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FDI network effects in Central Europe**

GÁBOR BÉKÉS – MÁRTA BISZTRAY

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Do friends follow each other? FDI network effects in Central Europe

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Abstract

A great deal of multinationals receive a bundle of hidden or cash subsidies upon investing in a foreign country. Policymakers often argue that a subsidy today will help locate friends of the investor later on. Using extensive data on FDI investments, we analyze such patterns. In particular, we investigate if co-location is more frequent among connected firms such as members of business groups as well as firms sharing similar background. Focusing on investments into Central and Eastern European countries we find evidence of co-location pattern of connected firms.

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Keywords: Foreign direct investment, agglomeration, location choice, network effects, business groups.

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Jönnek majd a baráti vállalatok?

FDI hálózati hatások Közép-Európában

Békés Gábor – Bisztray Márta

Összefoglaló

A külföldön beruházó multinacionális vállalatok jelentős hányada részesül különféle adókedvezményekben és egyéb állami támogatásokban. A gazdaságpolitikai döntéshozók gyakran érvelnek azzal, hogy ezek a támogatások a későbbiekben azáltal is megtérülnek, hogy a befektetőhöz közel álló többi vállalat így nagyobb eséllyel fog a közelben beruházni. Erre a mintázatra keresünk bizonyítékot külföldi működőtőke-beruházásokat tartalmazó részletes adatbázis segítségével. A tanulmányban megvizsgáljuk, hogy kapcsolódó cégek – ugyanabból az üzleti csoportból, illetve hasonló háttérrel – gyakrabban választanak-e közeli telephelyeket a beruházásaikhoz. Közép-kelet-európai beruházások mintázatai alapján azt a következtetést vonhatjuk le, hogy valóban van egy ilyen tendencia a kapcsolódó cégek körében.

JEL: F23, R3

Tárgyszavak: Külföldi működőtőke-beruházás, agglomeráció, telephelyválasztás, hálózati hatás, üzleti csoportok.

Do friends follow each other? FDI network effects in Central Europe

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Abstract

A great deal of multinationals receive a bundle of hidden or cash subsidies upon investing in a foreign country. Policymakers often argue that a subsidy today will help locate friends of the investor later on. Using extensive data on FDI investments, we analyze such patterns. In particular, we investigate if co-location is more frequent among connected firms such as members of business groups as well as firms sharing similar background. Focusing on investments into Central and Eastern European countries we find evidence of co-location pattern of connected firms.

1. Introduction

Many countries spend a great amount of money and effort on attracting FDI, setting up massive institutions and giving direct subsidies. Harding and Javorcik (2011) show that investment promotion results in higher FDI inflows into targeted sectors, but not in industrialized countries. At the same time, one motivation for giving subsidies to FDI is their effect of attracting further foreign investments, potentially from different industries, as additional firms may learn about the location from the investors. This motivation is sometimes articulated explicitly by government authorities.

This paper investigates how the strength of potential information sharing between two firms may affect the likelihood of investing in the same country. Our starting point is the idea that firms agglomerate to benefit from several externalities such as saving on transport costs, labor pooling, information sharing or using indivisible goods. Negative externalities include competition and congestion effects. For instance, Crozet et al.

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(2004) study location choice within France and find strong evidence on clustering. In particular, firms from the same source country tend to pick locations in proximity to each other.

In this project we would like to find out if such patterns exist among firms with different types of connections, and judge the magnitude of this effect. Indeed, finding a spillover effect would show evidence of a higher return on subsidies than estimated directly (e.g. Greenstone et al. (2010)). In our exercise, we compare FDI location decision of multinationals doing investments in European countries. This 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 (Szemerédi (2017)). Gazaniol (2015) shows evidence that location choice 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. The main idea there is that membership in business groups should increase concentration of related firms in foreign markets. Firms that have trade link - "vertical relationship" - co-locate to benefit from saving shipment costs on frequent trade dealings. Moreover, horizontally related firms - centered around a bank - also end up co-locating abroad. In contrary to some sceptic take on collaboration within keiretsu, Blonigen et al. (2005) argue that there may be networking going on within groups, and if this was the case, it would manifest in co-location of related firms. Importantly, they find evidence that externalities are prevalent even beyond the supply-chain.

Why would non-vertically related firms in business groups co-locate? Blonigen et al. (2005) attribute these effects "to the networking and information sharing that occurs between members of horizontal keiretsu, as such information sharing can yield cost-savings to a newly locating firm" (p78). This is supported by the finding that firms that are closer in the group will co-locate more frequently.

Our aim in this paper is to generalize these findings to global business groups beyond the Japanese keiretsu, and to other networking possibilities. First, our benchmark case is when the investors company is the same. Second, we use a variety of global business groups headquartered in North America, Europe and Asia. Using global investor data we can study a variety of business group types. Third, we look at networking options beyond the business group. Such networking possibility comes from participation in local chambers of commerce, where firms from the same origin country and broad industry are likely to meet and socialize. Finally, an even weaker network could arise

as two multinationals have closely located investment projects in a foreign country. We are particularly interested in the relative strengths of evidence on co-location by various strengths of networking options.

