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# Headquarters intangible capital and FDI

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**Abstract**

Headquarters (HQs) provide a wide range of services, playing a fundamental role in Foreign Direct Investment (FDI). We use the structural gravity equation to investigate the effect of regional HQs on three dimensions of FDI (number of foreign firms, capital investment, and jobs) at the country-pair-sector level. Furthermore, we explore two underlying mechanisms that help explain this relationship: financial constraints and informational costs and uncertainty. We find a positive effect of regional HQs on FDI, as well as inter-country and inter-sector spillovers. Our results are robust, accounting for HQ intensity, domestic investment flows in the three dimensions and endogeneity tests.

Keywords: FDI; headquarters; spillovers; intangible capital; credit constraints; structural gravity
JEL Classification: F20, F21, F23.

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# 1 Introduction

Regional Headquarters (HQ) provide useful services to affiliates in foreign countries (e.g., management, training, software, data, research and development, and the like). These HQ services are part of the intangible capital of the Multinational Enterprise (MNE) and are a key factor to understand Foreign Direct Investment (FDI). With these services, firms reduce offshore subsidiaries' sunk costs and play a fundamental role on trade and FDI (Antràs 2003; Antràs and Helpman 2004; Wang 2021). These facilities act as hubs of intangible capital, which provide HQ services directly from a foreign facility.

Intangible capital is often non-rival and usually exhibits synergies and spillovers (Haskel and Westlake 2017). Therefore, HQ intangible capital resembles a public good shared by the affiliates located in different countries (Helpman 2011). The non-rivalry nature of HQ intangible capital (one's consumption does not impede other's) has motivated profuse research on spillovers from foreign to domestic firms (Amoroso and Müller 2018; Blomström and Kokko 1998; Javorcik 2004; Merlevede et al. 2014; Mullen and Williams 2007; Sinani and Meyer 2004) and within firms (Cristea 2015). The literature has identified several spillover mechanisms; for example, spillovers induced by employee mobility between MNEs active in the host country (Davies 2005), or the reduction in the cost of transmitting complex information (Cristea 2015). [1]

The literature has, however, overlooked the spillovers of foreign firms towards other foreign firms. Foreign spillovers are plausible since foreign HQ intangible capital is highly country- and sector-specific. Therefore, it is precisely fellow firms who might benefit from culturally or linguistic specific services, like organizational practices or marketing. For example, Volkswagen's "Made in Germany" marketing campaign benefits other German firms, specifically other German car manufacturers. Therefore, new entrants have a smoother entry when they find a larger pool of HQ intangible capital. [2]

This paper fills this gap with a fourfold contribution. Firstly, we provide empirical evidence on the effect of regional HQs on FDI. Secondly, we analyze this effect on the volume of FDI (intensive margin), the number of foreign affiliates (extensive margin), and foreign employment (jobs), at the country-pair-

[1] Some empirical studies have gathered indirect evidence associated with the theoretical predictions of headquarter services (eg., intra-firm trade Yeaple 2006 and informational asymmetries Mariotti and Piscitello 1995; Oldenski 2012). For a thorough survey on knowledge spillovers on trade and FDI see Keller (2021).

[2] It is worth noting that this might not be the case for all services. For instance, in services such as training, there might be rivalry since the number of trainees is limited.

sector level. Thirdly, we identify two channels that might fuel this relationship: financial constraints and informational and uncertainty costs. Fourthly, we study inter-sectoral and inter-country spillovers. In particular, we estimate the effect of intangible HQ services on a panel of greenfield FDI and job data for 200 host countries, 172 home countries and 24 sectors (out of a total of 39) during 2003-2016. We exploit the structural gravity equation that deals with the known biases in the gravity model, including domestic intra-national FDI flows. To the best of our knowledge, this paper is novel in introducing domestic employment in a structural gravity setting for foreign job flows.

The paper presents an intuitive empirical exercise that nonetheless rests on solid theoretical grounds. Helpman (1984) was among the first to highlight research and development relevance (e.g., blueprints) centralized at the HQ. He decomposed the production process into manufacturing and headquarter services to accommodate FDI in the Helpman-Krugman trade model. The production was unbundled into two physically separated stages or vertical integration, as highlighted more recently by Baldwin (2018). Lower trade costs allowed firms to manufacture HQ's blueprints in a foreign country with better capital or labor endowments. In this setup, parent firms provide a wide range of HQ services to several subsidiaries, which replicated the production process to produce final goods (Yeaple 2003; Davies 2005). However, we rely on a more general interpretation of HQ services. Firstly, they include a wider range of services like management, marketing or financial assistance, which has led to reconcile HQ services with Knowledge-Capital Model of the MNE (Blonigen et al. 2003). Secondly, multinational enterprises invest in regional or foreign HQ to offer services directly in the host country, which reduces information transfer costs and uncertainty.

Our results boil down to the finding that country-pair-sector triads with a higher level of regional HQs exhibit higher levels of FDI, foreign affiliates and jobs. We also find other several interesting traits: i) Country-specific financial constraints and distance affect this relationship. ii) We observe sectoral heterogeneity where high-tech and service sectors exhibit a higher HQ effect. iii) Inter-sector and inter-country spillovers are significant. Our empirical strategy allows us to hedge endogeneity with country-pair fixed effects, lags, interactions with exogenous variables, the use of stocks as independent variable, and Instrumental Variables (IV). The results could be of interest for policymakers designing FDI promotion strategies.

The remainder of the paper is organized as follows: section 2 describes the empirical strategy and provides facts on the data; section 3 discusses the results, and finally section 4 concludes.

# 2 Data and Empirical strategy

## 2.1 Data

The dataset covers greenfield bilateral firm-level investments from 2003 to 2016 and covers 200 countries. We observe capital investment and jobs for each individual project, i.e., the establishment of a new foreign production facility.[3] We construct a project count (or extensive margin), aggregate capital investment (or intensive margin), and the number of foreign jobs from these data. These multifaceted measures provide different insights to FDI. The extensive margin provides a rationale for creating new investor partners and reduces the over-aggregation bias of capital flows (Hillberry 2002). The intensive margin measures the intensity of investment links. Foreign jobs capture the labor intensity of the foreign project.

