*UCD CENTRE FOR ECONOMIC RESEARCH*

*WORKING PAPER SERIES*

*2016*

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WP16/08

August 2016

**UCD SCHOOL OF ECONOMICS**
**UNIVERSITY COLLEGE DUBLIN**
**BELFIELD DUBLIN 4**

# The Impact of Taxes on the Extensive and Intensive Margins of FDI*

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July 2016

Work in Progress. Comments appreciated.

**Abstract:** The design of optimal tax policy, especially with respect to attracting FDI, hinges on whether taxes affect multinational firms at the extensive or the intensive margins. Nevertheless, the literature has not yet explored the simultaneous impact of taxation on FDI on these two margins. Using firm-level cross-border investments into Europe during 2004-2013, we do so with a Heckman two-step estimator, an approach which also allows us to endogenize the number of investments and include home country and parent firm characteristics. We find that taxes affect both margins, particularly for firms that invest only once, with 92 percent of tax-induced changes in aggregate inbound FDI driven by movements at the extensive margin. In addition, we find significant effects of both home country and parent firm characteristics, pointing towards the granularity of investment decisions.

**JEL Codes:** F23; F14; H25.

**Keywords:** Foreign direct investment; taxation; extensive margin; intensive margin.

* This research is part of the joint Economic and Social Research Institute and the Department of Finance Research Programme on the Macro-Economy and Taxation. The views expressed in this paper are those of the authors and they should not be regarded as an official position of the Department of Finance. We thank seminar participants at the Irish Department of Finance, ETH Zürich, and Université de Genève for useful discussions. All errors are our own.

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## 1. Introduction

Given the large role foreign direct investment (FDI) plays in many economies, there has developed a sizeable literature describing the effects FDI has on economies (both the home and host) as well as the factors influencing the amount of FDI that takes place between countries. In particular, the role of taxes in affecting FDI activity has received a great deal of attention, in no small part because taxes are one of the key policy instruments that governments use to influence investment, both unilaterally and in a strategic setting. These studies include those that consider the role of taxes at the aggregate level, where FDI is commonly measured as stocks of investment, sales of affiliates, or the number of firms, and at the firm level, where the question is whether or not taxes affect whether or not a given firm invests in a given host.

To date, however, these approaches have yet to be combined in a single estimation, that is, to ask how taxes affect a given firm's decision of whether or not to invest and, conditional on investment, how they affect the size of the investment.[1] Further, existing studies have ignored the impact of the owner's (the foreign investing firm's) characteristics on these decisions. This paper fills this void by using a Heckman two-step estimator to simultaneously examine investment at the extensive (whether to invest) and intensive (how much to invest) margins using a sample of 10,845 greenfield cross-border investments involving 30 European countries from 2004-2013. Beyond estimating both the extensive and intensive margins, this empirical approach has advantages relative to those used elsewhere that include endogenizing the number of investments by a given owner and including owner and home country characteristics that do not vary across potential hosts.

Understanding the extent to which taxes alter FDI at the extensive and intensive margins is important for developing effective policy. This is because in the presence of fixed investment costs, an investment will typically have a minimum operating scale where the variable profits are just sufficient to cover these fixed costs (see, for example, Helpman, Melitz, and Yeaple (2004)). If not all of the fixed costs are tax deductible, such as when they include entrepreneurial effort, as taxes rise the affiliate eventually becomes unprofitable. As such, a rise in the tax has a marginal effect on the intensive margin (if it is distortionary) and then a discrete effect at the extensive margin. This then introduces a discontinuity in the size of FDI as a function of taxes. This discontinuity impacts the choice of the revenue-maximizing tax rate. Indeed, the welfare impacts of taxation in open economies often hinges on whether investment decisions are intensive, as in the classical models of Wilson (1986) and Zodrow and Mieszkowski (1986), or extensive, as in Haufler and Wooton (1999), with this latter approach finding that taxation generally leads to efficient investment with larger rents captured by firms. Recent models of taxation combine these, finding that even with a continuum of firms, the discrete investment decision by individual firms significantly impacts optimal equilibrium taxes, efficiency, and the distribution of surplus.[2] Beyond taxation, the extensive and intensive effects have implications for other benefits from inbound FDI since, for example, changes in the intensive margin may

[1] As discussed below, existing work either considers the size of (aggregate) investment or the probability of investment. Yeaple (2009) is an exception who considers the probability of investment and the size of FDI using a linear probability model and a separate OLS regression.

[2] Examples here include Davies and Eckel (2010), Haufler and Wooton (2010), and Krautheim and Schmidt-Eisenlohr (2011).

affect the speed of technology transfer to the local economy whereas changes at the extensive margin stop them altogether.

We find that taxes affect both margins of investment, although their impact on the extensive margin is more robust. This holds for both country-level and firm-specific tax measures. Further, our estimates suggest that approximately 92% of tax-driven changes in aggregate inbound investment levels are explained by changes at the extensive margin. This suggests that many affiliates may be established roughly at their minimum operating scale, below which investment ceases to be profitable and it is therefore better not to invest at all. An implication of this is that it suggests that taxes are more likely to affect the host economy by changes in the number of inbound investments rather than through the scale of those affiliates which can affect both the nature and desirability of using tax policy to attract investment. In addition, we find that the impact of taxes varies with owner characteristics. Specifically, we find that host taxes matter more for multinationals that invest only once during sample, a group which accounts for 80% of our investors but only 59% of investments (i.e. 41% of investments come from the 20% of firms that invest multiple times; these multi-investors also account for 59.6% of the value of FDI in our data). This may be driven by the ability of larger firms to engage in more aggressive transfer pricing, mitigating the impact of host taxes.[3] Understanding this is important in light of the OECD's current initiative to curb base erosion and profit shifting.[4] In addition, it highlights the granular effects of tax policy which, if the different types of owners create spillovers to the host economy, has implications for the use of tax policy to promote local development.[5]

Beyond the role of taxes, we find that traditional gravity variables affect the different margins of investment. Note that by virtue of using the Heckman estimator, we can include those home country factors which do not vary across potential hosts, some conditional logit cannot do. Of particular interest is that some, such as distance, affect the extensive and intensive margins in different directions. For example, the distance between the home and host countries reduces the likelihood of investment but, conditional on investing, increases the size of that investment. Such patterns would arise if larger distances increase both the fixed cost of investment and trade costs, the first increasing the desire to concentrate investment and the latter increasing the preference for proximity in a horizontal style model.[6] Beyond these traditional gravity variables, we find that barriers to inbound investment are a significant deterrent, suggesting that by combining tax hikes with reductions in red tape, it may be possible to increase revenues from FDI without lowering investment.

Finally we find that owner characteristics play a significant role which, as with home variables, cannot be done under conditional logit. Larger owners are both more likely to invest and when they do so the investment is larger. The same holds for younger owners and those that invest multiple times during the sample. Beyond this, we find that the industry of the owner matters. In particular, the financial sector seems to be especially sensitive to taxes on both margins.

[3] Using price level data, Davies, et al. (2015) find that transfer pricing is observed only for large French multinationals.
[4] See http://www.oecd.org/ctp/beps.htm for details on these efforts.
[5] The granular effects of FDI on host economies has been explored by Davies and Desbordes (2015) and Harms and Meon (2014) among others.
[6] See Markusen (1984) for a theoretical treatment of the horizontal model and Brainard (1997) for a seminal discussion of the proximity-concentration tradeoff.

Conversely, services appear to be the least sensitive to taxes with manufacturing in the middle. If services are on average more able to engage in tax-reducing transfer pricing as compared to manufacturing, this would be consistent with our results.

In the next section, we review the literature on the impact of taxes on FDI. Section 3 lays out our empirical methodology, including a comparison of its relative benefits and shortcomings relative to those used elsewhere. Section 4 describes the data, including the measures of taxation we use. Section 5 contains our results, ending with a decomposition of changes in aggregate FDI into those caused by changes in the number of investments and those driven by changes in the average size of investments. Section 6 concludes.

## 2. Literature Review

The literature on foreign direct investment is as large and varied as the phenomenon itself with works like Navaretti and Venables (2006) providing useful entry points. Within this literature, the work closest to our study focuses on the choice of where to locate investment (as opposed to, for example, the choice between exporting and FDI).[7] Even within this subset, different contributions focus on different issues, including how the location choice depends on factors such as access to other markets (Head and Mayer, 2004), agglomeration (Head, Ries, and Swenson, 1995; Crozet, Mayer, and Mucchielli, 2004; Brülhart, Jametti, and Schmidheiny, 2012), EU Cohesion Fund spending (Basile, Castellani, and Zanfei, 2008), firm productivity (Chen and Moore, 2010), or local R&D and innovation (Siedschlag et al. 2013a, Siedschlag, Zhang, and Smith, 2013b). That said, the predominant factor examined in the location choice literature is that of taxes (and indeed, the above studies also typically include taxes among their control variables).

The rationale for this is simple. First, as is well documented, FDI in the aggregate responds to taxation issues.[8] Overall, the results indicate that FDI flees taxes, with the meta-analysis of Heckemeyer and Overesch (2013) estimating the semi-elasticity of MNE profits with respect to the tax rate of 0.8.[9] Second, unlike many of the factors that influence investment decisions such as market size or the skill of the workforce, tax policy is something that governments are capable of swiftly altering in order to influence investment.[10]

An early contribution in this vein is that of Devereux and Griffith (1998) who use a nested multinomial logit model to examine the location decision of US owned affiliates in Europe. They find that, although taxes are unimportant for whether or not a firm locates within Europe or somewhere else in the world, they do play a role in where in Europe it locates. More recent examples in this vein include Hebous, Ruf, and Weichenrieder (2011) and Davies and Killeen (2015), both of which estimate conditional logit models. The first of these uses information on

[7] See Helpman, Melitz, Yeaple (2004) for a recent and influential contribution to the export/invest strand of the literature.
[8] See Gresik (2001), Fuest, Huber, and Mintz (2005), or de Mooij and Edverdeen (2008) for surveys of this work.
[9] Note that, as we focus on the effect of tax rates, we similarly limit our discussion here. Lawless (2013) examines the role of tax complexity on aggreagate FDI, finding that it has a significantly detrimental effect on inflows. Davies, Norbäck, and Tekin-Koru (2010) examine the impact of tax treaties on location, finding no significant effect on where Swedish firms locate but an impact on their trade patterns.
[10] See Blonigen and Piger (2014) for an overview of the typical variables used in FDI empirical analysis.

German outbound FDI which is further broken down into greenfield FDI and those affiliates created via a merger or an acquisition. They find that although host taxes reduce the likelihood of investment via either mode, the impact is significantly smaller for mergers and acquisitions. This is consistent with the model of Becker and Fuest (2010) where the intuition is that the tax advantages of an acquisition will be factored into the equilibrium target price. Davies and Killeen (2015), meanwhile utilize data on non-bank financial FDI into Europe. Comparable to the others, they find that higher host taxes lower the probability of investment. In addition, they find that smaller firms in this industry (i.e. ones that are established primarily for tax minimization purposes) are more sensitive to taxes than their larger counterparts.

One limitation of these papers is that they do not consider the role of home taxes which, especially for a foreign tax crediting country like the US, can significantly alter the effective taxes of a host country.[11] In response, Barrios, et al. (2012) include both home and host taxes in their conditional estimation of intra-European MNE location choices.[12] They find that higher taxes in either the home or a potential host reduce the likelihood of that location being chosen. In their study using FDI into Europe, Lawless, et al. (2015) find that using the cross-border effective average tax rate (EATR), which includes host taxes as well as the taxes that would be levied on affiliate income by the home country, has comparable effects to other measures of the tax rate (including the policy rate, the host EATR, and the host effective marginal tax rate (EMTR)). It is worth noting that this latter study also breaks the data down into FDI in manufacturing and services, finding that while both sectors are deterred by host taxes, services are less so.

Outside of tax rates, the above work finds that the impact of other control variables on the affiliate location choice are comparable in direction to what is found in the literature examining aggregate FDI, i.e. investment is more likely in large, proximate countries with low trade and investment barriers. Additionally, access to other markets and skill tend to increase the location probability whereas higher labour costs tend to reduce it.

This prior research then informs several of our choices. First, as in Barrios, et al. (2012), Siedschlag et al. (2013a, 2013b) and Lawless, et al. (2015) we will use investment choices across Europe from multiple source countries. Second, we include both home and host tax rates with the expectation that as taxes increase this decreases the likelihood of investment.[13] Third, our selection of control variables draws from those identified in the literature. Fourth, we disaggregate our sample along various lines in order to examine the potential for differential effects across sectors and firm groups.

That said, our analysis has two additional contributions. First, in contrast to the logit-based estimator used in papers such as Devereux and Griffith (1998) and Barrios et al. (2012), we employ a Heckman sample selection estimator. As described in more detail in the next section,

[11] See Kemsley (1998) who demonstrates that this does indeed affect exporting relative to affiliate sales for US MNEs. Concerns over this also lead Davies and Killeen (2015) to estimate their regressions using subsamples of the home countries, something which does not overly impact their results.

