitals),

[6] Unfortunately, the migration stock data for Poland only has the cross-section year 2002. The migration openness between Poland and Germany is rather high, 0.003, reflecting that the net cost of moving from Germany to Poland is not too high.

and dummies for neighboring countries, a common language and colonial ties. I then go on to examine the hypothesis presented above that geographically closer countries have had the largest increase in bilateral openness to FDI, a hypothesis which is clearly confirmed.

I also examine whether openness to migration and FDI are related, finding ample evidence that this is the case. The relation appears not to be causal, but driven by unobservables affecting both migration and FDI, for instance cultural barriers.

Table 2 The components of bilateral openness to FDI, ϕ_{ijt}^{FDI}, and migration, ϕ_{ijt}^{Mig}.

Specification	(1)	(2)	(3)
Dependant variable	$\log(\phi_{ijt}^{FDI})$	$\log(\phi_{ijt}^{Mig})$	$\log(\phi_{ijt}^{FDI})$
Log(Distance)	-0.212 [a]	0.101 [a]	-0.173 [a]
	(0.360)	(0.026)	(0.038)
Neighbors (0,1)	1.155 [a]	1.994 [a]	1.539 [a]
	(0.084)	(0.068)	(0.086)
Common language (0,1)	0.956 [a]	0.965 [a]	0.704 [a]
	(0.092)	(0.083)	(0.106)
Colonial ties (0,1)	0.934 [a]	1.245 [a]	1.177 [a]
	(0.140)	(0.125)	(0.145)
Migration openness residual, u_{ijt}^{Mig}	–	–	1.016 [a]
			(0.026)
Time trend	0.049 [a]	0.016 [a]	0.075 [a]
	(0.005)	(0.003)	(0.006)
Sender/Receiver F.E.	Yes	Yes	Yes
No. of Obs	4122	3927	2032
R^2	0.4161	0.5029	0.6770

Results from OLS regression of the constructed FDI and migration openness measures on country pair specific variables, a time trend and sender/receiver fixed effect. Standard errors in parentheses.
[a] Significant at the 1% level.

Table 2 presents results from regressing log(distance) and dummies for neighboring countries, a common language and colonial ties as well as sender/receiver fixed effects (country dummies) and a time trend, on the log of the inferred openness measures for FDI and migration. The log of the dependant variables is chosen due to the assumption underlying gravity regressions that bilateral factors enter multiplicatively.

Although the explanatory variables are time-invariant, they do a reasonable job at explaining the openness measures; the R^2 is not too low. For FDI, the coefficients take the expected form, consistent with previous studies. Regression (1) shows that a 1% increase in distance lowers the openness to FDI with 0.2%, neighbors have $\exp(1.155) = 3$ times higher openness, whereas colonial ties or common languages increases openness with a factor of around 2.5.

The estimated distance coefficient for migration is more puzzling: Conditional on neighbors having much lower barriers (openness increases with a factor of $\exp(1.994) = 7.3$), the openness to migration is actually slightly but significantly increasing with distance. Migration openness actually increases over time, although clearly much less than FDI openness, an evolution which is not apparent from visual examination of the series.

A natural question is whether countries' openness to FDI and migration are related. Regression (3) adds the residuals from regression (2) as an explanatory variable for FDI openness, to see whether the unexplained part of migration openness can predict FDI openness. This turns out indeed to be the case: Conditional on the observed bilateral factors, the two go hand in hand: A 1% increase in migration openness implies a 1% increase in FDI openness.

Table 3 tries to assess the relative importance of the components of the aggregate openness measures, by providing standardized coefficients (also known as beta coefficients) and partial R^2 for each of the explanatory variables.

Table 3 Relative components of bilateral openness to FDI and migration.