The dataset allows us to identify regional HQs at the country-pair-sector level. Each observation is a greenfield investment tagged with five dimensions: country of origin, country of destination, year, sector and the affiliate's activity. Each MNE operates in one out of 39 sectors, and foreign affiliates of these firms have a specific activity. There are 17 sector-independent activities, including regional HQ (the other 16 include activities like technical support, manufacturing, construction, or business services). Out of the 39 sectors, 24 had a new regional HQ establishment during the sample period. This distinction allows us to track HQ's investment in intangible capital-related directly to HQ services. [4]

### 2.1.1 Data visualization

Three empirical observations aid to describe better the data. The first is related with the evolution of regional HQs during the 15 years of the sample period. The second fact is related to the correlation

[3]The data that support the findings of this study are available from FDIMarkets (2017). Restrictions apply to the availability of these data, which were used under license for this study. Data are available from `www.fdimarkets.com`. FDIMarkets (2017) (previously OCOMonitor) is the official data source of greenfield data of the UNCTAD's World Investment Report.

[4]Other studies had to rely on indirect measures of HQ services like R&D, see for example Cristea (2015).

of regional HQs and FDI. The third relates to sectoral heterogeneity.

**Fact 1.** *Regional HQs have increased steadily over the last decades.*

Figure 1 depicts several general yearly trends of Greenfield FDI (left) and regional HQs (right). Our FDI data come from FDIMarkets, which registers firm-level greenfield projects. The Figure 1 (a) exhibits the evolution of Greenfield capital investment (top left axis), labor (bottom left axis) and project count or extensive margin (right axis). The figure shows the surge of FDI up to the trade collapse in 2009 and the relative stable trend of these variables thereafter. [5]

[Figure 1 about here.]

The evolution of regional HQs measured in volumes or number of foreign HQ in Figure 1 (b) shows a different picture. Both the number of HQ and the investment in HQ show an upward trend during the period of the sample. This trend mainly breaks during the financial crisis (2009-2012) and at the end of the sample period (2015-2016). This behavior during the great recession of 2007-2008 motivates the use of systemic banking crisis variables to inspect whether financial constraints influences the HQ effect.

Figure 1 (c) depicts the jointly evolution of the number of regional HQs and the number of FDI projects (extensive margin). Both show a similar trend and slightly out of phase, suggesting that a lag would be appropriate to rule out reverse causality in the empirical analysis.

**Fact 2.** *Regional HQs and FDI are correlated.*

The scatter plots of Figure 2 shows that Greenfield FDI is correlated with both measures of regional HQs. Each point represents a country-pair and we plot the average investment over the period against the intensity in regional HQs in Figure 2 (a) and the number of foreign HQ in Figure 2 (b). It is readily seen that both measures are strongly correlated. One of our empirical tasks consists to clean this simple correlation from other cofounding factors that might drive this apparent relationship. We deal with endogeneity including in the regression country-pair fixed effects, lags, interaction with exogenous variables, and using an IV approach.

[Figure 2 about here.]

[5] For estimates on the effect of crisis on Greenfield FDI see Gil-Pareja et al. (2013)

**Fact 3.** *The heterogeneity of regional HQs across and within sectors and countries is high.*

The general trends shown in Figure 1 hide several facts that surfaces when we inspect regional HQs across sectors of activity. Firstly, only 24 out of 39 sectors have a regional HQ during the sample period. Secondly, the sectoral differences in regional HQs are sizable. In both measures the standard deviation is larger than the mean. The range reveals the difference between the sector with least regional HQs (minerals with only 3 HQ) and that with the highest regional HQs (Software & IT with more than 1000) is large.

We find similar results when we inspect country differences. During 2003-2016, the USA hosted more than 1,200 foreign HQ with a total investment of nearly 30 billion dollars. Conversely, 90 countries from our sample (45% of the total), received no foreign intangible capital during this period. Additionally, the variability in the intensity or capital invested in these HQ is also high. This means that heterogeneity within sectors and countries is also high.

The descriptive statistics of the variables used in this study, shown in Tables A.1 and A.2 of the Appendix, also reveal several interesting traits. Each country-pair hosted 1.3 regional HQ from a specific sector on average, with and investment of 34 million USD. Nine percent of the country-pairs hosted an HQ from all sectors and 22% of the country-pairs had a regional HQ during the sampling period (2003-2016). On average, countries hosted eight regional HQs with a total investment of 212 million USD.

## 2.2 Empirical strategy: The Gravity equation

The empirical strategy of this paper rests upon the gravity equation (Anderson 2011; Bergstrand and Egger 2011; Griffith 2007). The gravity equation for FDI has solid theoretical grounds (see, for example, Kleinert and Toubal 2010). The bilateral flow of goods, capital and people can be successfully modeled and estimated applying the gravity model. Boiled down, the gravity model predicts that the bilateral flows between country-pairs is affected by the expenditure at destination, income at origin, bilateral transaction costs and multilateral resistance or third country effects. In a panel setup, the most recent estimation techniques allows us to control for all determinants with effects except for time-varying bilateral varibles (Yotov et al. 2016).

We estimate our empirical equations with the variant of Silva and Tenreyro's (2006) PPML estimator proposed by Correia et al. (2019). Our specifications deal with the known biases in gravity estimation (i.e., unobserved bilateral heterogeneity, multilateral resistance terms, zero trade flows and heteroskedastic residuals). In particular, we estimate the following non-linear structural gravity equation:

$$FDI_{ijst} = \exp\begin{pmatrix} \beta_1 FTA_{ijt} + \beta_2 BIT_{ijt} + \beta_3 HQ_{ijst-1} + \\ \lambda_{it} + \lambda_{jt} + \lambda_{ij} + \lambda_s \end{pmatrix} + e_{ijst}, \quad (1)$$

where FDI is the foreign direct investment, measured either by capital (the intensive margin), projects (the extensive margin) or jobs, between source country $i$ and destination country $j$ in year $t$, and sector $s$. $HQ$ measures regional HQs with a dummy variable set to one when we observe a HQ in a given country-pair, sector and year and $e_{ijst}$ is a stochastic error term. The gravity equation includes a full set of time-varying home and host, country-pair, and sector fixed effects ($\lambda$). The use of structural gravity, with home-year, host-year, sector, and country-pair fixed effects, leaves little room for omitted variable bias. However, we use two other control variables. The first is Free Trade Agreements (FTA) and the second Bilateral Investment Treaties (BIT). These variables are dummies set to 1 whenever country-pairs have trade or investment agreements in force.