[12] In unreported robustness checks, comparable results were found using a nested logit estimator.

[13] Note that Barrios et al. (2012) control for the additional tax on affiliate profits by the home country and thus do not estimate the impact of the host tax relative to the tax that would be incurred if the firm invested at home rather than overseas.

this approach has several advantages, including endogenizing the number of investments and permitting the inclusion of owner variables (which is not possible under conditional logit). Second, we estimate both the extensive (location choice) and intensive (investment size) decisions. In particular, if higher host taxes reduce the size of investment (as our results indicate), then focusing on only the extensive margin likely underestimates the impact of host taxes on the amount of FDI it receives.

To our knowledge, the two papers that come closest to ours are Yeaple (2009) and Davies and Kristjánsdóttir (2010). Yeaple (2009) examines the extensive and intensive margins of US firm-level FDI decisions. His analysis, however, differs from ours in several respects. First, rather than using a two-step approach and dealing with sample selection in the second stage, he uses a linear probability model for the extensive margin and a separate OLS estimator for the intensive margin. Second, in these estimates, he only controls for industry dummies, owner size, and owner productivity; later regressing aggregate activity variables on host country characteristics. In contrast, we include firm and country variables at the same time. Third, he does not consider home country variables as all of his observations are for US outbound investment. Finally, he does not consider the role of taxes. That said, he finds that both the size and probability of investment are increasing in owner size, something we also find in our analysis. As with our approach, Davies and Kristjánsdóttir (2010) use a Heckman two-step estimator on FDI into Iceland in the power-intensive industry. Their analysis, however, only considers a single host and a single industry, operates at the aggregate bilateral level (i.e. the model the initial entry from a given home country, not from a given owner), and, like Yeaple (2009), do not consider taxes.

## 3. Empirical Approach

In this section, we lay out a simple discussion of a representative firm's FDI location decision in order to explain our empirical approach and how it differs in interpretation from that used elsewhere.

Consider a firm from home country *h* that can raise capital from the global capital market at rate *r*. This firm has the ability to invest in a subset of *L* locations. The profit from a given location *l* is:

$$\pi_{i,l} = R\left(K_{i,l}; X_{h,l}, Z_i\right) - V\left(K_{i,l}; X_{h,l}, Z_i\right) - F\left(X_{h,l}, Z_i\right) + \varepsilon_{i,l} \qquad (1.1)$$

where $X_{h,l}$ is a matrix of characteristics of the firm's home country *h* (such as GDP and the cost of capital), the potential host *l*, and pair specific variables (such as distance), $Z_i$ is a vector of firm characteristics, and $\varepsilon_{i,l}$ is the firm-potential host error term which is normally distributed. The first term represents revenues from choosing a capital-level $K_{i,l}$ . The middle two terms represent variable costs *V* (which again depend on the capital choice) and fixed costs *F*.

Given that it invests, the firm will choose the capital level such that marginal revenues equal marginal cost:

$$R_K\left(K_{i,l}^{*}; X_{h,l}, Z_i\right) = V_K\left(K_{i,l}^{*}; X_{h,l}, Z_i\right) \qquad (1.2)$$

which would yield a maximum profit of (conditional on investment):

$$\pi_{i,l}^{*} = R\left(K_{i,l}^{*}; X_{h,l}, Z_i\right) - V\left(K_{i,l}^{*}; X_{h,l}, Z_i\right) - F\left(X_{h,l}, Z_i\right) + \varepsilon_{i,l}. \quad (1.3)$$

With this in mind, the firm invests only when

$$\pi_{i,l}^{*} \geq 0. \quad (1.4)$$

This latent variable, however, is unobserved. Instead, what is observed is the firm's decision of whether to invest and, given the decision to do so, the size of its investment. As is well established, if one estimates the impact of the exogenous variables on the size of the investment (i.e. the observed capital stock or some other measure of affiliate size), there is a possibility of sample selection bias. If the error term is normally distributed, we can deal with this by using a Heckman two-step estimator.[14]

In doing so, it is necessary to identify variables that affect the decision of whether or not to invest but not the size of investment. (i.e. would be found only in the fixed costs $F\left(X_{h,l}, Z_i\right)$). These selection variables would be those that affect fixed costs and/or total profits but not the marginal rate of return on capital. In the first group, as detailed in the data section, we include variables on host investment barriers. The key element in the second group is the effective *average* tax rates which influence the location choice. Note that these differ from effective *marginal* rates which affect the size of the investment (placing them in $V\left(K_{i,l}; X_{h,l}, Z_i\right)$).

Note that a key aspect of this approach to the investment decision is that the firm can invest in multiple locations with the number of such locations being endogenous. This is distinct from alternative approaches to location choice which assume that the firm has an exogenous number of investment choices where each one carries an opportunity cost of forgone investment elsewhere. Put differently, under this approach, each firm *can* invest in all or none of the potential hosts; whether or not it does so depends on the profitability of each host.[15] This is thus very different from the underlying model of the logit estimators used to date and discussed in Section 2. As detailed in the next section, 40% of the investments in our data come from a small number of firms that invest multiple times. Thus, not only is it intuitive to seek to endogenize the number of investments, the data suggests that multiple investments are a key aspect of the data.

This approach has other benefits beyond endogenizing the number of investments by a given firm. First, it allows us to control for variables that do not vary across hosts, something not possible to do with logit estimators. This allows us to control for home country features (such as taxes and other gravity variables) as well as for characteristics of the owner. This gives us new insights into features affecting the location choice of firms. Second, the two-step methodology allows us to simultaneously estimate the size of the investment (the intensive margin), not just the decision of whether or not to invest (the extensive margin). This does not happen in a logit estimator. Third, the probit approach does not suffer from the independence of irrelevant alternatives problem because it does not force the firm to compare one location against a well-specified set of alternative locations. Instead, it presents the firm with two options for each potential location – invest or not – for which there is no third alternative.

[14] See Greene (2011) for an introduction to this method.

[15] It must be noted, however, that as with all other studies we only include firms that actually invest. Thus, the results must nevertheless be interpreted in light of this selection.

That said, there are two limitations to our approach. First, although it would be advantageous to use a multi-variate Heckman probit in the first stage so that a given owner's choice across potential hosts is treated as a joint decision, there is a difficulty in doing so. This arises because many of our home countries are also potential hosts. Because we consider only cross-border investments, the set of potential hosts varies by home. For example, a UK-based owner considers all European countries except the UK as a potential host (including Germany) whereas a German-based owner considers the UK a potential host but not Germany. Since the set of potential hosts vary, so too does the multivariate probit we would seek to estimate, implying that we would have to do this country-by-country.[16] Nevertheless, we cluster our errors by firm *i* (i.e. by the owner, not the affiliate) in an attempt to partially deal with this. Further, we control for past investment activity, both in a potential host and elsewhere. Second, including fixed effects (or even a large number of categorical variables) in a probit regression biases both coefficients and standard errors (see Greene (2004) for discussion). This does not occur in logit estimators and is something explored in our analysis.

## 4. Data

Our firm level data comes from Bureau van Djik's Amadeus dataset which covers activity in Europe.[17] From this, we extract information on new cross-border greenfield investments.[18] This information provides several key pieces of information. First, it indicates the owner of the affiliate, the owner's country of residence (the home country) and location of the investment (the host country). Table 1 provides the list of home and host countries along with the share of outbound and inbound investments for the set of firms we use.[19] As can be seen, although all of the countries in our data are homes, four are not hosts during the sample. This is because, although they did receive investment, those investments were missing firm-level information we need for our regressions. Second, Amadeus provides the year of the investment. We restrict our sample to 2004 to 2013 for consistency purposes. Table 2 breaks down the number of investments by year. Third, from Amadeus we obtain information on the size of the affiliate (measured as total assets in constant 2005 US dollars), the size of the owner (measured as total assets in constant 2005 US dollars from unconsolidated statements so as to exclude the affiliate for the year prior to the investment or, if missing, for the closest year for which it was available), the age of the owner (i.e. the years since its incorporation), and the 4-digit NACE code of the owner and the affiliate. If these data are missing, we are forced to exclude the investment from our analysis. When a given owner invests multiple times in a given host in a given sector during

[16] It should be noted that a comparable problem arises in the logit estimations of Lawless, et al. (2015), Barrios, et al. (2012), and other multiple-home studies. In Davies and Killeen (2015), this issue does not occur when using only the non-European home subsample, as then all homes have the same set of potential European hosts. As they discuss, at least in their data, the results are comparable to where they simply treat investment in the home country as another non-chosen option. Thus, it may be that this issue does not overly impact the literature's results.

[17] This can be found at https://amadeus.bvdinfo.com/.

[18] As shown by Davies, Desbordes, and Ray (2015) greenfield investments make up about half of FDI investments in Europe during this sample. In addition, they demonstrate that consistent with Hebous, Ruf, and Weichenrieder (2011), only greenfield FDI is sensitive to taxes, hence our focus on greenfield investments.

[19] The home country is defined as the country of residence of the affiliate's global ultimate owner.

the same year, these were added together.[20] In addition, we drop investments where the 2005 US dollar value was under $1,000 or above $1 billion. This leaves us with 10,845 investments for which we have our control variables. Note that because of the use of owner data, our home countries all belong to Europe. In addition, for a subset of 5,972 firms, we are able to construct a rough proxy for owner productivity, measured as the owner's operating revenues (in constant US dollars) relative to its size. With these data, for a year in which an owner invests in a given sector somewhere, we estimate the probability of it investing in a given host and, conditional on that occurring, how large that investment is.

From the empirical heterogeneous firms literature (e.g. Yeaple (2009) and Davies and Jeppesen (2015)), we expect that larger and older firms are more likely productive ones. As such, we expect that they are both more likely to invest in a given host and, conditional on investment, that the size of the affiliate is larger. Likewise, we expect a positive effect from productivity. Therefore, a priori, we anticipate positive coefficients for these variables at the extensive and intensive margins.

One important aspect of the data is that some owners have multiple investments. As shown in Table 3, our 10,845 investments are spread across 7,980 owners. Of these owners, almost 80% only have one investment, meaning that 41% of our investments come from only 20% of owners. Put differently, most owners invest only once in the sample, but a large share of investments are done by firms that invest multiple times. Indeed, just 1% of owners invest six or more times in the data, yet they account for 6.6% of total investments. Using this information, we classify our owners into those that are single investors or multi-investors. Nearly by construction, we anticipate that the probability of investment in a given location is higher for multi-investors. However, as such firms are again potentially more productive, we also expect them to invest more conditional on investment. Thus, as with the other owner variables, we anticipate that multi-investor will have a positive coefficient at the extensive and intensive margins. In addition to this, we construct a variable counting the number of investments a given owner has done prior to the year of the investment in question.

In addition to the owner variables, we utilize a set of common home, host, and home-host control variables. To control for the market size of the countries, we utilize GDP and market potential (constructed as the sum of other countries' GDPs weighted by their distance to the country in question). We generally expect a positive effect from home and host GDP at both the extensive and intensive margins (i.e. investment is more likely and bigger in large economies). GDP per capita can capture both desirable market income effects (encouraging FDI to locate there), higher skill levels (the attractiveness of which may depend on the skill-intensity of the industry), and higher worker wages (driving investment away). Thus, it is unclear what to anticipate a priori. Market potential is typically presumed to have positive effects on FDI and indeed, this is commonly found (see for example a review by Fontagné and Mayer, 2005). That said, several studies such as Blonigen, et al. (2007) instead find the opposite, implying that investment prefers the periphery. As shown by Blonigen, et al. (2007), the extent of this can vary across industry. Thus, we are initially agnostic about the expected effect of market potential.

[20] We do this because with the estimation approach, we operate at the owner-host-sector-year level. This merged 87 investments.

Beyond market size, we control for the level of tertiary education of the home and host (measured as the share of population with tertiary education).[21] Much like GDP per capita, this can have a positive effect (reflecting skill) or a negative effect (reflecting costs). Also, as is common, we control for "openness", i.e. exports and imports relative to GDP. This is one measure of an economy's trade barriers which is generally seen as a hindrance to both outbound and inbound vertical FDI but something that increases horizontal FDI. In addition to this, we include dummies for whether the host, home, or both countries are EU15 members or Eurozone members. We also use three pair-wise proxies for the cost of doing business across borders: contiguity, common language, and distance (measured as the distance between themost important cities/agglomerations in terms of population). These were obtained from the CEPII.[22] In unreported results, contiguity and language were insignificant in the intensive estimation stage, therefore we only include them in the extensive selection stage. Beyond these, we include the average FDI investment barrier index developed by the OECD.[23] This index combines data on four subcategories restricting foreign-owned firms (equity restrictions on foreign ownership, screen and approval requirements, the use of key foreign personnel, and other restrictions). As this is about the establishment of the firm rather than affecting its marginal costs, we use this only in our extensive margin selection stage, where we anticipate a negative coefficient.

