Corporate Taxation and Bilateral FDI with Threshold Barriers

By

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Corporate Taxation and Bilateral FDI with Threshold Barriers*

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Abstract

This paper brings out the special mechanism through which taxes influence bilateral FDI, when investment decisions are two-fold in the presence of fixed setup flows costs. For each pair of source-host countries, there is a set of factors determining whether aggregate FDI flows will occur at all, and a different set of factors determining the volume of FDI flows (provided that they occur). We demonstrate that the notion that the mere international tax differentials are a key factor behind the direction and magnitude of FDI flows is too simple. We argue that the source country tax rate works primarily on the selection process, whereas the host-country tax rate affect mainly the magnitude of the FDI, once they occur. We analyze international panel data with 24 OECD countries over the period 1981-1998 by the Heckman selection method to bring evidence in support of this argument.

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1 Introduction

"European countries have been steadily slashing corporate-tax rates as they vie for foreign investment, potentially adding to pressure on the U.S. for similar cuts as it weighs a tax overhaul. Following the lead of Ireland, which dropped its rates to 12.5% from 24% between 2000 and 2003, one nation after another has moved toward flatter, lower corporate rates with fewer loopholes" (Wall Street Journal Europe, January 28-30, 2005).1,2

Indeed, the economic literature has extensively dealt with the effects of taxation on investment, going back to the well-known works of Harbeger (1962) and Hall and Jorgenson (1967). Of particular interest in this era of increasing globalization are the effects of international differences in tax rates on foreign direct investment (FDI); see, for instance, Auerbach and Hassett (1993), Hines (1999), Desai and Hines (2001), De Mooij and Ederven (2001), and Devereux and Hubbard (2003).

In this paper we attempt to provide a new look at the mechanisms through which corporate tax rates influence aggregate FDI flows. Specifically, we assume "lumpy" setup costs for new investment. This specification, which has been recently supported empirically by Caballero and Engel (1999, 2000), creates a situation in which FDI decisions are two-fold: whether to export FDI at all, and, if so, how much. These decisions are pair-wise: that is, they are made by each source country with respect to each host country, as the "lumpy" cost is specific for each source-host pair. In this context, the source and host tax rates may have different effects on these two decisions.

We begin with the observation that there are in fact no investment flows for many source-host pair countries, as indeed our lumpy setup cost model suggests. We employ a Heckman estimation approach to ask which source-host pairs have any investment at all and to investigate which are the determinants of these flows in those pairs that have. We employ panel data for OECD countries for the period 1981 to 1998.3

The organization of this paper is as follows. The next section provides a simple conceptual framework for the analysis of the effects of taxation on two-fold FDI decisions. Section 3 presents the data and empirical findings. Section 4 concludes.

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1In fact, Ireland had during the 1990’s corporate tax rates of only 10% on certain activities. Under pressure from the EU, it has limited the applicability of this low rate to certain regimes (e.g. the Shannon Free Zone).
2The tax rate was 28% in 1999.
3For a recent survey of the empirical literature about the determinants (including taxes) of FDI, see Blonigen (2005).
2 Source and Host Taxation

Elsewhere (Razin, Rubinstein and Sadka (2004)) we emphasize the two-fold nature of investment decisions. In the presence of fixed setup costs of new investment, a firm determines how much to invest according to the standard marginal productivity conditions. For this decision, the setup costs play no role. But in the presence of fixed setup costs, the profits, that are generated when the firm carries out the amount of investment called for by marginal productivity conditions, may be negative. Therefore, the firm faces also a decision whether to incur the setup costs and invest at all. Thus, the investment decision of the firm is two-fold: whether to invest at all, and if so, how much to invest. Indeed, in Razin, Rubinstein and Sadka (2004) we provide evidence in support of this two-fold mechanism of investment in the context of foreign direct investment. Looking at aggregate FDI inflows and outflows among all potential source-host pairs of OECD countries, we find a large proportion of such pairs with no FDI flows at all. Following the two-fold decision mechanism, we accordingly estimate jointly a selection equation (whether to invest all) and a flow equation (how much to invest). The estimation results point out to the importance of fixed setup costs of new investments for the determination of aggregate FDI flows.

Consider for concreteness the case of a parent firm that weighs the development of a new product line. We can think of the fixed setup costs as the costs of developing the product line. The firm may choose to make the development at home and then carry the production at a subsidiary abroad. This choice may be determined by some "genuine" economic considerations such as source-host differences in labor costs, in infrastructure, in human capital, etc. But it may also be influenced by tax considerations. Of course, the fixed setup cost is not limited only to R&D, but may include also the cost of orientation in a foreign country - such as learning and adopting a new language, a new judicial system, a set of new political norms and institutions, etc.

In this context of FDI, there arises the issue of double taxation. The income of a foreign affiliate is typically taxed by the host country. If the source country taxes this income too, then the combined (double) tax rate may be very high, and even exceeds 100%\(^4\). This double taxation is typically relieved at the source country by either exempting foreign-source income altogether or granting tax credits\(^5\). In the former case, foreign-source income is subject to the tax levied by the host country only. When the source country taxes its resident on their world-wide income and grants full credit for foreign taxes, then in principle the foreign-source income is taxed at the source-country tax rate, so that the host-country tax rate becomes irrelevant for investment decisions in the source country. But, in practice, foreign-source income is far from being taxed at the source country rate. First, there are various reduced tax rates for foreign-source income. Second, foreign-source income is usually taxed only upon repatriation,\(^4\)For a succinct review of this issue see, for example, Hines(2001).
\(^5\)This is also the recommendation of the OECD model tax treaty (OECD, 1997). A similar recommendation is made also by the United Nations model tax treaty (U.N. 1980).
thereby effectively reducing the present value of the tax.\textsuperscript{6} Thus, in practice, the host country tax-rate is much relevant for investment decisions of the parent firm at the source country. The relevance of the host-country tax rate intensifies through transfer pricing.