## 2.3 Channels

The second aim of the paper is to identify the underlying mechanisms of the HQ's effect on FDI flows. The literature has identified two channels that make this possible: financial costs, and informational asymmetries and uncertainty.

Firstly, credit supply is an evident constraint on FDI. Companies that want to invest in foreign markets face entry cost barriers in the form of fixed and information costs. Financial constraints may affect both the number of investments across borders and the amount invested. Gil-Pareja et al. (2013), using the gravity equation on a sample of 161 countries over the period 2003 to 2010, find that the great recession, through credit constraints on supply markets, reduced the number of FDI projects, but not their size, forcing investors to become more selective on their international endeavours. In a similar way, Buch et al. (2014) document that, for German firms, financial constrains appear to be a key factor for

the decision to engage in FDI, but less so for the aggregate magnitude of sales of foreign affiliates.

Several studies suggest that certain HQ intangible capital is related to finance and access to credit. Guariglia and Poncet (2008) contribute with a relevant finding for our analysis: the role of financial constraints. The authors provide empirical evidence that suggests that FDI is used to alleviate the costs associated with the inefficient banking sector. They find that the negative impact of financial distortions on economic growth in China is weaker for high FDI recipients. In line with these results, Héricourt and Poncet (2009) report that Chinese firms hedge financial constraints by seeking cross-border relationships with foreign firms. Efficient financial markets enable access to the capital needed for foreign production (Di Giovanni 2005) and underdeveloped financial markets impede FDI and growth (Alfaro et al. 2004). In line with these arguments, we capture financial constraints with dummy variables that measure credit constraints at the country level. As it is usual in this literature (Gil-Pareja et al. 2013, 2017), we use dummy variables set to one for those countries with extreme credit shortening in our sample period.

The crisis indicators are constructed with the list of systemic banking crises developed by Laeven and Valencia (2013). According to these authors, a systemic banking crisis must satisfy two conditions: "significant signs of financial distress in the banking system" and "significant banking policy intervention measures in response to significant losses in the banking system." In particular, we create three separate dummy variables. The first variable captures limited access to credit in both origin and destination countries at the same time. The other two variables take the value of one when only the home or the host country, but not both simultaneously, is involved in a financial crisis. The interaction of these crisis variables with HQ reveals the extent by which the effect of HQ operates through financial constraints. We expect that the presence of an HQ alleviates the negative effect of financial constraints on FDI when only one country in the pair faces a credit crisis. In this situation, the HQ can provide financial information and help from the market unaffected by credit constraints increasing FDI prospects. The reason is that regional HQs have contacts and information to facilitate the access to credit to firms at the destination and, obviously, at the origin country. However, no effect is expected when both countries in the pair suffer a credit crisis simultaneously since the HQ is unable to broker financial information in this case.

Secondly, FDI is subject to transaction costs associated to informational asymmetries and uncer-

tainty. We measure information asymmetries and uncertainty with physical distance, which we took from CEPII (2011). The effect of distance on FDI and its relationship with transportation costs is a topic of growing interest in the literature. Alfaro and Chen (2018) overview how transportation costs, including broadly the cost of transporting goods, services and ideas, have shaped FDI and multinational production. Most estimates of the distance effect on FDI are negative, which lead authors to identify distance with freight costs. [6] However, distance captures more that transport costs and are a measure of communication costs that arise from information asymmetries (Choi and Choi 2014). Additionally, Conconi et al. (2016) highlights the role of uncertainty by examining how it affects firm's exports and FDI choices. These authors provide strong evidence that the impact of export experience on FDI entry decision depends crucially on the extent of foreign market uncertainty. In more uncertain foreign markets, firms experiment longer with exports, before engaging in FDI. Therefore, in our context, HQ services could contribute to reduce information asymmetries and uncertainty in more distant markets. Thus, we expect a positive coefficient for the interaction of HQ and the log of distance. [7]

## 2.4 Spillovers

According to the endogenous growth theory, spillovers that stem from the non-rivalry of knowledge are central in generating long-run economic growth (Romer 1990). In a recent survey, Keller (2021) documents robust evidence that both trade and FDI lead to sizable knowledge spillovers. Therefore, we expect additional knowledge spillovers from regional HQ that interact with other foreign firms.

Consider, for example, that the German car manufacturer Volkswagen establishes a regional HQ in Spain. The "made in Germany" campaign has a direct effect on other German car manufactures operating in Spain. However, spillovers could occur at least in two ways. Firstly, inter-sector spillovers where the "made in Germany" campaign could spillover to other German firms from other sectors because economic agents in Spain increase their knowledge set of German firms. Secondly, inter-country spillovers where Volkswagen's campaign could spill over onto car manufactures from other countries.

[6] For exceptions see Daniels and von der Ruhr (2014), who find that transportation costs have a positive and statistically significant relationship with FDI.

[7] Several authors use an interaction with distance as a country-level measure of uncertainty, for example Conconi et al. (2016) and Myburgh and Paniagua (2016).

We estimate inter-country spillovers by creating the following variable:

$$\sum_{i} HQ_{ijst-1} - HQ_{ijst-1}, \tag{2}$$

where the first term of equation 2 is the sum of number of HQs from all origins in a particular sector s in the country-pair-sector triad. The second term is the specific investment from country i to country j in sector s. Therefore, we are estimating the spillover of the rest of countries within a country-pair-sector.

We estimate inter-sector spillovers by creating the following variable:

$$\sum_{s} HQ_{ijst-1} - HQ_{ijst-1} \tag{3}$$

where the first term of equation 3 is the sum of number of HQs from all sectors in the country-pair. As above, the second term is the specific investment from country i to country j in sector s. Therefore, we are estimating the spillover of the rest of sectors within a country-pair-sector.

## 2.5 Endogenity

A common bias in most empirical work is endogeneity and we employ several different strategies to combat it. Firstly, we introduce a lag in the HQ variable as a first attempt to address the possible reverse causality bias between FDI flows and regional HQs. Secondly, the inclusion of country-pair fixed effects in all regression controls for unobservable bilateral heterogeneity that remains constant over time, and thus reduces the endogeneity bias as show Baier and Bergstrand (2007). Thirdly, we interact the HQ variable with the exogenous variables like distance, banking crisis, and border. Nizalova and Murtazashvili (2016) demonstrate that the interaction term between an exogenous and a potentially endogenous factor turns out to be exogenous. Fourthly, we use a measure of HQs in stocks, which reduces the potential adverse effects of reverse causality when the dependent variable is in flows. Fifthly, we use an IV approach when estimating the effect of HQ intensity, which is measured as the investment in foreign firms in million USD.