In addition to these common gravity measures, we include the cost of capital (K) from Spengel, et al. (2014) which measures the after-tax cost of creating €1 of investment. At first blush, one might expect that a higher cost of capital in the host reduces FDI at the extensive and intensive margins. Alternatively, a high cost of capital can reflect a high rate of return and high productivity, increasing FDI. Similarly, when the home country has a high cost of capital, FDI can go down (if investment is at least partially financed in the home country) or up (if this again reflects productivity).

Finally, and for us our variable of focus, we use four measures of tax rates, two which are country-specific and two which are firm-specific. From Spengel, et al. (2014), we obtained the effective average tax rate (EATR) and the effective marginal tax rate (EMTR) for each of the countries in our sample. [24, 25] Given our two-stage question, having access to both of these rates is extremely important. When choosing whether or not to locate in a given host country, the firm would consider the total-after tax profit. In this case, the relevant tax is the average tax ($t^a$ )

[21] This comes from the World Development Indicators database (http://data.worldbank.org/data-catalog/world-development-indicators). In unreported results, we used the share of workers in R&D or the share of GDP spent on R&D, measures which reduced the number of countries in the sample. Comparable results were found and are available on request.

[22] See Mayer and Zignago (2011) for more details. The CEPII can be accessed at http:// www.cepii.fr/.

[23] This can be found at http://www.oecd.org/investment/fdiindex.htm. Note that this measure is how difficult it is for a foreign firm to establish itself in a given host, including those barriers existing for domestic investors. Thus, although national treatment under the EU would imply lower barriers to investment from another EU country than a non-EU home, barriers still exist.

[24] This can be found at https://assets.kpmg.com/content/dam/kpmg/pdf/2015/11/global-tax-rate-survey-2015-v2-web.pdf.

[25] The EATR is calculated as the difference of the net present value of a profitable investment project in the absence of tax and the net present value of the same investment in the presence of tax. The EMTR is calculated as the difference between the cost of capital and the required post-tax real rate of return, i.e. the additional return required due to taxation. Both of these are calculated using the methodology of Devereux and Griffith (2003).

since after tax income would be $\left(1-t^a\right)\pi$ where $\pi$ is pre-tax income. Alternatively, if the question is how taxes affect marginal, intensive decisions, the appropriate tax rate to use is the effective marginal tax rate. The reason for this is that, by increasing investment and generating an additional euro of income, the firm does not pay the average tax rate on that additional income, but the marginal rate. Unless the tax system is flat, these two will typically differ. On personal income, under a progressive tax system, the marginal rate will exceed the average rate. In our data, as shown in Figure 1, the reverse is generally true. This is because of the large tax benefits from debt financing at the margin (see Graham, 2000, for a thorough discussion). Because the tax measure we use is constructed by averaging the effective rates across three financing modes – retained earnings, equity, and debt – this results in a marginal rate below the average rate.[26]

Further, it must be remembered that the effective rates are calculated as averages across three financing modes and five income-generating assets (which are industrial buildings, intangibles, machinery, financial assets, and inventories). As such, the true tax will vary across firms depending on their ability to access differing finance sources and the industry in which they operate (which will affect the relative importance of different assets). With this in mind, we construct firm-specific tax rates using the product of the owner's share of a specific asset in its total assets and the country's tax rate for this type of asset, i.e. for firm *i* in country $c \in \{l,h\}$ in year *t* with assets $a_{i,x,t}$ of type *x* out of its total assets $A_{i,t}$ :

$$EATR_{i,c,t} = \sum_x \frac{a_{i,x,t}}{A_{i,t}} EATR_{c,x,t}$$

where we use four asset categories (intangible fixed assets, total fixed assets, inventories, and financial assets). We similarly construct firm specific EMTRs and costs of capital.[27]

Figure 1 illustrates the average of these four tax variables across countries. [28] As can be seen, there is a good deal of variation across countries, both in the levels of taxes and the differences between the EATR and the EMTR. Table 4 presents correlations between the four taxes for the host and home, as well as the cost of capital. This suggests that, although our firm-specific EATRs are highly correlated with the country one, this is less true for the EMTR.

Table 5 presents our summary statistics. Note that all non-binary variables are logged, including the size of the affiliate and that they are lagged by one year relative to the date of investment.[29] Finally, in the intensive stage, we include dummies for the home country, host country, 2-digit owner and affiliate industries, and year.[30] As is well established, however, this cannot be done in the extensive (probit) stage of the estimation as doing so biases both the standard errors and the

[26] In our data, for approximately 250 investments, this actually results in a negative marginal rate for a potential host (mostly Belgium in 2008). Note that as we use the log of taxes, we lose these observations from our sample.
[27] Note that Amadeus does not distinguish between investments in buildings and machinery. For these types of assets we use the sum of total fixed assets and other fixed assets and the average of two tax rates for industrial buildings and machinery.
[28] Although omitted here, examination of the time trend in the average across countries yields no clear-cut pattern.
[29] This is because the decision to invest is likely made before the actual investment occurs and is therefore based on information prior to the date of investment.
[30] Note that this does not permit estimation of the host/home country's EU15 or Euro dummies.

coefficients (see Greene, 2004, for a complete discussion; below we illustrate this result in our data). With this in mind, in the extensive stage, we only include year dummies and use the owner-sector average of size, age, and multiple investor status to help to control for sector-specific factors.

## 5. Results

In this section, we develop our baseline specification. Following that, we explore various features of the data, including differences across sectors and between single and multi-investors.

### *5.1 Baseline*

In Table 6, we develop our baseline specification. In each of the three specifications, the intensive column contains the estimates for the size of the affiliate conditional on investment taking place. The extensive column, meanwhile, shows the results from the selection estimation, i.e. whether or not investment occurs. In the first specification, we use the country-level taxes and cost of capital. Specification 2 replaces these with the firm-specific measures. As this lowers the sample size somewhat due to missing subcategories of owner assets, Specification 3 uses the same sample as 2, but the tax and cost measures of 1.

We begin our discussion with the tax rates. As can be seen, regardless of the specification we find that higher home or host EATRs significantly reduce the probability of an investment. This is consistent with the conditional logit findings of papers such as Barrios, et al. (2012) and Lawless, et al. (2015). Although the point coefficients on the EMTRs are also negative, they are not significant. This may be due to the inclusion of the country dummies which force the estimates to rely on the admittedly small variation across time (specification 1 and 3) or firms (2). We explore this in more detail below.

In terms of the firm-specific variables, we find that, as expected, larger owners invest more often and have larger affiliates. This then mirrors Yeaple (2009). Contrary to our expectations, younger owners invest more often and with larger size. This may be because older owners have already done the bulk of their FDI prior to the start of the sample. Finally, multi-investors invest more often (which is not surprising) and larger than do their single investor counterparts.[31] When the owner is in a sector that is larger and younger, the probability of investment is again higher. The opposite is true for multi-investor status, i.e. the higher probability of investment by a multi-investor in a sector with many multi-investors is smaller than when it stands out compared to its peers. The cost of capital in the host is significantly positive at the extensive margin, suggestive of more likely investment where rates of return are high. The home cost of capital, however, is only significant when using the country-specific taxes.

Moving to the country variables, as expected, when the host has large barriers to FDI, this reduces the probability of investment. Again, as this variable measures the costs of setting up a firm, we only use it in the extensive stage. The other country variables are typically significant only in the extensive estimation. This is potentially due to the inclusion of country dummies, something explored below. Beginning with the market size variables, we find that the probability

[31] Omitting this variable does not impact the estimates, something explored in detail below.

of investment is higher when the host is large with low income (i.e. low wages). Conversely, the probability is higher when the home is small yet wealthy. In addition, we find that host per capita GDP is positive in the intensive stage in two of our specifications. This suggests that investment is less likely in high income hosts but that if it does happen, the investment tends to be larger. Market potential is generally negative with significance for both host and home in the extensive stage and for the host in the intensive stage. This suggests that, for European investors, they are attracted to the periphery countries.

Although unimportant for the size of investment, the probability is rising in the home's education level but falling in the host's (again suggestive of a deterrent effect of high wages on the extensive margin). Investments in less-open hosts is more likely and larger, investments from less-open homes are also more likely. This is suggestive of market-seeking horizontal FDI (Markusen, 1984).

EU15 membership increases the probability of investment when one or both countries are members.[32] Euro membership, however, is only significant for the host and there it reduces the probability of investment (reflective of the preference for the periphery found by market potential). For distance, we find differing effects at the extensive and intensive margins, with investment less likely in a distant host but, if it occurs, investment tends to be larger. This would be consistent with distance increasing both the fixed cost of investment and the marginal cost of exporting, i.e. leading towards greater concentration but, if investment happens, encouraging more production in the host in a horizontal manner (Markusen, 1984). Common language and contiguity increase the probability of investments.[33]

Finally, in each specification, we find a significant coefficient on rho, indicative of sample selection bias. This suggests that it is indeed important to control for the probability of investment occurring when estimating the size of the affiliate. As the results are similar across specifications, we adopt 2 as our baseline as this uses the firm-specific taxes, providing more variation in this key variable. In unreported results using the country-specific measures, the following estimates were very similar and are available on request.

Thus, from our baseline, three features are clear. First, the decision of whether to invest is influenced by owner characteristics, a feature of the data that cannot be analyzed when using a conditional logit estimator. Second, our estimates suggest that these variables also affect the size of investment, something missing when using aggregated data. Third, the omission of the selection stage has the potential to bias the coefficients from a gravity regression performed at the firm level.

Given the non-linear nature of the extensive estimation, Table 7 reports the estimated elasticities for our baseline specification evaluated and the sample mean. In particular, this suggests that a 1% increase in the host EATR (i.e. a rise from 10 to 10.1%) would reduce the probability of

[32] Note that as nearly all of our countries are EU members, we use this EU15 designation rather than EU membership to achieve suitable variation in the variable.

[33] As noted above, when these two were included in the intensive stage, they were insignificant. Given their discrete nature, we therefore use them only in the extensive stage where the dependent variable is also discrete to aid in selection identification. These alternative results are available on request.

investment by 1.29%. One policy implication from our estimates is that this reduction can be offset by a 2.7% reduction in the FDI barriers. Thus, when coupled with a reduction in investment barriers, a country may be able to increase its tax revenues via higher taxes without a loss of inbound FDI.

*5.2 Dummy Variables*

One possible reason for the lack of significance of the EMTR and country controls in the intensive stage is that we include home and host country dummies. Particularly for slow-changing variables such as the EMTR, this can eliminate their significance. To explore this, in Table 8, we repeat Table 6's specifications 1 and 2 but exclude the home and host dummies. As expected, doing so increases the significance of the country variables in both specifications. In addition, for specification 1 where taxes are country-specific, we now find significantly negative impacts of the EMTR which are roughly the same magnitude as the insignificant coefficients in Table 6. This suggests that the EMTR does indeed matter for the size of investment, but that this effect was obscured by the country dummies. When using the firm-specific taxes, however, although we again find negative point estimates that are very close to those in the baseline, they fall just outside the normal significance levels.

As established by Greene (2004) among others, probit estimation does not perform well with large numbers of categorical variables, often yielding poor standard errors and biased coefficients. This is why we have not included sector, home, or host country dummies in our first stage analysis. Nevertheless, it is important to at least attempt to understand what may be uncovered by doing so while being cognizant of the potential issues. In Table 8's specification 3, we do this by adding owner 2-digit sector dummies, host dummies, and home dummies to the year dummies already used in the extensive stage.

Doing so results in similar impacts for the owner characteristics, but has two important effects. First, comparable to what happens to the EMTR, including country dummies wipes out significance of the EATR. Second, we now find counter-intuitive results for FDI barriers, which now suggest that investment is more likely where it is more difficult. This is then indicative of the biases Greene (2004) warns of and we therefore do not use these additional dummies in our estimation.

*5.3 Productivity*

Before delving deeper into the issue of tax measurement, Table 9 expands on the baseline by including our measure of owner productivity. We do so because Yeaple (2009) finds that more productive firms are both more likely to invest and invest larger amounts. We do not do so in the baseline because it was available for only half of our investments. For those where productivity was available, the results of specification 1 indicate that more productive firms are no more likely to invest in a given host; however conditional on investment, the size of the affiliate is smaller. This stands in contrast to Yeaple, suggesting that by not controlling for sample selection, his results may be biased (or that our measure of productivity is weak). In addition, we see a general fall in the significance of our other controls. When significant, excepting the home cost of capital, the coefficients match the sign of that in the baseline. To determine whether this

is due to the inclusion of productivity, specification 2 uses the same sample but omits productivity. As can be seen, this does indeed point to the reduction in the sample for these changes. Thus, since the inclusion of productivity seems to generate sample selection without eliminating any obvious omitted variable bias, we proceed without it.[34]

*5.4 Sector Differences*

To this point, although we have controlled for sector-specific effects, we have not examined whether there is a difference in the tax responsiveness of investment across different industries. In Tables 10 and 11, we do so in two ways. First, in Table 10, we split the sample into affiliates in manufacturing (specification 1), services other than financial services (specification 2), financial sector (specification 3), and utilities and construction (specification 4).[35] Based on the findings of Lawless, et al. (2015), we anticipate that finance FDI is more sensitive to the host EATR than is manufacturing, which is more sensitive than services. Looking at the point estimates, this does indeed seem to be the case, with utilities and raw materials as sensitive as finance. While we can reject the equality of the finance/utilities and manufacturing/services host EATR coefficients at the 95% level, we cannot do so between finance and utilities or between manufacturing and services. In addition, we find that FDI in services and finance is sensitive to the home EATR with no significant difference between these coefficients. Also consistent with the relative sensitivity of financial FDI, we find an impact from the host EMTR in the intensive estimation for this sector. Although this split and its reduction in the number of observations lowers the significance of our various control variables, on the whole we find similar patterns across the four sectors. That said, we only find evidence of sample selection for the financial investment regression.

