A Global Analysis of Factors Impacting the Intensive and Extensive Margins of Bilateral FDI

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Abstract

This study investigates determinants of bilateral foreign direct investment (FDI) on both margins: the extensive margin (whether to invest) and the intensive margin (how much to invest), based on recent FDI theories. Currently, there are only a handful of empirical studies in the literature on the two margins of FDI. They focus on FDI originating from developed countries only, are based on smaller samples, and do not apply panel estimation methods. I examine a global dataset comprised of 110 countries over nine years, 2004-2012. Apart from conventional gravity variables, I find significant impacts of the source country's share of global technology capital and FDI share in production of the host country. Additionally, the two FDI margins are affected differently by a number of covariates. Results on FDI stocks and FDI flows can lead to different conclusions; thus, research should consult both types of data series to find which variables have robust effects. Furthermore, breaking down the sample by country development levels reveals that FDI from less developed countries (LDCs) is not affected by many common variables and thus there is a need to develop more theories and empirical work to investigate the FDI from LDCs in particular.

JEL Classification: F23

Keywords: FDI, intensive margin, extensive margin, gravity model.

Acknowledgement: I am grateful to Prof. Alfred Haug, Prof. Dorian Owen, and Dr. Murat Genc, for many helpful comments and suggestions.

1. Introduction

Recent theoretical models for foreign direct investment (FDI) rely on partial or general equilibrium (Anderson et al., 2017; Bergstrand and Egger, 2007; Markusen, 2002). Those models are mainly constructed for a world with two countries and derive the determinants of bilateral FDI by finding the analytical or numerical solutions for the equilibrium. Many empirical papers apply these models to analyze drivers of FDI, taking into account both home and host countries' characteristics. However, the majority of these studies focus on only FDI from developed countries (DCs) or on a small number of countries such as Davies (2008), Dixon and Haslam (2016), and Araujo et al. (2017); FDI between less-developed countries (LDCs) has been neglected. In their extensive survey of FDI studies, Paul and Singh (2017) also show that there is still a need for a global study with an extensive sample to compare the results between different groups of countries. Furthermore, most of the previous studies ignore the fact that zero FDI is far more prevalent than positive FDI. Figure 1 indicates that 60% to 70% of country pairs do not invest in one another over the whole period, 2001-2012. Simply pooling data of both zero and positive values into a one-stage regression like OLS, Tobit, or Poisson pseudo-maximum likelihood (PPML) may lead to inappropriate results. Recent theories of FDI, as proposed by Razin and Sadka (2007) and Anderson et al. (2017), also separate determinants of zero and positive FDI which corresponds to the extensive and intensive margins of FDI, respectively. The extensive margin of FDI refers to the decision of whether or not to invest, while the intensive margin is concerned with the amount of FDI invested once the decision to invest is made.

This is the first study to apply the formal structural gravity model of FDI developed by Anderson et al. (2017) combined with recent theories to find the determinants of both margins of FDI. Using the biggest and most up-to-date dataset of 110 countries over nine years, 2004-2012, this is also the first study that examines the results for country groups by development extensively at a global level. There are only a very small number of empirical studies analyzing the determinants of both FDI margins, but they do not consider FDI between developing countries and do not apply panel methods. In addition, beside previously used variables, I explores the impact of new variables: global technology capital share, capital depreciation, share of FDI in production, and remoteness. Further, this study argues against the use of country fixed-effects as a means to control for the multilateral resistance terms of the structural gravity model. I also thoroughly investigates each data series, especially bilateral FDI, which will contribute to future research with better data quality.

The remainder of the paper proceeds as follows. The next section presents a literature survey of determinants of both margins of FDI. Section 3 describes the theoretical framework. Section 4 argues for additional variables, while Section 5 discusses the multilateral resistance terms in empirical studies in international trade. Data and hypotheses are given in Section 6, followed by the methodology in Section 7. Section 8 presents the regression results. Section 9 concludes and suggests extensions and improvements for future studies.

2. Literature Review

Although the general literature on determinants of FDI at the aggregate or bilateral levels is vast, there are only a handful of empirical studies analyzing the drivers of both intensive and extensive margins of FDI. Razin and Sadka (2007) pioneer the development of FDI models explaining zero and positive FDI separately and then empirically test their theoretical models using OECD data. Beside typical gravity variables, the authors find that the intensive and extensive margins of FDI are not affected identically by the same factors such as corporate tax rates and setup costs. Davies and Kristjánsdóttir (2010) investigate the impact of natural resources on FDI inflows to Iceland over the peirod 1989-2001. Cavallari and d'Addona (2013) examine FDI between 24 OECD countries from 1985 to 2007 and find the negative influence of volatility. Garrett (2016) employs data from 101 countries between 1995 and 2002 and finds the important role of productivity thresholds in FDI decisions. Meanwhile, Araujo et al. (2017) focus on market entry costs as the key factor between the two margins and investigate outward FDI data from OECD countries to the rest of the world. Eicher et al. (2012) use a panel dataset including 46 countries and estimates a wide variety of determinants of FDI. There are aspects of these studies that can be improved on.

In these studies the estimation equations are all of the gravity-type without a model clearly showing the functional form of the relationship. Particularly, their general or partial equilibrium models tend to show just the intuitive relationships between FDI and other variables. Then, with empirical estimation, they may or may not take logs of variables. In addition, they all employ panel data but solely rely on pooled estimation techniques for the intensive margin (outcome equation) and/or the extensive margin (participation equation). Araujo et al. (2017) apply panel estimation for the volume equation but simply employ pooled probit for the participation equation. More suitable estimation methods for panel data may lead to significantly different results. In addition, Araujo et al.'s (2017) study does not control for time fixed effects in any of their estimations and thus their results can be affected by the time trend.

Last but not least, all of these studies employ a Heckman selection process (Heckit) to estimate determinants of zero and positive FDI. The application of Heckit is to deal with corner solution outcomes when there are excessive zeros in the dependent variable (FDI). However, these studies do not employ a statistical test to show if the Heckit estimation method is truly needed. If the participation and outcome equations are not correlated, the lognormal hurdle model is a better choice as it estimates the two margins separately and does not require a valid exclusion restriction. Additionally, finding a valid exclusion variable for Heckit is not an easy task. According to Wooldridge (2010), if we do not find a valid exclusion variable, regression results from Heckit are imprecise due to the severe collinearity resulting from the inclusion of inverse Mills ratio in the outcome equation.

There are two ways to justify a valid exclusion variable: theory or empirics. Theoretically, fixed setup costs can serve as a valid exclusion variable as they should not affect the volume of FDI once the investment is made (Helpman et al., 2008; Razin and Sadka, 2007). However, the problem is that fixed setup cost data are infeasible and thus studies often rely on different indicators for the fixed setup cost. Razin and Sadka (2007), Davies and Kristjánsdóttir (2010), and Eicher et al. (2012) use a dummy for FDI in the past year as a proxy for the FDI setup costs which also implies a profitability threshold for the firm to invest in the current year. Cavallari and d'Addona (2013), meanwhile, use the lagged value of FDI. However, it is likely that the dummy or lagged FDI also significantly impact the volume of FDI as when the firm has invested in a country before, it would likely invest more or less in the following years due to the accumulation of investment experience in the host country. Araujo et al. (2017) use the cost to register a business as the threshold for the two margins. This is probably the closest indicator for the fixed setup costs in the FDI literature so far and similar to the use of regulation costs for firm entry in Helpman et al. (2008). But, using indicators for setup costs may likely reflect a country’s investment environment in general. As a result, they may also significantly affect the amount of FDI if included in the outcome equation. It is difficult to find a valid exclusion variable both theoretically and empirically. Estimation results will show if there is a clear exclusion variable for my data.

3. Theoretical Framework

The gravity model of international trade has been widely applied for FDI. However, bilateral trade is not the same as bilateral FDI. In FDI, the firms actually invest and produce inside the foreign country and are affected directly by capital depreciation, taxation, and the business environment in the host countries. Hence, it is essential to construct a ‘formal’ structural gravity model specifically designed for FDI. Fortunately, Anderson et al. (2017) have made a novel contribution to the FDI literature by developing the first formal structural gravity model specifically for bilateral FDI. Their model clearly shows the functional form of the relationship between FDI and its drivers. This model resembles, but is not identical to, the structural gravity model in international trade constructed by Anderson and van Wincoop (2003). FDI in this model is in the form of non-rival technology capital. This type of capital can be employed in multiple locations at the same time without reducing its value in any particular location. The standalone gravity system for FDI is as follows:[1]

$$FDI_{ij} = \begin{cases} \dfrac{\beta \phi_j^2 \eta_i^2}{1-\beta+\beta\delta_j} \omega_{ij} \dfrac{E_i}{P_i} \dfrac{Y_j}{M_i} & if\ \omega_{ij} M_i > 1 \quad (1) \\ 0 & if\ \omega_{ij} M_i \leq 1 \quad (2) \end{cases}$$

$$P_i^{1-\sigma} = \sum_j \left(\frac{t_{ij}}{\pi_j}\right)^{1-\sigma} \frac{Y_j}{Y} \quad (3)$$

$$\pi_j^{1-\sigma} = \sum_i \left(\frac{t_{ij}}{P_i}\right)^{1-\sigma} \frac{E_i}{Y} \quad (4)$$

where i denotes the source country; j denotes the host country; FDI_{ij} is FDI stocks from i in j; β is the discount factor in the consumer's utility function; ϕ_j is the production share of FDI; η_i is the share of technology capital; δ_j is the depreciation rate of technology capital[2]; ω_{ij} is country j's openness to FDI from country i; M_i is the technology capital stock; σ is the elasticity of substitution; P_i is the inward multilateral resistance term (IMR); π_j is the outward multilateral resistance term (OMR); Y is the total world income; E_i is the source country's expenditure; Y_j is the host country's production or income; and t_{ij} is trade costs from i to j.