The instrument for our IV strategy is reinvestment. The UNCTAD's World Investment Report distinguishes FDI between new greenfield projects (i.e. investing in new production facilities abroad)

and expansion projects (i.e. re-investing in existing facilities abroad). Together they represent 72% of the cross-border economic activity abroad (the rest are mergers and acquisitions). Particularly in developed countries, nearly half of the cross-border investment takes place through reinvestment aimed to expand existing production facilities abroad (UNCTAD 2013, p. 24). Policymakers allocate substantial resources to aftercare investment services since most FDI "is in the form of re-investment or expansions by existing investors" (Loewendahl 2001, p. 25). [8]

The literature on reinvestment is not only smaller compared to other FDI types,[9] but predominantly empirical, with the exception of Paniagua (2015) who developed a theoretical gravity model for reinvestment. Reinvestment in affiliates improve their production process, management or financial capabilities (Wells and Wint 2000). When MNEs reinvest, they expand their production and increase staff and therefore reduce communication barriers (Paniagua and Sapena 2013).

Moreover, several studies show that reinvestment have different determinants from greenfield investment. Additionally, the sample of greenfield firms and reinvestment is different. Studies reveal that foreign reinvestment depends largely on firm's internal factors, such as sales (Wren and Jones 2009) and the track record of past endeavors (Chiţu et al. 2014). Paniagua and Sapena (2013) show that the host's governance variables (e.g. political openness) exhort influence on greenfield but no significant effect on reinvestment. Regarding transaction costs, Gil-Pareja et al. (2013) show the different effects of systemic banking crisis on greenfield and reinvestment.

# 3 Results

## 3.1 Country-pair-sector results and channels

Overall, the results show that the gravity equation performs well explaining the three FDI-related flows at the country-pair-sector level. The results reported in Table 1 include the HQ dummy to measure intangible capital.

[8] For instance, Ireland and Spain IPAs have built departments to deal exclusively with after-care investment. One illustrative example is Oregon, USA, which "focuses exclusively on after-care with existing investors as the primary mechanism to generate new investment" (Loewendahl 2001, p. 5).

[9] For example greenfield FDI, mergers, acquisitions, reinvestment, complex integration or partial ownership (Fatica 2010; Grossman et al. 2006; Nocke and Yeaple 2007; Portes and Rey 2005)

[Table 1 about here.]

The control variables BIT and FTA have the expected positive signs, but only in two out of the six cases the estimated coefficients are significant at conventional levels. Columns (1) - (3) reveal that switching from no HQs to at least one HQ on a certain year in a particular country-pair-sector increases on average by 51%, 53%, and 59% the level of FDI, greenfield projects, and job flows, respectively. [10] Columns (4) - (6) report the marginal effect of the stock of regional HQ. Increasing by at least one regional HQ increase on average by 27%, 19% and 23% the level of FDI, greenfield projects, and job flows, respectively.

Next we look into the channels through which HQ's might operates on FDI (Table 2). As noted before we examine two potential channels related to (i) financial constraints and (ii) informational asymmetries and uncertainty. We start by looking at the financial channel by interacting the HQ dummy with three dummy variables capturing systemic banking crises: one of these dummy variables takes the value one when both countries in the pair have credit constraints at the same time while the other two dummy variables take the value unity when only one country in the pair (but not both) is involved in a banking crisis. As noted before, we expect that the presence of an HQ alleviates the negative effect of financial constraints on FDI when they affect only one country in the pair. Gil-Pareja et al. (2013) and Buch et al. (2014) document robust evidence that financial constraints affect the decision to engage on new FDI projects (extensive margin) but have no significant effect on the monetary quantities invested (intensive margin). Our results, reported in columns (1) to (3) of Table 2 are in line with this evidence. We find that when either the home or the host country face credit constraints, the presence of regional HQ facilities has a positive effect on the number of FDI projects, but not on their size. Moreover, we find that this effect on the extensive margin is larger when who faces the credit crisis is the home country (the origin of the FDI). Additionally, we find that the contribution of regional HQ facilities to jobs is positive and similar in both cases. In contrast, when both countries are immersed at the same time in a banking crisis, regional HQ do not have a significant effect in any of the three cases (intensive margin, extensive margin and jobs), as expected.

[10] Calculated by $(\exp(\hat{\beta}) - 1) * 100$

[Table 2 about here.]

The second channel that we consider is related with the role that HQ might play in reducing informational asymmetries and uncertainty. Our hypothesis is that HQ facilities could contribute to reduce information asymmetries and uncertainty in more distant markets and so we expect a positive coefficient for the interaction between HQ and the log of distance. The results reported in columns (4) to (6) of Table 2 confirm our hypothesis for the three measures of FDI considered (the volume of FDI, the number of foreign affiliates and foreign jobs) with a similar effect for the interaction variable between HQ and the log of distance in all three cases.

It is informative to report in Table 3 the HQ coefficient of independent regressions by sector at the country-pair level. The results reveal some heterogeneity behind the aggregate result. On the one hand, HQ's effect is positive and significant in eight sectors: Aerospace, Software, Chemicals, Electronic Components, Communications, Business Machines Equipment, Transportation, and Financial Services (in order of magnitude). On the other hand, we find a significant negative effect in three sectors: Paper, Metals, and Textiles.

[Table 3 about here.]

These results reveal several appealing traits. Firstly, that the effect of regional HQ is heterogeneous across sectors. Secondly, that negative effects are uncommon but possible. Thirdly, all sectors that exhibit positive effects of HQs are either service or high-tech sectors. Interestingly, in these more intangible capital intensive sectors, having more regional HQs might lead to more FDI because they can benefit easily from other intangible services offered by regional HQ. To test this hypothesis, we introduce in the regression an interaction between the HQ dummy variable and a dummy variable that takes the value of one for service or high-tech sectors. [11] The effect of regional HQs in service and high-tech sectors is statistically significant and around 38% higher on the intensive margin, 24% on the extensive and the intensive margin and 27% on jobs. [12]

[11] High-tech or service sectors considered are: Aerospace, Alternative/Renewable Energy, Automotive Components, Automotive OEM, Biotechnology, Chemicals, Communications, Consumer Electronics, Financial Services, Industrial Machinery, Equipment & Tools, Semiconductors, Software & IT services.