As an illustration, consider these examples:

1. equality of the investor company (e.g. Audi AG sets up plant A in Hungary, then plant B also in Hungary)
2. membership in the same business group (e.g. Volkswagen sets up a plant in Slovakia following Audi's plant)
3. sharing the same background - country of the headquarter and main industry (e.g. a French car maker builds a plant in Romania following another, unattached French car maker)
4. unrelated firms having previous co-located investments in another country (e.g. Continental (Germany, rubber industry) invests in Slovakia following Magna International (Canada, automotive components sector), when they both had investment in Guanajuato region of Mexico.)

In all these cases, there may be information sharing about advantages and disadvantages of comparable business locations, sharing information about the quality of institutions or workforce. Importantly, this information is privately held or is tacit knowledge. Indeed, our aim is to investigate the presence of networking externality.

At the same time, there may be other considerations. Most importantly for our exercise, the new investor may be part of the same supply chain, such as being a supplier to the producer already established¹. Furthermore, there may be country or country-industry specific aspects of the location choice, like institutional quality and tax incentives.

Results on the role of connected firms' existing investments in FDI location choice can be relevant for policy. As investment agencies want to promote their countries as favorable sites, the notion that specific types of business group networks matter, can help optimize spending.²

To test networking externalities, we will consider FDI going to five countries in Central-Eastern Europe (CEE5): the Czech Republic, Hungary, Poland, Romania and Slovakia. The advantage of picking Central and Eastern Europe is that FDI plays a

¹To rule out this possibility is left for future research.

²In future work, we aim at including data on subsidies into the line inquiry.

very important role in these countries. The advantage of picking similar countries is that we can use the assumption that investors may first decide about a site in CEE and then consider all these markets as substitutes³.

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 two models, a conditional logit on a set of five countries and a set of simple linear probability models. We first concentrate on five countries followed by an extension to a dozen, including South and Eastern European countries as well.

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 investments⁴. 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 FDI⁵.

The dataset covers investment projects for the 2003-2014 period. We consider investments to five CEE countries: the Czech Republic, Hungary, Poland, Romania and Slovakia. We create our *main sample* taking all the investments going to any of the five Central-Eastern European countries, from any source country outside these five. 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. Table A1 in the Appendix shows the number of

³This is the basis for the independence of irrelevant alternatives we need for the conditional logit model.

⁴For instance, in the Amadeus dataset that we will use a new investment is captured mostly when a new firm is set up

⁵See for example Burger et al. (2013), Castellani et al. (2013), Crescenzi et al. (2014).

projects in CEE5 in our estimation period (2006-2014) by year and Table A2 presents the same numbers by country.

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—or creation of additional plants (e.g. the investing company GE Energy has an investment in both Nagykanizsa and Ózd within Hungary.)

There are 4125 different parent company names and 5374 different local investing company names. In about 18% of the investments the parents come from Germany and in more than 15% 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 5000 new jobs created, with a mean of 266 employees, and 44, 100 and 216 as the three quartiles.

To classify FDI projects by industry, we use the industry sector variable. This includes 39 categories, like Automotive OEM, Automotive Components, Engines and Turbines or Chemicals. The number of projects by industry and country is presented in Table A3 of the Appendix. 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. Table A4 of the Appendix presents the distribution of projects by activity and country. 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 is manufacturing. We also know that it is an expansion of a previous investment.

2.2. Matching firms in fDi Markets with Amadeus

To add more information on investors we rely on Amadeus, a firm level database operated by Bureau van Dijk. This allows us to create firm groups based on ownership links, and to use additional information on the investment stock. So far we could match about half of the European firms in fDi Markets.

We match firms in fDi Markets to firms in Amadeus using the firm name and its country. Different forms of firm names are used in the two data sources—Amadeus includes the company form and fDi Markets does not⁶—so we do the matching based on the first x words of the firm name where x is the length of the firm name as given in fDi Markets. At this stage we only use exact matches. If there is no exact match, we allow for differences in the last one or two words of the firm name, but we plan to do fuzzy matching in the future. If there are multiple matches we choose based on additional information, like the city or the industry of the firm. If there are still multiple matches but all the matched firms have the same global ultimate owner in Amadeus, then we choose randomly.

2.3. Creation of business groups

We assume that firm names are unique within a country, and define an investor as a parent company from a specific source country in fDi Markets. Similarly, we can identify the local investing company as an investing company in a specific destination country. These may or may not be identical to the parent company, e.g. Lukoil is both a parent and an investing company in Romania, while Audi is the investing company and Volkswagen is the parent in Hungary. Investing companies might be destination-country specific, like Pirelli Romania with the parent Pirelli. In the main sample (CEE5, 2003-2014) there are 9199 projects with 4140 different investors (parent company-source country) and 6458 local investing companies (investing company-destination country). In the estimation sample (CEE5, 2006-2014) there are 6585 projects with 3135 different investors and 4730 different local investing companies. In what follows, we refer to a parent company-source country pair as an investor or a parent, and similarly, (local) investing company means an investing company-destination country pair.

