Coordinated location decisions in business groups and the boundary of the firm

PRELIMINARY and INCOMPLETE. This version: 2019 August 15.

Gábor Békés[a,*], Márta Bisztray[b], Péter Harasztosi[c]

[a] *Central European University, HAS Institute of Economics and CEPR*
[b] *HAS Institute of Economics - Hungary*
[c] *European Commission, Joint Research Centre (JRC), Ispra, Italy*

Abstract

Business groups are important organizations with often a complex web of ownership ties linking uniquely registered firms together. This paper investigates how investment decisions may be correlated in business groups as a function of these ownership linkages. As information and management decisions may be transferred across firms, actions may be coordinated across subsidiaries. This paper investigates how proximity in the ownership network and the type of ownership (such as majority holding, minority stake or financial investment) between two firms may affect the likelihood of investing in the same country. Combining data from FdiMarkets and Orbis, we focus on investment projects into fourteen Eastern European countries including Poland, Romania and Turkey. We estimated a location choice model extended with variables capturing the strength of the relationship between two firms in a business groups. We found that having related firms with experience increased investment probability substantially - about half the impact compared to having past project by the investor itself. When two firms are closer within an ownership network, their decisions were found to be more correlated, too.

JEL: F23, C25, L23

Keywords: business groups , location choice, firm network , boundary of firms

*Corresponding author: Gabor Bekes, Central European University, Department of Economics and Business, Budapest 1051 Nador u. 9. E-mail: bekesg@ceu.edu.

**The authors gratefully acknowledge financial assistance from the MTA "Firms, Strategy and Performance" Momentum grant and from the European Commission's Seventh Framework Programme

1. Introduction

The traditional discussion of a firm's action is centered around the dichotomy of within firm versus market transactions. However, in reality, tightly or loosely connected companies such as business groups and global value chains play a rather important role in many economically important aspects such as investment, trade or innovation. For instance business groups - a set of uniquely registered firms linked by ownership - are not the same firm, but they would not be independent either. The prevalence of business groups make the boundary of firms less stark: some transactions and knowledge transfer will happen between firms that are not independent actors.

Our big picture question is how closely related are location decisions of connected firms, and what these decisions say about the boundary of firm in this complex world of connected firms. In particular, we will look at how information and management decisions may be transferred across firms, focusing on one type of decisions: location of subsidiaries abroad. Firms in the same business group may share information about advantages and disadvantages of comparable business locations or firms with controlling influence may make affiliates carry out projects for the greater good of the group. The main advantage of focusing on FDI decisions comes from the fact that they are both important and easily observed. Indeed, we study FDI location decisions to learn about how decisions are correlated within business groups.

Our main question is investigating if location decisions made by firms that are part of the same business groups would be more correlated than predicted by a traditional model of location choice. In other words, is a firm more likely to invest in a given country if another company in the business group has already experience there. We will map out patterns of correlation across a variety of relationships and compare their magnitude. In particular, we will analyze how proximity in the ownership network and the type of ownership between two firms may affect the likelihood of investing in the same country.

We differentiate by the distance and the strength of the link. Two firms in the network could be close if firms are few steps away from each other in the ownership network, or far if there are many ownership steps in the network despite having a common ultimate owner. Strength is defined as combined ownership share, it could add up to majority, can be minority (25-50%) or be of financial nature (below 25%).

("Mapcompete" project number: 320197). We thank participants at CAED Ann Arbor, LEIT Slovenia conferences for comments.

In our paper, we compare FDI location decision of multinationals located all over the world doing investments in a set of European countries. We will combine two powerful datasets with global coverage of corporate activity: FdiMarkets (a collection of greenfield projects compiled by the FT) and Orbis (a collection of financial and ownership data by the Moody's owned Bureau van Dijk). We use FdiMarkets to define our investment projects, and use Orbis to recreate business groups and define the relationships between related companies.

We will consider FDI going to 14 countries in Central-Eastern and Eastern Europe: Bulgaria, Croatia, the Czech Republic, Estonia, Greece, Hungary, Latvia, Lithuania, Poland, Romania, Serbia, Slovakia, Turkey and Ukraine. The advantage of picking more or less similar countries is that we can use the assumption that investors may first decide about a site in the region and then consider these markets as substitutes.

Our data showed that business groups play a rather important role in FDI. During the 2006-2014 period, we found 8,871 FDI projects (by 4,088 firms) into 14 countries in the Eastern and Central-Eastern European region, creating over 2.5 million new jobs. We found that 62% of projects (61% of jobs) were carried out by firms that belong to business groups. Two-thirds of business group related firms did actually belong to business groups that had another member of the group with earlier projects in that country.

To estimate how business group membership may affect location choice, we extend models from location choice literature. An FDI location decision is typically modelled as one driven by comparing the advantages sites (in our case: countries) may offer as well as expected costs of operation. Agglomeration at the country-industry level is important as firms benefit from several externalities such as saving on transport costs, labor pooling, information sharing or using indivisible goods. For instance, Crozet et al. (2004) study location choice within France and find strong evidence on clustering. Furthermore, there may be country or country-industry specific aspects of the location choice, like institutional quality and tax incentives. We took our theory to the data and estimated a location choice model extended with variables capturing the strength of the relationship between two firms in a business groups. We found that having related firms with experience increased investment probability substantially - about half the impact compared to having past project by the investor itself.

When two firms are closer within an ownership network, their decisions were found to be more correlated, too. Weak links between firms still have some impact albeit a smaller one. Interestingly, the effect of having peers from the same business group with

past investment experience is larger for Asian investors, with a point estimate almost twice the size of European ones.