Since η_i and M_i represent the share of global technology capital and the total amount of technology capital of the source country, respectively: $\eta_i = \frac{M_i}{\sum_i M_i}$ => $M_i = \eta_i \sum_i M_i$. Also, according to Yao et al. (2012), followed by Anderson et al. (2017), β is very close to 1 (~0.98). Therefore, for simplicity, setting $\beta=1$ and replacing $M_i = \eta_i \sum_i M_i$, the structural gravity system becomes:

[1] For more details about how to derive the gravity system for FDI, see Anderson et al. (2017). The time index t is supressed for brevity as all variables are time-specific.

[2] Anderson et al. (2017) use δ_M to denote the depreciation rate of technology capital. However, I use δ_j to clarify that this is the depreciation rate in the host country j.

$$FDI_{ij} = \begin{cases} \frac{\phi_j^2 \eta_i}{\delta_j} \omega_{ij} \frac{E_i}{P_i} \frac{Y_j}{(\sum_i M_i)} & if\ \omega_{ij} M_i > 1 \quad (5) \\ 0 & if\ \omega_{ij} M_i \leq 1 \quad (6) \end{cases}$$

Taking the log of Equation (5) for positive FDI leads to a log-linear equation for the intensive margin of FDI:

$$lnFDI_{ij} = -\ ln(\textstyle\sum_i M_i) + \underbrace{lnE_i + 2ln\eta_i - lnP_i}_{\text{Source country's characteristics}} + \underbrace{lnY_j + 2ln\phi_j - ln\delta_j}_{\text{Host country's characteristics}} + \underbrace{ln\omega_{ij}}_{\text{Pair characteristics}} \quad (7)$$

Equation (7) shows the three sets of FDI determinants and direction of impacts for variables of interest, with $ln(\sum_i M_i)$ acting as the constant term. This equation implies a 'strong' restriction on the parameters, i.e. taking the values of either ±1 or 2 according to (7). However, as I have to use a number of proxies for variables in the model in the regression analysis, the magnitude of estimated coefficients is prone to differ from these values. Thus, I will focus on testing the model's predictions on the direction of impacts rather than the magnitude.

The share of FDI production in the host country is calculated as:

$$\phi_{jt} = \frac{\alpha_{j(t-1)}(\frac{FDI^{in}_{j(t-1)}}{K_{j(t-1)}})}{1+\alpha_{j(t-1)}(\frac{FDI^{in}_{j(t-1)}}{K_{j(t-1)}})}$$

where $FDI^{in}_{j(t-1)}$ is the total inward FDI stocks in year *(t-1); $K_{j(t-1)}$* is the physical capital stock in year *(t-1)*; and $\alpha_{j(t-1)}$ is the capital share of production in year *(t-1)*, which equals 1 minus the labor share of production, assuming that capital and labor are the only two factors of production.[3]

4. Arguments for Augmented Variables

From Equation (7), we can employ a number of variables as potential determinants of bilateral FDI. To be clearer, GDPs of home and host countries can represent E_i and Y_j. Pair variables representing ω_{ij} are common language, common border, colonial relationship, common colonizer, common religion, common legal origin, common currency, bilateral investment treaty (BIT), preferential trade agreement (PTA), and distance. Other country-specific variables

[3] Anderson et al. (2017) calculate ϕ_{jt} by the same formula but using values of *FDI*, *K*, α in year *t* instead of year *(t-1)* in their welfare analysis. This approach will lead to an obvious positive relationship between ϕ_{jt} and bilateral FDI from *i* to *j* as $d(\phi_{jt})/d(FDI_{ijt}) > 0$. Thus, I use lagged values of *FDI*, *K* and α to calculate ϕ.

affecting FDI are technical capital share of source country i (η_i), technical capital depreciation rate in host country j (δ_j), and FDI share of production in the host country j (ϕ_j).

If we solely relied on Anderson et al.'s (2017) model, Equation (7) would include all determinants of the extensive margin of FDI. Meanwhile, (5) and (6) show that investment openness of the host country to the source country (ω_{ij}) and technology capital of the source country (M_i) would determine the probability of observing positive FDI. There are two main limitations of this approach.

First, the extensive margin in Anderson et al. (2017) depends on only ω_{ij} and M_i, which neglects the fixed setup costs in the host country that an FDI firm has to face when entering the foreign market. These costs, acting as investment thresholds, are particularly important for the FDI firm's initial decision of whether or not to invest (Razin and Sadka, 2007). The different views on the key drivers of the selection process between these two studies, Razin and Sadka (2007) and Anderson et al. (2017), do not rule out each other but, in fact, complement each other. Therefore, I am going to combine these two new approaches to construct my estimation equation. Also, because it is not feasible to identify a priori variables that affect only either intensive or extensive margins, I will use the same set of variables in both margin estimations.

Second, Equation (7) disregards a range of important factors affecting FDI derived from other models such as labor, taxation, and the general business environment in the host country. This limitation of Anderson et al.'s (2017) model can be a limitation for any FDI equilibrium model. This is because they all have to make numerous assumptions and focus on a few aspects of reality in order to find a numerical or analytical equilibrium. As emphasized by Faeth (2009), FDI determinants should be derived from a combination of theories rather than solely focusing on one theory. Therefore, Equation (7) from Anderson's model will act as the main theme for my choice of variables but does not restrict the variables of interest. Following other recent models of FDI developed by Markusen (2002), Bergstrand and Egger (2007), and Razin and Sadka (2007), I will add variables for labor quality, business environment, and taxation in the estimation equation.

Lastly, although theories on FDI tend to put more weight on the host country's characteristics, bilateral FDI is undeniably affected by features of both countries. This is because the situation back home, such as political stability, may significantly affect the parent firms, which in turn affects the amount of investment they will send abroad. Further, according to the structural gravity model, more FDI is encouraged to countries with lower technology capital depreciation rates. However, in a bilateral framework, high capital depreciation rates of a host country must be considered from a relative respective of each source country. Denmark, for instance, has a relatively high capital depreciation rate (0.043) compared to Portugal (0.035) but a relatively low depreciation rate compared to Singapore (0.053) in 2012 (PWT, 2017). Hence, in order to fully test the theories' predictions, I will include variables from both home and host countries if the predictions comes from a comparison basis between the two countries.

5. Discussion on the Multilateral Resistance Terms

The multilateral resistance (MR) terms in the structural gravity model for FDI (P_i and π_j) are identical to the MR terms in the gravity model for trade. They represent the ease of market access to the home country and host country compared to the rest of the world. However, different from trade, in the final gravity system for FDI, the OMR term (π_j) is omitted. Anderson et al. (2017, p. 15) explain that "goods sold to *j* from *i* cannot be used elsewhere whereas *i*'s technology used in *j* has no effect on its utilization elsewhere". Theoretically, this can be true with the assumption of non-rival technology capital. However, in terms of empirical estimation, FDI data are literally in monetary value which reflects the transfer of both physical and implicit technology capital simultaneously. If in the form of physical capital, an amount of money sent from country *i* to country *j*, to build a factory for example, cannot be used elsewhere. Therefore, the exclusion of an OMR term in the theoretical model is not appropriate in empirical analysis with aggregate FDI data.