To highlight the issue of source-host differences in tax rates, suppose that the source country does not tax foreign-source income at all. Denote the fixed cost of development by $c$. Now, if the host-country tax rate is lower than that of the source country, then the parent firm at the source country attempts to keep this cost at home for tax purposes. (Furthermore, there may exist some jointness to the product which enables the parent firm to produce it in multiple markets, once it is created, so that the source country may be crucial in the development process.) The firm may thus charge its subsidiary artificially low royalties for the right to produce the new product. Thus, this cost remains largely deductible in the high-tax source country. Denote the (maximized) present value of the cash flows arising from the production and sale of the new product by $v(H)$; as explained above, it depends (negatively) on the corporate tax rate ($\tau_H$) levied by the host country. Thus, the parent firm will indulge into the project if

$$c(1 - \tau_S) \leq v(H),$$

where $\tau_S$ is the corporate tax rate in the source country\textsuperscript{7}.

As is evident from condition (1), the tax rate in the source country, $\tau_S$, affects positively the decision by a parent firm in country $S$ whether to carry a foreign direct investment in country $H$; whereas the tax rate in the host country, $\tau_H$, has a negative effect on this decision.

The amount of foreign direct investment is determined by the standard marginal productivity conditions derived from the maximization of the present value of the cash flows of the foreign subsidiary, after taxes paid in the host country. Therefore, the tax rate in host country ($\tau_H$) has a negative effect on the flow of FDI from $S$ to $H$; whereas the tax rate in the source country ($\tau_S$) is irrelevant for the determination of the magnitude of their flow.

### 3 The Empirical Approach

Our economic approach is based on Razin, Rubinstein and Sadka (2004), where attention is paid to the problems that arise when FDI flows are "lumpy": FDI flows are actually observed only when their profitability exceeds a certain (unobserved) threshold, as indicated by condition (1). Therefore, the Heckman selection-bias method is adopted to jointly estimate the likelihood of surpassing this threshold (the "selection" equation) and the magnitude of the FDI

\textsuperscript{6}See also Hines and Rice (1994) for a detailed discussion of the benefit of tax deferral.

\textsuperscript{7}When the tax-allowed depreciation is close to the true physical (or economic) depreciation, investments are financed primarily by debt, then $v(\tau_H)$ may be approximated by $(1 - \tau_H)v_0$, where $v_0$ is the pre-tax present value of the cash flows of the subsidiary; see, for instance, Auerbach (2002), and Hasse and Hubbard (1996). In this case, condition (1) is approximated by $c[1 - (\tau_S - \tau_H)] \leq v_0$, where we note that $(1 - \tau_S)/(1 - \tau_H)$ is approximated by $1 - (\tau_S - \tau_H)$.
flow, provided that the threshold is indeed surpassed (the "flow" equation). We briefly describe this procedure in this section.\footnote{Eaton and Tamura (1996) introduced the use of a threshold tobit estimation to deal with zeros in trade or FDI bilateral flows. The potential for zero FDI activity is also recognized by Brainard (1997) who studies the method multinationals use to serve markets. In robustness checks she provides generalized tobit estimates that include a probit for the probability of any affiliate sales, combined with the OLS for the import share, where affiliate sales are observed. In Razin, Rubinstein and Sadka (2004) we demonstrate the shortcomings of the tobit methodology in dealing with zeros in FDI bilateral flows.}

Specify the flow equation as

$$Y_{ijt} = X_{ijt} \beta + u_{ijt},$$

where $Y_{ijt}$ is the flow of FDI from source country $i$ to host country $j$ in period $t$; $X_{ijt}$ is a vector of explanatory variables; $\beta$ is a coefficient vector; and $u_{ijt}$ is an error term. The associated profit equation is specified by

$$\pi_{ijt}/\sigma_{\pi'} = (W_{ijt}\gamma + Y_{ijt}\alpha - C_{ijt})/\sigma_{\pi'},$$

where $\pi_{ijt}$ is the net profit (possibly negative; $W_{ijt}$ is a vector of explanatory variables; $C_{ijt}$ is the fixed cost of setting up new investment; $\gamma, \alpha$ is a vector of coefficients; and $\sigma_{\pi'}$ is the standard deviation of profits. The setup cost $C_{ijt}$ is given by

$$C_{ijt} = A_{ijt}\delta + v_{ijt},$$

where $A_{ijt}$ is a vector of explanatory variables; $\delta$ is a vector of coefficients; and $v_{ijt}$ is an error term. Substituting for $Y_{ijt}$ and $C_{ijt}$ in equation (3) from equations (2) and (4), respectively, we get:

$$\pi_{ijt} = Z_{ijt}\theta + \varepsilon_{ijt},$$

where $Z_{ijt} = (W_{ijt}, X_{ijt}, A_{ijt}); \theta = (\gamma/\sigma_{\pi'}, \alpha\beta/\sigma_{\pi'}, -\delta/\sigma_{\pi'});$ and

$$\varepsilon_{ijt} = (\alpha u_{ijt} - v_{ijt})/\sigma_{\pi'}.$$  

Assuming that $u_{ijt}$ and $v_{ijt}$ are normally distribute with zero means, it follows that $\varepsilon_{ijt} \sim N(0,1)$. The error terms $u_{ijt}$ and $\varepsilon_{ijt}$ are bivariate normal:

$$
\begin{pmatrix}
  u_{ijt} \\
  \varepsilon_{ijt}
\end{pmatrix} 
\sim N
\begin{pmatrix}
  0 \\
  0
\end{pmatrix}
, 
\begin{pmatrix}
  \sigma^2_{\pi'} & \rho_{\pi}\sigma_{\pi}\sigma_Y \\
  \rho_{\pi}\sigma_{\pi}\sigma_Y & \sigma^2_Y
\end{pmatrix}.
$$