A crucial step is to establish links between investors which belong to the same business group. At this stage, we define a business group as firms sharing an ultimate

⁶For some countries the cyrillic or Greek alphabet is used in Amadeus while firm names are written using the latin alphabet in fDi Markets. At this stage we don't match these firms.

owner. We use the global ultimate owner variable in the Amadeus database to assign ultimate owners to investors. This variable presents the ultimate controlling unit of the firm in those cases when it is unambiguous.

As a starting point, we match investors in fDi Markets to firms in Amadeus, as described before. In those cases when the investor is not a European firm or we cannot match an ultimate owner to it from Amadeus, we use the ultimate owner matched to the local investing company. We assume that ultimate owners of the investors stay the same during our sample period. If a parent has multiple investing companies, no ultimate owner can be matched to the parent, but an ultimate owner can be matched to one of its local investing companies, then we match this ultimate owner to the parent. When different ultimate owners are matched to multiple investing companies of the same parent—for 1.7% of all the investors—we assign the one from the same country as the source country in fDi Markets, or a random one if still multiple ultimate owners remain.

We can match 38.6% of the investors—36.7% of the projects—in our main sample to an Amadeus firm, and 34.7% of all the investors has a global ultimate owner. This ratio can be increased to 57.5% by adding ultimate owners of the local investing companies for parents with missing ultimate owners. We assume that each of the remaining parents form a distinct business group. As ownership links might still exist among these firms, this is a limitation in our current approach. Using additional data on direct owners might be a remedy in future research.⁷ As a result, in our main sample we have 4140 investors in 3983 separate business groups, of which 145 have multiple investors. Three tables in the Appendix show descriptive statistics on investors and business groups. Table A2 presents the number of projects, investors and business groups by country. Table A5 shows the number of business groups with a specific number of investors having FDI in CEE5 in our sample period. Finally, Table A6 shows the number of investors and business groups having investments in a specific number of countries from CEE5.

2.4. Variable definitions

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 three types of connected firms: 1. firms in the same business group, 2. firms with shared background, 3. firms with

⁷Earlier studies rebuilt ownership structures of Amadeus - Del Prete and Rungi (2015) and Fons-Rosen et al. (2013) worked on it

different background but shared previous experience. We define firms in the same business group as a different investor having the same ultimate owner. Firms with shared background are firms in a different business group but from the same country and investing in the same industry. We classify firms as having shared experience if they belong to different business groups but both invested in the same within country region—destination state variable in fDi Markets, roughly corresponding to NUTS-1—outside CEE5. We also require that these firms should come from a different country and invest in a different industry, ensuring a different background. Descriptive statistics on these variables are presented in Table A7 and A10 of the Appendix.

We create some further indicators showing if the same investor had a previous same-country FDI in the same industry or only in a different industry. As Table A7 of the Appendix shows, in one-fifth of the observations with previous FDI by the same investor, the previous investment was in a different industry sector. We make a similar distinction for previous investments by other investors in the same business group.

Table A7 of the Appendix 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 project. As a result, the country was chosen for the FDI in one-fifth of the observations. The last two columns of Table A7 show 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 4) compared to the average share in all the observations (column 3).

3. Model estimation results

In this section we present two models estimating the strengths of co-location patterns of connected firms. We start by estimating a model for five countries and we extend it to thirteen Eastern and Southern European countries.

3.1. Baseline conditional logit model

In this section, 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 of the five countries. Our independent variables measure the existence of connected firms and we consider country and country-industry specific control variables, and control for the stock of foreign firms in the given industry as a measure of broad agglomeration economies.

For each FDI project going into CEE5 we create 5 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 $6,585 \cdot 5 = 32,925$ as the number of observations. We estimate a conditional logit model:

$$Prob(FDI_{pct} = 1) = F(\alpha + \beta_1 DF_{i(p)ct-1} + \beta_2 DO_{i(p)ct-1} + \beta_3 DCI_{i(p)ct-1} + \beta_4 DPI_{i(p)ct-1} + X_{i(p)ct} + \epsilon_{pct}) \quad (1)$$

where $F(\cdot)$ 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 . $DO_{i(p)ct-1}$ is an indicator showing that another investor in the same business group had an investment in c before t . $DCI_{i(p)ct-1}$ is an indicator showing that an investor from another business group, but from the same country and industry had an investment in c before t . Finally, $DPI_{i(p)ct-1}$ is an indicator, showing that another investor having FDI in the same third-country region as i had an investment in c before t . $X_{i(p)ct}$ includes destination country FE and industry-country specific FDI stock measures. We cluster the standard errors by industry.

3.2. Basic results

Table 1 presents the baseline results. Accordingly, average marginal effects suggest that investment by the same firm is the most likely outcome, followed by investment by firms in the same business group and firms with the same nationality and industry.

Table 1: Main results

Dep.var.: FDI in country	(1)	(2)	(3)	(4)	(5)
Same investor	1.513*** (0.101)				1.480*** (0.100)
Same business group		0.512*** (0.103)			0.311*** (0.100)
Same country and ind.			0.497*** (0.067)		0.385*** (0.065)
Same pre. FDI location, other country and ind.				0.877** (0.408)	0.723* (0.432)
Country FE	YES	YES	YES	YES	YES
Observations	32,925	32,925	32,925	32,925	32,925

Standard errors clustered by industry

Having investments in the same third country region is very imprecisely measured. We found this to be a particular problem for our five countries. In an enlarged sample, this will be more precisely measured.