The most difficult task with the MR terms is that their functional forms in Equations (3) and (4) are too complex to be calculated with real data. As the MR terms have been commonly used in the trade literature for over ten years, but not in the FDI literature until the work of Anderson et al. (2017), I will discuss the approaches adopted in the trade literature to deal with these MR terms in an empirical analysis. Anderson and van Wincoop (2003) customize programming to capture the MR terms for trade between the US and Canada. However, this method is sophisticated and computationally burdensome (Feenstra, 2004). It also requires a country's trade with itself and distance to itself, which are infeasible with a global analysis. Hence, this method is hardly applied (Head and Mayer, 2014). Feenstra (2004) performs estimations based on country fixed-effects (FE) and finds that controlling for country FE gives consistent estimates, taking into account the MR terms. As a result, he supports the country FE method as it is easy to implement. Furthermore, Head and Mayer (2014) argue that the results of country-specific variables become meaningless with the inclusion of country FE, and we are primarily interested in the bilateral trade costs to explain trade between a pair of countries. Therefore, from the birth of the structural gravity model with the MRs, there is a tendency to estimate the model with country FE and pair variables and exclude all country-specific variables (see for instance Anderson et al., 2016; Helpman et al., 2008; Santos Silva et al., 2014). The estimation equation in these studies is of the form:

$$Trade_{ij} = \beta_1 \, i\text{-}dummy + \beta_2 \, j\text{-}dummy + \beta_3 X_{ij} + \varepsilon_{ij} \quad (8)$$

where X_{ij} is a vector of pair variables representing bilateral trade costs. The country dummies are time-invariant for cross-sectional data and time-varying for panels. Although theoretically, these pair variables are directional ($X_{ij} \neq X_{ji}$), in empirical practice almost all studies rely on non-directional (dyadic) variables such as common language, common border, and distance for instance. This leads to $X_{ij} = X_{ji}$. For variables that are not pair variables, such as WTO membership, Helpman et al. (2008) construct a dummy for both countries being WTO members and a dummy for both not being WTO members. The regression results for the above setup will give us some values for β_3. Then, for a particular pair (i, j) no matter what country is the importer or exporter, the marginal effect of X_{ij} on bilateral trade from i to j or from j to i is the same at β_3. This also means any asymmetry in bilateral trade between i and j completely depends on the dummies and the directional error terms ε_{ij}. Our fundamental interest in estimating bilateral trade or FDI is to find the determinants of the bilateral flows, including the factors that can explain the heavily asymmetric features in those flows as shown in Figure 1. Why trade from i to j is different from trade from j to i depends on the asymmetric and time-changing features between importers and exporters such as market sizes and political stability. A setup like Equation (8) cannot do this. A dummy for each country does not convey all of these characteristics as it simply takes on a value of 1 for the country in the pair anyway. The inclusion of country FEs is often motivated by a desire to control for omitted variables problems but a specification like Equation (8) likely exacerbates the omitted variables problem.

The second problem of the empirical specification (8) is that it cannot find the drivers of time-varying international trade. Global trade changes dramatically over time, whereas Equation (8) relies on almost all time-invariant or dummy variables. Estimation will give values for the βs and all the dummies' values stay the same over time (either 0 or 1). Even if X_{ij} includes some dummies such as sharing a free trade agreement, which may change its value from 0 to 1 after some year, these variables' values only change once and then stay unchanged for the rest of the period of analysis. These time-invariant variables cannot explain considerably time-varying bilateral trade. Again, too much weight is put on the error term and the country dummies.

These arguments suggest that a specification like Equation (8) should be avoided as it rules out all the interesting determinants that can explain the asymmetry and time-variance in bilateral trade. Instead, I follow Baldwin and Harrigan (2011) in using a proxy for the MR terms:

$$Remote_i = \left(\sum_j \frac{Y_j}{dist_{ij}}\right)^{-1} \ (i \neq j)$$

This proxy is the inverse of Harris' (1954) market potential index. The Harris index has been widely applied in the economic geography literature, especially in investigating impacts of the home market effect (Hanson, 2005; Michie, 2003). While the use of this proxy for MR terms is criticized by Head and Mayer (2014, p. 151) because it does "not take the theory seriously enough", I believe that this option is better than controlling for country FE which they support. It offers a number of advantages: it does not rule out country-specific or monadic variables; it does not require complex estimation methods to deal with the extremely high number of dummies; it is close to the idea of the MR terms because it takes into account global income ($\sum_j Y_j$) and trade costs ($dist_{ij}$); and it also represents what the MR terms stand for: the ease of market access to that country compared to the rest of the world.

6. Data and Hypotheses

6.1. Country-Specific Variables

The dataset includes 110 countries from 2004 to 2012. There are 11,990 directional pairs or 5,995 non-directional pairs (dyads). Technology capital share, η, is calculated by the country share in the total global number of patent applications by its residents. The capital depreciation rate, δ, is defined as the depreciation rate of technology capital in the model. However, regarding data availability, there is only the capital depreciation rate of physical capital. Following Anderson et al. (2017), I also use data on the physical capital depreciation rate for δ.

With regards to additional variables, I use mean years of schooling as an indicator for labor quality. Moreover, wage rates are also manifested in labor quality (Razin and Sadka, 2007) and thus using mean years of schooling should be sufficient to capture the main feature of labor. In terms of business environment, I employ the Political Stability and Absence of Violence score in the World Governance Indicator database as an indicator for the business environment. In a recent survey, World Bank (2018) finds that political stability is among the most important factors concerning foreign investors. Moreover, Razin and Sadka (2007) examine the impact of taxation of both the source and host country on FDI as the economics literature has argued that the international differences in tax rates do affect FDI (Devereux and Hubbard, 2003; Harberger, 1962). I also include corporate tax rates of both home and source country as this tax rate directly affects the firm's profit, which in turn is expected to affect FDI as well.

To capture the fixed setup costs that may affect the investment decision I use data on starting business distance-to-frontier scores from the World Bank (2017) Doing Business Database. This score records the official procedures, their time and costs, and minimum capital requirements that a firm needs to undergo in order to start-up a business. As higher scores mean lower start-up costs, I take 100 minus this score to get the fixed start-up costs for each country.

6.2. Pair variables

Anderson et al. (2017) assume the dependent variable is FDI stocks while Razin and Sadka (2007) use FDI flows. Therefore, I will employ both data series. Among other pair variables, I constructed the common religion index and common legal origin. Common language takes the value of 1 if a language is spoken by at least 9% of the population in both countries.

Lastly, Equation (7) implies that all variables in the estimation equation are to be in the logarithmic format. Nevertheless, as Head and Mayer (2014) emphasize, the multiplicative form of the gravity model in international trade simply results from its historical usage to resemble the gravity equation in physics. It does not strictly mean that all variables have to be in logarithmic form. I follow the conventional application in the literature to take the log of only continuous unrestricted variables (FDI, GDP, means of years of schooling, and distance). The other variables, including dummies, indexes, or share variables are kept unchanged or rescaled only as they contain numerous zero observations and would be unidentified if logarithmically transformed. The list of variables and data sources is illustrated in Table 1. Variable endings: "_s" denotes source country and "_h" denote host country; variables without these endings are pair-specific.

7. Methods and Preliminary Tests

For the extensive margin of FDI – the probability to invest – the estimation equation is:

$$P(decision_{ijt}=1|X, c_{ij}) \equiv G(X\beta, c_{ij}) \quad (9)$$

where $decision_{ijt}$ is the binary response of whether to invest or not; X is the vector of explanatory variables listed in Table 1; $G(.)$ is an unknown function of X and c_{ij}; c_{ij} represents the unobserved effects.

Common panel methods to estimate Equation (9) are the linear probability model (LPM), pooled probit, random effects (RE) probit, fixed effects (FE) logit, and Chamberlain's correlated random effects probit (CRE). LPM does not produce good estimates of the average partial effects (APEs) if the covariates have a wide range of values (Wooldridge, 2010), which is the case in this global study. Also, the FE logit model is unable to estimate the APEs. Therefore, I will not present results from LPM and FE logit for the extensive margin.

For the intensive margin of FDI – the amount of positive investment – according to Equation (7), the general estimation equation is:

$$lnFDI_{ijt} = \beta_0 + \beta_1 X + \lambda_t + c_{ij} + u_{ijt} \quad (10)$$

where the general error term comprises three components: time effects (λ_t), pair effects (c_{ij}), and the remaining idiosyncratic component (u_{ijt}), which is similar to other studies on bilateral data such as Baltagi et al. (2008), Egger et al. (2009), and Baltagi et al. (2015).

Common panel estimators for Equation (10) are pooled OLS (POLS), random effects (RE), fixed effects (FE), and first differencing (FD). In POLS, c_{ij} is included in the error term and thus POLS will be biased and inconsistent if c_{ij} is correlated with any element in X. Also, since POLS ignores the correlation of the error terms over time, its standard errors are usually underestimated (Cameron and Trivedi, 2005). I perform both the AR(1) selection correlation test (Wooldridge, 2010) and Breusch and Pagan (1980) LM test for the presence of unobserved effects and compare RE versus POLS. Results show that the c_{ij} terms are present and RE outperforms POLS. While RE treats c_{ij} as being distributed independently of the regressors, FE assumes that c_{ij} is correlated with the regressors. The Hausman test shows that the unobserved effects are correlated with covariates and thus FE is better than RE. Besides FE and RE, researchers can also apply FD to remove the unobserved effects. However, FD requires data to be available in adjacent time periods. Using FD in my sample would lead to a significant drop in the number of observations as I am dealing with positive FDI separately from zero FDI. Therefore, I do not apply FD in this study.