In Table 11, we split the non-financial firms into high-technology (specification 1) and low-technology (specification 2) categories using the classification of Eurostat.[36] As can be seen, the two groups are broadly the same, with coefficients comparable across the two groups in terms of magnitude and significance. One notable difference, however, is owner age which is only significant for the low technology group. Thus, for this group, it may particularly be the case that older owners had undertaken the bulk of their investments prior to the start of the sample.

*5.5 Single versus Multi-Investors*

As discussed above, a small minority of firms carry out a large share of the investments. In this subsection, we explore the differences between owners that invest a single time and those that do so multiple times. We begin by splitting the sample in Table 12.[37] Specification 1 reports the estimates using only the single investors; specification 2 does so for the multi-investors.[38] On the whole, the two look fairly similar, although the negative effect from owner age is significant

[34] Results including productivity in all specifications are available on request.
[35] Specifically, the financial sector includes services engaged in financial intermediation, which is sectors 6420, 6430, 6491, 6499, 6600, 6610, 6611, 6612, 6619, 6621, 6622, 6629, and 6630.
[36] See http://ec.europa.eu/eurostat/cache/metadata/Annexes/htec_esms_an2.pdf.
[37] It is important to remember that this distinction is based on the number of new investments during our ten year time frame and thus potentially classifies firms with additional investments prior to 2004 or after 2013 as single investors.
[38] Note that we are therefore unable to include the "multi-investor" dummy.

only for the single investor group. Looking at the EATR estimates, we find that the point estimates are roughly 50% larger for the single investors (although we fail to reject equality of the coefficients). These coefficients then suggest that single investors are more deterred by taxes than are multi-investors. This might be the case if multi-investors, by virtue of a larger, more complex pattern of intra-firm trade, are more able to engage in transfer pricing and other tax minimization strategies. This would then mean that host taxes would have a smaller – or even no – impact as they can be avoided. This is consistent with the results of Davies, et al. (2015) who find that transfer pricing is an activity only identifiable by the largest multinationals.

In Table 13, we further examine the behavior of multi-investors by using the full sample but introducing the number of investments in prior years (which is zero for all single investors and multi-investors in the year of their first investment).[39] We do so to examine whether prior investment experience affects the current investment behavior. As can be seen, the more prior investments an owner has undertaken, the greater its probability of investing in the current year in a given host. This would be suggestive of a "learning by investing" effect making investments easier. That said, the more prior investments an owner has done, the smaller the current investment is. This may be reminiscent of the literature on how firms expand their trade destinations, with marginally profitable choices being undertaken last (see Albornoz, et al. (2012) for a review).

In specification 2, we extend this by decomposing the prior investment variable into those in the same host and those in other hosts. When doing so, we find that comparable to specification 1, the more investments in other hosts, the more likely investment in the country in question and the smaller any investment that occurs. For prior investments in the same host, however, we find that the more prior investments the less likely a new investment is with no effect on its size. This then argues against agglomeration driving location choice.

Adding these additional variables, however, does not affect our other coefficients including those for taxes.

*5.6 The Impact of Host Taxes on Aggregate FDI*

Given the above, we see that host taxes affect inbound FDI at the extensive margin and, when omitting country effects, some indication that they also do so at the intensive margin. In this subsection, we calculate a "back of the envelope" change in aggregate FDI (the number of firms times the size of the average firm) due to a 1% increase in the host EATR and EMTR (i.e. going from 10% to 10.1%) and decompose this into those caused by changes at the extensive and intensive margin.

Using the baseline estimates, the average probability of obtaining an investment from a given investor is 2.41%, implying that if there are 100 potential investors, on average a given host should get investment from 2.41 of them. In the sample, the average size of an affiliate is $3.069 million. Thus, baseline aggregate investment would be $12.97 million. Increasing the host EATR, using the average elasticity of -1.29 from Table 7 would reduce the expected number of

[39] Note that this is only for investments done during the sample and misses those carried out before 2004. Specifically, for year *t*, this is the sum of investments across all sectors prior to *t*.

firms from 2.41 to 2.38. Of the firms the host still receives, using the intensive elasticity of -.115, the average size of an affiliate would shrink to $3.066 million. Together, these two changes result in aggregate FDI falling from $7.39 million to $7.29 million, a decline of 1.4% (compare this to the 0.8% found in Heckemeyer and Overesch's (2013) meta-study). Of this 1.4% decline, 92% of it is due to changes in the extensive margin with the remaining 8% coming from a reduction in the size of firms that do invest.

Thus, our estimates suggest that the bulk of changes in inbound aggregate FDI activity due to host tax changes occur at the decision of whether or not to invest, not in how much to invest. In particular, it suggests that for many firms, the affiliate investment may operate near a minimum operating scale, making the extensive margin more sensitive to policy. Note that although a tax increase would deter investors, our estimates indicate that this can be undone by altering FDI barriers with our estimates suggesting that a 1% tax increase can be offset by a 3% barrier decrease. Thus, when considering tax policy changes, our estimates suggest that there may be particular gains in doing so in the context of an overall investment liberalization strategy.

## 7. Conclusion

Although it has long been recognized that taxes affect both the size of aggregate investment and the probability of a given host being chosen by a multinational, to date these have not been studied as a single, integrated decision. In this paper, we have done so using over 10,000 investments across 30 European countries during 2004-2013. While we find evidence that taxes affect both margins of an individual firm's investment, the evidence is stronger for changes at the extensive margin. This effect appears particularly large for firms that invest only once during the sample, i.e the majority of our owners. In addition, we find differences across sectors, with the financial sector the most sensitive and services other than financial services the least. Using our estimates, we find that host taxes contribute to aggregate FDI more through changes at the extensive margin than at the intensive margin as may be expected if affiliates are established near their minimum operating scale. Understanding these differing effects has important implications for the use of tax policy vis-à-vis FDI, in particular if different types of investors and different industries have varying impacts on host economies. In addition, this suggests a discontinuity in the investment decision, which has critical implications for the optimal tax rate. Finally, our estimates reiterate the literature's findings that taxes, while important, are only a part of the overall investment decision. In particular, by combining tax changes with investment liberalization, it may be possible to raise taxes without lowering FDI, resulting in even greater revenue gains.

**Figure 1: Comparison of Tax Rates**

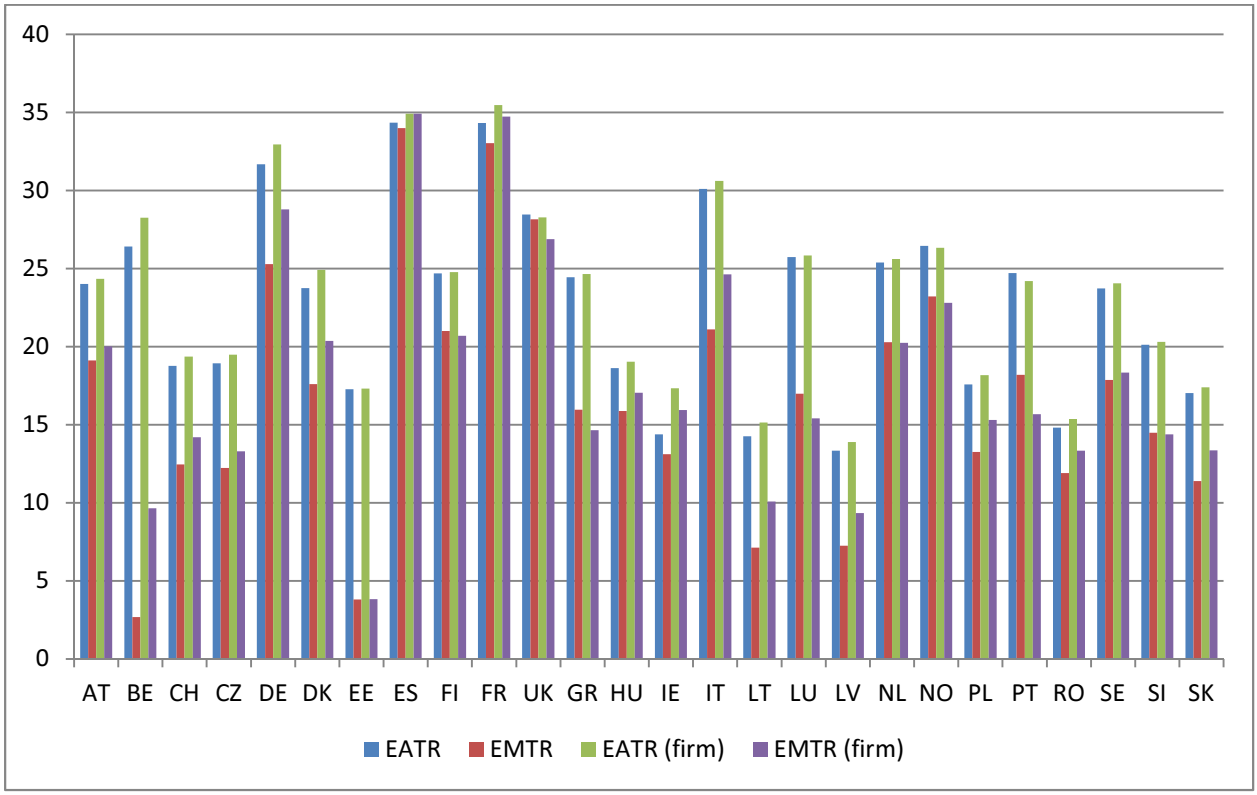

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**Table 1: Home and Host Countries**

| Country | Number of Outbound | Percent of Outbound | Number of Inbound | Percent of Inbound |
|---|---|---|---|---|
| AT | 347 | 3.2 | 603 | 5.56 |
| BE | 910 | 8.39 | 256 | 2.36 |
| BG | 64 | 0.59 | 0 | 0 |
| CH | 144 | 1.33 | 318 | 2.93 |
| CY | 1,245 | 11.48 | 1,580 | 14.57 |
| CZ | 790 | 7.28 | 163 | 1.5 |
| DE | 81 | 0.75 | 120 | 1.11 |
| DK | 938 | 8.65 | 629 | 5.8 |
| EE | 268 | 2.47 | 163 | 1.5 |
| ES | 544 | 5.02 | 592 | 5.46 |
| FI | 46 | 0.42 | 8 | 0.07 |
| FR | 192 | 1.77 | 137 | 1.26 |
| GR | 162 | 1.49 | 119 | 1.1 |
| HR | 802 | 7.4 | 937 | 8.64 |
| HU | 12 | 0.11 | 43 | 0.4 |
| IE | 553 | 5.1 | 50 | 0.46 |
| IT | 20 | 0.18 | 142 | 1.31 |
| LT | 1,537 | 14.17 | 846 | 7.8 |
| LU | 271 | 2.5 | 559 | 5.15 |
| LV | 90 | 0.83 | 302 | 2.78 |
| MT | 236 | 2.18 | 521 | 4.8 |
| NL | 8 | 0.07 | 1,782 | 16.43 |
| NO | 914 | 8.43 | 0 | 0 |
| PL | 28 | 0.26 | 0 | 0 |
| PT | 107 | 0.99 | 244 | 2.25 |
| RO | 536 | 4.94 | 731 | 6.74 |
| SE | 347 | 3.2 | 603 | 5.56 |
| SI | 910 | 8.39 | 256 | 2.36 |
| SK | 64 | 0.59 | 0 | 0 |
| UK | 144 | 1.33 | 318 | 2.93 |
| Total | 10,845 | 100 | 10,845 | 100 |

*Source*: Authors' calculations based on the *Amadeus* data set.

**Table 2: Investments by Year**

| Year | Number of Investments | Percent |
|---|---|---|
| 2004 | 615 | 5.67 |
| 2005 | 900 | 8.3 |
| 2006 | 1,263 | 11.65 |
| 2007 | 1,453 | 13.4 |
| 2008 | 1,403 | 12.94 |
| 2009 | 1,200 | 11.07 |
| 2010 | 1,096 | 10.11 |
| 2011 | 1,182 | 10.9 |
| 2012 | 1,020 | 9.41 |
| 2013 | 713 | 6.57 |

*Source*: Authors' calculations based on the *Amadeus* data set.