In terms of checking robustness, we make several attempts. In Table A13 (in Appendix) we do a robustness check excluding FDI projects classified as “Expansion” or “Co-location” in the fDi Markets database. 75% of the projects in our main sample is classified as new by fDi Markets, 23% is an expansion and 2% is a co-location. With the exclusion of the latter two we ensure that only location choice for new investments is considered. Results are robust to these restrictions.

In Table A14 (in Appendix) we do another robustness check in which we exploit the feature of the fDi Markets database that it not only includes the industry of the FDI but also the activity. We do our estimates excluding FDI projects with an activity “Sales, marketing and support”. Results are robust to these restrictions.

As an additional robustness check we specifically look at the effect of recent investments made by connected firms. As right-hand side variables we create indicators for having a connected firm in the specific group investing in the same country over the previous 3 years.⁸ Table A12 (in Appendix) shows that the main patterns stay the same.

Next, we take into account general agglomeration issues - captured by the sum of past foreign investments in the given industry. Even after controlling for time-invariant differences across host countries, our estimates might be biased if specific countries are more attractive for specific groups of connected firms.

To address this concern as an additional control we include the baseline FDI stock by industry in a specific country, measured as one plus the total number of employees in large foreign firms with at least 100 employees, in logs.^{9,10} We use 2007 as the baseline year, because this is the first year when we have reliable information on existing foreign firms in Amadeus. Then we constrain our estimation sample to the subsequent period, 2008-2014.

Table 2 shows that the shorter sample in itself doesn’t change our main results. The only exception is the coefficient on connected firms with previous co-located investments in the main version with CEE5, which we cannot estimate in a reliable way due to lack of variation in the data. All the other results are robust to controlling for the industry-

⁸Descriptive statistics are presented in Table A8 of the Appendix.

⁹We define a firm as foreign if it has shareholders from another country. Our measure is slightly imprecise, as in the Amadeus data we know which firms existed in 2007, but information on the owners is only available for 2013. We assume that foreign status of the firm is the same in 2007 and 2013.

¹⁰We assign 4-digit NACE Rev. 2 categories from Amadeus to broad industry sectors in fDi Markets based on finer classification, also available in fDi Markets: the name of the subsectors connected to each industry sector.

specific FDI stock as a proxy for the attractiveness of the country to specific firm groups.

Table 2: Estimates controlling for FDI stock using Amadeus data

Dep.var.: FDI in country	5 countries		13 countries	
	(1)	(2)	(3)	(4)
Same investor	1.525*** (0.102)	1.528*** (0.103)	1.597*** (0.107)	1.593*** (0.107)
Same business group	0.325*** (0.110)	0.341*** (0.108)	0.439*** (0.130)	0.441*** (0.131)
Same country and ind.	0.439*** (0.066)	0.440*** (0.066)	0.623*** (0.059)	0.621*** (0.058)
Same pre. FDI location, other country and ind.			0.032 (0.353)	0.034 (0.347)
FDI stock in country-ind.		0.059*** (0.021)		0.041** (0.016)
Country FE	YES	YES	YES	YES
Observations	22 815	22 815	116,558	116,558

Sample: FDI in 2008-2014. Standard errors clustered by industry.

Finally we consider expanding the scope of locations. Investors may actually consider a larger region than CEE. One option is basically looking broadly at the European periphery from Portugal to Ukraine. Hence, we extend our sample to include thirteen countries in total, adding Southern Europe (Portugal, Spain, Greece) and Eastern Europe (Bulgaria, Croatia, Serbia, Turkey and Ukraine). On the one hand, we expect greater external validity of our exercise. On the other hand, supporting our IIA assumption is now harder. We present detailed descriptive statistics on the estimation sample in the Appendix. Descriptive statistics on the right-hand side variables can be found in Table A9.

Results, presented in Table 3 show very similar patterns as before.

3.3. Extensions

In this section we extend our basic model to learn more about details of which relationships may matter. We discuss the role of industry and source of the origin of business groups.

We start by looking into how information and cost sharing by related companies may be enhanced if both are in the same industry. Note that the same investor may invest in different industries. Out of 3135 investors in our estimation sample 200 have investments in the same country in multiple industrial sectors. Some are close (e.g. E.On both in "Alternative/renewable energy" and "Coal, Oil and Natural Gas" or Deutsche

Table 3: Estimates using 13 countries

Dep.var.: FDI in country	(1)	(2)	(3)	(4)	(5)
Same investor	1.579*** (0.095)				1.525*** (0.091)
Same business group		0.635*** (0.115)			0.421*** (0.113)
Same country and ind.			0.692*** (0.071)		0.578*** (0.054)
Same pre. FDI location, other country and ind.				0.412 (0.282)	0.485* (0.269)
Country FE	YES	YES	YES	YES	YES
Observations	159,952	159,952	159,952	159,952	159,952

Standard errors clustered by industry

Telekom in "Software and IT Services" and "Communications") and some others not (e.g. Siemens in "Electronic Components" and "Financial Services" or Cortizo Group in "Metals" and "Plastics").