Our project is related to the literature on the agglomeration of FDI (Cheng and Kwan (2000), Lefilleur and Maurel (2010)), supplier-buyer linkages (Blonigen et al. (2005)) and business groups (Szemeredi (2017)). Gazaniol (2015) shows evidence that location choices of multinationals depend on the international experience of affiliated firms. The closest paper to ours are Blonigen et al. (2005) and Head et al. (1995) who study how the chances of repeated investment may increase if firms are part of the same keiretsu. Their main concept is that membership in business groups could increase concentration of related firms in foreign markets if there was some information sharing within the group. Importantly, Blonigen et al. (2005) found evidence that externalities such as knowledge transfer via networking are prevalent even beyond the direct supply-chain.

Our paper is also related to a growing literature on business groups. A set of recent papers such as Alfaro and Chen (2018), Alfaro et al. (2019), Del Prete and Rungi (2017), Rungi et al. (2017), Almonte et al. (2018) analyze complicated ownership structure variations in groups. For instance Rungi et al. (2017) shows the super complicated networks of firms such as the Toyota group.

Our main contribution in this paper is twofold: first, we aim to generalize previous findings on the Japanese *keiretsu* to global business groups and to other networking possibilities. Using global investor data, we can study a variety of business group types. In our data we have investors from global business groups headquartered in North America, Europe and Asia. Second, we compare the effect of different types of links between firms, both within and beyond the business group as we link complexity of groups literature to FDI decisions.

Apart from learning about the how information may flow within business groups, insight from our exercise shall be able to assist policy making. Many countries spend a considerable amount of money and effort on attracting FDI, setting up massive institutions and giving direct subsidies. Just in recent years BMW built a new plant in Hungary and received 40 million euros in state subsidies, Slovakia provided 125 million euros to the new Jaguar Land Rover factory in 2018. One particular motivation for giving subsidies to these FDI projects was argued to have been their effect to attract further foreign investments. Indeed, our finding of spillover effects in a business group offers some support this argument. In what follows, we first present our data, and describe how we create business groups and other groups of connected firms outside

the business group. We then estimate a conditional logit model on a set of fourteen countries and present our results.

2. Data

In this paper we use two datasets that we merged along company names.

2.1. FT fDi Markets

The main dataset we use is the fDi Markets database. This is an online database maintained by fDi Intelligence, which is a specialist division of the Financial Times Ltd. fDi Intelligence creates and continuously updates the fDi Markets database using media announcements of cross-border greenfield investments covering all sectors and countries worldwide.

There are several advantages of the fDi Markets data we are using over other related datasets. First, it is cleaner for our purpose as it contains only greenfield investments[1]. Second, we have the city of both the parent and the investing firm. Finally, we know both the industry and the activity of the investment. Note that this data has been already used to study FDI[2].

The dataset covers investment projects for the 2003-2014 period. We consider investments to fourteen Central and Eastern European countries: Bulgaria, Croatia, the Czech Republic, Estonia, Greece, Hungary, Latvia, Lithuania, Poland, Romania, Serbia, Slovakia, Turkey, Ukraine. We create our *main sample* taking all the investments going to any of the fourteen countries, from any source country outside these fourteen. For the *estimation sample* we use only the period 2006-2014. This choice ensures that we have data on previous FDI from at least three years, which is crucial for identifying previous FDI by connected firms. In the estimation sample we exclude all FDI projects 1. which have an investor from any of the 14 countries, 2. which are expansions of already existing FDI[3], 3. which have the activity 'Sales, marketing and support'. This leaves us with 6,458 FDI projects. Table A1 in the Appendix shows the total number of projects in the 14 countries by year and Table A2 shows the number of projects by

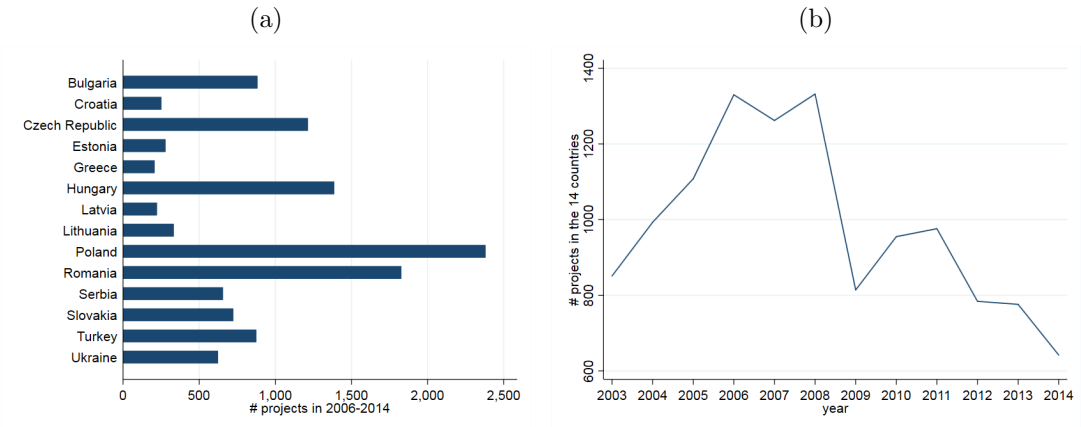
[1]For instance, in the Orbis dataset that we will use a new investment is captured mostly when a new firm is set up

[2]See for example Burger et al. (2013), Castellani et al. (2013), Crescenzi et al. (2014).