**Table 3: Number of Investments by Owner**

| Number of Investments | Number of Owners | Share of Investors | Share of Investments |
|---|---|---|---|
| 1 | 6,409 | 80.31 | 59.1 |
| 2 | 981 | 12.29 | 18.09 |
| 3 | 324 | 4.06 | 8.96 |
| 4 | 119 | 1.49 | 4.39 |
| 5 | 62 | 0.78 | 2.86 |
| 6 | 32 | 0.4 | 1.77 |
| 7 | 15 | 0.19 | 0.97 |
| 8 | 11 | 0.14 | 0.81 |
| 9 | 6 | 0.08 | 0.5 |
| 10 | 5 | 0.06 | 0.46 |
| 11 | 5 | 0.06 | 0.51 |
| 12 | 2 | 0.03 | 0.22 |
| 13 | 1 | 0.01 | 0.12 |
| 14 | 2 | 0.03 | 0.26 |
| 15 | 2 | 0.03 | 0.28 |
| 16 | 1 | 0.01 | 0.15 |
| 17 | 1 | 0.01 | 0.16 |
| 19 | 1 | 0.01 | 0.18 |
| 25 | 1 | 0.01 | 0.23 |
| Total | 7,980 | 100 | 100 |

*Source*: Authors' calculations based on the *Amadeus* data set.

**Table 4: Country versus firm-specific taxes**

| | EMTR host | EATR host | EMTR host (firm-specific) | EATR host (firm-specific) |
|---|---|---|---|---|
| EMTR host | 1 | | | |
| EATR host | 0.5714 | 1 | | |
| EMTR host (firm-specific) | 0.7972 | 0.6264 | 1 | |
| EATR host (firm-specific) | 0.546 | 0.9681 | 0.6967 | 1 |

| | EMTR home | EATR home | EMTR home (firm-specific) | EATR home (firm-specific) |
|---|---|---|---|---|
| EMTR home | 1 | | | |
| EATR home | 0.4262 | 1 | | |
| EMTR home (firm-specific) | 0.7998 | 0.5988 | 1 | |
| EATR home (firm-specific) | 0.3536 | 0.956 | 0.6327 | 1 |

| | Cost of K host | Cost of K home | Cost of K host (firm-specific) | Cost of K home (firm-specific) |
|---|---|---|---|---|
| Cost of K host | 1 | | | |
| Cost of K home | -0.0027 | 1 | | |
| Cost of K host (firm-specific) | 0.8671 | 0.0108 | 1 | |
| Cost of K home (firm-specific) | 0.0039 | 0.8537 | 0.1232 | 1 |

*Source:* Spengel, et al. (2014) and authors' calculations based on Spengel, et al. (2014) and the *Amadeus* data set.

**Table 5: Summary Statistics**

| Variable | Obs. | Mean | Std.Dev. | Min | Max |
|---|---|---|---|---|---|
| | | Firm-level | | | |
| Affiliate size | 10,845 | 12.463 | 2.337 | 6.797 | 19.61 |
| Assets owner | 255,718 | 16.035 | 2.683 | 6.924 | 20.723 |
| Age owner | 255,718 | 1.909 | 1.275 | 0 | 5.549 |
| Multi investor | 255,718 | 0.4 | 0.49 | 0 | 1 |
| Productivity | 140550 | -1.585 | 2.557 | -18.55 | 5.903 |
| EMTR host (firm) | 228,699 | 2.78 | 0.563 | -3.986 | 6.561 |
| EMTR home (firm) | 228,890 | 3.034 | 0.502 | -0.735 | 5.963 |
| EATR host (firm) | 229,437 | 3.111 | 0.281 | 1.022 | 5.837 |
| EATR home (firm) | 229,442 | 3.313 | 0.204 | 1.781 | 4.744 |
| Cost of K host (firm) | 229,440 | 1.823 | 0.115 | 0.178 | 4.109 |
| Cost of K home (firm) | 229,442 | 1.881 | 0.117 | 0.544 | 3.401 |
| Prior investments | 255,718 | 0.485 | 1.402 | 0 | 23 |
| Prior host investments | 255,718 | 0.196 | 0.719 | 0 | 10 |
| Prior other investments | 255,718 | 0.29 | 1.09 | 0 | 20 |
| | | Country Level | | | |
| EMTR host | 255,718 | 2.682 | 0.645 | 0 | 3.567 |
| EMTR home | 255,718 | 2.875 | 0.744 | 0 | 3.567 |
| EATR host | 255,718 | 3.087 | 0.281 | 2.468 | 3.611 |
| EATR home | 255,718 | 3.277 | 0.2 | 2.468 | 3.611 |
| Cost of K host | 255,718 | 1.799 | 0.098 | 1.569 | 2.041 |
| Cost of K home | 255,718 | 1.846 | 0.104 | 1.569 | 2.041 |
| GDP host | 255,718 | 26.148 | 1.465 | 23.209 | 28.781 |
| GDP home | 255,718 | 27.119 | 1.2 | 23.209 | 28.781 |
| GDP per capita host | 255,718 | 10.099 | 0.735 | 8.304 | 11.364 |
| GDP per capita home | 255,718 | 10.515 | 0.403 | 8.61 | 11.364 |
| Market potential host | 255,718 | 10.032 | 0.324 | 9.453 | 10.817 |
| Market potential home | 255,718 | 10.169 | 0.39 | 9.453 | 10.817 |
| Education host | 255,718 | 3.259 | 0.318 | 2.425 | 3.761 |
| Education home | 255,718 | 3.345 | 0.263 | 2.573 | 3.761 |
| Openness host | 255,718 | 4.576 | 0.448 | 3.82 | 5.853 |
| Openness home | 255,718 | 4.523 | 0.469 | 3.82 | 5.853 |
| FDI barrier host | 255,718 | -3.377 | 0.859 | -5.521 | -1.726 |
| EU15 home | 255,718 | 0.906 | 0.292 | 0 | 1 |
| EU15 host | 255,718 | 0.664 | 0.472 | 0 | 1 |
| EU15 both | 255,718 | 0.622 | 0.485 | 0 | 1 |
| Euro home | 255,718 | 0.708 | 0.455 | 0 | 1 |
| Euro host | 255,718 | 0.595 | 0.491 | 0 | 1 |
| Euro both | 255,718 | 0.454 | 0.498 | 0 | 1 |
| | | Pair-level | | | |

| | | | | | |
|---|---|---|---|---|---|
| Contiguity | 255,718 | 0.143 | 0.35 | 0 | 1 |
| Common language | 255,718 | 0.079 | 0.27 | 0 | 1 |
| Distance | 255,718 | 6.921 | 0.658 | 4.088 | 8.121 |

*Source*: Authors' calculations.

**Table 6: Baseline Results**

| | (1) Country Taxes | | (2) Firm Taxes | | (3) Country Taxes | |
|---|---|---|---|---|---|---|
| | Int. | Ext. | Int. | Ext. | Int. | Ext. |
| EMTR host | -0.186 | | -0.115 | | -0.153 | |
| | (0.168) | | (0.157) | | (0.179) | |
| EMTR home | -0.176 | | 0.0668 | | -0.168 | |
| | (0.120) | | (0.119) | | (0.125) | |
| EATR host | | -0.543*** | | -0.550*** | | -0.580*** |
| | | (0.0553) | | (0.0586) | | (0.0593) |
| EATR home | | -0.215*** | | -0.197*** | | -0.209*** |
| | | (0.0198) | | (0.0245) | | (0.0209) |
| Assets owner | 0.195*** | 0.00346*** | 0.209*** | 0.00453*** | 0.210*** | 0.00329*** |
| | (0.0105) | (0.000740) | (0.0118) | (0.000844) | (0.0116) | (0.000822) |
| Age owner | -0.0485** | -0.00296* | -0.0546** | -0.00440*** | -0.0571*** | -0.00282* |
| | (0.0206) | (0.00158) | (0.0216) | (0.00170) | (0.0215) | (0.00170) |
| Multi investor | 0.224*** | 0.0212*** | 0.212*** | 0.0228*** | 0.214*** | 0.0241*** |
| | (0.0513) | (0.00396) | (0.0544) | (0.00414) | (0.0544) | (0.00416) |
| Cost of K host | 0.168 | 1.283*** | 0.808 | 0.992*** | -0.382 | 1.478*** |
| | (1.436) | (0.137) | (0.665) | (0.0941) | (1.496) | (0.148) |
| Cost of K home | 1.651 | 0.204*** | -0.836 | 0.00673 | 1.412 | 0.244*** |
| | (1.482) | (0.0352) | (0.611) | (0.0395) | (1.544) | (0.0392) |
| Mean Size | | 0.0232*** | | 0.0274*** | | 0.0264*** |
| | | (0.00464) | | (0.00517) | | (0.00511) |
| Mean Age | | -0.0385*** | | -0.0501*** | | -0.0454*** |
| | | (0.00682) | | (0.00769) | | (0.00754) |
| Mean Multi | | -0.109*** | | -0.124*** | | -0.123*** |
| | | (0.0226) | | (0.0247) | | (0.0245) |
| *Country-level Variables* | | | | | | |
| FDI barrier host | | -0.192*** | | -0.201*** | | -0.190*** |
| | | (0.00915) | | (0.00955) | | (0.00959) |
| GDP host | -2.465 | 0.247*** | -3.556 | 0.260*** | -2.425 | 0.250*** |
| | (2.159) | (0.0109) | (2.188) | (0.0114) | (2.256) | (0.0114) |
| GDP home | -2.267 | -0.0335*** | -1.406 | -0.0150*** | -2.116 | -0.0242*** |
| | (2.131) | (0.00536) | (2.141) | (0.00581) | (2.234) | (0.00598) |
| GDP per capita host | 3.156* | -0.160*** | 3.587** | -0.154*** | 2.546 | -0.164*** |
| | (1.771) | (0.0172) | (1.788) | (0.0180) | (1.856) | (0.0181) |
| GDP per capita home | 2.449 | 0.0403*** | 1.183 | 0.0352*** | 1.919 | 0.0312*** |
| | (1.947) | (0.00841) | (1.925) | (0.00843) | (2.022) | (0.00886) |
| Market potential host | -10.67** | -0.359*** | -11.74** | -0.372*** | -8.661 | -0.347*** |
| | (5.172) | (0.0411) | (5.207) | (0.0438) | (5.327) | (0.0435) |
| Market potential home | 0.0189 | -0.280*** | 2.330 | -0.336*** | 0.876 | -0.314*** |
| | (4.788) | (0.0151) | (4.543) | (0.0160) | (4.962) | (0.0164) |
| Education host | 0.391 | -0.606*** | 0.410 | -0.606*** | 0.708 | -0.647*** |
| | (0.652) | (0.0294) | (0.654) | (0.0300) | (0.674) | (0.0314) |
| Education home | 0.208 | 0.166*** | -0.000813 | 0.179*** | -0.229 | 0.153*** |

| | | | | | | |
|---|---|---|---|---|---|---|
| | (0.544) | (0.0126) | (0.589) | (0.0129) | (0.604) | (0.0133) |
| Openness host | -1.323*** | -0.212*** | -1.463*** | -0.204*** | -1.367** | -0.184*** |
| | (0.511) | (0.0367) | (0.536) | (0.0380) | (0.536) | (0.0383) |
| Openness home | 0.677 | -0.201*** | 0.854 | -0.159*** | 0.850 | -0.158*** |
| | (0.671) | (0.0158) | (0.718) | (0.0173) | (0.722) | (0.0175) |
| EU15 host | | 0.0412*** | | 0.0258** | | 0.0323*** |
| | | (0.0108) | | (0.0114) | | (0.0118) |
| EU15 home | | 0.0873*** | | 0.0588*** | | 0.0721*** |
| | | (0.0143) | | (0.0150) | | (0.0158) |
| EU 15 both | 0.445** | -0.0454*** | 0.466** | -0.0235** | 0.474** | -0.0319*** |
| | (0.176) | (0.0109) | (0.193) | (0.0116) | (0.192) | (0.0121) |
| Euro host | | -0.0206*** | | -0.0123** | | -0.0146** |
| | | (0.00528) | | (0.00591) | | (0.00597) |
| Euro home | | 0.00347 | | 0.0151** | | -0.000299 |
| | | (0.00569) | | (0.00614) | | (0.00616) |
| Euro both | -0.0970 | 0.000405 | 0.0314 | -0.0115* | 0.0315 | -0.00872 |
| | (0.116) | (0.00595) | (0.132) | (0.00691) | (0.131) | (0.00695) |
| Distance | 0.282** | -0.465*** | 0.186 | -0.465*** | 0.180 | -0.468*** |
| | (0.116) | (0.0144) | (0.126) | (0.0148) | (0.127) | (0.0149) |
| Contiguity | | 0.284*** | | 0.246*** | | 0.235*** |
| | | (0.0214) | | (0.0222) | | (0.0223) |
| Common Language | | 0.205*** | | 0.210*** | | 0.239*** |
| | | (0.0268) | | (0.0269) | | (0.0281) |
| Rho | -0.274*** | | -0.220** | | -0.210* | |
| | (0.0984) | | (0.112) | | (0.112) | |
| Sigma | 0.772*** | | 0.756*** | | 0.754*** | |
| | (0.0227) | | (0.0213) | | (0.0206) | |
| Constant | 181.4* | 5.138*** | 186.7* | 5.536*** | 160.9 | 4.723*** |
| | (103.1) | (0.409) | (96.52) | (0.412) | (106.0) | (0.421) |
| Observations | 255,718 | | 229,385 | | 229,385 | |

Notes: All intensive margin regressions include home country, host country, year, and owner and affiliate sector dummies. All extensive margin regressions include year dummies. Specification 1 uses country-level taxes and cost of capital; 2 and 3 use firm-level. Errors clustered at the owner level. *, **, and *** indicate significance at the 10%, 5%, and 1% level.