Define the following index function:

$$D_{ijt} = \begin{cases} 
  1 & \text{if } \pi_{ijt} \geq 0 \\ 
  0 & \text{otherwise}
\end{cases}.$$

The expected value of $Y_{ijt}$, conditional on the event that there is indeed a positive FDI flow, is given by
\[ E(Y_{ijt}/D_{ijt} = 1) = X_{ijt}\beta + E(u_{ijt}/D_{ijt} = 1) = X_{ijt}\beta + \beta_\lambda \lambda_{ijt}, \quad (9) \]

where

\[ \beta_\lambda = \rho_\gamma \pi \sigma_Y \]

and

\[ \lambda_{ijt} = \frac{\phi(\hat{\pi}_{ijt})}{\Phi(\hat{\pi}_{ijt})} \]

is the inverse Mills ratio; \( \phi \) and \( \Phi \) are the probability and cumulative unit-normal distribution functions, respectively; and \( \hat{\pi}_{ijt} \) is the projected standardized profit (that is, \( \hat{\pi}_{ijt} = Z_{ijt}\theta \), where \( \theta \) is the estimate of \( \theta \)). Note that we do not observe \( \pi_{ijt} \), but we do observe \( D_{ijt} \). Because \( \text{Prob}(D_{ijt} = 1) = \text{Prob}(\pi_{ijt} \geq 0) \), it follows from equation (5) that

\[ \text{Prob}(D_{ijt} = 1) = \Phi(Z_{ijt}\theta). \]

Equations (2) and (11) are the flow and selection equations, respectively. We estimate \( \beta \) (the flow coefficients) and \( \theta \) (the selection coefficients) by employing the well-know Heckman method (1979). The latter was first applied to cross section [Heckman (1974)]. In the context of FDI flows, one cannot separate country fixed effects from country-pair fixed effects with a cross-section data. Kean, Moffitt and Runkle (1988) control for selection and time-invariant heterogeneity by applying Heckman method to panel data. Similarly, as we employ panel data, we can control for selection and country-pair fixed effects.

4 Empirical Evidence

As was already pointed out in section 2, there are indeed H-S pairs for which no FDI flows appear in the data (covering 18 years). This probably indicates that the FDI flows called for by the standard marginal productivity conditions are not large enough to surpass a certain threshold level as the one described in condition (1), rather than that the desired flows, in the absence of a threshold, are actually zero. The traditional Ordinary Least Squares (OLS) methods treat the no-flow observations as either literally indicating zero flows, and assign a value of zero for the FDI in these observations, or discard these observations altogether. In both cases the estimates are biased.

We employ 3-year averages, so that we have six periods (each consisting of 3 years). The main variables we employ are: (1) standard country characteristics, such as GDP or GDP per-capita, population, educational attainment (as measured by average years of schooling), language, financial risk ratings, etc.; (2) S-H source-host pair, characteristics, such as S-H FDI flows, geographical distance, common language (zero-one variable), S-H flows of goods, bilateral telephone traffic per-capita as a proxy for informational distance, etc.; (3)
corporate-tax rates\textsuperscript{9}. Table 1 describes the list of the 24 countries in the sample, and whether they are observed in the sample (at least once) as a source or host country (but most source countries do not have positive flows more than with few host countries), and Table 2 describes the data sources.

The data employed in the empirical analysis are drawn from OECD reports (OECD, various years) on a sample of 24 OECD countries, over the period from 1981 to 1998. The FDI data are based on the OECD reports of FDI exports from 17 OECD source countries to 24 OECD host countries\textsuperscript{10}.

4.1 Baseline Results

Table 3 presents the effects of several potential explanatory variables of the two-fold decisions on FDI flows (baseline estimates). Our focus is on the role of the source and host corporate-tax rates. We analyze country-pair shocks as we use aggregate country-pair data.\textsuperscript{11}

But we naturally include in the empirical analysis a host of standard explanatory/control variables that are employed in studies of the determination of FDI flows. We briefly discuss these determinants first. They are analyzed in details in Razin, Rubinstein and Sadka (2004). These variables includes standard "mass" variables (the source and the host population sizes); "distance" variables (physical distance between the source and host countries and whether or not the two countries share a common language); and "economic" variables (source and host GDP per capita, source-host differences in average years of schooling, and source and host financial risk ratings). In addition, we include a dummy variable (previous FDI) to indicate whether or not the source-host pair of countries have already established FDI relations between them in the past; such past relations may have some bearing on the setup costs of establishing a new relation. Also, as in other international cross-section studies as well, there is the issue of endogeneity between some or all of the explanatory variables and the dependent variables. In our case, for example, some weak macroeconomic fundamentals in a host country may lead simultaneously to low FDI flows and tax rates. As finding appropriate instruments may be impossible or certainly hard, we follow the common procedure of handling the endogeneity issue by including country-fixed effects.

As explained in detail in Razin, Rubinstein and Sadka (2004), the OLS estimates of the effects of these variables are biased. This is true for both the OLS-D regression, where the observations with no FDI flows are discarded

\textsuperscript{9}We simply apply the statutory rates, because they are exogenously given. Average effective tax rates, suggested by Deverux and Griffith (2003) as determinants of the location of investments, are endogenous in the sense that they are determined by the amount of investment. To apply econometrically average effective tax rates, there is a need for a good instrument. The statutory rate is the best available instrument.