In Table 4, we divided earlier variables of same investor and and same business group by their industry classification. We see an interesting pattern: for a given investor, the attraction of the experienced location is greater within the industry, while within a business group, this makes no difference. Note that this result is not robust to model specification (see next subsection).

Table 4: Main results by industry

Dep.var.: FDI in country	(1)	(2)	(3)
Same investor same ind.	1.668*** (0.111)		1.660*** (0.111)
Same investor other ind.	0.844*** (0.098)		0.839*** (0.101)
Same business group same ind.		0.529*** (0.133)	0.326*** (0.115)
Same business group other ind.		0.491** (0.219)	0.266 (0.204)
Country FE	YES	YES	YES
Observations	32,925	32,925	32,925

Standard errors clustered by industry

As a first step towards better understanding networking in business groups, we compare groups headquartered in America, Europe and Asia. As before, the unit of observation is a project-country pair. We estimate

$$Pr(FDI_{pct} = 1) = F(\alpha + \beta_1 D_{i(p)ct-1} \cdot EU_{i(p)} + \beta_2 D_{i(p)ct-1} \cdot AM_{i(p)} + \beta_3 D_{i(p)ct-1} \cdot AS_{i(p)} + X_{i(p)ct} + \epsilon_{ict}) \quad (2)$$

where $F(\cdot)$ is a logistic function and indicators FDI_{ict} and $D = \{DF, DO, DCI, DPI\}$ are defined as before. Variables $EU_{i(p)}$, $AM_{i(p)}$ and $AS_{i(p)}$ are indicators for the business group of investor i of project p having its headquarters in Europe, in America or in Asia and the Pacific. Descriptive statistics on the share of investors by continent and the countries with the most investors within a continent are presented in Table A11 of the Appendix. $X_{i(p)ct}$ stands for destination country fixed effects in the current specification.

Results - from a single regression - are presented in Table 5. While investor and country-industry origin coefficients are the same across different source continent of the investor, it turns out, business groups are very different.

Importantly, we find that co-location pattern by far is the strongest among Asian firms - in line with evidence of Blonigen et al. (2005). Europe-based multinationals still agglomerate but to a smaller degree; and we find no evidence in America based groups. This is a very important result suggesting that earlier results on keiritsu is probably on the extreme side among business groups.

Table 5: Main results by Business group regions (single regression)

Dep.var.: FDI in country	Investor	Right-hand side var.: Same-Business group	Country-ind.
Investor from Europe	1.488*** (0.118)	0.341*** (0.112)	0.391*** (0.070)
Investor from America	1.278*** (0.192)	-0.007 (0.198)	0.399*** (0.146)
Investor from Asia-Pacific	1.813*** (0.244)	1.437*** (0.327)	0.339** (0.138)
Country FE		YES	
Observations		32,840	

Coefficients are presented from a single regression. Standard errors clustered by industry.

3.4. An alternative specification

In the second exercise, we estimate simple linear probability models, that allows a richer fixed effect structure¹¹. This allows us controlling for parent-specific unobservables.

¹¹Logit model results are presented in the Appendix (Tables A15 and A16.)

For the linear probability estimation we do two modifications. First, we collapse our data to investor-destination country-year observations. Second, we expand our estimation sample in such a way that it also includes those years when the investor had no investments in any of the countries. As we have 3135 parents, 5 countries and 9 years, we end up with 141,075 observations.¹²

As the dependent variable we use a similar indicator as in the baseline estimation, showing that the investor has an FDI in the specific country in the given year. The same investor can invest in multiple countries or in none of them. The FDI indicator is one for 4% of the observations. In 83% of the investor-year pairs the firm doesn't invest at all in CEE5, in 15% it invests into exactly one country, and in 0.01% it invests to all five in the specific year.

We estimate

$$FDI_{ict} = \alpha + \beta_1 DF_{ict-1} + \beta_2 DO_{ict-1} + \beta_3 DCI_{ict-1} + \beta_4 DPI_{ict-1} + X_{ict} + \epsilon_{ict} \quad (3)$$

with FDI_{ict} as an indicator for firm i investing in country c in year t , conditional on ever investing in CEE5 in the period 2006-2014. Indicators for previous FDI of the same firm (DF) or of connected firms (DO , DCI , DPI) are defined as before. X_{ict} is a set of fixed effects: country, industry and year; or a full set of country-year and industry-year dummies. Standard errors are clustered by country-industry.

Linear probability model results are presented in Tables 6 and 7. Results confirm earlier findings.

4. 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 evidence on agglomeration of related firms. In particular, firms belonging to the same business group are more likely to co-locate in the same country, as well as firms with the same source country and industry. Both these results point towards externalities either in terms of information sharing, using joint facilities

¹²The same investor might have multiple investments in the same country in a given year, potentially in multiple industries. In this case we assign all these industries to the observation, and consider all when creating right-hand side variables based on previous investments of connected firms in the same industry. In those years when there is no FDI by an investor, we assign the industry of previous—or if there is no such, then future—FDI of the same investor.