**Table 7: Estimated Elasticities**

| | | | |
|---|---|---|---|
| EATR host | -1.29*** | Market potential host | -0.881*** |
| EATR home | -0.434*** | Market potential home | -0.816*** |
| Assets owner | 0.0105** | Education host | -1.42*** |
| Age owner | -0.0102*** | Education home | 0.44** |
| Multi investor | 0.0536** | Openness host | -0.478*** |
| Cost of K host | 2.34** | Openness home | -0.364*** |
| Cost of K home | -0.0467 | EU15 host | -0.0061 |
| Mean Size | 0.0652** | EU15 home | 0.03 |
| Mean Age | -0.122*** | EU 15 both | -0.0176 |
| Mean Multi | -0.285*** | Euro host | -0.00268 |
| FDI barrier host | -0.473*** | Euro home | 0.0556** |
| GDP host | 0.612** | Euro both | -0.0254 |
| GDP home | -0.0229*** | Distance | -1.1*** |
| GDP per capita host | -0.362*** | Contiguity | 0.572** |
| GDP per capita home | 0.113** | Common Language | 0.497** |

Notes: Elasticities based on estimates of Table 6, specification 2 and calculated at the sample mean.

**Table 8: Additional Dummies in the Extensive Margin**

| | (1) Country Taxes | | (2) Firm Taxes | | (3) Firm Taxes | |
|---|---|---|---|---|---|---|
| | Int. | Ext. | Int. | Ext. | Int. | Ext. |
| EMTR host | -0.246** | | -0.117 | | -0.130 | |
| | (0.117) | | (0.133) | | (0.158) | |
| EMTR home | -0.259*** | | -0.0959 | | 0.0699 | |
| | (0.0831) | | (0.107) | | (0.119) | |
| EATR host | | -0.551*** | | -0.556*** | | 0.0330 |
| | | (0.0557) | | (0.0592) | | (0.103) |
| EATR home | | -0.207*** | | -0.184*** | | -0.0378 |
| | | (0.0207) | | (0.0257) | | (0.0311) |
| Assets owner | 0.205*** | 0.00339*** | 0.219*** | 0.00447*** | 0.209*** | 0.00565*** |
| | (0.0104) | (0.000741) | (0.0117) | (0.000846) | (0.0118) | (0.000653) |
| Age owner | -0.0738*** | -0.00255 | -0.0777*** | -0.00407** | -0.0561*** | 0.000157 |
| | (0.0201) | (0.00159) | (0.0211) | (0.00172) | (0.0216) | (0.00125) |
| Multi investor | 0.242*** | 0.0205*** | 0.236*** | 0.0221*** | 0.213*** | 0.0318*** |
| | (0.0516) | (0.00397) | (0.0549) | (0.00416) | (0.0544) | (0.00305) |
| Cost of K host | -0.553 | 1.297*** | 0.123 | 1.001*** | 0.900 | 0.412*** |
| | (0.878) | (0.137) | (0.538) | (0.0949) | (0.663) | (0.146) |
| Cost of K home | 1.413* | 0.197*** | -0.00588 | -0.00488 | -0.867 | -0.0723 |
| | (0.749) | (0.0355) | (0.506) | (0.0401) | (0.610) | (0.0595) |
| Mean Size | | 0.0247*** | | 0.0289*** | | |
| | | (0.00493) | | (0.00547) | | |
| Mean Age | | -0.0432*** | | -0.0543*** | | |
| | | (0.00737) | | (0.00829) | | |
| Mean Multi | | -0.109*** | | -0.124*** | | |
| | | (0.0248) | | (0.0268) | | |
| *Country-level Variables* | | | | | | |
| FDI barrier host | | -0.192*** | | -0.200*** | | 0.0739** |
| | | (0.00910) | | (0.00952) | | (0.0330) |
| GDP host | -0.147*** | 0.248*** | -0.207*** | 0.260*** | -3.520 | 0.603 |
| | (0.0505) | (0.0109) | (0.0534) | (0.0114) | (2.197) | (0.483) |
| GDP home | -0.0204 | -0.0330*** | -0.0277 | -0.0147** | -1.498 | 0.144 |
| | (0.0519) | (0.00536) | (0.0565) | (0.00581) | (2.143) | (0.135) |
| GDP per capita host | 0.427*** | -0.159*** | 0.368*** | -0.154*** | 3.860** | -1.932*** |
| | (0.0830) | (0.0172) | (0.0906) | (0.0181) | (1.807) | (0.407) |
| GDP per capita home | 0.318*** | 0.0394*** | 0.241** | 0.0340*** | 1.317 | -0.191 |
| | (0.0924) | (0.00841) | (0.0964) | (0.00843) | (1.926) | (0.116) |
| Market potential host | 0.436** | -0.360*** | 0.420** | -0.373*** | -13.53** | 11.42*** |
| | (0.174) | (0.0411) | (0.175) | (0.0438) | (5.402) | (1.311) |
| Market potential home | 0.202 | -0.283*** | 0.232 | -0.339*** | 2.053 | 0.397 |
| | (0.156) | (0.0152) | (0.166) | (0.0161) | (4.547) | (0.366) |
| Education host | 0.525*** | -0.607*** | 0.500*** | -0.607*** | 0.299 | -0.516*** |
| | (0.165) | (0.0294) | (0.154) | (0.0300) | (0.646) | (0.145) |
| Education home | -0.349** | 0.165*** | -0.134 | 0.178*** | 0.0616 | -0.0435 |
| | (0.143) | (0.0126) | (0.130) | (0.0128) | (0.587) | (0.0343) |
| Openness host | -0.399** | -0.212*** | -0.354* | -0.204*** | -1.611*** | 0.412*** |
| | (0.199) | (0.0366) | (0.194) | (0.0379) | (0.539) | (0.137) |

| | | | | | | |
|---|---|---|---|---|---|---|
| Openness home | 0.0421 | -0.199*** | -0.109 | -0.157*** | 0.750 | 0.142*** |
| | (0.178) | (0.0159) | (0.185) | (0.0173) | (0.720) | (0.0434) |
| EU15 host | -0.125 | 0.0406*** | -0.0956 | 0.0253** | | |
| | (0.196) | (0.0108) | (0.211) | (0.0114) | | |
| EU15 home | -0.233 | 0.0854*** | -0.307* | 0.0570*** | | |
| | (0.157) | (0.0144) | (0.170) | (0.0151) | | |
| EU 15 both | 0.408** | -0.0450*** | 0.451** | -0.0232** | 0.461** | -0.00122 |
| | (0.171) | (0.0109) | (0.186) | (0.0117) | (0.193) | (0.00502) |
| Euro host | -0.0473 | -0.0200*** | -0.177 | -0.0117** | | |
| | (0.112) | (0.00519) | (0.121) | (0.00583) | | |
| Euro home | 0.157 | 0.00316 | 0.213** | 0.0142** | | |
| | (0.0983) | (0.00571) | (0.108) | (0.00617) | | |
| Euro both | -0.0545 | -2.09e-06 | 0.0852 | -0.0121* | 0.0346 | -0.0210*** |
| | (0.107) | (0.00591) | (0.120) | (0.00688) | (0.132) | (0.00492) |
| Distance | 0.363*** | -0.466*** | 0.310*** | -0.466*** | 0.0939 | -0.441*** |
| | (0.0851) | (0.0144) | (0.0913) | (0.0148) | (0.0994) | (0.0160) |
| Contiguity | | 0.282*** | | 0.244*** | | 0.383*** |
| | | (0.0215) | | (0.0223) | | (0.0250) |
| Common Language | | 0.208*** | | 0.213*** | | 0.334*** |
| | | (0.0267) | | (0.0271) | | (0.0359) |
| Rho | -0.237*** | | -0.209*** | | -0.123 | |
| | (0.0684) | | (0.0770) | | (0.0792) | |
| Sigma | 0.776*** | | 0.768*** | | 0.742*** | |
| | (0.0149) | | (0.0152) | | (0.0109) | |
| Constant | 0.529 | 5.127*** | 3.956* | 5.534*** | 206.0** | -115.8*** |
| | (2.477) | (0.410) | (2.262) | (0.412) | (97.44) | (17.48) |
| Observations | 255,718 | | 229,385 | | 229,385 | |

Notes: All intensive margin regressions include year and owner and affiliate sector dummies. All extensive margin regressions include year dummies. Specification 3 also includes home, host, and owner dummies in both intensive and extensive regressions. Errors clustered at the owner level. *, **, and *** indicate significance at the 10%, 5%, and 1% level.

**Table 9: Including Owner Productivity**

| | (1) With Productivity | | (2) Without Productivity | |
|---|---|---|---|---|
| | Int. | Ext. | Int. | Ext. |
| EMTR host | 0.0802 | | 0.0124 | |
| | (0.207) | | (0.210) | |
| EMTR home | 0.139 | | 0.0992 | |
| | (0.178) | | (0.180) | |
| EATR host | | -0.567*** | | -0.566*** |
| | | (0.0818) | | (0.0817) |
| EATR home | | -0.0146 | | -0.0126 |
| | | (0.0395) | | (0.0380) |
| Productivity owner | -0.0708*** | -0.000107 | | |
| | (0.0160) | (0.000973) | | |
| Assets owner | 0.226*** | 0.00813*** | 0.248*** | 0.00816*** |
| | (0.0182) | (0.00127) | (0.0175) | (0.00125) |
| Age owner | 0.0148 | -0.00871*** | -0.00783 | -0.00875*** |
| | (0.0299) | (0.00248) | (0.0294) | (0.00243) |
| Multi investor | 0.0963 | 0.0234*** | 0.113 | 0.0233*** |
| | (0.0696) | (0.00480) | (0.0696) | (0.00479) |
| Cost of K host | -0.130 | 1.112*** | -0.0450 | 1.110*** |
| | (0.964) | (0.140) | (0.973) | (0.140) |
| Cost of K home | -0.346 | -0.168*** | -0.514 | -0.170*** |
| | (0.816) | (0.0576) | (0.833) | (0.0557) |
| Mean Size | | 0.0150** | | 0.0150** |
| | | (0.00587) | | (0.00587) |
| Mean Age | | -0.0199** | | -0.0201** |
| | | (0.00808) | | (0.00811) |
| Mean Multi | | -0.0592** | | -0.0591** |
| | | (0.0250) | | (0.0249) |
| *Country-level Variables* | | | | |
| FDI barrier host | | -0.186*** | | -0.186*** |
| | | (0.0122) | | (0.0122) |
| GDP host | -6.648** | 0.234*** | -6.470** | 0.234*** |
| | (2.617) | (0.0139) | (2.631) | (0.0139) |
| GDP home | -0.0748 | -0.0373*** | -0.123 | -0.0374*** |
| | (2.758) | (0.00718) | (2.745) | (0.00716) |
| GDP per capita host | 5.985*** | -0.152*** | 5.805*** | -0.152*** |
| | (2.178) | (0.0243) | (2.191) | (0.0243) |
| GDP per capita home | 0.145 | 0.0237** | 0.147 | 0.0236** |
| | (2.569) | (0.00950) | (2.560) | (0.00949) |
| Market potential host | -13.60** | -0.342*** | -13.61** | -0.342*** |
| | (6.447) | (0.0552) | (6.451) | (0.0552) |
| Market potential home | -1.275 | -0.365*** | -0.671 | -0.365*** |
| | (5.613) | (0.0199) | (5.584) | (0.0199) |
| Education host | -0.957 | -0.552*** | -0.918 | -0.551*** |
| | (0.859) | (0.0375) | (0.851) | (0.0375) |
| Education home | -0.0400 | 0.142*** | 0.0727 | 0.142*** |
| | (0.773) | (0.0154) | (0.768) | (0.0154) |

| | | | | |
|---|---|---|---|---|
| Openness host | -1.878*** | -0.281*** | -1.899*** | -0.281*** |
| | (0.659) | (0.0473) | (0.659) | (0.0473) |
| Openness home | 1.838** | -0.192*** | 1.788* | -0.192*** |
| | (0.937) | (0.0198) | (0.936) | (0.0198) |
| EU15 host | | 0.0290** | | 0.0291** |
| | | (0.0123) | | (0.0123) |
| EU15 home | | 0.0768*** | | 0.0768*** |
| | | (0.0164) | | (0.0164) |
| EU 15 both | 0.358 | -0.0164 | 0.347 | -0.0165 |
| | (0.220) | (0.0127) | (0.223) | (0.0127) |
| Euro host | | -0.000767 | | -0.000659 |
| | | (0.00669) | | (0.00666) |
| Euro home | | 0.00934 | | 0.00912 |
| | | (0.00835) | | (0.00832) |
| Euro both | 0.284* | -0.0192** | 0.285* | -0.0193** |
| | (0.159) | (0.00859) | (0.159) | (0.00857) |
| Distance | 0.216 | -0.519*** | 0.185 | -0.519*** |
| | (0.283) | (0.0178) | (0.248) | (0.0177) |
| Contiguity | | 0.238*** | | 0.238*** |
| | | (0.0272) | | (0.0271) |
| Common Language | | 0.120*** | | 0.120*** |
| | | (0.0397) | | (0.0397) |
| Rho | -0.195 | | -0.160 | |
| | (0.252) | | (0.219) | |
| Sigma | 0.724*** | | 0.721*** | |
| | (0.0411) | | (0.0303) | |
| Constant | 274.2** | 7.335*** | 266.8** | 7.338*** |
| | (118.9) | (0.475) | (118.9) | (0.475) |
| Observations | 134,524 | | 134,524 | |

Notes: All intensive margin regressions include home country, host country, year, and owner and affiliate sector dummies. All extensive margin regressions include year dummies. Errors clustered at the owner level. *, **, and *** indicate significance at the 10%, 5%, and 1% level.