Another way to allow for the correlation between c_{ij} and X is to use the Chamberlain-Mundlak device. I refer to this method as the Chamberlain-Mundlak random effects (CMRE) model. Adding the Chamberlain-Mundlak device to control for the correlation between the unobserved effects and covariates is also the practice in Egger and Nelson (2011) with PPML estimation and in Araujo et al. (2017) with RE Tobit estimation. CMRE can be applied to both linear and nonlinear models and it can produce consistent estimation even if some of the time-invariant variables in the model are correlated with c_{ij} (Egger and Nelson, 2011).

For the sake of comparison, I will report results from Heckit, which is the most popular method used in the previous studies on the two margins of FDI. Also, since the work of Santos Silva and Tenreyro (2006), PPML has become one of the most popular estimation methods for gravity equations and thus I also include results from PPML.

So far, I have discussed methodologies for the intensive and extensive margins of FDI separately. Meanwhile, estimating only positive FDI values in the amount equation can lead to selection bias if the mechanisms generating the zero and positive FDI are correlated. I have tested for selection bias, following Wooldridge (1995). The selection bias test shows that the null hypothesis of no selection bias cannot be rejected (p-value =0.1615 for FDI stocks and 0.1957 for FDI flows). Therefore, I investigate determinants of intensive and extensive margins of FDI separately and do not worry about the selection bias problem. In all results, I always control for time trend effects by including dummies for years in each regression. In addition, the standard errors are always clustered by non-directed pairs to account for within-pair correlation or heteroscedasticity. Failure to control for this may overstate significance levels with low *p*-values and small standard errors (Cameron and Miller, 2015).

8. Results

8.1. The Extensive Margin

Coefficients from pooled probit, RE probit, or CRE probit are not comparable; thus, results in Table 2 for the extensive margin are the APEs which can convey both the magnitude and direction of the impact. The rho value in the RE probit results is close to 1 (=0.867 for stocks and 0.685 for flows) and statistically significant at the 1% level; thus RE probit is better than pooled probit and there is an unobserved effect present (StataCorp, 2017; Wooldridge, 2010). However, pooled probit is the only estimator that has been used in the previous studies on the extensive margin of FDI.[4] CRE should be given preference as it allows for the correlation between explanatory variables in X and the unobserved effects (Wooldridge, 2010). Another striking feature in Table 2 is that APEs' magnitudes vary considerably across estimators. Since there is no model selection test to choose between RE probit and CRE, I draw conclusions from both methods and focus on the direction of impact only.

Robust covariates which have a statistically significant positive impact on the investment decision across estimators as well as FDI data types are: GDPs of both countries (lgdp_s, lgdp_h), schooling of source country (lsch_s), technology capital share of source country

[4] Those studies employ Heckit which estimates the extensive margin by pooled probit.

(tech_s), political stability of both countries (politics_s, politics_h), FDI share of production (phi_h), bilateral investment treaty (BIT), preferential trade agreement (PTA), common border, common language, colonial relationship, common legal origin, and common religion. On the other hand, start-up costs of the host country (startup_h) and distance negatively influence the investment probability at the 1% significance level.

A number of variables showing different results according to whether stocks or flows are considered. Particularly, schooling of host country (lsch_h), common currency, and common colonizer are positive and highly significant in the results for FDI stocks, but they are all statistically insignificant in the FDI flow results. By contrast, remoteness of source country (remote_s) has a negative and significant influence on FDI flows but not on FDI stocks. FDI flow data provide more accurate observations on the yearly probability to invest. Hence, FDI flow results should be given more preference in these cases.

Lastly, unclear results are seen in capital depreciation rates (delta_s, delta_h), source country's corporate tax rates (tax_s), host country's technology capital share (tech_h), and host country's remoteness (remote_h). Results on these variables are either statistically insignificant or opposite according to different estimation methods for the same type of FDI data. Thus, I do not draw conclusions about the impact of these variables on the extensive margin.

8.2. The Intensive Margin

Results for the intensive margin are illustrated in Table 3. According to the diagnostic tests discussed above, I omit results from RE and POLS. The number of observations in Heckit and PPML is considerably higher than the other methods because these two estimators deal with both zero and positive FDI simultaneously. For Heckit, I use start-up costs as the exclusion variable for both types of FDI. The validity of this variable as an exclusion restriction will be discussed later on.

Comparing results across estimators, the magnitudes of coefficients in Table 3 do vary substantially. However, results from FE (column 1) and CMRE (column 2) are particularly similar in terms of both signs and significance levels. Apart from this, CMRE offers more advantages than FE because CMRE is capable of estimating coefficients on time-invariant variables. According to Table 3, many coefficients from either FE or CMRE are smaller in size than those of Heckit and PPML, like lgdp_s, lgdp_h, and tech_h for instance. This should not be a surprise as the fixed effects in FE and the time-averages in CMRE absorb the impact of the main variables to some degree. On the other hand, there are no substantial contradicting results between FE and CMRE versus Heckit and PPML, i.e. apart from remote_h no other statistically significant variables have opposing signs between the two groups of estimators. However, considerably more variables are statistically significant in Heckit and PPML as these two methods do not deal with the unobserved effects in panel data. FE and CMRE are the two panel methods that can show which variables have a robust and significant impact on bilateral FDI even after controlling for the unobserved fixed effects. Therefore, I focus on the panel methods to draw conclusions on significant robust determinants of FDI. As Santos Silva et al. (2014, p. 70) emphasizes "the choice of estimator matters; indeed, it can matter a lot", I focus on variables' consistency in the direction of impact and significance levels.

The typical gravity variables show a statistically significant impact on the volume of FDI across panel estimators and FDI data types, which is similar to the results on the extensive margin. GDPs (lgdp_s, lgdp_h), schooling (lsch_s, lsch_h), source country's global share of patents (tech_s), and FDI share of production (phi_h) all positively affect the amount of bilateral FDI. Moreover, host country's global share of patents (tech_h) has a negative influence, although its coefficients are not statistically significant. These results confirm Anderson et al.'s (2017) prediction on the role of technology/ knowledge capital: this capital tends to flow from technology capital abundant countries to scarce countries due to diminishing returns to scale of technology capital. In addition, common currency, border, language, colonizer, colony, and religion all positively affect FDI, which is opposite to the impact of distance. The results for religion also invalidate the use of religion as an exclusion restriction variable in Heckit estimation for FDI, which is employed by Garrett (2016).

Besides the similarities, results on FDI flows and stocks are different for a number of variables. First, more variables are statistically significant in the case of FDI flows with panel methods (FE and CMRE). To be clearer, capital depreciation rates (delta_h) and political stability (politics_h) of the host country are not statistically significant determinants of FDI stocks but are highly significant in the case of FDI flows in both FE and CMRE results. According to the law of diminishing marginal return of capital, FDI should flow from capital abundant countries to capital scarce countries whose capital depreciation rates are lower. However, the positive impact of delta_h on FDI flows seems to follow the Lucas paradox (Lucas, 1990) where the majority of capital still goes to developed countries whose capital depreciation rates are high. Although delta_h has the opposite sign to the theory predictions, the original concept from Anderson et al.'s (2017) model is the depreciation rate of **technology** capital whereas I am forced to use the depreciation rate of physical capital. Thus, unexpected results here can be attributed to the use of an indirect and maybe not suitable proxy for technology capital depreciation. More directly related to the theory are results on tech_s and tech_h, which are consistent with the theory predictions. Further, host country's corporate tax rates (tax_h), start-up costs (startup_h), and common legal origin are negative and statistically significant only in the results for FDI flows. I believe the differences between results on stocks and flows are mainly due to the nature of each data series. A variable may have a significant impact on the yearly FDI flows but that impact is substantially small compared to the cumulative FDI stock value and thus it does not manifest in the results for FDI stocks. On the other hand, PTA significantly influences FDI stocks but not FDI flows whereas remote_h shows opposite and significant effects on the two types of FDI. Therefore, research on determinants of FDI should consult both data series to draw conclusions.

Interestingly, tax_h positively affects the probability of investment but negatively affects the amount of positive FDI flows. Countries with the highest tax rates, such as the US (40% in 2012) and Japan (38.01% in 2012), are also the ones with larger GDPs, better business environment, and higher labor quality. Therefore, when the firms initially decide to invest, they may look at other factors that are highly correlated with the high corporate tax rates. However, once they invest in that country, corporate tax rates directly affect their profits and thus the tax negatively affects the amount of positive FDI flows afterwards.