Table 6: Linear probability estimates with fixed effects

Dep.var.: FDI in country	(1)	(2)	(3)	(4)	(5)	(6)
Same investor	0.050*** (0.004)		0.045*** (0.004)		0.043*** (0.004)	
Same business group	0.037*** (0.006)		0.032*** (0.006)		0.031*** (0.006)	
Same investor same ind.		0.046*** (0.004)		0.041*** (0.004)		0.039*** (0.004)
Same investor other ind.		0.100*** (0.010)		0.095*** (0.010)		0.094*** (0.010)
Same business group same ind.		0.050*** (0.008)		0.040*** (0.008)		0.040*** (0.008)
Same business group other ind.		0.016** (0.008)		0.016** (0.007)		0.016** (0.007)
Country FE	NO	NO	YES	YES	NO	NO
Year FE	NO	NO	YES	YES	NO	NO
Industry FE	NO	NO	YES	YES	NO	NO
Country-year FE	NO	NO	NO	NO	YES	YES
Industry-year FE	NO	NO	NO	NO	YES	YES
Observations	141,075	141,075	141,075	141,075	141,075	141,075
R-squared	0.011	0.012	0.031	0.032	0.035	0.036

Standard errors are clustered by country-industry

Table 7: Linear probability estimates with fixed effects using 13 countries

Dep.var.: FDI in country	(1)	(2)	(3)	(4)	(5)	(6)
Same investor	0.060*** (0.003)		0.051*** (0.003)		0.049*** (0.003)	
Same business group	0.032*** (0.004)		0.026*** (0.004)		0.025*** (0.004)	
Same investor same ind.		0.059*** (0.003)		0.050*** (0.003)		0.047*** (0.003)
Same investor other ind.		0.074*** (0.005)		0.065*** (0.005)		0.064*** (0.005)
Same business group same ind.		0.045*** (0.005)		0.037*** (0.005)		0.034*** (0.005)
Same business group other ind.		0.016*** (0.004)		0.013*** (0.004)		0.013*** (0.004)
Country FE	NO	NO	YES	YES	NO	NO
Year FE	NO	NO	YES	YES	NO	NO
Industry FE	NO	NO	YES	YES	NO	NO
Country-year FE	NO	NO	NO	NO	YES	YES
Industry-year FE	NO	NO	NO	NO	YES	YES
Observations	618,111	618,111	618,111	618,111	618,111	618,111
R-squared	0.016	0.017	0.031	0.031	0.037	0.037

Standard errors are clustered by country-industry

or cost reduction of investment.

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 from investors and business groups already operating in the country, as well as for firms based in the same country and industry as existing firms.

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6. Appendix

6.1. Data information

The fDi Markets is a uniquely detailed database in many senses, 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 Dijk’s 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 sources 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.

6.2. Descriptive tables

Table A1: The number of projects by year

	Number of projects	
	CEE5	13 countries
2006	1,015	1,654
2007	1,007	1,684
2008	998	1870
2009	569	1143
2010	742	1343
2011	720	1369
2012	558	1189
2013	504	1120
2014	472	932
Total	6,585	12,304

Table A2: The number of projects and investors by destination country

	Number of projects		Number of parents		Number of owners	
	CEE5	13 countries	CEE5	13 countries	CEE5	13 countries
Czech Republic	1,030	1,004	676	652	663	641
Hungary	1,080	1,040	708	675	695	661
Poland	2,234	2,118	1,382	1,285	1,344	1,248
Romania	1,676	1,463	955	831	934	810
Slovakia	565	545	394	380	390	375
Bulgaria		675		427		423
Croatia		199		148		145
Greece		228		180		177
Portugal		268		211		207
Serbia		555		387		383
Spain		2,665		1,607		1,571
Turkey		977		739		729
Ukraine		567		416		413
Total	6,585	12,304	3,135	5,283	3,034	5,097