[12] For brevity, these results are available upon demand

Lastly, we perform additional tests to estimate the effect of the intensity of regional HQ. The HQ dummy and HQ stock variables allowed us to exploit the heterogeneity across sectors and country-pairs, capturing the difference in FDI levels due to regional HQs. The dimension of the regional HQ and their number, however, might also be relevant. Therefore, we construct a measure of the number of HQ and the the capital invested in HQ in each country-pair-sector.

Table 4 reports the estimates of the marginal effect of the volume and number of HQ in those pairs of countries with a new HQ in a given sector. This measure reduces the sample significantly. Nonetheless, we observe a positive and significant HQ intensity (measured in dollars invested in the new HQ and HQ number). Increasing by 1% the stock of capital invested in regional HQs, increases by 0.21% the intensive margin and by 0.14% the extensive margin, by 0.22% jobs, on average. However, the effect of increasing the number of HQs is higher than the effect of increasing their volume in terms of capital. Increasing by 1% the stock of the number of regional HQs, increases by 0.49% the intensive margin and by 0.38% the extensive margin, and by 0.44% jobs, on average. These results suggest that the establishment of new regional HQs has a higher effect that expanding existing ones. Therefore, in what follows we focus on the effect of the number of HQs rather than their volume.

[Table 4 about here.]

## 3.2 Spillovers

As highlighted by the inter-country spillover results reported in Table 5, the regional HQs have a positive effect on bilateral FDI from other countries in the same sector. The result in columns (1) - (3) of Table 5 reveal that increasing the total stock of regional HQ from all other countries in the same sector by 1%, increases by 0.33% the intensive margin, by 0.39% the extensive margin and by 0.27% jobs, on average. The result in columns (4) - (6) of Table 5 report the spillovers on other sectors by subtracting the stock of the country-pair-sector regional HQ from the total stock of HQs in the sectors from all countries. This spillover effect is positive and significant in all cases, but lower in magnitude.

[Table 5 about here.]

The inter-sector spillover results are reported in Table 6. The regional HQs have a positive effect on bilateral FDI from other sectors, but with a lower magnitude than inter-country spillovers. The result in columns (1) - (3) of Table 6 reveal that increasing the total sectoral stock of regional HQ by 1%, increases by 0.16% the intensive margin, and by 0.12% the extensive margin and jobs, on average. The result in columns (4) - (6) of Table 6 report the spillovers on other sectors by subtracting the stock of country-pair-sector regional HQ from the total stock of HQs in the country-pair from all sectors. This spillover effect is lower than previously. The effect on the extensive margin is halved and we observe a non-significant effect on jobs.

[Table 6 about here.]

### 3.3 Country-pair results with domestic investment

A common bias in estimates of the gravity equations stems from ignoring intra-national flows. Anderson and Yotov (2010) show that theoretically-consistent structural estimates of the gravity equation include country-specific internal trade costs. Therefore, in Table 7 we introduce internal domestic flows for the intensive margin, the extensive margin and jobs after collapsing the dataset by sector. We fetch the gross capital formation, new firms, and employment by country from the World Bank to construct internal flows at the intensive margin, extensive margin, and jobs. Unfortunately, these data are not available at the sector level.

As highlighted in columns (1) - (3) of Table 7 the effect of regional HQs on FDI is positive and significant at the country-pair level, regardless the sector. The interpretation of the coefficients with domestic investment is slightly different from the previous analysis. In this case, the base category is domestic investment since we interact the HQ dummy with a international border dummy that is one if the host country is different from the host country and zero otherwise. Switching from no HQs to at least one HQ in the country-pair on a certain year increases the intensive margin 10%, the extensive margin by 15% and jobs by 20%. These magnitudes are significantly lower than estimates by country-pair-sector. However, as mentioned previously, we are relatively confident that these estimates are free from endogeneity as the international border dummy is exogenous.

[Table 7 about here.]

An additional advantage of using domestic flows data is that we can identify time-varying country-specific data along with multilateral resistance terms (Beverelli et al. 2018; Heid et al. 2021). This is because the interaction of HQ with border is not colinear with the home-year and host-year dummies. The results reported in columns (4) - (6) of Table 7 reveal that there are significant spillovers from the stock of the number HQ from any country of origin. Again, the magnitude of this effect is lower than the previously reported spillover effects at the country-pair-sector. In this case, we are aggregating both at the country and sector level and previously we were aggregating only at the country level. Therefore, it makes sense that the effect is lower in this case. However, these results are interpreted relative to the effect of HQs on domestic variables.

### 3.4 Endogeneity - IV: Reinvestment

Our results end by performing an IV regression as a further step to deal with endogeneity. Table 8 reports the estimates using bilateral reinvestment capital as an instrument for HQ at the country-pair-sector level. Column 1 reports the first stage of the procedure, where we estimate the stock of the number of regional HQs against reinvestment (without internal investment since it is not available for reinvestment). The values of the Cragg-Donald Wald F test and the Anderson LM statistic allow us to reject the null hypotheses of weak instrument and underindentication. The Stock-Wright S statistic suggests that the orthogonality conditions are valid.

In the next three columns of Table 8, we estimated the effect of regional HQ with the predicted values of the first step equation. The results reveal that the effect of the stock of the number of HQ is positive and significant in the extensive margin and jobs. The effect on the intensive margin is positive, but non-significant.

[Table 8 about here.]

# 4 Conclusions

This paper offers several exciting contributions to the economics literature on FDI. We tackle the effects of intangible capital in foreign production, precisely the HQ effect and spillovers of intangible capital on the volume of FDI, the number of affiliates, and employment. We find that regional HQs has a positive and significant effect on both FDI margins, and jobs. The results suggest that part of the HQ effect stems from credit constraints, and asymmetric information and uncertainty. Specifically, affiliates seem hedging credit constraints with regional HQs. The HQ effect appears when there is a credit crisis either at the host or the host country. However, regional HQs have no significant effect during simultaneous banking crisis. Additionally, distance potentiates the effect of regional HQs. Further, the results revealed sectoral heterogeneity, in particular high-tech and service sectors profit the most from regional HQs.