**Table 10: Sector Differences**

| | (1) Manufacturing | | (2) Services | | (3) Financial | | (4) Utilities | |
|---|---|---|---|---|---|---|---|---|
| | Int. | Ext. | Int. | Ext. | Int. | Ext. | Int. | Ext. |
| EMTR host | -0.458 | | 0.0943 | | -1.603*** | | 0.781 | |
| | (0.421) | | (0.167) | | (0.612) | | (0.701) | |
| EMTR home | 0.291 | | -0.0284 | | 0.0428 | | 0.976* | |
| | (0.377) | | (0.130) | | (0.435) | | (0.541) | |
| EATR host | | -0.499*** | | -0.439*** | | -1.343*** | | -1.306*** |
| | | (0.155) | | (0.0702) | | (0.232) | | (0.207) |
| EATR home | | -0.0561 | | -0.204*** | | -0.383*** | | -0.0650 |
| | | (0.0693) | | (0.0281) | | (0.0955) | | (0.0804) |
| Assets owner | 0.284*** | 0.00412** | 0.205*** | 0.00398*** | 0.209*** | 0.00366 | 0.190*** | 0.00990*** |
| | (0.0298) | (0.00193) | (0.0136) | (0.000945) | (0.0511) | (0.00291) | (0.0367) | (0.00273) |
| Age owner | -0.108** | 0.000377 | -0.0287 | -0.00490** | -0.125 | -0.0128** | -0.144** | -0.00797 |
| | (0.0505) | (0.00337) | (0.0254) | (0.00193) | (0.110) | (0.00536) | (0.0718) | (0.00510) |
| Multi investor | 0.139 | 0.0314*** | 0.261*** | 0.0255*** | -0.158 | -0.0126 | 0.0617 | 0.000433 |
| | (0.134) | (0.00958) | (0.0633) | (0.00469) | (0.257) | (0.0127) | (0.181) | (0.0128) |
| Cost of K host | -0.240 | 1.165*** | 0.408 | 0.988*** | 5.581 | 0.903*** | -2.324 | 2.023*** |
| | (1.775) | (0.264) | (0.703) | (0.110) | (3.423) | (0.341) | (3.245) | (0.366) |
| Cost of K home | -1.195 | -0.190** | -0.492 | -0.0287 | -1.686 | 0.446*** | -4.854* | -0.181 |
| | (1.815) | (0.0941) | (0.663) | (0.0479) | (3.182) | (0.145) | (2.675) | (0.133) |
| Mean Size | | 0.0204* | | 0.0316*** | | 0.000802 | | 0.0228 |
| | | (0.0106) | | (0.00649) | | (0.0148) | | (0.0174) |
| Mean Age | | -0.0412** | | -0.0485*** | | -0.0421** | | -0.0661*** |
| | | (0.0162) | | (0.00859) | | (0.0211) | | (0.0251) |
| Mean Multi | | -0.103** | | -0.132*** | | -0.131** | | -0.139 |
| | | (0.0518) | | (0.0292) | | (0.0668) | | (0.0887) |
| *Country-level Variables* | | | | | | | | |
| FDI barrier host | | -0.247*** | | -0.159*** | | -0.279*** | | -0.234*** |
| | | (0.0242) | | (0.0111) | | (0.0434) | | (0.0291) |
| GDP host | 0.148 | 0.333*** | -0.526 | 0.239*** | 6.971 | 0.235*** | -14.62* | 0.326*** |
| | (0.156) | (0.0274) | (2.507) | (0.0133) | (16.14) | (0.0500) | (7.822) | (0.0367) |
| GDP home | 3.615 | 0.0176 | -1.818 | -0.0136** | -8.722 | -0.0847*** | 4.636 | -0.0127 |
| | (5.345) | (0.0123) | (2.565) | (0.00587) | (10.49) | (0.0199) | (6.695) | (0.0165) |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| GDP per capita host | 0.220 | -0.518*** | 2.342 | -0.0936*** | -13.29 | 0.225** | 10.61 | -0.211*** |
| | (0.291) | (0.0455) | (2.036) | (0.0208) | (13.57) | (0.0917) | (6.466) | (0.0625) |
| GDP per capita home | -5.454 | -0.00383 | -0.0166 | 0.0474*** | 16.80* | 0.0843*** | 5.600 | -0.00633 |
| | (5.111) | (0.0191) | (2.291) | (0.00949) | (8.760) | (0.0209) | (6.212) | (0.0300) |
| Market potential host | 0.139 | -0.595*** | -17.41*** | -0.456*** | -13.60 | 1.724*** | -24.66 | -0.978*** |
| | (0.510) | (0.113) | (5.842) | (0.0494) | (37.22) | (0.229) | (23.51) | (0.154) |
| Market potential home | 8.900 | -0.348*** | -1.136 | -0.339*** | 54.79** | -0.255*** | 8.638 | -0.238*** |
| | (11.38) | (0.0328) | (5.324) | (0.0183) | (23.23) | (0.0941) | (17.35) | (0.0432) |
| Education host | -0.156 | -0.565*** | 0.745 | -0.611*** | 4.756 | -0.596*** | -1.221 | -0.878*** |
| | (0.390) | (0.0764) | (0.739) | (0.0339) | (4.870) | (0.183) | (3.264) | (0.0909) |
| Education home | -0.542 | 0.253*** | -0.501 | 0.199*** | -2.337 | 0.0393 | 1.905 | 0.151*** |
| | (1.499) | (0.0257) | (0.673) | (0.0135) | (3.340) | (0.0309) | (1.903) | (0.0383) |
| Openness host | -0.704 | -0.0586 | -1.508** | -0.172*** | 5.358 | -0.832*** | -3.604* | -0.360*** |
| | (0.503) | (0.0947) | (0.635) | (0.0440) | (4.080) | (0.200) | (2.070) | (0.132) |
| Openness home | 0.424 | -0.103*** | 0.972 | -0.168*** | 7.835** | -0.276*** | 3.818 | -0.169*** |
| | (2.010) | (0.0377) | (0.831) | (0.0183) | (3.454) | (0.0600) | (2.515) | (0.0569) |
| EU15 host | | 0.0690** | | 0.00739 | | -0.137*** | | 0.100** |
| | | (0.0330) | | (0.0131) | | (0.0442) | | (0.0490) |
| EU15 home | | 0.00949 | | 0.0469*** | | 0.125*** | | 0.0782 |
| | | (0.0309) | | (0.0161) | | (0.0456) | | (0.0509) |
| EU 15 both | -0.504 | 0.00130 | 0.330 | -0.0201 | -0.126 | -0.0222 | 0.711 | 0.00787 |
| | (0.314) | (0.0333) | (0.214) | (0.0136) | (1.376) | (0.0459) | (0.793) | (0.0472) |
| Euro host | | -0.0456** | | -0.000525 | | -0.00466 | | -0.142*** |
| | | (0.0200) | | (0.00666) | | (0.0281) | | (0.0310) |
| Euro home | | -0.00589 | | 0.0369*** | | 0.00300 | | -0.0562*** |
| | | (0.0152) | | (0.00753) | | (0.0286) | | (0.0216) |
| Euro both | 0.0893 | 0.0110 | -0.0235 | -0.0364*** | -0.512 | -0.0545 | -0.0593 | 0.114*** |
| | (0.259) | (0.0202) | (0.151) | (0.00812) | (0.811) | (0.0352) | (0.579) | (0.0281) |
| Distance | -0.152 | -0.528*** | 0.0975 | -0.473*** | 0.690 | -0.292*** | -0.214 | -0.470*** |
| | (0.196) | (0.0357) | (0.121) | (0.0168) | (0.421) | (0.0794) | (0.370) | (0.0433) |
| Contiguity | | 0.0910* | | 0.309*** | | 0.409*** | | 0.134* |
| | | (0.0514) | | (0.0252) | | (0.0938) | | (0.0748) |
| Common Language | | 0.258*** | | 0.175*** | | -0.00312 | | 0.406*** |
| | | (0.0720) | | (0.0307) | | (0.0946) | | (0.0912) |
| Rho | 0.163 | | -0.127 | | -0.780*** | | 0.152 | |
| | (0.168) | | (0.105) | | (0.293) | | (0.291) | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Sigma | 0.719*** | | 0.685*** | | 1.058*** | | 0.799*** | |
| | (0.0268) | | (0.0145) | | (0.137) | | (0.0416) | |
| Constant | -117.3 | 7.596*** | 233.8** | 5.883*** | -457.3 | -12.82*** | 269.9 | 11.76*** |
| | (180.9) | (0.987) | (111.5) | (0.467) | (663.0) | (2.787) | (364.4) | (1.239) |
| Observations | 32,585 | | 159,188 | | 13,661 | | 23,831 | |

Notes: All intensive margin regressions include home country, host country, year, and owner and affiliate sector dummies. All extensive margin regressions include year dummies. Errors clustered at the owner level. *, **, and *** indicate significance at the 10%, 5%, and 1% level.

**Table 11: Sector Skill Differences**

| | (1) High Tech | | (2) Low Tech | |
|---|---|---|---|---|
| | Int. | Ext. | Int. | Ext. |
| EMTR host | -0.206 | | 0.103 | |
| | (0.302) | | (0.184) | |
| EMTR home | 0.0481 | | 0.0611 | |
| | (0.228) | | (0.149) | |
| EATR host | | -0.505*** | | -0.551*** |
| | | (0.101) | | (0.0750) |
| EATR home | | -0.230*** | | -0.134*** |
| | | (0.0387) | | (0.0316) |
| Assets owner | 0.204*** | 0.00355*** | 0.214*** | 0.00488*** |
| | (0.0198) | (0.00125) | (0.0146) | (0.00110) |
| Age owner | -0.0398 | -0.00160 | -0.0669*** | -0.00528*** |
| | (0.0405) | (0.00270) | (0.0259) | (0.00204) |
| Multi investor | 0.362*** | 0.0227*** | 0.144** | 0.0248*** |
| | (0.0949) | (0.00574) | (0.0666) | (0.00534) |
| Cost of K host | 2.179* | 0.885*** | -0.169 | 1.202*** |
| | (1.285) | (0.162) | (0.798) | (0.123) |
| Cost of K home | -1.365 | 0.155** | -0.441 | -0.169*** |
| | (1.175) | (0.0772) | (0.749) | (0.0482) |
| Mean Size | | 0.0173*** | | 0.0328*** |
| | | (0.00637) | | (0.00734) |
| Mean Age | | -0.0396*** | | -0.0561*** |
| | | (0.0102) | | (0.00974) |
| Mean Multi | | -0.0726** | | -0.152*** |
| | | (0.0326) | | (0.0325) |
| *Country-level Variables* | | | | |
| FDI barrier host | | -0.179*** | | -0.186*** |
| | | (0.0163) | | (0.0116) |
| GDP host | -1.164 | 0.296*** | -4.848* | 0.243*** |
| | (3.956) | (0.0204) | (2.729) | (0.0136) |
| GDP home | 5.017 | -0.00864 | -2.684 | -0.00900 |
| | (3.832) | (0.00808) | (2.493) | (0.00684) |
| GDP per capita host | 1.382 | -0.148*** | 4.726** | -0.180*** |
| | (3.137) | (0.0307) | (2.239) | (0.0223) |
| GDP per capita home | -4.494 | 0.0374*** | 1.681 | 0.0345*** |
| | (3.444) | (0.0116) | (2.245) | (0.0108) |
| Market potential host | -18.52** | -0.460*** | -7.049 | -0.554*** |
| | (8.719) | (0.0742) | (6.651) | (0.0538) |
| Market potential home | 6.629 | -0.346*** | -2.242 | -0.320*** |
| | (8.437) | (0.0255) | (5.577) | (0.0184) |
| Education host | 1.561 | -0.501*** | -0.167 | -0.691*** |
| | (1.194) | (0.0499) | (0.810) | (0.0360) |
| Education home | -0.800 | 0.189*** | 0.256 | 0.204*** |
| | (1.098) | (0.0200) | (0.700) | (0.0147) |
| Openness host | -1.776* | -0.0967 | -1.521** | -0.211*** |
| | (0.976) | (0.0664) | (0.647) | (0.0465) |