[3]At the same time we keep all FDI projects considered as new in fDiMarkets by firms which have already had an FDI in the country.

country in the whole 2006-2014 period in our estimation sample. Figure 1 offers an overview of trends in this period.

Figure 1: FDI projects by destination country



Notes: FDI going to 14 countries from the Eastern European region.

For each observation the database contains information on the time, location, industry, activity and monetary value of the investment, and on the number of jobs created. The data also contains the name and the city-level location of both the parent company (e.g. Audi AG) and the local investing company (e.g. Audi Hungaria Motor Kft.). Multiple investments can belong to the local investing company, because of expansions of existing plants—expansions of previous investments are also included in the data but we exclude it from our estimation sample—or creation of additional plants (e.g. the investing company GE Energy has an investment in both Nagykanizsa and Ózd within Hungary.)

There are 3313 different parent company names and 4103 different local investing company names. In about 15% of the investments the parents come from Germany and in more than 14% the parent comes from the US, as the two main source countries.

We also have information on the size of the investment (capital investment and number of jobs created), but it is less reliable than the other data. Based on the available numbers, the size of a project in our main sample varies from 1 to 8000 new jobs created, with a mean of 295 employees, and 49, 100 and 250 as the three quartiles.

To classify FDI projects by industry, we use the industry sector and sub-sector variables. The former includes 39 categories, like Automotive OEM, Automotive Components, Engines and Turbines or Chemicals, the latter is more detailed, corresponding

to 2-digit or 4-digit NAICS codes. Using this information we assign all FDI projects to a 2-digit NACE industry code. The fDi Markets database also includes information on the activity of the new investment. There are 17 categories, like Manufacturing, Headquarters, Business services or Sales, marketing and support. In all the industries there is FDI in our sample with at least two different types of activity.

For a small fraction of investments we also have information on the motivation of the location choice and the size of the market the FDI aims to serve (local/regional/worldwide).

One example for an observation in fDi Markets is the investment of Audi Hungaria Motor - as the investing company - in Győr, Hungary in 2010, with Volkswagen from Wolfsburg, Germany as the parent company. The industry sector is Automotive OEM, the sub-sector is Motor vehicle gasoline engines & engine parts and the activity if manufacturing. We also know that it is an expansion of a previous investment.

2.2. Fdi-markets match to Orbis

From FdiMarkets we are looking to identify 7,432 parent companies that undertake foreign investment. To match FdiMarkets to Orbis by the name of the company and additional in formations we use a multi-step approach. First, we use various matching techniques to create a pool of possible matches from Orbis to each parent company which carries out foreign direct investment. Second, we apply selection algorithms to choose the most likely match from the list of candidates. Third, we perform validation checks. Fourth, we check the largest FDI makers and possible bad matches of the previous step manually using information from company websites. We describe the above steps in detail below.

Step 1. To create possible matches by name we perform two matching algorithms on the name of firms in the Orbis dataset.

First, we run a matching algorithm[4]. To facilitate a more effective matching we have pre-selected the companies in Orbis that serve as source for matching using ownership information. Knowing that we are to match FDI maker companies we formed two pre-selected list: firms with foreign subsidiaries, firms with any detected subsidiary. This step allows us to identify 4,953 companies.

Second we apply matching by the first three words of the name of the company. Companies that have names that contain less than three words will be required match

[4]we apply matchit of STATA using soundex function. A particular advantage of the matchit function is that it can underweight the indication of company legal format such as *Limited*, *Aktiengesellshaft* or *S.r.L.*.

on those words only. In this step we match an additional 1,219 parent company.

Both steps necessitate to render names into English alphabet thus removing special characters from national alphabets used. They create a pool of candidates for each FDI maker company.

Step 2. To choose the best match form the candidates collected in the previous step we use additional information available from both FDiMarkets and Orbis. These include location at the city level, sector classification. Matching by location at the city level necessitates some adjustments for specific countries: the use of state identifier in the United States, the aggregation of smaller cities and settlements in the case of Japan to metropolitan areas.

We rank candidates based on the number of matching information. We pick firms as match when all three information (name, location, sector) matches. When less than three are matched, we prioritize location to sector. In the case of multiple matches we rank companies with larger total assets and known foreign affiliates from Orbis higher.

Step 3. To validate our matches we rely on various techniques to flag bad matches. First we flag misclassified larger companies when relating the number of investment in FDiMarkets to known number of subsidiaries in Orbis to detect if it shows deficit. We also flag companies where no ultimate owner in the Orbis dataset is provided for the selected match. We flag unmatched companies.

Step 4. We search for the Orbis identifier of companies flagged manually in Orbis online. To better identify parent companies, e.g. in the case of ambiguous name or change, we use the information on the investing company. We also use the internet address of companies identified to match them to Orbis.

In these last two steps we make 78 corrections to the matches found in the first two steps and we identify 923 additional companies. Our efforts allow us to match over 95 percent of the companies, and only 337 remain unidentified from the 7,432 parent companies.

2.3. Creation of business groups

We define investor firms with the help of the matched unique Orbis identifier. In those cases in which we can't find a match in Orbis, we use the name and the source country of the parent company in fDiMarkets, assuming that firm names are unique within a country.

A crucial step is to establish links between investors who belong to the same business group. We do this with the help of ownership data provided in Orbis. We combine two

types of information. First, we define two investor firms being in the same business group if they share an ultimate owner. We use the global ultimate owner variable in the Orbis database to assign ultimate owners to investors. This variable presents the ultimate controlling unit of the firm in those cases when it is unambiguous. A firm itself can be its own ultimate owner if it is at the top of the hierarchy.