Tax_s, remote_s, politics_s, and BIT show no statistically significant impact on both types of FDI after controlling for unobserved effects. The insignificant results on these source country variables agree with the fact that FDI theories tend to focus on the host country's characteristics as the main drivers of FDI. Moreover, the unclear results on both remote_s and remote_h in both margins can be due to two possible reasons: either the proxies I use do not perfectly capture the theoretical MR terms or that the terms are truly important determinants of bilateral FDI is still questionable.

Lastly, empirical evidence also shows that there is no strongly valid exclusion restriction for Heckit in this FDI study. Results on start-up costs and common legal origin indicate that these variables are valid exclusion variables for FDI stocks but not for FDI flows. Variables significantly affecting the extensive but not the intensive margin of both FDI data series are source country's political stability (politics_s) and bilateral investment treaty (BIT), according to panel estimators. However, although not shown, if politics_s or BIT are included in the pooled OLS or PPML regressions, they are both highly significant. Therefore, politics_s and BIT are still not valid exclusion variables for Heckit.

8.3. Results on Different Groups of Countries

Blonigen and Wang (2004) claim that although theories are supposedly constructed for the entire global economy, FDI to LDCs and DCs are affected differently. They suggest FDI research to consider different groups of countries based on development levels. Previous studies such as Dixon and Haslam (2016) and Araujo et al. (2017) rely on data from the OECD so they cannot analyze FDI between non-OECD countries. Blonigen et al. (2007) and Asiedu and Lien (2011) do investigate results by country development groups but they use only aggregate, not bilateral, FDI data of the receiving country. Therefore, these studies are unable to investigate the direction of FDI according to the development levels of both sending and receiving countries. This is the first global study that extensively investigates the bilateral FDI data across all combinations of country groups: DCs to DCs, DCs to LDCs, LDCs to DCs, and LDCs to LDCs. The country list is reported in the Appendix.

Results on the intensive and extensive margins are relatively similar for each data series as shown in the previous tables of results. Hence, in the robustness check with different country groups, I present results with the direction of impact for only the intensive margin, based on FE and CMRE, for brevity. Detailed results are in Table A1 and Table A2 in the Appendix. The first four columns in Table 4 summarize results for global FDI stocks and flows from the previous sections for both margins to compare with results for country groups. The rest of the table presents results for different country groups for the intensive margin only.

Firstly, a number of variables are robust across the four different country groups. They are source country's technology global share (tech_s), FDI share of production in the host country (phi_h), common language, common colonizer, colonial relationship, and distance. Common colonizer does not significantly affect bilateral FDI between LDCs as these countries were historically mainly colonized instead of colonizing. The robustness of tech_s also confirms the theory emphasizing technology capital as an important driver of FDI. A country, no matter what development group it belongs to, sends more FDI abroad if its share of global technology is higher. Similar to the global results, the host country's capital depreciation rates (delta_h) have a positive and statistically significant impact on FDI flows across all country groups except LDCs to LDCs.

Regarding DCs to DCs, labor quality proxied by average years of schooling and political stability of both countries are not significant drivers of FDI. These developed countries have similar features on these aspects and thus they are not significant determinants of FDI between them. By contrast, this group benefits from a common currency, according to results from both types of FDI. Since the majority of countries having a common currency are DCs with the Euro area as a stark example, this result is not surprising. Moreover, DCs to DCs is the only group that is statistically affected by corporate tax rates and startup costs. In particular, source country tax rates encourage FDI stocks while host country tax rates deter FDI flows. These results show that seeking lower corporate tax rates is an important reason for FDI between DCs. This is different from the conventional belief that only LDCs lower tax rates to attract more FDI from DCs. Corporate tax rates are not statistically significant in any other country groups. This result leaves a question of whether or not lower corporate tax rates of LDCs are effective in attracting FDI. In addition, it is only for FDI from DCs to either other DCs or LDCs that PTA and BIT are significant influences. PTA has a positive impact on FDI from DCs to either DCs or LDCs and is highly significant, while BIT benefits FDI from DCs to LDCs at merely the 10% significance level.

Another noticeable feature in Table 4 is that FDI from LDCs to either DCs or LDCs is not significantly driven by many covariates. Even typical gravity variables, such as source country's GDP and common religion show no significant impact on FDI from LDCs once controlling for the unobserved effects in the panel. These results suggest that FDI from LDCs may be driven by other specific factors rather than just conventional variables. There is a need to develop more theories and empirical works to explain FDI from LDCs in particular. Interestingly, common border is not significant in any groups except LDCs to LDCs. LDCs generally have less international investment experience. When they invest in other LDCs, they also face higher risks in terms of political stability, expropriation risk and infrastructure quality. Therefore, they may prefer to invest in other LDCs which are contiguous. Investing in a neighbouring country can reduce these risks to some degree as they would understand the situation better than for more distant countries.

Last but not least, some variables show unclear and difficult to explain impacts. Similar to the global results, host country remoteness (remote_h) shows contradicting results for the same group of countries but different types of FDI. The remoteness of the source country (remote_s) has the opposite or an unclear influence on different groups of countries. Technical capital share of the host country (tech_h) has an unexpected positive direction of impact on FDI between DCs and is insignificant in all the other equations.

9. Final Conclusion

Results from the global sample on the two margins reveal the following groups of bilateral FDI drivers:

Some variables demonstrate consistent results across both margins. Having a positive impact are GDPs and average schooling of both countries, source country technology capital share, host country FDI production, host country's political stability, PTA, common currency, common border, common religion, common language, and colonial relationship. In contrast, distance is a significant deterrence in both margins.

Variables showing opposite impacts on the two margins are host country's corporate tax rates and common legal origin. They have a positive influence on the investment probability but a negative effect on the amount of positive FDI. Also, there is no strongly valid exclusion variable for Heckit estimation.

Capital depreciation rates and remoteness of both countries are variables with results in both margins that are unclear or opposite to theory predictions. This leaves a question on whether there is a need for a structural gravity model for FDI with the MR terms.

Results on FDI flows and stocks can lead to opposite conclusions and each data series has its own advantages and disadvantages. Therefore, research on determinants of FDI should utilize both data series to find the robust factors.

Results on country groups lead to additional findings:

The robust positive impacts of the source country's technology capital share and the host country's FDI production share, across all types of FDI and country groups, strongly confirm the theory's predictions.

Some variables only affect a specific country group such as common currency, corporate tax rates and the host country's startup costs for FDI from DCs to DCs and common border for FDI from LDCs to LDCs. Also, DCs to LDCs is the only group benefiting from both PTA and BIT.

Various insignificant results found in the case of FDI from LDCs point to the need for more theoretical and empirical work to identify the distinctive factors driving this specific direction of FDI.

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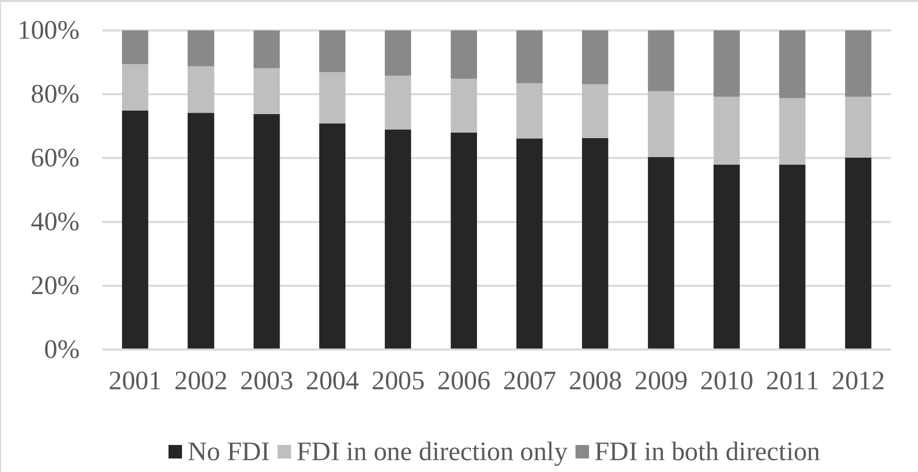
Figure 1: Distribution of Country Pairs Based on Direction of FDI stocks



Data source: UNCTAD, 110 countries.