\textsuperscript{10}The OECD reports accurately on \textit{all} rich and poor countries that are a host to OECD FDI exports. But data are missing for non-OECD countries as a source of FDI exports. This is the reason that we restrict our sample to the group of OECD countries, as potential source and host countries, among themselves, with no missing data.

\textsuperscript{11}For an analysis of micro-data see, e.g., Devereux and Griffith (1998).
(leaving only 851 observations out of the 2116 observations in the full sample); and for the OLS-Zero regressions, where the no-flow observations were recorded as having FDI flows of zero\textsuperscript{12}. Note that the difference in the coefficients between OLS-D and OLS-Zero indicate that there exist non-linear relationships between the dependent variable and the independent variables. The Heckman method is suitable for estimating such non-linear relationships. The Heckman joint estimation of the flow and selection equations are presented in the last two columns. We exclude certain variables from the flow equation for identification. The results are more or less in line with findings in Razin, Rubinstein and Sadka (2004). For instance, a high gap in education in favor of the source country reduces the probability of having FDI flows to the host country. This is expected because a gap in years of schooling may be a proxy for a productivity gap; see also Lucas (1990). The host financial risk rating affects positively the flow of FDI, whereas the analogous variable of the source country is negative and significant in the selection equation. Finally, the existence of past FDI relations is positive and significant in the selection equation, as it may help to reduce the setup costs of establishing a new FDI flow.

We turn now to the main focus of the paper - the effect of corporate-tax rates. First, the source corporate-tax rate is positive and significant in the selection equation, as indeed predicted by condition (1) of the preceding section. This rate plays no statistically significant role in the flow equation, again in line with our analysis. The coefficient of the host corporate-tax rate is indeed negative, although insignificant in the selection equation.\textsuperscript{13} But it is negative and significant in the flow equation, again as predicted by our analysis. Note that it is not merely the source-host tax differential \((\tau_S - \tau_H)\) which is the main determinant of FDI flows.

Interestingly, the role of the source and host corporate-tax rates is not properly revealed by the traditional OLS regressions. In the first regression (OLS-D), only the host corporate-tax rate plays a statistically significant role in reducing FDI flows to the host country; whereas in the other regression (OLS-Zero), it is only the source corporate-tax rate which plays a statistically significant role in promoting FDI outflows from the source country. Thus, OLS analysis does not detect a role for both tax rates to play in the determination of FDI.

Note that the relationship in the selection equation between the probability

\textsuperscript{12}More accurately, as we measured FDI by logs, we put a large negative number for these FDI flows.

\textsuperscript{13}One may argue that since previous FDI indicates that the fiscal environment was acceptable to the investors before, it may soak up elements of the host’s fiscal environment. If host country taxes change only infrequently, the previous FDI variable may pick up the overall attractiveness of the country (taxes included), causing the host tax to appear unimportant, even if it does influence investment selection. This concern was mitigated in the baseline estimation, because we employed previous FDI as a dummy variable rather than a continuous (quantity) variable. Furthermore, country fixed effects, that we employed, soak up the correlation of the host tax rate with the country overall fiscal environment.

\textsuperscript{14}To the extent that some source country in the sample do effectively tax foreign source income, granting credits for foreign taxes paid, the host-country tax loses its importance. This may provide an alternative explanation for the absence of a significant effect of the host-country corporate tax rate in the selection equation.
(P) of making a new FDI and the explanatory variables (including \( \tau_S \)) is not linear. It is rather given by

\[
P(\tau_S) = \int_{-\infty}^{a+b\tau_S} (2\pi)^{-1/2} \exp(-y^2/2) dy,
\]

where \( a \) represents the effect of all the other explanatory variables (held fixed at their sample averages), including country fixed effects, and \( b \) is the coefficient of \( \tau_S \) in the selection equation. Note also that the estimate of \( b \) is positive and statistically significant. The marginal effect of \( \tau_S \) on \( P \) is

\[
\frac{\partial P}{\partial \tau_S} = b(2\pi)^{-1/2} \exp[-(a + b\tau_S)^2/2] > 0.15
\]

Figure 1 depicts the graph of the function \( P(\tau_S) \) for the U.S. as a source country and four EU countries (Denmark, Greece, the Netherlands and the U.K.) as host countries. The U.S.-U.K. characteristics in the sample are such that the estimated probability of a positive FDI flow from the U.S. to the U.K. is one, unaffected by the source country (namely, U.S.) tax rate. For all other three countries, the U.S. tax rate has a strong positive effect in the relevant range of 0-40%. But the marginal effects of the source-country tax rate is not the same for all three countries, being highest for Greece. Figure 2 depicts the flow equation for the U.S., as a source country, and the four EU countries as host countries. The host-country tax rate seems to have a negative effect at all rates, including the very high rates that approach 100%. Notably, the tax rate of the U.K. (as a host country) has a very strong negative marginal effect, whereas in the tax rate of Greece has a relatively small marginal effect.

\[\text{4.2 Robustness}\]

In this section we perform several robustness tests.