This definition has two drawbacks. There is a considerable number of firms for which no global ultimate owner could be defined in Orbis. Additionally, the ultimate owner definition uses majority links[5], while information might also flow between firms which are connected to each other through minority shares.

Consequently, we also look at pairs of closely linked FDI making firms, in which i) one owns the other, ii) the two have a common shareholder, iii) both are shareholders in the same firm. For each type of connection we consider either direct or indirect connections, looking at indirect shareholders being at most 2-steps away.[6]

To further differentiate close connections we categorize them to majority, minority and other non-controlling stake connections. For majority connections we require that there exists a connection between the two firms in which all direct links are at least 50%. We define a minority connection if there is no majority connection between the two firms but there is a connection in which all direct links are at least 25%. Other non-controlling stake connections are defined as those which include at least one direct link below 25%.

We try to exclude financial ownership in multiple ways. We disregard those owners for which the shareholder type provided in Orbis suggests that they are financial investors[7], and they are not an investor in the fDiMarkets database. We also disregard all the weak (i.e. 'other non-controlling stake') connections of those firms which have more than 1000 connections of a specific connection type (e.g. common direct shareholder). In spite of that, we think that the 'other non-controlling stake' category still includes some links resulting from financial investments. Additionally, we exclude connections through public or NGO shareholders (including states and foundations).

As the starting year of a shareholder link is imprecisely measured in Orbis, especially

[5]Orbis also provides another measure, in which the global ultimate owner is defined using links with $\leq 25\%$ shares.

[6]For example firm A and B are connected indirectly via connection type ii), if A has a shareholder C and B has another shareholder D, and C and D have a common shareholder E.

[7]banks, insurance companies, mutual & pension funds, financial, companies, hedge funds, venture capital and private equity firms

in earlier years, we don't use the timing of the connection. We define two firms as being connected if they have been ever connected based on Orbis. At the same time, when we define indirect links between two firms, we require that there is an overlap in time between the direct links forming the indirect link.

In our estimation sample there are 6,458 FDI projects of 3,290 different investors. We could match 96% of the investors to Orbis firms. At least 56% of these firms - being the investor in 66% of the projects - is connected to a business group. This is a lower bound estimate for two reasons. First, we only consider those business groups in which there is at least one other firm doing FDI in Europe in the period 2003-2014. Second, we neglect those business group peers which are far away from each other in the ownership network and which have no common global ultimate owner in the Orbis data. 74% of the parents which we define being connected to a business group has at least one peer in the business group who already had an FDI in the country of the new project before. These are the investors in 51% of all the projects in the estimation sample.

Let us illustrate the process. In Figure 2, we present the hypothetical firm group of firm F. In this easy case owners are above the owned firms, connected with a single line if the owner has a share less than 50% and with double lines if it has a majority share in the owned firm. GUO is the global ultimate owner of firm F. All firms marked with blue or green share the same global ultimate owner with firm F. We add to these firms the ones which are closely linked to F, i.e. the farthest having the same "grandparent", but which have different global ultimate owners. These are the yellow circles. The green firms fulfill both conditions, these are closely linked firms sharing the same global ultimate owner. Firms denoted with white circles are outside the firm group of F according to the definition we use here.

Figure 2: Business groups: simpler case

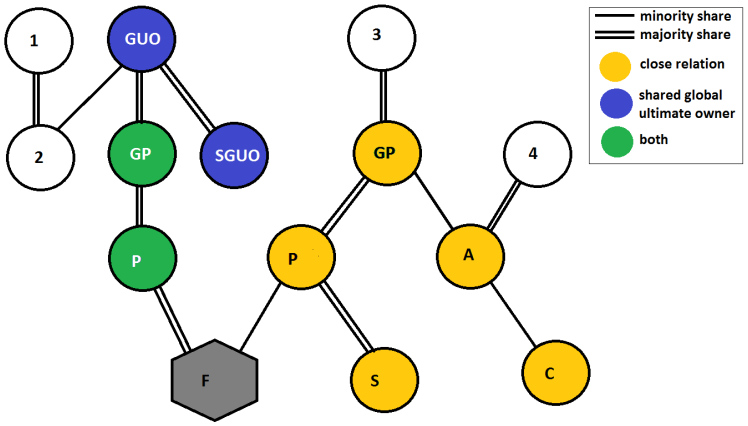
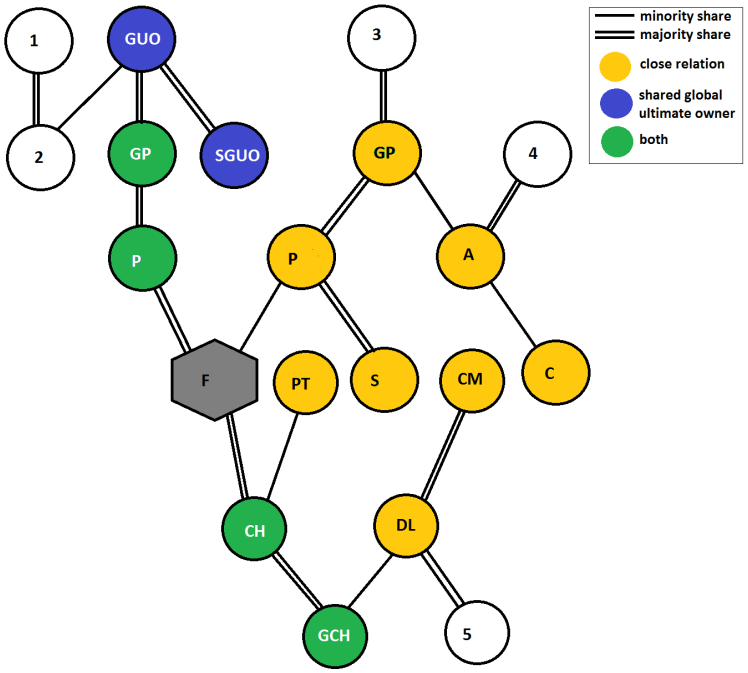


Figure 3 extends the example firm group with subsidiaries of firm F and closely connected firms to subsidiaries, as we not only consider shareholders but also subsidiaries in a symmetrical way.