Table 1: Variable Explanation and Expected Sign

Variable group	Variable	Abbreviation	Expected sign	Data source
Dependent variable	Nominal FDI stocks, USD (log)	lstock	N/A	UNCTAD
	Nominal FDI flows, USD (log)	lflow	N/A	
Country-specific variables	Nominal GDP, USD (log)	lgdp_s	+	World Bank
		lgdp_h	+	
	Mean years of schooling (log)	lsch_s	-	UNDP
		lsch_h	+	
	Share of global technology capital $\eta \equiv$ share of global number of patent applications, [0, 1]	tech_s	+	World Bank, Own calculation
		tech_h	-	
	Capital depreciation rate δ, [0, 1]	delta_s	+	Penn World Table 9.0
		delta_h	-	
	Corporation tax, [0, 1]	tax_s	+	KPMG, Trading Economics & countries' tax guides
		tax_h	-	
	Political stability, [-2.5, 2.5]	politics_s	?	World Bank
		politics_h	+	
	Remoteness index	remote_s	-	Own calculation
		remote_h	-	
	Startup costs, [0, 10] (rescale by dividing by 10)	startup_h	+	World Bank
	Share of FDI in production ϕ, [0, 1]	phi_h	+	Own calculation
	Physical capital stock	K	N/A	Penn World Table 9.0
	Labor shares of production	1-α	N/A	
Pair variables	Bilateral investment treaty, dummy	BIT	+	UNCTAD
	Preferential trade agreement, dummy	PTA	+	World Bank
	Common currency, dummy	currency	+	De Sousa (2012)
	Distance, populated cities, Km (log)	ldist	-	CEPII
	Common border, dummy	border	+	
	Common spoken language, dummy	language	+	
	Common colonizer post 1945, dummy	colonizer	+	
	Ever in a colonial relationship, dummy	colony	+	
	Common legal origin, dummy	legal	+	CIA World Factbook & Own calculation
	Common religion index, [0, 10] (rescale by dividing by 10)	religion	+	

Table 2: Results for the Extensive Margins (APEs)

	Expected Sign	FDI Stocks			FDI Flows		
		Pooled Probit (1)	RE Probit (2)	CRE Probit (3)	Pooled Probit (4)	RE Probit (5)	CRE Probit (6)
lgdp_s	+	0.077***	0.075***	0.030***	0.061***	0.058***	0.044***
		(0.002)	(0.001)	(0.008)	(0.002)	(0.001)	(0.008)
lgdp_h	+	0.049***	0.046***	0.035***	0.042***	0.041***	0.023***
		(0.002)	(0.001)	(0.008)	(0.002)	(0.001)	(0.008)
lsch_s	+	0.104***	0.139***	0.082**	0.086***	0.096***	0.101***
		(0.012)	(0.011)	(0.037)	(0.010)	(0.009)	(0.034)
lsch_h	+	0.087***	0.105***	0.224***	0.009	0.011	0.006
		(0.011)	(0.010)	(0.035)	(0.009)	(0.008)	(0.032)
tech_s	+	0.318***	0.296***	0.191	0.408***	0.352***	0.238***
		(0.070)	(0.073)	(0.121)	(0.049)	(0.044)	(0.073)
tech_h	-	-0.112**	0.022	0.192*	0.050	0.002	-0.074
		(0.057)	(0.051)	(0.103)	(0.044)	(0.042)	(0.079)
delta_s	+	-0.002	-0.137	0.330	-0.199	-0.053	0.223
		(0.255)	(0.237)	(0.500)	(0.225)	(0.201)	(0.470)
delta_h	-	-0.635**	-0.130	1.077**	-0.930***	-0.464**	1.322***
		(0.257)	(0.236)	(0.515)	(0.234)	(0.208)	(0.476)
tax_s	+	-0.138***	-0.040	-0.017	-0.037	0.013	0.069**
		(0.035)	(0.027)	(0.033)	(0.031)	(0.024)	(0.033)
tax_h	-	-0.055	0.098***	0.132***	0.027	0.042*	0.021
		(0.034)	(0.028)	(0.035)	(0.029)	(0.024)	(0.034)
politics_s	?	0.065***	0.045***	-0.000	0.052***	0.042***	0.015***
		(0.003)	(0.003)	(0.005)	(0.003)	(0.003)	(0.005)
politics_h	+	0.021***	0.010***	-0.001	0.002	0.005**	0.013**
		(0.003)	(0.003)	(0.005)	(0.003)	(0.002)	(0.005)
remote_s	-	0.028	0.042	-0.013	-0.059	-0.127***	-0.177*
		(0.062)	(0.058)	(0.114)	(0.054)	(0.047)	(0.101)
remote_h	-	0.387***	0.041	-0.315***	0.296***	0.083*	-0.242**
		(0.066)	(0.059)	(0.116)	(0.053)	(0.046)	(0.099)
startup_h	-	-0.005***	-0.005***	-0.004**	-0.007***	-0.006***	-0.005***
		(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)
phi_h	+	0.158***	0.165***	0.170***	0.399***	0.306***	0.179***
		(0.032)	(0.022)	(0.029)	(0.029)	(0.026)	(0.041)
BIT	+	0.061***	0.040***	0.007	0.066***	0.056***	0.017*
		(0.006)	(0.006)	(0.008)	(0.005)	(0.005)	(0.009)
PTA	+	0.056***	0.038***	0.013*	0.043***	0.027***	0.007
		(0.007)	(0.006)	(0.007)	(0.006)	(0.005)	(0.007)
currency	+	0.093***	0.050***	0.024	0.002	0.003	0.013
		(0.020)	(0.014)	(0.015)	(0.012)	(0.010)	(0.013)
ldist	-	-0.079***	-0.089***	-0.081***	-0.072***	-0.067***	-0.065***
		(0.005)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
border	+	0.068***	0.063***	0.060***	0.058***	0.049***	0.047***
		(0.020)	(0.020)	(0.019)	(0.017)	(0.016)	(0.016)
language	+	0.049***	0.056***	0.055***	0.037***	0.037***	0.032***
		(0.009)	(0.008)	(0.008)	(0.008)	(0.008)	(0.007)
colonizer	+	0.062***	0.067***	0.070***	0.013	0.018	0.019
		(0.014)	(0.012)	(0.011)	(0.014)	(0.013)	(0.013)
colony	+	0.047*	0.050**	0.045**	0.054***	0.051***	0.048***
		(0.024)	(0.021)	(0.020)	(0.017)	(0.017)	(0.017)
legal	+	0.031***	0.034***	0.030***	0.009*	0.009*	0.007
		(0.006)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
religion	+	0.004***	0.003***	0.003***	0.010***	0.009***	0.009***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Log pseudolikelihood		-32765.958	-19275.758	-18951.947	-30586.505	-22900.215	-22775.635
Observations		93744	93744	93744	93744	93744	93744

Standard errors in parentheses: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 3: Results for the Intensive Margin