First, other empirical work on FDI has relied on variants of gravity equations, which include the GDP of the host and source countries. Home and host GDP are also key regressors in the FDI estimation framework carried by Carr, Markusen and Maskus (2001), or the slightly modified version proposed by Blonigen, Davies and Head (2003). Since rich and often high tax countries were responsible for much of the FDI activity over the period analyzed here, the positive coefficient on source country taxes may possibly reflect investor size. We therefore replace in Table 4, panel (a) the host and source GDP per capita and population size by the host and source GDP. The effects on FDI of the host and source corporate tax rates are intact: the source tax rate has a positive and significant coefficient in the selection equation, whereas the host tax rate has a negative and significant coefficient in the flow equation. Also, the coefficients of the host and source GDP are insignificant. (The coefficients of the host population, as a size variable, was significant in the baseline estimations - negative in the flow equation and positive in the selection equation.)

\[15\text{To complete the picture, note also that } P(\tau_S) \text{ has an inflection point at } \tau_S = -a/b.\]
The selection equation includes two variables (previous FDI dummy and source country risk rating) that are not included in the flow equation, as a device for identifying the selection equation. Indeed, a lack of previous FDI may serve as a proxy for the existence and magnitude of fixed setup costs. We therefore included a dummy for previous FDI flow in the selection equation, but not in the flow equation. As a robustness test, we included also the previous FDI dummy in the flow equation. The results are reported in Table 4, panel (b). Indeed, the coefficient of the previous FDI dummy is insignificant in the flow equation. Our main results concerning the host and source corporate tax rates remain intact.

A further robustness test with respect to the previous FDI as an exclusion restriction variables is reported in Table 4, panel (c). We replace the previous FDI dummy by previous FDI stock. Due to a lack of sufficient data on FDI stocks, the sample size reduces from 2116 to just 1036 observations. Even in this smaller sample (with a different restriction exclusion variable), our main results remain intact: the coefficient of the source tax rate is positive and significant in the selection equation, whereas the host tax rate is negative and significant in the flow equation.

The results of another robustness test are reported in Table 4, panel (d). We added the lagged host and source tax rates to both the flow and selection equations. The lagged tax variables prove to be significant, underscoring the importance of the contemporaneous tax variables; as in the baseline case.

We also include country-pair fixed effects in order to control for selection and time-invariant heterogeneity. The results are reported in Table 4, panel (e). The effects of source and host corporate tax rates remain as in the baseline case: the coefficient of the source tax rate is positive and significant in the selection equation, but much lower and insignificant in the flow equation; whereas the coefficient of the host tax rate is negative and significant in the flow equation, but insignificant in the selection equation.

5 Conclusion

We analyze the effects of taxes on bilateral FDI flows. Evidently, economists and policymakers reckon with the fact that taxes do affect economic activity. Bilateral FDI flows are no exception. Our aim is to bring out the special mechanisms through which taxes influence FDI, when investment decisions are likely to be two-fold because of the existence of fixed setup costs of new investments. Specifically, for each pair of source-host countries, there is a set of factors determining whether aggregate FDI flows will occur, and a different set of factors determining the volume of FDI flows, given that they at all occur. We demonstrate that the notion that the mere international tax differentials are the main factors behind the direction and magnitude of FDI flows is too simple. We hypothesize that the source-country tax rate works primarily on the selection process, whereas the host-country tax rate affects mainly the magnitude of the
FDI, once they occur\textsuperscript{16}. Analyzing an international panel data of 24 OECD countries, we bring empirical evidence, using selection bias methods, in support of this hypothesis.

\textsuperscript{16}This finding has some bearing on the nature of international tax competition, as is evident from the citation at the beginning of the paper; for an overview of the traditional analysis of international taxation see, for instance, Frenkel, Razin and Sadka (1991), Wilson (1999), and Haufler (2001).
References


Table 1: Frequency of Source-Host Positive Flows by Countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Source</th>
<th>Host</th>
<th>Country</th>
<th>Source</th>
<th>Host</th>
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<tbody>
<tr>
<td>Australia</td>
<td>0.43</td>
<td>0.41</td>
<td>Korea</td>
<td>0.09</td>
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<td>Denmark</td>
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<td>0.33</td>
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<td>United States</td>
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Table 3: The Effects of Host and Source Corporate-Tax Rates on FDI: Baseline Estimates

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<tr>
<td><strong>Source Tax Rate</strong></td>
<td>1.880</td>
<td>2.420**</td>
<td>1.168</td>
<td>5.614**</td>
</tr>
<tr>
<td>(1.175)</td>
<td>(0.717)**</td>
<td>(1.236)</td>
<td>(1.821)**</td>
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</tr>
<tr>
<td><strong>Host Tax Rate</strong></td>
<td>-3.461**</td>
<td>-0.683</td>
<td>-3.636**</td>
<td>2.568</td>
</tr>
<tr>
<td>(1.109)**</td>
<td>(0.763)</td>
<td>(1.103)**</td>
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<td></td>
</tr>
<tr>
<td><strong>Host Real GDP per Capita</strong></td>
<td>0.088</td>
<td>0.198</td>
<td>-0.046</td>
<td>0.280</td>
</tr>
<tr>
<td>(0.704)</td>
<td>(0.463)</td>
<td>(0.723)</td>
<td>(0.889)</td>
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<tr>
<td><strong>Source Real GDP per Capita</strong></td>
<td>0.258</td>
<td>0.311</td>
<td>0.095</td>
<td>-4.697**</td>
</tr>
<tr>
<td>(0.757)</td>
<td>(0.318)</td>
<td>(0.774)</td>
<td>(2.390)*</td>
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</tr>
<tr>
<td><strong>Host Population</strong></td>
<td>-4.810*</td>
<td>0.592</td>
<td>-6.524**</td>
<td>10.147**</td>
</tr>
<tr>
<td>(2.332)*</td>
<td>(1.641)</td>
<td>(2.350)*</td>
<td>(2.906)**</td>
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</tr>
<tr>
<td><strong>Source Population</strong></td>
<td>0.330</td>
<td>0.973</td>
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<tr>
<td>(2.843)</td>
<td>(1.508)</td>
<td>(2.748)</td>
<td>(3.732)</td>
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<td><strong>Source-Host Difference in Schooling</strong></td>
<td>-0.009</td>
<td>-0.066</td>
<td>0.034</td>
<td>-0.287**</td>
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<tr>
<td>(0.093)</td>
<td>(0.056)</td>
<td>(0.102)</td>
<td>(0.107)**</td>
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</tr>
<tr>
<td><strong>Common Language</strong></td>
<td>0.922**</td>
<td>0.453**</td>
<td>0.892**</td>
<td>0.392**</td>
</tr>
<tr>
<td>(0.136)**</td>
<td>(0.119)**</td>
<td>(0.123)**</td>
<td>(0.189)**</td>
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<tr>
<td><strong>Source-Host Distance</strong></td>
<td>-0.689**</td>
<td>-0.389**</td>
<td>-0.663**</td>
<td>-0.415**</td>
</tr>
<tr>
<td>(0.087)**</td>
<td>(0.069)**</td>
<td>(0.082)**</td>
<td>(0.099)**</td>
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</tr>
<tr>
<td><strong>Host Financial Risk Rating</strong></td>
<td>0.049**</td>
<td>0.005</td>
<td>0.060**</td>
<td>-0.023</td>
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<tr>
<td>(0.017)**</td>
<td>(0.012)</td>
<td>(0.017)**</td>
<td>(0.026)</td>
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<tr>
<td><strong>Source Financial Risk Rating</strong></td>
<td>-0.082**</td>
<td>-0.036**</td>
<td>0.060**</td>
<td>-0.138**</td>
</tr>
<tr>
<td>(0.090)**</td>
<td>(0.011)**</td>
<td>(0.050)**</td>
<td></td>
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</tr>
<tr>
<td><strong>Previous FDI</strong></td>
<td>0.395**</td>
<td>1.526**</td>
<td>0.630**</td>
<td>0.148**</td>
</tr>
<tr>
<td>(0.129)**</td>
<td>(0.200)**</td>
<td>(0.148)**</td>
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</tr>
<tr>
<td><strong>Number of Observations</strong></td>
<td>851</td>
<td>2116</td>
<td>2116</td>
<td>2116</td>
</tr>
</tbody>
</table>