	Standardized (beta) coefficient			Partial R^2		
Specification (from table 1)	(1) FDI	(2) Mig	(3) FDI	(1) FDI	(2) Mig	(3) FDI
Log(Distance)	-0.119	0.067	-0.095	0.008	0.004	0.010
Neighbors (0/1)	0.221	0.442	0.313	0.044	0.179	0.138
Common language (0,1)	0.161	0.127	0.113	0.011	0.034	0.021
Colonial ties (0,1)	0.091	0.164	0.126	0.025	0.025	0.032
Migration openness, $\log(\phi_{ij}^{Mig})$	–	–	0.532	–	–	0.441
Time trend	0.116	0.056	0.169	0.021	0.006	0.074

The standardized coefficients are computed as $b\sigma_x/\sigma_y$, where b is the estimated coefficient from table 2, σ_x is the standard variation of the corresponding independent variable and σ_y is the standard deviation of the explained variable.

As seen, the residual migration openness is the most important determinant for FDI openness. It may be that migration and FDI opennesses are directly related: Firms could send employees along when acquiring a foreign firm. It is certainly also possible that the high explanatory power is caused by unobserved factors that lower both the cost of FDI and migration, such as cultural similarities. Before turning to this important question, observe that another key determinant of FDI and migration openness is whether countries are neighbors or not. For FDI, this importance could reflect that firms often set up foreign affiliates just across the border, as documented in Crozet, Mayer, Mucchielli (2004).

Table 4. The changes in bilateral openness to FDI, ϕ_{ij}^{FDI}

Specification Dependant variable	(1) $\Delta \log(\phi_{ijt}^{FDI})$	(2) $\Delta \log(\phi_{ijt}^{FDI})$	(3) $\Delta \log(\phi_{ijt}^{FDI})$	(4) $\Delta_{12} \log(\phi_{ijt}^{FDI})$
Log(Distance)	-0.020 [a] (.007)	-0.024 [b] (0.010)	-0.010 (0.009)	-0.259 [a] (0.039)
Neighbors (0,1)	-0.024 (0.020)	-0.028 (0.028)	-0.014 (.021)	-0.346 [a] (0.092)
Common language (0,1)	-0.006 (0.021)	0.068 (0.036)	0.001 (0.023)	0.054 (0.098)
Colonial ties (0,1)	-0.027 (0.334)	-0.049 (0.050)	-0.027 (0.035)	-.0178 (0.133)
Yearly changes in migration openness, $\Delta \log(\phi_{ij}^{Mig})$	–	0.059 (0.046)	–	–
Time trend (acceleration)	0.003 [a] (0.005)	0.001 (0.002)	0.003 [c] (0.001)	-0.002 (0.017)
Sender/Receiver F.E. (slopes)	No	No	Yes	Yes
No. of Obs	3518	1532	3518	693
R^2	0.0067	0.0074	0.0153	0.4086

Results from OLS regression of the constructed FDI openness measures on country pair specific variables, a time trend and sender/receiver fixed effect. Standard errors in parantheses.
[a, b, c] Significant at the 1%, 5% and 10% level, respectively.

Table 4 provides answers for two questions. First, the results of specification (2) indicate that the strong interdependence between FDI and migration openness is driven by unobserved variables rather than a causal relationship. If the two were causally related in the short run, changes in one openness measure should bring along changes in the other, but there is no significant sign of this.

Second, it seems that distance indeed plays an increasing role for FDI. Distance does not vary over time, the estimates are therefore changes in the coefficients in ϕ_{ijt}^{FDI}. [7] Countries that are farther apart experience lower growth in their FDI openness with each other. This effect disappears in specification (3), however, when controlling for country fixed effects. When allowing a 12-year period for the impact of distance on FDI to change in regression (4), the changing effect of distance is clear, however (the dependant variable is $\left[\log\left(\phi_{ijt}^{FDI}\right) - \log\left(\phi_{ijt-12}^{FDI}\right)\right]$). Perhaps surprisingly, specification (4) also reveals a large drop in the positive effect of a common border on bilateral FDI. Note also that very little of the yearly changes in FDI openness can be explained using these time-invariant regressors, which are typically employed to explain bilateral FDI, the R^2s are very low.