	Expected Sign	FDI Stocks				FDI Flows			
		FE	CMRE	Heckit	PPML	FE	CMRE	Heckit	PPML
		(1)	(2)	(4)	(5)	(6)	(7)	(8)	(9)
lgdp_s	+	0.473***	0.440***	0.896***	0.592***	0.676***	0.626***	0.778***	0.517***
		(0.085)	(0.084)	(0.031)	(0.082)	(0.110)	(0.107)	(0.031)	(0.069)
lgdp_h	+	0.366***	0.366***	0.817***	0.959***	0.288***	0.297***	0.713***	0.864***
		(0.080)	(0.079)	(0.026)	(0.048)	(0.100)	(0.099)	(0.026)	(0.045)
lsch_s	+	0.613*	0.638*	1.212***	1.094	1.087**	1.120***	1.141***	1.371**
		(0.362)	(0.359)	(0.158)	(0.927)	(0.447)	(0.434)	(0.142)	(0.635)
lsch_h	+	1.012***	1.018***	0.324**	-0.585	1.028**	1.135***	0.185	-0.128
		(0.329)	(0.326)	(0.139)	(0.548)	(0.403)	(0.395)	(0.137)	(0.515)
tech_s	+	2.763***	2.866***	0.238	3.511***	2.179***	2.312***	0.705	2.866***
		(0.566)	(0.564)	(0.556)	(0.979)	(0.636)	(0.623)	(0.503)	(0.882)
tech_h	-	-0.562	-0.552	-2.374***	-1.188	-0.201	-0.058	-1.249*	-0.927
		(0.581)	(0.579)	(0.746)	(1.235)	(0.753)	(0.744)	(0.681)	(1.446)
delta_s	+	7.780	6.601	7.443*	-0.390	-8.153	-9.610	6.889*	2.188
		(5.092)	(5.004)	(4.209)	(7.450)	(7.489)	(7.222)	(3.833)	(6.935)
delta_h	-	5.255	5.432	6.628*	8.723	27.224***	27.627***	1.194	0.985
		(5.431)	(5.349)	(3.515)	(8.805)	(6.917)	(6.656)	(3.371)	(7.785)
tax_s	+	0.327	0.306	2.010***	-0.265	0.107	0.164	1.033**	0.867
		(0.353)	(0.346)	(0.540)	(2.057)	(0.470)	(0.459)	(0.480)	(1.767)
tax_h	-	0.107	0.135	-1.745***	-3.183**	-1.214**	-1.051**	-1.455***	-2.268*
		(0.448)	(0.444)	(0.481)	(1.574)	(0.518)	(0.503)	(0.441)	(1.329)
politics_s	?	0.024	0.026	0.922***	0.706***	0.047	0.054	0.710***	0.566***
		(0.053)	(0.053)	(0.048)	(0.095)	(0.071)	(0.069)	(0.048)	(0.088)
politics_h	+	0.067	0.073	0.134***	0.174*	0.132**	0.142**	0.143***	0.026
		(0.049)	(0.048)	(0.047)	(0.100)	(0.060)	(0.059)	(0.043)	(0.084)
remote_s	-	-0.652	-1.036	-0.550	-4.076***	-0.927	-1.037	-2.013***	-4.156***
		(1.002)	(0.996)	(0.768)	(1.319)	(1.221)	(1.189)	(0.720)	(1.204)
remote_h	-	2.508***	2.637***	8.093***	7.485***	-4.059***	-3.616***	6.490***	4.383***
		(0.932)	(0.926)	(0.767)	(1.036)	(1.298)	(1.266)	(0.740)	(1.309)
startup_h	-	-0.017	-0.015		-0.059	-0.055**	-0.048**		-0.042
		(0.018)	(0.017)		(0.053)	(0.022)	(0.022)		(0.049)
phi_h	+	2.840***	2.835***	5.656***	5.520***	2.273***	2.143***	6.446***	7.709***
		(0.322)	(0.314)	(0.499)	(0.773)	(0.633)	(0.618)	(0.387)	(0.654)
BIT	+	0.015	0.003	-0.219***	-0.474***	0.042	0.013	-0.255***	-0.411***
		(0.095)	(0.093)	(0.078)	(0.183)	(0.112)	(0.110)	(0.073)	(0.146)
PTA	+	0.140**	0.142**	0.454***	0.494*	0.073	0.057	0.171**	0.277
		(0.061)	(0.060)	(0.089)	(0.278)	(0.072)	(0.071)	(0.081)	(0.263)
currency	+	0.228*	0.217*	0.566***	0.397**	0.324**	0.304**	0.422***	0.292
		(0.125)	(0.125)	(0.149)	(0.187)	(0.152)	(0.145)	(0.137)	(0.178)
ldist	-		-0.744***	-0.811***	-0.572***		-0.608***	-0.812***	-0.517***
			(0.056)	(0.057)	(0.087)		(0.047)	(0.052)	(0.087)
border	+		0.501***	0.427**	0.039		0.314**	0.263*	-0.013
			(0.158)	(0.170)	(0.412)		(0.134)	(0.150)	(0.361)
language	+		1.072***	1.128***	0.580***		0.882***	0.972***	0.591***
			(0.100)	(0.103)	(0.198)		(0.091)	(0.099)	(0.185)
colonizer	+		0.692***	0.888***	0.785*		0.635***	0.659***	0.887**
			(0.173)	(0.201)	(0.448)		(0.180)	(0.225)	(0.439)
colony	+		1.324***	1.358***	0.976***		1.000***	1.029***	0.731***
			(0.174)	(0.171)	(0.202)		(0.137)	(0.145)	(0.189)
legal	+		-0.088	-0.017	-0.427		-0.174**	-0.122	-0.474*
			(0.078)	(0.081)	(0.311)		(0.068)	(0.074)	(0.254)
religion	+		0.065***	0.088***	0.050		0.054***	0.094***	0.056
			(0.017)	(0.019)	(0.070)		(0.014)	(0.016)	(0.047)
N		27238	27238	93744	93744	20817	20817	93744	93744

Standard errors in parentheses: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4: Summary Results for Country Groups

	Expected signs	Extensive Margin		Intensive Margin									
		Global		Global		DCs to DCs		DCs to LDCs		LDCs to DCs		LDCs to LDCs	
		Stock	Flow	Stock	Flow	Stock	Flow	Stock	Flow	Stock	Flow	Stock	Flow
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
lgdp_s	+	+	+	+	+	+	+	+	+				
lgdp_h	+	+	+	+	+	+	+	+	+			+	+
lsch_s	+	+	+	+	+				+		+		+
lsch_h	+	+		+	+				+	+		+	+
tech_s	+	+	+	+	+	+		+		+	+	+	+
tech_h	-	?					+						
delta_s	+							+					
delta_h	-	?	?		+		+		+		+		
tax_s	+	-	+			+							
tax_h	-	+	+		-		-						
politics_s	?	+	+					-		+			
politics_h	+	+	+		+					+			
remote_s	-		-					-		+			
remote_h	-	?	?	+	-	+	-	+	-				-
startup_h	-	-	-		-	-	-						
phi_h	+	+	+	+	+	+	+	+	+	+		+	+
BIT	+	+	+					+					
PTA	+	+	+	+			+	+					
currency	+	+		+	+	+	+						+
ldist	-	-	-	-	-	-	-	-	-	-	-	-	-
border	+	+	+	+	+							+	+
language	+	+	+	+	+	+	+	+	+	+	+	+	+
colonizer	+	+		+	+	+	+	+		+	+		
colony	+	+	+	+	+	+	+	+	+	+	+	+	+
legal	+	+	+		-			-	-				
religion	+	+	+	+	+	+		+	+				
Obs		93744	93744	27238	20817	9124	6913	9091	7347	4448	3155	4575	3042

(?): significant and conflicting results; (-): negative impact; (+) positive impact; empty cells: no statistically significant impact

Appendix

Country List

In the scope of this research, developed countries (DCs) are countries in the high income bracket according to the World Bank's 2008 data on global income groups. The rest of the world is considered less developed countries (LDCs).

43 DCs: Australia, Austria, Bahamas, Bahrain, Barbados, Belgium, Canada, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong, Hungary, Iceland, Ireland, Israel, Italy, Japan, South Korea, Kuwait, Luxembourg, Malta, Netherlands, New Zealand, Norway, Oman, Portugal, Qatar, Saudi Arabia, Singapore, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Trinidad and Tobago, United Kingdom, United States.

67 LDCs: Argentina, Armenia, Azerbaijan, Belarus, Benin, Bolivia, Bosnia & Herzegovina, Botswana, Brazil, Bulgaria, Burkina Faso, Cameroon, Chile, China, Colombia, Costa Rica, Cote d'Ivoire, Dominican Republic, Ecuador, Egypt, Fiji, Gabon, Georgia, Guatemala, Guinea, Honduras, India, Indonesia, Iran, Iraq, Jamaica, Jordan, Kazakhstan, Kenya, Kyrgyz Republic, Latvia, Lebanon, Lithuania, Malaysia, Mauritius, Mexico, Moldova, Mongolia, Morocco, Mozambique, Namibia, Nicaragua, Nigeria, Panama, Paraguay, Peru, Philippines, Poland, Russian Federation, Rwanda, Senegal, South Africa, Sri Lanka, Swaziland, Tanzania, Thailand, Tunisia, Turkey, Ukraine, Uruguay, Venezuela, Zimbabwe.