**Notes:**
(a) All estimations include country and time fixed effects
(b) Robust standard errors appear in parentheses
* Indicates significance at the five percent level;
** Indicates significance at the one percent level;
1 In fractions
2 In logs, lagged one period
3 In average years of schooling, lagged one period
4 One for common language; zero otherwise
5 In logs
6 Lagged one period
7 One for existence of previous FDI; zero otherwise
Table 4: The Effects of Host and Source Corporate-Tax Rates on FDI: Robustness Tests
(a) GDP as a size variable

<table>
<thead>
<tr>
<th></th>
<th>OLS-D</th>
<th>OLS-Zero</th>
<th>Heckman Estimation</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Flow</td>
<td>Selection</td>
<td></td>
</tr>
<tr>
<td>Source Tax Rate</td>
<td>1.970</td>
<td>2.367**</td>
<td>1.256 (1.149)**</td>
</tr>
<tr>
<td>Host Tax Rate</td>
<td>-3.046</td>
<td>-0.718 (0.739)</td>
<td>-3.109 (1.149)**</td>
</tr>
<tr>
<td></td>
<td>(1.154)</td>
<td>(0.703)**</td>
<td>(1.217) (1.800)**</td>
</tr>
<tr>
<td>Host Real GDP per capita</td>
<td>0.045</td>
<td>0.199 (0.462)</td>
<td>-0.109 (0.722)</td>
</tr>
<tr>
<td>Host Real GDP</td>
<td>(0.7)</td>
<td>(0.894)</td>
<td>0.363 (0.737)</td>
</tr>
<tr>
<td>Source Real GDP per capita</td>
<td>0.261</td>
<td>0.317 (0.318)</td>
<td>0.075 (0.756)</td>
</tr>
<tr>
<td>Source Real GDP</td>
<td>(0.737)</td>
<td>(0.119)**</td>
<td>-4.581 (2.414)</td>
</tr>
<tr>
<td>Host Population</td>
<td>0.031</td>
<td>0.068 (0.056)</td>
<td>-0.012 (0.096)</td>
</tr>
<tr>
<td>Source Population</td>
<td>(0.089)</td>
<td>(0.054)</td>
<td>0.251 (0.097)**</td>
</tr>
<tr>
<td>Source-Host Difference in Schooling</td>
<td>0.923</td>
<td>0.453 (0.119)**</td>
<td>0.891 (0.123)**</td>
</tr>
<tr>
<td>Common Language</td>
<td>(0.137)**</td>
<td>(0.069)**</td>
<td>0.394 (0.185)**</td>
</tr>
<tr>
<td>Source-Host Distance</td>
<td>-0.694</td>
<td>-0.389 (0.087)**</td>
<td>-0.667 (0.083)**</td>
</tr>
<tr>
<td>Host Financial Distance</td>
<td>(0.087)**</td>
<td>(0.069)**</td>
<td>-0.403 (0.098)**</td>
</tr>
<tr>
<td>Source Financial Risk Rating</td>
<td>0.038</td>
<td>-0.004 (0.011)</td>
<td>0.046 (0.015)**</td>
</tr>
<tr>
<td>Source Financial Risk Rating</td>
<td>(0.016)*</td>
<td>(0.111)</td>
<td>-0.002 (0.025)</td>
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<tr>
<td>Previous FDI (dummy)</td>
<td>-0.084</td>
<td>-0.035 (0.030)**</td>
<td>-0.128 (0.050)*</td>
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<tr>
<td>Previous FDI (dummy)</td>
<td>(0.030)**</td>
<td>(0.010)**</td>
<td>-0.128 (0.050)*</td>
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<td>Number of Observations</td>
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*significant at 5%; **significant at 1%
(b) Lagged FDI dummy included in the flow and selection equations