[7] Because $\log(\phi_{ijt}^{FDI}) = \frac{1}{2}\left(\mathbf{D}_{ii}\boldsymbol{\theta}_t + \mathbf{D}_{jj}\boldsymbol{\theta}_t - \mathbf{D}_{ij}\boldsymbol{\theta}_t - \mathbf{D}_{ji}\boldsymbol{\theta}_t\right)$, the time difference will be $\Delta \log(\phi_{ijt}^{FDI}) = \frac{1}{2}\left(\mathbf{D}_{ii}\Delta\boldsymbol{\theta}_t + \mathbf{D}_{jj}\Delta\boldsymbol{\theta}_t - \mathbf{D}_{ij}\Delta\boldsymbol{\theta}_t - \mathbf{D}_{ji}\Delta\boldsymbol{\theta}_t\right)$; regressing $\Delta \log(\phi_{ijt}^{FDI})$ on $\mathbf{D}_{ij}$ will give coefficients equal to $\Delta\boldsymbol{\theta}_t$ (since $\mathbf{D}_{ij} = \mathbf{D}_{ji}$).

Table 5. Changing components of bilateral openness to FDI, ϕ_{ijt}^{FDI} :
Comparing relative importance in 1994 and 2005

	Standardized (beta) coefficient		Partial R^2	
Specification:	1994-cross section	2005-cross section	1994-cross section	2005-cross section
Log(Distance)	-0.210 [b]	-0.521 [a]	0.029	0.182
Neighbors (0,1)	0.229 [a]	0.146 [c]	0.054	0.025
Common language (0,1)	0.166 [b]	0.047	0.029	0.003
Colonial ties (0,1)	0.113 [c]	0.170 [b]	0.018	0.045
No. of Obs.	197	155	197	155

The standardized coefficients are computed as $b\sigma_x/\sigma_y$, where b is the estimated coefficient from table 2, σ_x is the standard variation of the corresponding independent variable and σ_y is the standard deviation of the explained variable.
[a, b, c] Non-standardized coefficients are significant at the 1%, 5% and 10% level, respectively.

Further evidence for the rising role of distance is given in table 5 by comparing cross-sectional regressions for 1994 and 2005. The standardized coefficient of distance more than doubles, whereas that of neighboring countries is almost halved. A similar story is told by the partial R^2s.

An explanation for the increasing role of distance could be a higher contribution from the extensive margin of FDI: If FDI becomes easier, it may lead new, smaller firms to increase their affiliate activity abroad, a story in line with for example Helpman, Melitz and Yeaple (2004). This explanation does not go well with the decreased positive effect of a common border. Another explanation could be increased vertical FDI. When firms set up for example production facilities abroad in order to exploit lower factor prices there, this investment is sensitive to distance, because the produced goods need to be imported back. This type of investment might be less sensitive to common borders, as the directly neighboring countries might not provide the best deals in terms of factor prices. A separate explanation for the falling importance of common borders could be improved communication technology, making it less crucial for employees to commute between headquarters and affiliates.

3.4 Overall Barriers to FDI

The analysis so far has dealt with bilateral openness. For FDI, it is also possible to infer a country's overall barriers to FDI. Consider the fraction of a country's total capital stock which is on domestic hands:

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

I construct total capital stock in country i as the investment-based domestic capital stock plus all inwards FDI stocks: $K_i = F_{ii} + \sum_{h \neq i} F_{hi}$. The share of a country's capital which is domestically owned is a quite intuitive way of measuring a country's FDI openness. Following the model of Head and Ries (2008) and (2) above, Φ_i^{FDI} can be written as

$$\Phi_i^{FDI} = \frac{\exp\left(\mu_i/\sigma - \mathbf{D}_{ii}\boldsymbol{\theta}\right) s_i^m}{\sum_{h=1}^{M} \exp\left(\mu_h/\sigma - \mathbf{D}_{hi}\boldsymbol{\theta}\right) s_h^m} = \frac{b_{ii}}{B_i},$$

where $b_{ii} = \exp\left(\mu_i/\sigma - \mathbf{D}_{ii}\boldsymbol{\theta}\right) s_i^m$ summarizes the strength of domestic bids, and B_i is the "bidder competition" defined in section 2. The interpretation of

$\Phi_i^{FDI} \in [0,1]$ is therefore a measure of the advantage of domestic bidders, the higher Φ_i^{FDI}, the higher their advantage over foreign bidders. If a country has high net barriers to FDI ($\mathbf{D}_{ii}\boldsymbol{\theta}$ is lower than $\mathbf{D}_{hi}\boldsymbol{\theta}$ for $h \neq i$), 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, 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.