The results are free from the usual empirical biases associated with structural gravity, including domestic investment flows. Moreover, these data allowed us to capture inter-sectoral and inter-country spillovers. The results rest unchanged when challenged with different measures of intangible capital. However, the number of regional HQs has a higher impact than their volume. Additionally, we use several techniques to deal with endogeneity including an IV approach.

The paper offers several lessons that might help policymakers interested in promoting FDI. For example, policies aimed at fostering investment in headquarters might have positive effects on foreign capital. Moreover, policies targeted at reducing transaction costs and information asymmetries could potentiate HQ's effect. However, sectoral heterogeneity suggests that these types of policies might prove more useful on sectors where intangible capital is predominant.

# Appendix

[Table 9 about here.]

[Table 10 about here.]

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Table 1: Country-pair-sector Results

| | (1) Intensive M. | (2) Extensive M. | (3) Jobs | (4) Intensive M. | (5) Extensive M. | (6) Jobs |
|---|---|---|---|---|---|---|
| $BIT_{ijt}$ | 0.120 | 0.240 | 0.563* | 0.187 | 0.258 | 0.630* |
| | (0.28) | (0.17) | (0.34) | (0.27) | (0.16) | (0.33) |
| $FTA_{ijt}$ | 0.263* | 0.051 | 0.075 | 0.225 | -0.010 | 0.025 |
| | (0.15) | (0.07) | (0.16) | (0.15) | (0.06) | (0.16) |
| $HQ_{ijst-1}$ dummy | 0.411*** | 0.423*** | 0.462*** | | | |
| | (0.05) | (0.02) | (0.05) | | | |
| $HQ_{ijst-1}$ stock | | | | 0.272*** | 0.194*** | 0.234*** |
| | | | | (0.01) | (0.00) | (0.01) |
| Observations | 24007 | 24007 | 24007 | 24007 | 24007 | 24007 |
| pseudo-$R^2$ | 0.514 | 0.328 | 0.557 | 0.540 | 0.354 | 0.572 |
| Home*Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Host*Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Country-pair FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Sector FE | Yes | Yes | Yes | Yes | Yes | Yes |

Robust standard errors in parentheses, clustered by country-pair. HQ variables lagged one year.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2: Results: Channels

| | (1) Intensive M. | (2) Extensive M. | (3) Jobs | (4) Intensive M. | (5) Extensive M. | (6) Jobs |
|---|---|---|---|---|---|---|
| $\text{BIT}_{ijt}$ | 0.139 | 0.225 | 0.546* | 0.111 | 0.221 | 0.527 |
| | (0.27) | (0.17) | (0.33) | (0.27) | (0.17) | (0.33) |
| $\text{FTA}_{ijt}$ | 0.259* | 0.051 | 0.088 | 0.252* | 0.048 | 0.072 |
| | (0.15) | (0.07) | (0.16) | (0.15) | (0.07) | (0.16) |
| $HQ_{ijst-1}$ dummy | 0.489*** | 0.526*** | 0.564*** | 0.450*** | 0.483*** | 0.525*** |
| | (0.05) | (0.02) | (0.05) | (0.05) | (0.02) | (0.05) |
| $HQ_{ijst-1} \times crisis_{ijt}$ | -0.454 | 0.157 | -0.268 | | | |
| | (0.34) | (0.13) | (0.23) | | | |
| $HQ_{ijst-1} \times crisis_{jt}$ | 0.342 | 0.151* | 0.313** | | | |
| | (0.25) | (0.08) | (0.16) | | | |
| $HQ_{ijst-1} \times crisis_{it}$ | 0.006 | 0.260*** | 0.312* | | | |
| | (0.12) | (0.06) | (0.16) | | | |
| $HQ_{ijst-1} \times \ln D_{ij}$ | | | | 0.042*** | 0.042*** | 0.046*** |
| | | | | (0.01) | (0.00) | (0.01) |
| Observations | 24007 | 24007 | 24007 | 24007 | 24007 | 24007 |
| pseudo-$R^2$ | 0.517 | 0.336 | 0.561 | 0.520 | 0.343 | 0.566 |
| Home*Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Host*Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Country-pair FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Sector FE | Yes | Yes | Yes | Yes | Yes | Yes |

Robust standard errors in parentheses, clustered by country-pair. HQ variables lagged one year.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3: Results sector by sector

| Sector | $HQ_{ijst-1}$ dummy | Sector | $HQ_{ijst-1}$ dummy |
|---|---|---|---|
| Aerospace | 1.279** | Financial Services | 0.243** |
| | (0.57) | | (0.11) |
| Alternative/Renewable energy | 0.362 | Food Tobacco | -0.089 |
| | (0.37) | | (0.23) |
| Automotive Components | 0.290 | Industrial Machinery, Equipment Tools | 0.140 |
| | (0.22) | | (0.15) |
| Automotive OEM | 0.022 | Medical Devices | 0.114 |
| | (0.17) | | (0.27) |
| Beverages | -0.086 | Metals | -0.665*** |
| | (0.57) | | (0.25) |
| Biotechnology | 0.153 | Paper, Printing & Packaging | -1.473** |
| | (0.42) | | (0.49) |
| Business Machines Equipment | 0.615* | Plastics | 0.116 |
| | (0.32) | | (0.33) |
| Chemicals | 0.697*** | Rubber | 0.178 |
| | (0.24) | | (0.62) |
| Coal, Oil and Natural Gas | 0.152 | Semiconductors | 0.053 |
| | (0.25) | | (0.42) |
| Communications | 0.637*** | Software & IT services | 1.146** |
| | (0.16) | | (0.10) |
| Consumer Electronics | -0.227 | Textiles | -0.513* |
| | (0.41) | | (0.30) |
| Electronic Components | 0.675*** | Transportation | 0.453** |
| | (0.21) | | (0.18) |

Notes: Dependent variable: Intensive margin. Control variables included but not reported