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<th>Source Tax Rate</th>
<th>1.880 (1.175)</th>
<th>2.420 (0.717)**</th>
<th>1.489 (1.223)</th>
<th>5.804 (1.807)**</th>
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<tbody>
<tr>
<td>Host Tax Rate</td>
<td>-3.461 (1.109)**</td>
<td>-0.683 (0.763)</td>
<td>-3.600 (1.076)**</td>
<td>2.292 (1.532)</td>
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<tr>
<td>Host Real GDP per capita</td>
<td>0.088 (0.704)</td>
<td>0.198 (0.463)</td>
<td>-0.016 (0.699)</td>
<td>0.510 (0.930)</td>
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<tr>
<td>Host Real GDP</td>
<td>0.258 (0.757)</td>
<td>0.311 (0.318)</td>
<td>0.199 (0.751)</td>
<td>-4.407 (2.583)</td>
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<td>Host Population</td>
<td>-4.810 (2.332)*</td>
<td>0.592 (1.641)</td>
<td>-5.803 (2.442)*</td>
<td>10.579 (2.919)**</td>
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<td>Source Population</td>
<td>0.330 (2.843)</td>
<td>0.973 (1.508)</td>
<td>0.311 (2.748)</td>
<td>-2.327 (3.838)</td>
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<td>Source-Host Difference</td>
<td>0.009 (0.093)</td>
<td>0.066 (0.056)</td>
<td>-0.016 (0.099)</td>
<td>0.283 (0.109)**</td>
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<td>Common Language</td>
<td>0.922 (0.136)**</td>
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<td>0.896 (0.122)**</td>
<td>0.370 (0.199)</td>
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<tr>
<td>Source-Host Distance</td>
<td>-0.689 (0.087)**</td>
<td>-0.389 (0.069)**</td>
<td>-0.668 (0.084)**</td>
<td>-0.401 (0.112)**</td>
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<td>Host Financial Risk Rating</td>
<td>0.049 (0.017)**</td>
<td>-0.005 (0.012)</td>
<td>0.053 (0.017)**</td>
<td>-0.031 (0.027)</td>
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<td>Source Financial Risk Rating</td>
<td>-0.082 (0.030)**</td>
<td>-0.036 (0.011)**</td>
<td>-0.069 (0.030)*</td>
<td>-0.114 (0.049)*</td>
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<td>Previous FDI (dummy)</td>
<td>0.395 (0.129)**</td>
<td>1.526 (0.200)**</td>
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<td>0.571 (0.157)**</td>
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<td>2116</td>
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*significant at 5%; **significant at 1%
(c) Lagged FDI flows as an exclusion restriction

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<td>(1.468)</td>
<td>(0.768)*</td>
<td>(1.350)</td>
<td>(5.300)</td>
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<tr>
<td>Host Tax Rate</td>
<td>−0.708</td>
<td>−0.589</td>
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<td>(1.257)*</td>
<td>(0.753)</td>
<td>(1.253)**</td>
<td>(9.984)</td>
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<tr>
<td>Host Real GDP per capita</td>
<td>0.298</td>
<td>0.287</td>
<td>0.131</td>
<td>−0.693</td>
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<td>(0.498)</td>
<td>(0.764)</td>
<td>(5.271)</td>
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<td>0.039</td>
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<td>(0.877)</td>
<td>(0.317)</td>
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<td>(6.018)</td>
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<td>0.046</td>
<td>−0.038</td>
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<td>(0.398)</td>
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<td>(0.895)**</td>
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<td>(5.203)</td>
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<td>Source-Host Difference in Schooling</td>
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<td>0.415</td>
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<tr>
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<td>(0.101)</td>
<td>(0.058)</td>
<td>(0.126)</td>
<td>(0.398)</td>
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<td>(0.092)**</td>
<td>(0.070)**</td>
<td>(0.126)**</td>
<td>(0.523)</td>
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<td>Source-Host Distance</td>
<td>−0.378</td>
<td>−0.214</td>
<td>−0.638</td>
<td>0.098</td>
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<td>(0.059)**</td>
<td>(0.041)**</td>
<td>(0.086)**</td>
<td>(0.334)**</td>
</tr>
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<td>Host Financial Risk Rating</td>
<td>0.016</td>
<td>−0.006</td>
<td>0.059</td>
<td>−0.058</td>
</tr>
<tr>
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<td>(0.016)**</td>
<td>(0.012)</td>
<td>(0.018)**</td>
<td>(0.102)</td>
</tr>
<tr>
<td>Source Financial Risk Rating</td>
<td>−0.074</td>
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<td>(0.036)*</td>
<td>(0.012)</td>
<td>(0.037)**</td>
<td>(0.184)</td>
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<td>(0.044)**</td>
<td>(0.037)**</td>
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<td>(0.160)</td>
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*significant at 5%; **significant at 1%
(d) Contemporaneous and lagged tax rates