Figure 10: Overall Barriers to FDI

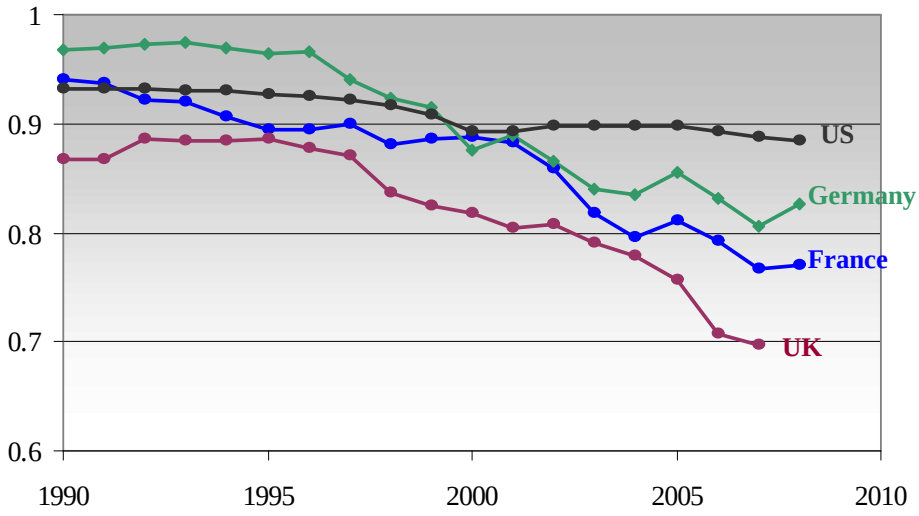


Figure 10 depicts Φ_i^{FDI} for the US, Germany, France and the UK. The chosen countries examples illustrate three tendencies in the data: Overall barriers fall for all countries, with Japan and Korea as sole exceptions remaining hermetically closed to FDI. Also, the openings are largest for European countries. Bilateral barriers do not seem to fall more for European country pairs, the driver is simply that more bilateral barriers fall for European countries, because they have more OECD countries in their proximity. The final tendency illustrated in Figure 10 is that the three aforementioned hubs (the UK, the Netherlands and Switzerland) show the most marked fall in overall barriers to FDI, reflecting that they are increasingly important partners for many countries.

An important implication follows from Figure 10. 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 10 shows that the solution applied by Head and Ries (2008), country fixed effects, is insufficient: Φ_i^{FDI}, which is closely related to bidder competition, changes, even over a relatively short time period.

The problem is similar to the one pointed out in Novy (2008) for trade in goods and changes in multilateral resistance. One can even argue that the problem is more severe for FDI, since bidder competition also arises in partial equilibrium and therefore plays a role even for short time series (see discussion in footnote 3). Moreover, the reductions in Φ_i^{FDI} are proportionally larger than those of inferred multilateral resistance reported in Novy (2008).

The debate on how to correct for time-variant multilateral resistance for trade in goods has not yet reached a conclusion, and as shown, the same problem

applies to FDI. Correcting by including country-year fixed effects may require estimating too many parameters. Based on inspection of the Φ_i^{FDI} series, I recommend using country-specific *trends*, most of the evolution in a country's overall barriers can be approximated reasonably well with a negative linear trend. The correction is straightforward to implement in a panel, see for instance section 11.2 in Wooldrigde (2002). In studies with long time periods, it may be necessary to inspect plots of Φ_i^{FDI} to check for breaks in the trends.