Figure 3: Business groups: extended case



3. Information flow in business groups

[TO BE ADDED]

4. Empirical setup and descriptive statistics

To evaluate the effect of previous investments by connected firms on FDI location choice, we create indicator variables showing if the same investor or a connected firm had an FDI in the same country before. We look at two types of connected firms: 1. firms in the same business group, 2. firms with shared background. We define firms in the same business group as firms having the same ultimate owner or being only a few steps away from each other in the ownership network. Firms with shared background are firms in a different business group but from the same country and investing in the same industry.

Before presenting our empirical setup, consider the following examples as an illustration. Our first benchmark is the equality of the investor company (e.g. Audi AG sets up plant A in Hungary, then plant B also in Hungary). In this case we will focus on membership in the same business group (e.g. Volkswagen sets up a plant in Slovakia following Audi's plant). In our second benchmark case we will consider firms with the same background (country of the headquarter and main industry). (For example, a French car maker builds a plant in Romania following another, unattached French car maker.)

4.1. Business groups

As we describe in the previous section we also differentiate between close and far, as well as majority, $\leq$25% minority and other non-controlling links. These indicator variables are create disjoint groups. First we check if there is close peer connected with majority links who already had an FDI in the country. If there is no such, we check the same for close peers with $\leq$ 25% minority links, then far peers with majority or $\leq$25% minority links[8], and finally for 'other non-controlling stake' peers. The second column of Table 1 shows the number of projects going to a country with a previous FDI from the specific peer group.

We create some further indicators showing if there was an FDI in the same industry from the specific peer group in the same country before. As Table 1, in more than half

[8]there are relatively few of those connections which are based on a common global ultimate owner but which are not close connections.

Table 1: The number of observations and projects by previous FDI

	N. obs.	N. projects
Total	90,412	6,458
Previous FDI		
... by same firm	11,670	2,075
... by broad business group peer	41,609	3,304
... by business group peer	14,000	1,485
... by close peers with >50% links	6,363	772
... by close peers with 25-50% links	7,140	651
... by far peers with 25-50% links	497	62
... by non-controlling stake peers	27,609	1,819
... in the same industry	83,650	6,249
... with same source country & industry	34,698	3,734
... by business group peer in same ind.	6,072	719
... by close peers with >50% links in same ind.	2,473	327
... by close peers with 25-50% links in same ind.	2,632	263
... by far peers with 25-50% links in same ind.	172	21
... by non-controlling stake peers in same ind.	9,940	769

of the observations with previous FDI by a business group peer, the previous investment was in a different industry sector.

Table 1 already suggests some descriptive evidence on co-location patterns by connected firms. An observation corresponds to a project-country pair in such a way, that we create a separate observation for each of the five countries in case of each FDI project. This means, that the specific country was chosen for the FDI in exactly 1\14 of the observations. The second column of Table 1 shows that the share of observations with a connected firm already having FDI in the country is larger in those cases when the specific country was chosen as the location of the project (column 2) compared to the average share in all the observations (column 1).

4.2. Baseline conditional logit model

First, we follow the methodology of Blonigen et al. (2005) and estimate a conditional logit model. We compare the likelihood of investing in a particular country, conditional on choosing one the fourteen countries. Our independent variables measure the existence of FDI by the same firm and by connected firms in the country, and we consider country and country-industry specific control variables.

For each FDI project going into one of the 14 countries we create 14 observations to

ask which country did the investor choose from the available? The unit of observation is project-country with project p of firm i in year t. This gives $6,458 \cdot 14 = 90,412$ as the number of observations. We estimate a conditional logit model:

$$Prob(FDI_{pct} = 1) = F(\alpha + \beta_1 DF_{i(p)ct-1} + \beta_2 DP_{i(p)ct-1} + X_{i(p)ct} + \epsilon_{pct}) \qquad (1)$$

where F(.) is a logistic function. FDI_{pct} is an indicator showing that country c is the chosen location for project p of firm i in year t. $DF_{i(p)ct-1}$ is an indicator showing that the same investor had an investment in c before t. $DP_{i(p)ct-1}$ is a set of indicators showing that another related firm had an investment in c before t. Here we allow for heterogeneity by the type of the link and by the industry of the FDI. We use two alternative measures: we either measure the previous investment of peers with a dummy, or with the log of total number of jobs created + 1.[9] $X_{i(p)ct}$ includes destination country FE and an industry-country specific time-invariant FDI stock measure to control for broad industry-specific agglomeration economies. [10] We cluster the standard errors by industry.

5. Model estimation results

In this section we present a models estimating the strengths of co-location patterns of connected firms.

5.1. Core results

Table 2 presents the baseline results. Average marginal effects suggest that the probability of choosing a specific country is significantly higher if the same firm already had an FDI in the same country before. The coefficient for a previous investment in the business group is also significantly positive, but about one-third of the same-firm coefficient (column (1)). If we define the business group based on links of at least 15% shares and look at the role of having previous FDI only by firms with 'other non-controlling stake' connections separately (column (2)), we see that the estimated coefficient for these weak links is about half of that for the stronger connections. These

[9]While dummies across the different business group categories - majority close, minority close, far and 'other non-controlling stake' - are mutually exclusive, variables showing number of jobs created are not. Thus the interpretation of the two specifications is different.