All estimates include a full set con country*year and country-pair FE

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4: Results: HQ intensity

| | (1) Intensive M. | (2) Extensive M. | (3) Jobs | (4) Intensive M. | (5) Extensive M. | (6) Jobs |
|---|---|---|---|---|---|---|
| $\text{BIT}_{ijt}$ | 1.065** | 0.228 | 0.408 | 0.976** | 0.199 | 0.374 |
| | (0.43) | (0.23) | (0.48) | (0.46) | (0.21) | (0.48) |
| $\text{FTA}_{ijt}$ | -0.711* | -0.299 | -0.413 | -0.629 | -0.264 | -0.293 |
| | (0.38) | (0.20) | (0.30) | (0.39) | (0.19) | (0.29) |
| $\ln HQ_{ijst-1}$ Capital | 0.206*** | 0.138*** | 0.215*** | | | |
| | (0.02) | (0.01) | (0.02) | | | |
| $\ln HQ_{ijst-1}$ Number | | | | 0.493*** | 0.383*** | 0.436*** |
| | | | | (0.04) | (0.02) | (0.04) |
| Observations | 5607 | 5607 | 5607 | 5607 | 5607 | 5607 |
| pseudo-$R^2$ | 0.577 | 0.503 | 0.669 | 0.593 | 0.520 | 0.674 |
| Home*Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Host*Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Country-pair FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Sector FE | Yes | Yes | Yes | Yes | Yes | Yes |

Robust standard errors in parentheses, clustered by country-pair. HQ variables lagged one year.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5: Results: Inter-country spillovers

| | (1) Intensive M. | (2) Extensive M. | (3) Jobs | (4) Intensive M. | (5) Extensive M. | (6) Jobs |
|---|---|---|---|---|---|---|
| $\text{BIT}_{ijt}$ | 0.179 | 0.248 | 0.611* | 0.178 | 0.249 | 0.610* |
| | (0.27) | (0.17) | (0.34) | (0.27) | (0.17) | (0.34) |
| $\text{FTA}_{ijt}$ | 0.209 | 0.069 | 0.154 | 0.208 | 0.068 | 0.152 |
| | (0.14) | (0.07) | (0.15) | (0.14) | (0.07) | (0.15) |
| $\ln(\sum_i HQ_{ijst-1})$ Number | 0.334*** | 0.387*** | 0.271*** | | | |
| | (0.10) | (0.04) | (0.09) | | | |
| $\ln(\sum_i HQ_{ijst-1} - HQ_{ijst-1})$ Number | | | | 0.302*** | 0.334*** | 0.242*** |
| | | | | (0.10) | (0.04) | (0.09) |
| Observations | 23952 | 23952 | 23801 | 23952 | 23952 | 23801 |
| pseudo-$R^2$ | 0.511 | 0.320 | 0.552 | 0.511 | 0.320 | 0.552 |
| Home*Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Host*Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Country-pair FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Sector FE | Yes | Yes | Yes | Yes | Yes | Yes |

Robust standard errors in parentheses, clustered by country-pair. HQ variables lagged one year.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Results: Inter-sector spillovers

| | (1) Intensive M. | (2) Extensive M. | (3) Jobs | (4) Intensive M. | (5) Extensive M. | (6) Jobs |
|---|---|---|---|---|---|---|
| $\text{BIT}_{ijt}$ | 0.178 | -0.166 | -0.134 | 0.174 | -0.173 | -0.137 |
| | (0.30) | (0.14) | (0.32) | (0.30) | (0.14) | (0.32) |
| $\text{FTA}_{ijt}$ | 0.016 | -0.098 | -0.042 | 0.023 | -0.084 | -0.011 |
| | (0.20) | (0.10) | (0.22) | (0.19) | (0.10) | (0.22) |
| $\ln(\sum_s HQ_{ijst-1})$ Number | 0.163** | 0.116*** | 0.122* | | | |
| | (0.07) | (0.03) | (0.07) | | | |
| $\ln(\sum_s HQ_{ijst-1} - HQ_{ijst-1})$ Number | | | | 0.138** | 0.069** | 0.057 |
| | | | | (0.07) | (0.03) | (0.07) |
| Observations | 17392 | 17392 | 17372 | 17392 | 17392 | 17372 |
| pseudo-$R^2$ | 0.473 | 0.343 | 0.533 | 0.473 | 0.343 | 0.533 |
| Home*Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Host*Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Country-pair FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Sector FE | Yes | Yes | Yes | Yes | Yes | Yes |

Robust standard errors in parentheses, clustered by country-pair. HQ variables lagged one year.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7: Country-pair results with internal domestic flows

| | (1) Intensive M. | (2) Extensive M. | (3) Jobs | (4) Intensive M. | (5) Extensive M. | (6) Jobs |
|---|---|---|---|---|---|---|
| $\text{BIT}_{ijt}$ | 0.477** | -0.096 | 0.260 | 0.094 | 0.113 | 0.612*** |
| | (0.24) | (0.09) | (0.18) | (0.30) | (0.09) | (0.22) |
| $\text{FTA}_{ijt}$ | 0.255*** | -0.053 | 0.016 | 0.329** | 0.004 | -0.064 |
| | (0.10) | (0.04) | (0.07) | (0.14) | (0.06) | (0.13) |
| $HQ_{ijt-1} \times INT$ Dummy | 0.104*** | 0.151*** | 0.197*** | | | |
| | (0.04) | (0.01) | (0.03) | | | |
| $\ln(\sum_i HQ_{ijt-1}) \times INT$ Number | | | | 0.093** | 0.160*** | 0.202*** |
| | | | | (0.04) | (0.02) | (0.04) |
| Observations | 15684 | 15330 | 15498 | 5030 | 5030 | 5019 |
| r2_p | 0.997 | 0.999 | 0.999 | 0.874 | 0.841 | 0.925 |
| Internal flows | No | No | No | Yes | Yes | Yes |
| Home*Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Host*Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Country-pair FE | Yes | Yes | Yes | Yes | Yes | Yes |

Robust standard errors in parentheses, clustered by country-pair. HQ variables lagged one year.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8: Endogeneity: IV with reinvestment

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | First stage | | Second stage | |
| | $\ln HQ_{ijt}$ Number | Intensive M. | Extensive M. | Jobs |
| $\text{FTA}_{ijt}$ | 0.002 | 0.038 | 0.049** | -0.070 |
| | (0.12) | (0.08) | (0.02) | (0.08) |
| $\text{BIT}_{ijt}$ | -0.024 | -0.058 | -0.013 | 0.136 |
| | (0.02) | (0.12) | (0.03) | (0.13) |
| $\text{lnReinvestment}_{ijt}$ | 0.207*** | | | |
| | (0.002) | | | |
| $\ln \hat{HQ}_{ijt}$ (Number) | | 0.059 | 0.056** | 0.200** |
| | | (0.08) | (0.02) | (0.09) |
| Observations | 23627 | 23627 | 23627 | 23627 |
| Cragg-Donald Wald F | 5597.64 | | | |
| Anderson LM statistic | 5748.08*** | | | |
| Stock-Wright LM S statistic | 0.66 | | | |
| Home*Year FE | Yes | Yes | Yes | Yes |
| Host*Year FE | Yes | Yes | Yes | Yes |
| Country-pair FE | Yes | Yes | Yes | Yes |