Table A1: Intensive Margin – Country Groups – FDI Stock

	Expected sign	DCs to DCs		DCs to LDCs		LDCs to DCs		LDCs to LDCs	
		FE	CMRE	FE	CMRE	FE	CMRE	FE	CMRE
lgdp_s	+	0.666***	0.648***	0.481***	0.428***	0.098	0.075	-0.105	-0.141
		(0.148)	(0.147)	(0.164)	(0.161)	(0.214)	(0.211)	(0.203)	(0.200)
lgdp_h	+	0.588***	0.600***	0.315**	0.339***	0.451	0.389	0.516***	0.505***
		(0.148)	(0.148)	(0.125)	(0.124)	(0.366)	(0.358)	(0.181)	(0.178)
lsch_s	+	0.819	0.775	0.481	0.401	0.327	0.367	-0.076	0.169
		(0.639)	(0.637)	(0.733)	(0.726)	(0.866)	(0.852)	(0.743)	(0.738)
lsch_h	+	0.622	0.681	0.348	0.369	2.304**	2.473**	2.308***	2.120***
		(0.569)	(0.568)	(0.476)	(0.472)	(1.084)	(1.069)	(0.828)	(0.802)
tech_s	+	2.539**	2.565**	1.724	1.860*	4.395***	4.363***	2.572***	2.707***
		(1.011)	(1.011)	(1.099)	(1.091)	(1.170)	(1.157)	(0.964)	(0.958)
tech_h	-	-1.024	-0.964	-0.660	-0.612	3.325	2.882	-0.898	-1.014
		(1.264)	(1.264)	(0.616)	(0.625)	(3.665)	(3.628)	(1.395)	(1.380)
delta_s	+	-0.148	-0.786	30.160***	23.682**	2.378	1.767	9.153	8.232
		(8.020)	(7.923)	(11.146)	(10.742)	(12.731)	(12.524)	(12.210)	(11.890)
delta_h	-	6.941	5.703	8.518	7.877	22.817	25.778	-4.578	-2.650
		(9.240)	(9.153)	(8.244)	(8.132)	(21.698)	(20.899)	(12.363)	(12.029)
tax_s	+	1.163**	1.118*	-0.260	-0.253	-0.991	-0.929	0.860	0.625
		(0.579)	(0.572)	(0.548)	(0.536)	(1.275)	(1.252)	(0.748)	(0.747)
tax_h	-	0.637	0.656	-0.125	-0.138	-1.272	-0.731	-0.040	0.020
		(0.849)	(0.842)	(0.554)	(0.553)	(1.256)	(1.232)	(0.935)	(0.928)
politics_s	?	-0.112	-0.109	-0.237**	-0.210**	0.375***	0.364***	0.043	0.027
		(0.102)	(0.102)	(0.092)	(0.092)	(0.122)	(0.121)	(0.097)	(0.096)
politics_h	+	0.075	0.081	-0.024	-0.019	0.457**	0.436**	0.129	0.125
		(0.095)	(0.095)	(0.068)	(0.068)	(0.183)	(0.182)	(0.117)	(0.115)
remote_s	-	-1.300	-1.384	-2.575	-2.737*	8.757***	7.901***	3.232	2.850
		(1.732)	(1.729)	(1.661)	(1.646)	(3.007)	(2.978)	(3.631)	(3.518)
remote_h	-	2.660**	2.653**	4.626***	4.856***	-4.177	-3.004	-1.571	-1.346
		(1.287)	(1.285)	(1.756)	(1.746)	(3.728)	(3.639)	(3.280)	(3.200)
startup_h	-	-0.078***	-0.081***	0.008	0.017	0.070	0.075	-0.032	-0.031
		(0.026)	(0.026)	(0.029)	(0.029)	(0.055)	(0.054)	(0.046)	(0.045)
phi_h	+	5.503***	4.956***	3.052***	3.086***	4.752	5.938**	1.514**	1.351**
		(1.245)	(1.180)	(0.367)	(0.360)	(3.472)	(2.862)	(0.587)	(0.576)
BIT	+	-0.412	-0.413	0.207*	0.180	-0.095	-0.120	0.088	0.115
		(0.283)	(0.281)	(0.112)	(0.111)	(0.214)	(0.208)	(0.175)	(0.170)
PTA	+	0.127	0.134	0.161**	0.163**	0.170	0.162	-0.024	-0.008
		(0.126)	(0.125)	(0.080)	(0.080)	(0.180)	(0.177)	(0.153)	(0.151)
currency	+	0.229*	0.224*				1.652		0.539
		(0.126)	(0.126)				(1.392)		(0.362)
ldist	-		-0.598***		-0.894***		-0.851***		-0.769***
			(0.115)		(0.098)		(0.122)		(0.117)
border	+		0.097		0.399		0.517		0.655***
			(0.285)		(0.488)		(0.649)		(0.247)
language	+		1.085***		0.603***		1.025***		0.528***
			(0.216)		(0.169)		(0.237)		(0.188)
colonizer	+		1.314**		0.862**		1.208***		-0.052
			(0.522)		(0.356)		(0.454)		(0.218)
colony	+		0.992***		2.127***		1.576***		0.986***
			(0.272)		(0.275)		(0.402)		(0.355)
legal	+		0.034		-0.327***		0.043		0.018
			(0.146)		(0.120)		(0.168)		(0.190)
religion	+		0.099**		0.170***		0.054		0.035
			(0.039)		(0.030)		(0.038)		(0.028)
N		9124	9124	9091	9091	4448	4448	4575	4575

Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A2: Intensive Margin –Country Groups – FDI Flows

	Expected Signs	DCs to DCs		DCs to LDCs		LDCs to DCs		LDCs to LDCs	
		FE	CMRE	FE	CMRE	FE	CMRE	FE	CMRE
lgdp_s	+	0.917***	0.879***	0.868***	0.869***	0.130	0.149	0.060	-0.041
		(0.239)	(0.234)	(0.219)	(0.217)	(0.298)	(0.282)	(0.297)	(0.289)
lgdp_h	+	0.365	0.420*	0.790***	0.795***	0.279	0.053	0.692***	0.742***
		(0.257)	(0.253)	(0.145)	(0.144)	(0.409)	(0.394)	(0.241)	(0.234)
lsch_s	+	-1.166	-1.016	1.565*	1.451*	1.702*	1.725*	1.555**	1.721**
		(0.970)	(0.943)	(0.850)	(0.837)	(0.993)	(0.952)	(0.778)	(0.746)
lsch_h	+	0.613	0.936	1.284**	1.330**	0.975	1.546	1.671*	1.852**
		(0.861)	(0.854)	(0.598)	(0.590)	(1.257)	(1.218)	(0.875)	(0.848)
tech_s	+	0.292	0.417	0.606	0.481	4.482***	4.276***	3.331***	3.639***
		(1.631)	(1.610)	(1.679)	(1.654)	(1.261)	(1.234)	(1.071)	(1.038)
tech_h	-	3.076	3.264*	-1.210	-1.301	4.276	4.306	-2.354	-1.972
		(1.881)	(1.876)	(0.888)	(0.881)	(4.068)	(3.904)	(1.757)	(1.675)
delta_s	+	-6.310	-10.558	-11.216	-16.411	10.103	15.687	-3.035	-3.106
		(12.809)	(12.577)	(15.137)	(14.881)	(16.169)	(15.880)	(18.095)	(16.661)
delta_h	-	27.155*	23.926*	28.975***	29.808***	52.172**	54.409**	1.160	2.647
		(14.858)	(14.291)	(9.775)	(9.512)	(25.758)	(24.844)	(13.116)	(12.532)
tax_s	+	0.263	0.352	0.119	0.201	0.036	-0.275	0.305	0.093
		(0.811)	(0.791)	(0.797)	(0.783)	(1.431)	(1.388)	(1.060)	(1.044)
tax_h	-	-1.956**	-1.724**	-0.676	-0.596	-0.230	-0.234	0.699	0.907
		(0.893)	(0.861)	(0.887)	(0.874)	(1.460)	(1.419)	(1.310)	(1.261)
politics_s	?	0.014	0.014	-0.069	-0.021	0.174	0.181	0.188	0.151
		(0.152)	(0.148)	(0.125)	(0.124)	(0.153)	(0.147)	(0.130)	(0.127)
politics_h	+	0.097	0.106	0.083	0.088	0.186	0.197	0.173	0.156
		(0.133)	(0.132)	(0.084)	(0.083)	(0.257)	(0.249)	(0.144)	(0.139)
remote_s	-	-0.219	-0.042	1.222	1.619	-2.715	-1.918	1.010	0.004
		(2.207)	(2.162)	(1.962)	(1.929)	(3.885)	(3.669)	(3.873)	(3.619)
remote_h	-	-4.642**	-4.616**	-6.677***	-6.108***	-1.932	-1.292	-15.331***	-12.843***
		(2.156)	(2.128)	(2.258)	(2.216)	(4.322)	(4.075)	(4.062)	(3.852)
startup_h	-	-0.143***	-0.130***	-0.051	-0.042	0.009	0.012	0.010	0.021
		(0.040)	(0.040)	(0.032)	(0.032)	(0.074)	(0.071)	(0.053)	(0.051)
phi_h	+	5.258***	3.337**	1.353*	1.360*	0.782	3.053	2.450**	2.343**
		(1.755)	(1.598)	(0.771)	(0.766)	(3.070)	(2.523)	(1.087)	(1.159)
BIT	+	-0.350	-0.387	0.057	0.040	0.452	0.354	0.147	0.175
		(0.252)	(0.247)	(0.143)	(0.141)	(0.301)	(0.282)	(0.139)	(0.137)
PTA	+	0.430***	0.430***	0.040	0.049	0.196	0.098	-0.035	-0.056
		(0.151)	(0.153)	(0.101)	(0.100)	(0.208)	(0.197)	(0.160)	(0.157)
currency	+	0.314**	0.307**		0.246		1.189		1.935**
		(0.155)	(0.148)		(0.308)		(1.322)		(0.856)
ldist	-		-0.512***		-0.810***		-0.705***		-0.553***
			(0.097)		(0.082)		(0.098)		(0.097)
border	+		0.124		0.101		0.377		0.393*
			(0.229)		(0.466)		(0.445)		(0.201)
language	+		0.844***		0.469***		0.985***		0.412**
			(0.178)		(0.181)		(0.216)		(0.183)
colonizer	+		0.947**		0.322		1.068***		0.338
			(0.457)		(0.451)		(0.379)		(0.232)
colony	+		0.860***		1.457***		1.031***		1.071***
			(0.231)		(0.251)		(0.290)		(0.269)
legal	+		-0.115		-0.401***		0.040		-0.020
			(0.125)		(0.107)		(0.137)		(0.157)
religion	+		0.056		0.135***		0.023		0.037
			(0.035)		(0.025)		(0.028)		(0.023)
N		6913	6913	7347	7347	3155	3155	3402	3402