[10]We proxy the industry-specific FDI stock in a country with the total number of FDI in a country going to a given 2-digit industry in the period 2003-2005.

results are robust for the inclusion of an industry-specific FDI stock measure in the country, as well as indicators for previous FDI in the same industry and in the same industry and from the same source country. The latter can correspond to the category of 'firms with a shared background', and its coefficient has a similar magnitude as that of the FDI in the business group indicator.

These results are in line with the hypothesis, that country-specific FDI experience in the business group matters for FDI location choice.

Table 2: Main results

Dep.var.: FDI locates in the country

VARIABLES	(1)	(2)	(3)	(4)
Previous FDI ...				
... by the same firm	1.491***	1.474***	1.417***	1.404***
	(0.090)	(0.088)	(0.087)	(0.084)
... by broad business group peers	0.484***		0.432***	
	(0.086)		(0.087)	
... by business group peers		0.685***		0.603***
		(0.110)		(0.110)
... by non-controlling stake peers		0.371***		0.336***
		(0.086)		(0.088)
... in the same industry			0.314***	0.315***
			(0.091)	(0.091)
... same source country & industry			0.501***	0.494***
			(0.044)	(0.044)
Destination country FE	YES	YES	YES	YES
Industry-spec. FDI stock	NO	NO	YES	YES
Observations	90,412	90,412	90,412	90,412

All FDI to the 14 countries (2006-2014). FDI stock is country and industry specific and refers to the year before the FDI project started. Standard errors, clustered at the industry level, are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

In Table 3 we look at the potential heterogeneity across different types of business group connections. Column (2) shows, that we cannot find any significant difference between close and far links, or between majority and $\leq$ 25% minority connections. Majority connections or close connections clearly doesn't have higher coefficients. This result might be in line with centralization of decision within the business group, where the headquarter decides independent of the distance from the firm. But this result might also mean that we don't capture heterogeneity correctly. This is a question still

open to further investigations.

Columns (3) and (4) of Table 3 show similar specifications with the difference that we measure the size of previous FDI using the total number of jobs created and not only the existence. It also means, that right-hand side variables across the different business group categories are not exclusive any more. Patterns are broadly similar, suggesting that FDI by the same firm is much more important than FDI in related firms. As before, coefficients of the different business group categories are not significantly different from each other.

Table 3: Main results - heterogeneity within business groups

Dep.var.: FDI locates in the country

	Previous FDI		Total jobs created	
VARIABLES	(1)	(2)	(3)	(4)
Previous FDI ...				
... by the same firm	1.404***	1.402***	0.243***	0.243***
	(0.084)	(0.084)	(0.010)	(0.010)
... by business group peers	0.603***		0.036***	
	(0.110)		(0.012)	
... by close peers with >50% links		0.637***		0.023*
		(0.120)		(0.013)
... by close peers with 25-50% links		0.537***		0.027**
		(0.120)		(0.012)
... by far peers with >25% links		0.718***		0.051***
		(0.180)		(0.019)
... by close peers with ≤25% links	0.336***	0.325***	0.068***	0.068***
	(0.088)	(0.089)	(0.011)	(0.011)
... in the same industry	0.315***	0.315***	0.088***	0.089***
	(0.091)	(0.091)	(0.012)	(0.012)
... with same source country & industry	0.494***	0.495***	0.065***	0.065***
	(0.044)	(0.044)	(0.008)	(0.008)
Destination country FE	YES	YES	YES	YES
Industry-spec. FDI stock in country	NO	NO	YES	YES
Observations	90,412	90,412	90,412	90,412

All FDI to the 14 countries (2006-2014). FDI stock is country and industry specific and refers to the year before the FDI project started. Standard errors, clustered at the industry level, are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

5.2. Extensions and robustness

[TO BE EXTENDED]

5.3. Heterogeneity

Beyond differences by the type of the business group connection, we look at two additional sources of heterogeneity. First, we check if the positive coefficients for previous FDI by peers in the same business group are driven by same-industry FDI. Second, we check if there is any difference in the main patterns by the origin of the business group.

In Table 4 we include additional right-hand side variables for same-industry FDI by the firm or by a peer in a specific group. Using either previous FDI indicators (column (1)-(2)) or size measures (column (3)-(4)) shows the same patterns: previous FDI in the same industry has no additional effect compared to any previous FDI by the same firm group.

A limitation for the interpretation of these results comes from the fact that different-industry FDI includes supplier- or buyer-industry FDI as well. Consequently the importance of different-industry FDI might result from these industry links. We plan to check this option in further work. An alternative explanation would be the importance of information driving our results as opposed to co-location motivated by vertical links and decreasing transport costs.

Finally, we look at the heterogeneity of the estimated effects by the continent of the investor. We group investors to firm from Europe, America (including both North and South) and Asia-Pacific (also including a handful of investors from Africa). Table 5 and Table 6 show the results. Both present coefficient estimates of a single regression. Table 5 uses indicators of previous FDI and Table 6 uses the total number of jobs created. We see some difference in the estimated coefficients, being somewhat larger for firms of an Asian origin, but the coefficient estimates are not significantly different from each other by continent.

Still, we can conclude that are results are in line with the importance of previous FDI within the business group for business groups of different origin. This also suggests that previous results for the importance of FDI by peers in the same keiretsu Blonigen et al. (2005) might be generalized to other business groups as well.