In principle, one can construct a similar measure of a country's overall openness to migration. However, the exact calculation and interpretation of overall openness is sensitive to the theoretical framework. A measure inferring overall openness to migration will have to wait for a theoretical framework to migration patterns.[8]

3.5 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 the relative attractiveness of mutual investment may increase because the two countries' barriers to the rest of the world have gone up.

FDI activity has indeed grown in recent years. With 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 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 flows between country i and j as follows:

$$F_{ij}F_{ji} = \frac{F_{ij}F_{ji}}{F_{ii}F_{jj}}\frac{F_{ii}}{K_i}\frac{F_{jj}}{K_j}K_iK_j.$$

The product of bilateral FDI stocks can then be expressed as

$$F_{ij}F_{ji} = \left(\phi_{ij}^{FDI}\right)^2 \Phi_i^{FDI}\Phi_j^{FDI}K_iK_j,$$

that is, the two country's domestic capital stock times the two countries' overall 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,

$$\Delta\log\left(F_{ij}F_{ji}\right) = 2\Delta\log\left(\phi_{ij}^{FDI}\right) + \Delta\log\left(\Phi_i^{FDI}\Phi_j^{FDI}\right) + \Delta\log\left(K_iK_j\right),$$

and divide through with $\Delta\log\left(F_{ij}F_{ji}\right)$ in order to calculate each factors percental contribution to total growth:

$$100\% = \frac{2\Delta\log\left(\phi_{ij}^{FDI}\right)}{\Delta\log\left(F_{ij}F_{ji}\right)} + \frac{\Delta\log\left(K_iK_j\right)}{\Delta\log\left(F_{ij}F_{ji}\right)} + \frac{\Delta\log\left(\Phi_i^{FDI}\Phi_j^{FDI}\right)}{\Delta\log\left(F_{ij}F_{ji}\right)}. \qquad (3)$$

Table 1 presents the relative contributions of bilateral barriers (ϕ_{ij}^{FDI}), overall barriers to FDI ($\Phi_i^{FDI}\Phi_j^{FDI}$) and capital stocks (K_iK_j) in the growth of FDI between 1990 and 2007 (2006 for pairs including Germany).

[8] In particular, inferred overall openness is calculated differently if it is a general equilibrium phenomenon, following the discussion in footnote 3. Novy's (2008) inferred measure of the corresponding "domestic trade barriers relative to multilateral restistance" therefore needs to correct for world production. Third-country effects (or "multilateral resistance") clearly exists in partial equilibrium for migration: A migrant can only go to one country at the time, if the attractiveness of moving to Portugal increases, then Spain might receive fewer migrants. Large migration waves are also likely to have general equilibrium effects.

Table 1. Decomposing the Growth of FDI					
Contributions:	Germany – Netherlands	Germany – France	France – UK	UK – US	US – Canada
Reduction in bilateral barriers, ϕ_{ij}	67 %	70 %	63 %	40 %	38 %
Reduction in third-country barriers, Φ_i, Φ_j	-11 %	-7%	-10%	-9 %	-7 %
Growth in Capital, K_i, K_j	44 %	37 %	47 %	69 %	69 %
.The decomposition is done according to equation (3). The two years compared are 1990 and 2007 (1990 and 2006 for Germany - France and Germany - Netherlands)					

All bilateral investments are suppressed by the decline in third-country barriers, as can be seen from the negative contribution of Φ_i^{FDI}. Moreover, in this sample at least, appears that increased within the EU, FDI has been growing because of lower barriers, to a larger degree than the growth in FDI between the US.and partner countries.

4 Conclusion

This study shows how countries' openness (the inverse of net costs) to FDI and migration can be inferred from observed data, by extending a method hitherto used only for trade in goods. In principle, the method can be used to infer bilateral openness to any social or economic activity whose diffusion in space can be described by the gravity equation (patenting, traffic, etc.). The only condition is that a location's "diffusion to itself" (x_{ii}) can be properly measured.