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<tr>
<th>Source Tax Rate</th>
<th>OLS-D</th>
<th>OLS-Zero</th>
<th>Heckman Estimation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source Tax Rate (lagged)</td>
<td>-0.398 (1.220)</td>
<td>0.763 (0.827)**</td>
<td>-0.833 (1.269)</td>
</tr>
<tr>
<td>Host Tax Rate</td>
<td>-3.080 (1.133)**</td>
<td>-0.480 (0.769)</td>
<td>-3.257 (1.124)**</td>
</tr>
<tr>
<td>Host Tax Rate (lagged)</td>
<td>-1.190 (1.118)</td>
<td>-0.679 (0.741)</td>
<td>-1.126 (1.153)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Host Real GDP per capita</th>
<th>OLS-D</th>
<th>OLS-Zero</th>
<th>Heckman Estimation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Host Real GDP per capita</td>
<td>0.030 (0.713)</td>
<td>0.309 (0.498)</td>
<td>0.165 (0.729)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Source Real GDP per capita</th>
<th>OLS-D</th>
<th>OLS-Zero</th>
<th>Heckman Estimation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source Real GDP per capita</td>
<td>0.297 (0.727)</td>
<td>0.182 (0.363)</td>
<td>0.170 (0.748)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Host Population</th>
<th>OLS-D</th>
<th>OLS-Zero</th>
<th>Heckman Estimation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Host Population</td>
<td>-4.646 (2.343)*</td>
<td>0.753 (1.670)</td>
<td>-6.338 (2.361)**</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Source Population</th>
<th>OLS-D</th>
<th>OLS-Zero</th>
<th>Heckman Estimation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source Population</td>
<td>0.189 (2.840)</td>
<td>0.794 (3.536)</td>
<td>-0.936 (2.744)</td>
</tr>
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</table>

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<thead>
<tr>
<th>Source-Host Difference in Schooling</th>
<th>OLS-D</th>
<th>OLS-Zero</th>
<th>Heckman Estimation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source-Host Difference in Schooling</td>
<td>0.017 (0.101)</td>
<td>0.086 (0.058)</td>
<td>-0.035 (0.113)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Common Language</th>
<th>OLS-D</th>
<th>OLS-Zero</th>
<th>Heckman Estimation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common Language</td>
<td>0.922 (0.136)**</td>
<td>0.452 (0.119)**</td>
<td>0.892 (0.122)**</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Source-Host Distance</th>
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<th>Heckman Estimation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source-Host Distance</td>
<td>-0.689 (0.087)**</td>
<td>-0.389 (0.069)**</td>
<td>-0.663 (0.082)**</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Host Financial Risk Rating</th>
<th>OLS-D</th>
<th>OLS-Zero</th>
<th>Heckman Estimation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Host Financial Risk Rating</td>
<td>0.046 (0.017)**</td>
<td>-0.007 (0.013)</td>
<td>0.058 (0.017)**</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
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<th>OLS-D</th>
<th>OLS-Zero</th>
<th>Heckman Estimation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source Financial Risk Rating</td>
<td>-0.082 (0.031)**</td>
<td>-0.034 (0.012)**</td>
<td>-0.135 (0.050)*</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Previous FDI (dummy)</th>
<th>OLS-D</th>
<th>OLS-Zero</th>
<th>Heckman Estimation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Previous FDI (dummy)</td>
<td>0.395 (0.128)**</td>
<td>1.530 (0.200)**</td>
<td>0.618 (0.149)**</td>
</tr>
</tbody>
</table>

Number of Observations | 851 | 2116 | 2116 | 2116

*significant at 5%; **significant at 1%
(e) Country-pair fixed effects

<table>
<thead>
<tr>
<th>Source Tax Rate</th>
<th>OLS</th>
<th>OLS-Zero</th>
<th>Heckman Estimation</th>
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<tbody>
<tr>
<td></td>
<td>OLS-D</td>
<td>OLS-Zero</td>
<td>Flow</td>
</tr>
<tr>
<td>Host Tax Rate</td>
<td>2.381 (0.744)**</td>
<td>0.747 (0.816)</td>
<td>3.344 (1.122)**</td>
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<tr>
<td>Source Tax Rate</td>
<td>1.482 (1.301)</td>
<td>0.208 (0.478)</td>
<td>0.001 (0.729)</td>
</tr>
<tr>
<td>Host Real GDP per capita</td>
<td>0.044 (0.832)</td>
<td>0.384 (0.320)</td>
<td>0.112 (0.756)</td>
</tr>
<tr>
<td>Source Real GDP per capita</td>
<td>0.218 (0.854)</td>
<td>0.384 (0.320)</td>
<td>0.112 (0.756)</td>
</tr>
<tr>
<td>Host Population</td>
<td>3.778 (2.679)</td>
<td>1.017 (1.747)</td>
<td>0.982 (2.555)</td>
</tr>
<tr>
<td>Source Population</td>
<td>0.431 (3.281)</td>
<td>1.013 (1.611)</td>
<td>0.982 (2.555)</td>
</tr>
<tr>
<td>Source-Host Difference in Schooling</td>
<td>0.017 (0.105)</td>
<td>0.083 (0.059)</td>
<td>0.023 (0.091)</td>
</tr>
<tr>
<td>Common Language</td>
<td>1.321 (0.060)**</td>
<td>0.162 (0.030)**</td>
<td>0.773 (0.086)**</td>
</tr>
<tr>
<td>Source-Host Distance</td>
<td>-1.006 (0.054)**</td>
<td>-0.374 (0.011)**</td>
<td>-0.826 (0.026)**</td>
</tr>
<tr>
<td>Host Financial Risk Rating</td>
<td>0.037 (0.019)</td>
<td>-0.002 (0.013)</td>
<td>0.045 (0.017)**</td>
</tr>
<tr>
<td>Source Financial Risk Rating</td>
<td>-0.088 (0.034)*</td>
<td>-0.038 (0.012)**</td>
<td>-0.205 (0.078)**</td>
</tr>
<tr>
<td>Previous FDI (dummy)</td>
<td>0.429 (0.146)**</td>
<td>0.969 (0.221)**</td>
<td>-0.667 (0.231)**</td>
</tr>
<tr>
<td>Number of Observations</td>
<td>851</td>
<td>2116</td>
<td>2116</td>
</tr>
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*significant at 5%; **significant at 1%
Figure 1: A Selection Equation (from the U.S. to four EU Countries)
Figure 2: A Flow Equation (from the U.S. to four EU Countries)
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