6. Conclusion

In this paper we investigated co-location patterns of multinationals looking for evidence of networking effects. Analyzing global direct investment projects to Central and Eastern Europe, we found some evidence on agglomeration of related firms. In particular, firms belonging to the same business group are more likely to co-locate in the same

Table 4: Main results - heterogeneity within business groups and by industry

Dep.var.: FDI locates in the country

VARIABLES	Previous FDI (1)	Previous FDI (2)	Total jobs created (3)	Total jobs created (4)
Previous FDI ...				
... by business group peers	0.620***		0.045***	
	(0.113)		(0.014)	
... by business group peers in same ind.	-0.019		-0.021	
	(0.076)		(0.016)	
... by close peers with >50% links		0.674***		0.033**
		(0.136)		(0.015)
... by close peers with >50% links in same ind.		-0.066		-0.022
		(0.127)		(0.030)
... by close peers with 25-50% links		0.572***		0.031**
		(0.131)		(0.015)
... by close peers with 25-50% links in same ind.		-0.056		-0.008
		(0.098)		(0.018)
... by far peers with >25% links		0.765***		0.046**
		(0.160)		(0.024)
... by far peers with >25% links in same ind.		-0.169		0.016
		(0.277)		(0.038)
... by close peers with ≤25% links	0.316***	0.309***	0.071***	0.071***
	(0.078)	(0.079)	(0.011)	(0.011)
... by close peers with ≤25% links in same ind.	0.069	0.063	-0.009	-0.009
	(0.097)	(0.099)	(0.013)	(0.013)
Same firm FDI	YES	YES	YES	YES
Same industry FDI	YES	YES	YES	YES
Same source & industry FDI	YES	YES	YES	YES
Destination country FE	YES	YES	YES	YES
Initial industry-spec. FDI stock in country	NO	NO	YES	YES
Observations	90,412	90,412	90,412	90,412

All FDI to the 14 countries (2006-2014). FDI stock is country and industry specific and refers to the year before the FDI project started. Standard errors, clustered at the industry level, are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 5: Main results by the continent of the investor

Dep.var.: FDI locates in the country			
Right-hand side: Previous FDI		(1)	
Investors from	Europe	America	Asia-Pacific
VARIABLES			
Previous FDI ...			
... by the same firm	1.439***	1.103***	1.596***
	(0.084)	(0.157)	(0.160)
... by business group peers	0.506***	0.640***	0.940***
	(0.132)	(0.203)	(0.252)
... by non-controlling stake peers	0.221*	0.557***	0.542**
	(0.115)	(0.181)	(0.233)
... in the same industry	0.294***	0.278	0.620**
	(0.095)	(0.230)	(0.287)
... with same source country & industry	0.438***	0.512***	0.870***
	(0.040)	(0.145)	(0.185)
Destination country FE		YES	
Industry-spec. FDI stock		YES	
Observations		90,412	

All FDI to the 14 countries (2006-2014). FDI stock is country and industry specific and refers to the year before the FDI project started. Standard errors, clustered at the industry level, are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 6: Main results by the continent of the investor - size of previous FDI

Dep.var.: FDI locates in the country Right-hand side: Total jobs created	(1)		
Investors from	Europe	America	Asia-Pacific
VARIABLES			
Previous FDI ...			
... by the same firm	0.253***	0.201***	0.237***
	(0.011)	(0.025)	(0.030)
... by business group peers	0.032**	0.024	0.058*
	(0.014)	(0.020)	(0.031)
... by non-controlling stake peers	0.056***	0.072***	0.096***
	(0.016)	(0.023)	(0.031)
... in the same industry	0.081***	0.111***	0.119***
	(0.013)	(0.026)	(0.035)
... with same source country & industry	0.059***	0.060***	0.111***
	(0.008)	(0.017)	(0.035)
Destination country FE		YES	
Industry-spec. FDI stock		YES	
Observations		90,412	

All FDI to the 14 countries (2006-2014). FDI stock is country and industry specific and refers to the year before the FDI project started. Standard errors, clustered at the industry level, are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

country, even after controlling for previous same- and related-industry FDI in general. These results point towards externalities either in terms of information sharing, using joint facilities or cost reduction of investment.

We also show that there is some heterogeneity in the role of business group links: minority links below 25% matter less. We also find that these patterns are similar for investors coming from different regions.

These results confirm and generalize results of Blonigen et al. (2005) on Japanese business groups and Crozet et al. (2004) on foreign investments into France. Our evidence suggest that Asian business groups are the most likely to build on earlier experience. These results also support a view of multinational group as platform of information sharing. Our approach combining various measures of inter-firm connections allowed us looking into the relative importance of these patterns.

Our starting point was a policy question: will firms invite their friends in? At this stage of our research, there are several impediments to a causal interpretation. While our approach aimed at controlling for some aspects, we fall short of making a causal claim.

Despite this shortcoming, we believe that results are informative for policy makers, as we suggest that future FDI projects may indeed come form investors and business groups already operating in the country, as well as for firms based in the same country and industry as existing firms.

7. References

Alfaro, L. and Chen, M. X. (2018), 'Selection and market reallocation: Productivity gains from multinational production', *American Economic Journal: Economic Policy* **10**(2), 1–38.

Alfaro, L., Chor, D., Pol, A. and Conconi, P. (2019), 'Internalizing global value chains: A firm-level analysis', *Journal of Political Economy* **127**(2), 508–559.