Table A3: The number of projects by industry and destination country

	Number of projects						13 countries Tot.
	CZ	HU	CEE5 PL RO SK			Tot.	
Aerospace	6	4	23	5	2	40	88
Alternative/Renewable energy	21	26	52	82	14	195	453
Automotive Components	133	117	143	119	63	575	708
Automotive OEM	37	26	34	34	21	152	301
Beverages	3	4	19	21	4	51	118
Biotechnology	4	2	1	1	0	8	26
Building & Construction Materials	8	13	28	51	6	106	184
Business Machines & Equipment	10	7	20	7	8	52	120
Business Services	60	55	143	99	20	377	923
Ceramics & Glass	6	11	18	11	3	49	78
Chemicals	12	38	65	25	14	154	338
Coal, Oil and Natural Gas	21	18	28	40	8	115	244
Communications	40	68	77	75	18	278	513
Consumer Electronics	16	21	53	18	16	124	214
Consumer Products	28	35	60	21	17	161	266
Electronic Components	50	51	77	46	35	259	418
Engines & Turbines	2	3	13	5	0	23	52
Financial Services	98	58	132	152	24	464	1,079
Food & Tobacco	24	47	107	81	7	266	517
Healthcare	1	2	30	23	0	56	73
Hotels & Tourism	20	18	31	21	5	95	242
Industrial Machinery,Equip.,Tools	73	77	119	76	40	385	638
Leisure & Entertainment	1	7	1	6	1	16	29
Medical Devices	14	18	12	3	9	56	108
Metals	29	44	91	72	44	280	431
Minerals	0	0	1	2	1	4	14
Non-Automotive Transport OEM	3	7	10	3	1	24	69
Paper, Printing & Packaging	10	22	59	15	7	113	171
Pharmaceuticals	24	28	43	19	4	118	239
Plastics	41	34	92	26	30	223	326
Real Estate	58	59	215	225	46	603	940
Rubber	9	16	16	26	8	75	108
Semiconductors	6	9	2	6	3	26	42
Software & IT services	70	60	186	138	27	481	1,076
Space & Defence	0	1	1	0	0	2	7
Textiles	9	16	24	12	10	71	192
Transportation	72	41	158	79	39	389	764
Warehousing & Storage	10	11	25	11	6	63	126
Wood Products	1	6	25	20	4	56	69
Total	1,030	1,080	2,234	1,676	565	6,585	12,304

Table A4: The number of projects by activity and destination country

	Number of projects						13 countries Tot.
	CZ	HU	CEE5			Tot.	
			PL	RO	SK		
Business Services	143	97	248	242	44	774	1,761
Construction	66	68	217	215	46	612	983
Customer Contact Centre	10	13	27	29	6	85	164
Design, Developm., Testing	46	40	102	83	16	287	524
Education & Training	17	14	7	5	2	45	89
Electricity	16	22	49	89	13	189	424
Extraction	1	4	4	4	0	13	42
Headquarters	20	9	27	26	6	88	265
ICT & Internet Infrastruct.	23	17	22	25	9	96	174
Logistics, Distrib., Transport.	85	86	233	123	60	587	1,044
Maintenance & Servicing	21	8	27	13	3	72	154
Manufacturing	371	506	769	518	271	2,435	3,734
Recycling	5	4	13	10	3	35	66
Research & Development	9	25	17	8	2	61	140
Sales, Marketing & Support	176	129	375	231	70	981	2,448
Shared Services Centre	14	26	72	27	9	148	174
Technical Support Centre	7	12	25	28	5	77	118
Total	1,030	1,080	2,234	1,676	565	6,585	12,304

Table A5: The number of investors by business group

Nr. of investors	Number of business groups	
	CEE5	13 countries
1	2,941	4,939
2	86	134
3	6	20
4	1	3
5	0	1
Total	3,034	5,097

Table A6: The number of countries in which the same investor or investors from the same business group invest

Nr. countries	Number of countries with FDI by the same investor business group			
	CEE5	13 countries	CEE5	13 countries
1	2,508	4,029	2,411	3,853
2	396	657	384	649
3	133	280	134	274
4	74	124	80	118
5	24	61	25	60
6		52		54
7		44		44
8		18		23
9		10		10
10		3		5
11		1		2
12		5		5
Total	3,135	5,284	3,034	5,097

Table A7: Number and share of observations with connected firms having previous FDI in the country, using FDI of connected firms from all previous years, CEE5

Baseline specification with FDI in all previous years	Number of observations		Share of observations (%)	
	total	with FDI	total	with FDI
Total	32,925	6,585	100	100
With previous FDI in the same country				
by the same investor	8,329	2,731	25.3	41.5
- in the same industry	6,594	2,339	20.0	35.5
- only in a different industry	1,735	392	5.3	6.0
by another investor from the same business group	1,381	368	4.2	5.6
- and no FDI by the same firm	541	109	1.6	1.7
by an investor in another business group				
- in the same industry and from the same country	22,147	4,868	67.3	73.9
- in the same industry but from another country	31,824	6,436	96.7	97.7
- and no FDI in same industry and from same country	10,583	1,694	32.1	25.7
- in another industry but from the same country	32,667	6,554	99.2	99.5
- and no FDI in same industry and from same country	9,749	1,579	29.6	24.0
by an investor in another business group with previous co-located FDI outside CEE5				
- in the same industry and from the same country	12,029	2,571	36.5	39.0
- in the same industry but from another country	20,121	4,084	61.1	62.0
- and no FDI in same industry and from same country	8,322	1,555	25.3	23.6
- in another industry but from the same country	19,523	3,992	59.3	60.6
- and no FDI in same industry and from same country	7,629	1,447	23.2	22.0
- in a different industry and from a different country	22,372	4,481	67.9	68.0
- and no FDI in same industry or from same country	792	130	2.4	2.0

Table A8: Number and share of observations with connected firms having previous FDI in the country, using FDI of connected firms from the previous 3 years, CEE5