Robust standard errors in parentheses, clustered by country-pair. HQ variables lagged one year. Variables in logs.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

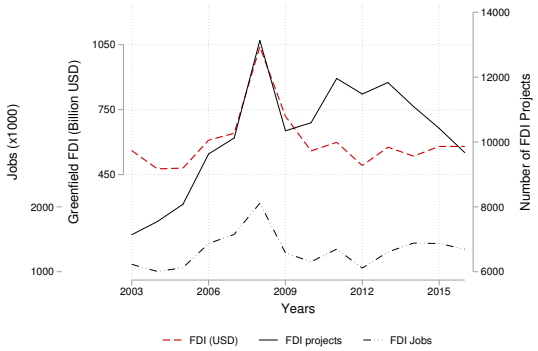
Table A.1: Country-pair-sector level descriptive statistics

| | mean | sd | max | min |
|---|---|---|---|---|
| Country-pair-sector level | | | | |
| Intensive margin (m USD) | 106.904 | 385.896 | 20919 | 0 |
| Enxtensive margin | 1.802 | 2.84003 | 116 | 0 |
| Jobs | 235.383 | 794.438 | 32441 | 0 |
| $HQ_{ijst}$ dummy | 0.055 | 0.228 | 1 | 0 |
| $HQ_{ijst}$ stock | 0.115 | 0.650 | 14 | 0 |
| $HQ_{ijst}$ Capital (m USD) | 34.384 | 86.008 | 2639.3 | .03 |
| $HQ_{ijst}$ Number | 1.301 | 1.155 | 7 | 1 |
| BIT | 0.435 | 0.495 | 1 | 0 |
| FTA | 0.387 | 0.487 | 1 | 0 |
| $crisis_{it}$ | 0.061 | 0.239 | 1 | 0 |
| $crisis_{jt}$ | .035 | .185 | 1 | 0 |
| $crisis_{ijt}$ | 0.008 | 0.093 | 1 | 0 |
| $D_{ij}$ | 5865.119 | 4324.599 | 19781.39 | 60.77 |

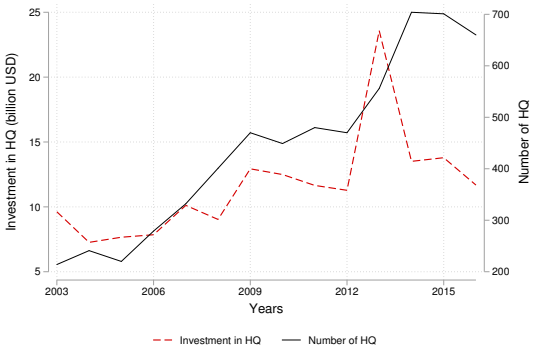
Table A.2: Country-pair level descriptive statistics

| | mean | sd | max | min |
|---|---|---|---|---|
| Country-pair level | | | | |
| $HQ_{jt}$ Capital (m USD) | 211.659 | 549.157 | 5920.82 | 0 |
| $HQ_{jt}$ Number | 8.22 | 21.334 | 190 | 0 |
| $HQ_{ijt}$ dummy | 0.092 | .289 | 1 | 0 |
| $HQ_{ijt}$ 1+dummy | 0.219 | 0.413 | 1 | 0 |
| Reinvestment (m USD) | 1.229 | 17.099 | 1099.46 | 0 |

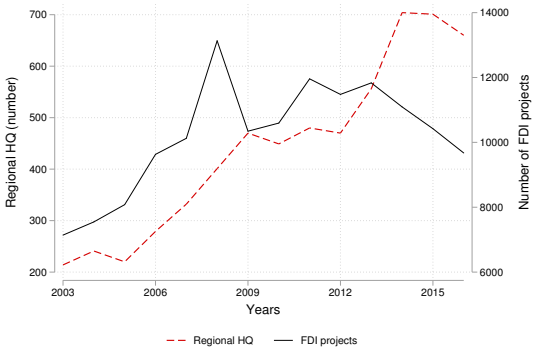
$HQ_{ijt}$ 1+dummy takes the value of 1 in all years after hosting an HQ.




(a) Greenfield FDI

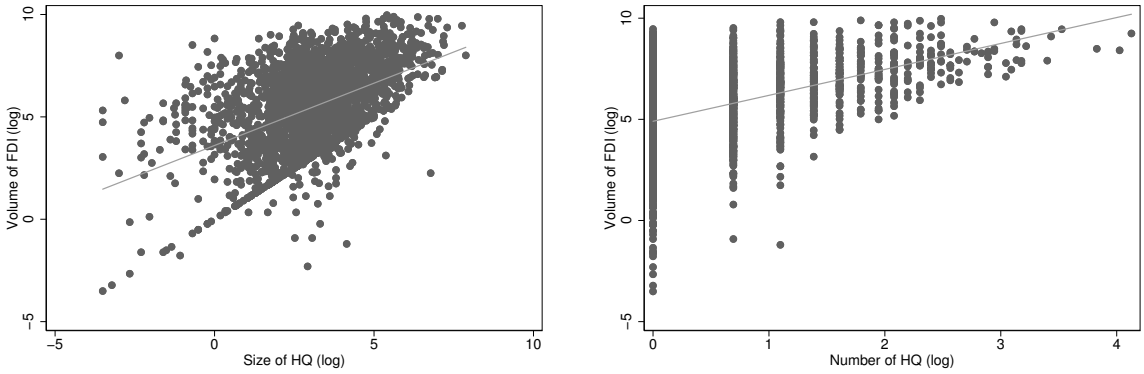



(b) Regional Headquaters




(c) Regional HQ and FDI

Figure 1: FDI and HQ




(a) Regional HQ intensity

(b) Regional HQ number

Figure 2: FDI and HQ