| | | | | |
|---|---|---|---|---|
| Openness home | 0.576 | -0.113*** | 0.788 | -0.180*** |
| | (1.237) | (0.0255) | (0.901) | (0.0209) |
| EU15 host | | -0.00784 | | 0.0416*** |
| | | (0.0193) | | (0.0141) |
| EU15 home | | 0.0444** | | 0.0458** |
| | | (0.0212) | | (0.0184) |
| EU 15 both | -0.00345 | -0.0149 | 0.472** | -0.0174 |
| | (0.376) | (0.0202) | (0.219) | (0.0142) |
| Euro host | | -0.00646 | | -0.0206*** |
| | | (0.00992) | | (0.00780) |
| Euro home | | 0.0231** | | 0.0118 |
| | | (0.0116) | | (0.00746) |
| Euro both | -0.0467 | -0.0315*** | 0.115 | -0.00445 |
| | (0.225) | (0.0122) | (0.162) | (0.00855) |
| Distance | 0.158 | -0.444*** | 0.116 | -0.495*** |
| | (0.151) | (0.0253) | (0.185) | (0.0173) |
| Contiguity | | 0.272*** | | 0.241*** |
| | | (0.0404) | | (0.0262) |
| Common Language | | 0.190*** | | 0.237*** |
| | | (0.0457) | | (0.0329) |
| Rho | -0.231* | | -0.121 | |
| | (0.133) | | (0.165) | |
| Sigma | 0.696*** | | 0.723*** | |
| | (0.0281) | | (0.0189) | |
| Constant | 64.86 | 4.237*** | 237.7* | 7.936*** |
| | (166.0) | (0.725) | (122.8) | (0.476) |
| Observations | 66,701 | | 148,903 | |

Notes: All intensive margin regressions include home country, host country, year, and owner and affiliate sector dummies. All extensive margin regressions include year dummies. Errors clustered at the owner level. *, **, and *** indicate significance at the 10%, 5%, and 1% level.

**Table 12: Single versus Multi-Investors**

| | (1) Single Investors | | (2) Multi-investors | |
|---|---|---|---|---|
| | Int. | Ext. | Int. | Ext. |
| EMTR host | -0.000463 | | -0.319 | |
| | (0.188) | | (0.279) | |
| EMTR home | -0.0741 | | 0.254 | |
| | (0.145) | | (0.194) | |
| EATR host | | -0.631*** | | -0.437*** |
| | | (0.0690) | | (0.0991) |
| EATR home | | -0.241*** | | -0.142*** |
| | | (0.0279) | | (0.0401) |
| Assets owner | 0.270*** | 0.00445*** | 0.133*** | 0.00523*** |
| | (0.0140) | (0.000842) | (0.0192) | (0.00143) |
| Age owner | -0.109*** | -0.00438*** | 0.0340 | -0.00435 |
| | (0.0257) | (0.00164) | (0.0364) | (0.00284) |
| Cost of K host | 0.992 | 1.005*** | 0.442 | 1.011*** |
| | (0.780) | (0.111) | (1.308) | (0.161) |
| Cost of K home | -0.473 | 0.0441 | -1.880 | 9.72e-05 |
| | (0.702) | (0.0468) | (1.176) | (0.0654) |
| Mean Size | | 0.0214*** | | 0.0382*** |
| | | (0.00436) | | (0.0127) |
| Mean Age | | -0.0459*** | | -0.0515*** |
| | | (0.00715) | | (0.0141) |
| *Country-level Variables* | | | | |
| FDI barrier host | | -0.221*** | | -0.171*** |
| | | (0.0113) | | (0.0164) |
| GDP host | -5.452** | 0.278*** | -1.917 | 0.236*** |
| | (2.648) | (0.0130) | (3.657) | (0.0203) |
| GDP home | -0.841 | -0.0117** | -1.965 | -0.0144 |
| | (2.671) | (0.00539) | (3.432) | (0.00923) |
| GDP per capita host | 5.870*** | -0.203*** | 1.255 | -0.0914*** |
| | (2.204) | (0.0201) | (2.969) | (0.0317) |
| GDP per capita home | -0.826 | 0.0509*** | 3.930 | 0.0111 |
| | (2.343) | (0.00775) | (3.193) | (0.0153) |
| Market potential host | -20.72*** | -0.483*** | -3.141 | -0.221*** |
| | (6.857) | (0.0506) | (7.951) | (0.0752) |
| Market potential home | 1.048 | -0.352*** | 2.097 | -0.303*** |
| | (5.516) | (0.0158) | (7.739) | (0.0282) |
| Education host | 0.448 | -0.596*** | 0.393 | -0.623*** |
| | (0.795) | (0.0346) | (1.137) | (0.0522) |
| Education home | -0.0165 | 0.189*** | 0.345 | 0.153*** |
| | (0.740) | (0.0118) | (0.946) | (0.0225) |
| Openness host | -1.385** | -0.218*** | -1.514* | -0.189*** |
| | (0.652) | (0.0433) | (0.890) | (0.0672) |
| Openness home | 1.496* | -0.195*** | -0.760 | -0.101*** |
| | (0.876) | (0.0166) | (1.227) | (0.0289) |
| EU15 host | | 0.0487*** | | 0.00131 |
| | | (0.0122) | | (0.0231) |

| | | | | |
|---|---|---|---|---|
| EU15 home | | 0.0600*** | | 0.0533* |
| | | (0.0138) | | (0.0280) |
| EU 15 both | 0.339 | -0.0294** | 0.446 | -0.0202 |
| | (0.215) | (0.0124) | (0.378) | (0.0232) |
| Euro host | | -0.0334*** | | 0.00833 |
| | | (0.00676) | | (0.0103) |
| Euro home | | 0.000130 | | 0.0233** |
| | | (0.00655) | | (0.0113) |
| Euro both | 0.00225 | 0.00390 | 0.101 | -0.0278** |
| | (0.152) | (0.00780) | (0.229) | (0.0116) |
| Distance | 0.184 | -0.538*** | 0.130 | -0.362*** |
| | (0.134) | (0.0162) | (0.303) | (0.0272) |
| Contiguity | | 0.260*** | | 0.227*** |
| | | (0.0244) | | (0.0408) |
| Common Language | | 0.278*** | | 0.138*** |
| | | (0.0292) | | (0.0490) |
| Rho | -0.162 | | -0.319 | |
| | (0.115) | | (0.306) | |
| Sigma | 0.659*** | | 0.847*** | |
| | (0.0183) | | (0.0784) | |
| Constant | 316.2*** | 7.520*** | 81.57 | 2.454*** |
| | (122.1) | (0.447) | (155.2) | (0.770) |
| Observations | 135,630 | | 93,755 | |

Notes: All intensive margin regressions include home country, host country, year, and owner and affiliate sector dummies. All extensive margin regressions include year and sector dummies. Errors clustered at the owner level. *, **, and *** indicate significance at the 10%, 5%, and 1% level.

**Table 13: Prior Investments**

| | (1) Single Investors | | (2) Multi-investors | |
|---|---|---|---|---|
| | Int. | Ext. | Int. | Ext. |
| EMTR host | -0.114 | | -0.132 | |
| | (0.157) | | (0.158) | |
| EMTR home | 0.0721 | | 0.0800 | |
| | (0.119) | | (0.119) | |
| EATR host | | -0.550*** | | -0.551*** |
| | | (0.0586) | | (0.0587) |
| EATR home | | -0.200*** | | -0.201*** |
| | | (0.0242) | | (0.0242) |
| Prior Investments | -0.0456** | 0.00739*** | | |
| | (0.0182) | (0.00213) | | |
| Prior Same Host | | | 0.0504 | -0.00635** |
| | | | (0.0377) | (0.00280) |
| Prior Other Hosts | | | -0.0858*** | 0.0132*** |
| | | | (0.0219) | (0.00227) |
| Assets owner | 0.212*** | 0.00395*** | 0.213*** | 0.00383*** |
| | (0.0118) | (0.000806) | (0.0117) | (0.000800) |
| Age owner | -0.0521** | -0.00467*** | -0.0523** | -0.00470*** |
| | (0.0216) | (0.00168) | (0.0216) | (0.00167) |
| Multi investor | 0.260*** | 0.0147*** | 0.246*** | 0.0168*** |
| | (0.0565) | (0.00409) | (0.0566) | (0.00407) |
| Cost of K host | 0.813 | 0.992*** | 0.913 | 0.991*** |
| | (0.665) | (0.0940) | (0.665) | (0.0943) |
| Cost of K home | -0.837 | 0.00512 | -0.873 | 0.00705 |
| | (0.611) | (0.0391) | (0.606) | (0.0393) |
| Mean Size | | 0.0271*** | | 0.0270*** |
| | | (0.00509) | | (0.00504) |
| Mean Age | | -0.0492*** | | -0.0489*** |
| | | (0.00740) | | (0.00722) |
| Mean Multi | | -0.128*** | | -0.125*** |
| | | (0.0243) | | (0.0240) |
| *Country-level Variables* | | | | |
| FDI barrier host | | -0.201*** | | -0.201*** |
| | | (0.00955) | | (0.00956) |
| GDP host | -3.517 | 0.260*** | -3.235 | 0.260*** |
| | (2.183) | (0.0114) | (2.180) | (0.0114) |
| GDP home | -1.492 | -0.0139*** | -1.687 | -0.0141*** |
| | (2.159) | (0.00531) | (2.163) | (0.00519) |
| GDP per capita host | 3.547** | -0.154*** | 3.365* | -0.154*** |
| | (1.785) | (0.0180) | (1.785) | (0.0180) |
| GDP per capita home | 1.230 | 0.0365*** | 1.436 | 0.0370*** |
| | (1.945) | (0.00796) | (1.950) | (0.00769) |
| Market potential host | -11.67** | -0.373*** | -11.82** | -0.373*** |
| | (5.203) | (0.0438) | (5.205) | (0.0438) |
| Market potential home | 1.950 | -0.337*** | 1.981 | -0.334*** |
| | (4.558) | (0.0155) | (4.559) | (0.0154) |

| | | | | |
|---|---|---|---|---|
| Education host | 0.408 | -0.606*** | 0.440 | -0.606*** |
| | (0.653) | (0.0300) | (0.652) | (0.0300) |
| Education home | 0.0704 | 0.181*** | 0.0802 | 0.181*** |
| | (0.597) | (0.0120) | (0.598) | (0.0117) |
| Openness host | -1.429*** | -0.204*** | -1.380*** | -0.205*** |
| | (0.534) | (0.0379) | (0.534) | (0.0380) |
| Openness home | 0.793 | -0.158*** | 0.748 | -0.158*** |
| | (0.718) | (0.0163) | (0.717) | (0.0160) |
| EU15 host | | 0.0250** | | 0.0245** |
| | | (0.0111) | | (0.0109) |
| EU15 home | | 0.0565*** | | 0.0584*** |
| | | (0.0139) | | (0.0134) |
| EU 15 both | 0.465** | -0.0220* | 0.477** | -0.0234** |
| | (0.193) | (0.0114) | (0.192) | (0.0112) |
| Euro host | | -0.0119** | | -0.0133** |
| | | (0.00591) | | (0.00583) |
| Euro home | | 0.0154** | | 0.0129** |
| | | (0.00611) | | (0.00600) |
| Euro both | 0.0334 | -0.0125* | 0.0136 | -0.00910 |
| | (0.132) | (0.00693) | (0.131) | (0.00677) |
| Distance | 0.179 | -0.465*** | 0.172 | -0.466*** |
| | (0.126) | (0.0147) | (0.125) | (0.0147) |
| Contiguity | | 0.246*** | | 0.246*** |
| | | (0.0223) | | (0.0223) |
| Common Language | | 0.210*** | | 0.210*** |
| | | (0.0269) | | (0.0270) |
| Rho | -0.211* | | -0.196* | |
| | (0.112) | | (0.111) | |
| Sigma | 0.754*** | | 0.751*** | |
| | (0.0207) | | (0.0195) | |
| Constant | 190.8** | 5.531*** | 189.2* | 5.517*** |
| | (96.98) | (0.410) | (97.41) | (0.410) |
| Observations | 229,385 | | 229,385 | |

Notes: All intensive margin regressions include home country, host country, year, and owner and affiliate sector dummies. All extensive margin regressions include year dummies. Errors clustered at the owner level. *, **, and *** indicate significance at the 10%, 5%, and 1% level.

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