The resulting inferred bilateral openness is intuitive and easy to apply and compare over time and space. Moreover, the measure includes the costs and benefits that cannot be measured directly, and may be the only way of assessing these unobservables. My analysis documents their existence by showing the high degree of simulateneity between FDI and migration openness.

For FDI, inferred bilateral openness expose the rising importance of three hubs, UK, Netherlands and Switzerland. The analysis also reveals an interesting change in the impact of geography, with distance being more important to bilateral FDI stocks, whereas common borders lose importance. A plausible explanation is a growing role of vertical FDI. In comparison, there is little happening for openness of migration, although migration openness increases slightly over the examined time period. Only easier access for migration from Northern to Southern Europe and from Central Europe to Western Europe are visible in the aggregate measures.

For FDI, I have also shown how a country's overall barriers to FDI can be inferred. Virtually all OECD countries become more open to FDI over time. This finding is not surprising, but it must be taken into account when running regressions with bilateral FDI, as more open countries will tend to receive lower bilateral FDI from individual partners. I suggest country-specific trends instead of the country fixed effect proposed by Head and Ries (2008).

References

Anderson, J. and E. van Wincoop (2003). Gravity with Gravitas: A Solution to the Border Puzzle. The American Economic Review, Vol. 93, No. 1, pp170-192.

Benassy-Quéré, A., Fontagné, L., Lahreche-Revil, A. (2001). Exchange-rate strategies in the competition for attracting foreign direct investment. Journal of the Japanese and International Economies vol. 15, pp178– 198.

Bénassy-Quéré, A., M. Coupet. and T. Mayer (2007). Institutional Determinants of Foreign Direct Investment. World Economy, vol. 30, No. 5, pp764-782.

Crozet, M., T. Mayer and J.-L. Mucchielli (2004). How do firms agglomerate? A study of FDI in France. Regional Science and Urban Economics vol. 34 pp27– 54

Eaton J. and A. Tamura (1994). Bilateralism and Regionalism in Japanese and U.S. Trade and Direct Foreign Investment Patterns. Journal of the Japanese and International Economies vol. 8, pp478-510.

Head, K. and T. Mayer (2004). The Empirics of Agglomeration and Trade. *In* Handbook of Regional and Urban Economics (Ed. J. V. Henderson and J.-F. Thisse) vol. 4, pp2609-69. Amsterdam: North-Holland.

Head, K. and J. Ries (2008). FDI as an outcome of the market for corporate control: Theory and evidence Journal of International Economics Vol. 74 pp2–20

Helpman, E., M. Melitz and S. Yeaple (2004).Export versus FDI with Heterogeneous Firms. The American Economic Review, Vol. 94, No. 1, pp300-316.

Jacks, D., C. Meissner and D. Novy (2008). Trade Costs, 1870–2000. American Economic Review: Papers & Proceedings, 98:2, pp529–534

Lewer, J. and H. van den Berg (2008). A gravity model of immigration. Economics Letters vol. 99 pp164–167.

Karemera, D., V. Oguledo and B. Davis. A gravity model analysis of international migration to North America. Applied Economics, vol. 32, pp1745-1755

Novy, D. (2008). Gravity Redux: Measuring International Trade Costs with Panel Data. Working paper.

Novy, D. and Chen, N. (2009). International Trade Integration: A Disaggregated Approach. Working paper.

Pedersen, P., M. Pytlikova and N. Smith (2008). Selection and network effects—Migration flows into OECD countries 1990–2000. European Economic Review vol. 52, pp1160–1186.

Wei, S.-J. (2002). How Taxing is Corruption on International Investors? The Review of Economics and Statistics, Vol. 82, No. 1, pp. 1-11

Wooldridge, J. M. (2002). Econometric Analysis of Cross Section and Panel Data. Cambridge, MA: MIT Press.

Zavodny, M. (1997). Welfare and the locational choices of new immigrants. Economic and Financial Policy Review—Federal Reserve Bank of Dallas, QII, pp. 2–10.