Almonte, C., Ottaviano, G. and Rungi, A. (2018), 'Business groups as knowledge-based hierarchies of firms', *Working Paper* .

Blonigen, B. A., Ellis, C. J. and Fausten, D. (2005), 'Industrial groupings and foreign direct investment', *Journal of International Economics* **65**(1), 75–91.

Burger, M. J., van der Knaap, B. and Wall, R. S. (2013), 'Revealed competition for greenfield investments between european regions', *Journal of economic geography* **13**(4), 619–648.

Castellani, D., Jimenez, A. and Zanfei, A. (2013), 'How remote are r&d labs? distance factors and international innovative activities', *Journal of International Business Studies* **44**(7), 649–675.

Cheng, L. K. and Kwan, Y. K. (2000), 'What are the determinants of the location of foreign direct investment? the chinese experience', *Journal of international economics* **51**(2), 379–400.

Crescenzi, R., Pietrobelli, C. and Rabellotti, R. (2014), 'Innovation drivers, value chains and the geography of multinational corporations in europe', *Journal of Economic Geography* **14**(6), 1053–1086.

Crozet, M., Mayer, T. and Mucchielli, J.-L. (2004), 'How do firms agglomerate? A study of FDI in France', *Regional Science and Urban Economics* **34**(1), 27–54.

Del Prete, D. and Rungi, A. (2017), 'Organizing the global value chain: a firm-level test', *Journal of International Economics* **109**, 16–30.

Gazaniol, A. (2015), 'The location choices of multinational firms: The role of internationalisation experience and group affiliation', *The World Economy* **38**(8), 1246–1277.

Head, K., Ries, J. and Swenson, D. (1995), 'Agglomeration benefits and location choice: Evidence from japanese manufacturing investments in the united states', *Journal of international economics* **38**(3), 223–247.

Lefilleur, J. and Maurel, M. (2010), 'Inter-and intra-industry linkages as a determinant of fdi in central and eastern europe', *Economic Systems* **34**(3), 309–330.

Rungi, A., Gregory, M. and Pammolli, F. (2017), 'Global ownership and corporate control networks', *Working Paper* (07).

Szemeredi, K. (2017), Multinational business groups, *in* 'Geography, Location, and Strategy', Emerald Publishing Limited, pp. 87–123.

8. Appendix

8.1. Data information

The fDi Markets is a uniquely detailed database in many sense, suiting well for our research question.

First, it allows building measures of inward and outward multinational activity at the sub-national level (at the regional level, but even at the level of the city) and making cross-country comparisons at the same time.

Second, it allows breaking down the overall multinational activities into different business activities along the value chain (such as, among others, production, sales and marketing, distribution and logistics, R&D and related activities), and differentiating across industries.

Third, by containing both source and destination locations it allows building bilateral measures of multinational activities, which is usually not available. Fourth, by providing names and total turnover of the investing firms, fDiMarkets can be combined with other sources of information at the firm level, such as Bureau Van Djcks Amadeus, thus allowing an analysis of the relationship between ownership links and location choice, controlling for a wide range of firm characteristics.

The database is used as one of the main data source in UNCTAD's World Investment Report, in publications by the Economist Intelligence Unit and in a growing number of scientific papers.

Despite its increasing popularity, it is worth mentioning some limitations of the fDiMarkets dataset.

First, investment projects enter the dataset once they are announced and appear in the press. Some of these projects may be never realized, and in some cases they may be postponed. However, the dataset is constantly updated and if a project is discarded (and this information appears in the press) this project is excluded. This suggests that earlier years of data may provide more reliable information on projects which have actually been realized.

Second, fDi Markets does not include M&As. This selectivity raises the question if our estimates could be biased as a result, since we neglect an important mode of entry into foreign markets. Greenfield investments indeed represent only a portion of the total amount of FDI. The relative importance of greenfield investments and M&As is highly volatile and hard to quantify due to lack of official and comparable data. According to UNCTAD (2010, 2013), over the period 2005-2008, the number of greenfield projects worldwide was twice as large as the number of M&A deals, although the relative importance of greenfield investments is lower but still non-negligible in developed economies, such as the European Union. Furthermore, as opposed to the location choice of greenfield investments M&A are very much affected by the availability and characteristics of target firms.

Third, in the majority of cases values of the investment projects are estimated by the data provider. Exact values are given only in a very limited number of cases, and the estimates might not be reliable, putting a limit on the usefulness of project value data.

8.2. Descriptive tables

Table A1: The number of projects by year

Year	FDI projects
2006	1,027
2007	969
2008	1,015
2009	617
2010	660
2011	670
2012	548
2013	543
2014	409
Total	6,458

Table A2: The number of projects by destination country

Destination country	FDI projects in 2006-2014
Bulgaria	473
Croatia	142
Czech Republic	597
Estonia	115
Greece	130
Hungary	583
Latvia	109
Lithuania	177
Poland	1,412
Romania	997
Serbia	397
Slovakia	351
Turkey	633
Ukraine	342
Total	6,458

Table A3: The number of projects by the continent of the investor and by destination country

Destination country	FDI projects in 2006-2014 with investor from		
	Europe	America	Asia-Pacific
Bulgaria	370	52	51
Croatia	114	19	9
Czech Republic	407	103	87
Estonia	103	10	2
Greece	91	22	17
Hungary	401	108	74
Latvia	90	17	2
Lithuania	149	17	11
Poland	1,002	251	159
Romania	762	125	110
Serbia	313	46	38
Slovakia	262	50	39
Turkey	371	126	136
Ukraine	263	49	30
Total	4,698	995	765