Alternative specifications with FDI in previous 3 years	Number of observations		Share of observations (%)	
	total	with FDI	total	with FDI
Total	32,925	6,585	100	100
With previous FDI in the same country				
by the same investor	6,250	2,157	19.0	32.8
- in the same industry	4,760	1,778	14.5	27.0
- only in a different industry	1,490	379	4.5	5.8
by another investor from the same business group	780	205	2.4	3.1
- and no FDI by the same firm	411	92	1.2	1.4
by an investor in another business group				
- in the same industry and from the same country	18,635	4,202	56.6	63.8
- in the same industry but from another country	32,235	6,502	97.9	98.7
- and no FDI in same industry and from same country	13,743	2,322	41.7	35.3
- in another industry but from the same country	31,294	6,366	95.0	96.7
- and no FDI in same industry and from same country	12,738	2,178	38.7	33.1
by an investor in another business group with previous co-located FDI outside CEE5				
- in the same industry and from the same country	10,195	2,230	31.0	33.9
- in the same industry but from another country	19,404	3,969	58.9	60.3
- and no FDI in same industry and from same country	9,548	1,797	29.0	27.3
- in another industry but from the same country	18,802	3,876	57.1	58.9
- and no FDI in same industry and from same country	8,750	1,677	26.6	25.5
- in a different industry and from a different country	22,351	4,478	67.9	68.0
- and no FDI in same industry or from same country	1,039	167	3.2	2.5

Table A9: Number and share of observations with connected firms having previous FDI in the country, using FDI of connected firms from all previous years, 13 countries

Baseline specification with FDI in all previous years	Number of observations		Share of observations (%)	
	total	with FDI	total	with FDI
Total	159,952	12,304	100	100
With previous FDI in the same country				
by the same investor	25,773	4,559	16.1	37.1
- in the same industry	19,731	3,896	12.3	31.7
- only in a different industry	6,042	663	3.8	5.4
by another investor from the same business group	4528	637	2.8	5.2
- and no FDI by the same firm	2355	205	1.5	1.7
by an investor in another business group				
- in the same industry and from the same country	86,327	8,618	54.0	70.0
- in the same industry but from another country	154,156	12,160	96.4	98.8
- and no FDI in same industry and from same country	68,872	3,578	43.1	29.1
- in another industry but from the same country	147,319	11,862	92.1	96.4
- and no FDI in same industry and from same country	61,494	3,308	38.4	26.9
by an investor in another business group with previous co-located FDI outside the 13 countries				
- in the same industry and from the same country	46,543	4,448	29.1	36.2
- in the same industry but from another country	88,599	7,247	55.4	58.9
- and no FDI in same industry and from same country	44,015	2,896	27.5	23.5
- in another industry but from the same country	86,441	7,124	54.0	57.9
- and no FDI in same industry and from same country	40,567	2,736	25.4	22.2
- in a different industry and from a different country	106,184	8,199	66.4	66.6
- and no FDI in same industry or from same country	7,000	317	4.4	2.6

Table A10: Share of choices with a connected firms having FDI in a specific number of countries within CEE5

Type of connection	Share of choices having a connected firm with previous FDI in X countries (%)					
	X=0	X=1	X=2	X=3	X=4	X=5
same investor	45.38	21.14	11.45	9.78	8.17	4.09
- in the same industry	52.1	21.55	10.24	8.64	5.16	2.31
- only in a different industry	84.12	9.84	2.98	1.97	0.84	0.26
same business group (other firm)	89.89	4.63	2.43	1.66	0.47	0.93
another business group						
- same industry and country	11.36	7.99	10.36	13.85	16.16	40.29
- same industry, other country	0.03	0.11	0.06	0.47	2.22	97.11
- other industry, same country	0.74	0.9	0.97	1.56	3.37	92.45
previous co-located FDI outside CEE5 (other business group)						
- same industry and country	53.23	5.57	4.01	5.32	6.24	25.63
- same industry, other country	35	1.61	1.38	2.03	4.77	55.2
- other industry, same country	36.19	1.72	2.08	2.48	4.53	53.01
- other industry and country	31.86	0.03	0.06	0.14	0.38	67.53

Table A11: The number of projects by the continent of the owner and by the top3 source countries within each continent

Continent of the owner	Top 3 countries in the continent	Number of projects	
		CEE5	13 countries
America		1,086	2,335
	USA	1,004	2,059
	Canada	37	107
	Bermuda	21	
	Cayman Islands		32
Asia-Pacific		711	1,447
	Japan	259	494
	South Korea	111	173
	China	100	190
Europe		4,771	8,442
	Germany	1,199	2,072
	Austria	527	
	UK	488	1,008
	France		1,065
Other		17	80
Total		6,585	12,304

6.3. Additional results

Table A12: Estimates using investments of connected firms only from the previous 3 years

Dep.var.: FDI in country	(1)	(2)	(3)	(4)	(5)
Same investor	1.344*** (0.095)				1.322*** (0.095)
Same business group		0.264* (0.137)			0.126 (0.132)
Same country and ind.			0.399*** (0.050)		0.320*** (0.047)
Same pre. FDI location, other country and ind.				0.830*** (0.295)	0.744*** (0.307)
Country FE	YES	YES	YES	YES	YES
Observations	32,925	32,925	32,925	32,925	32,925

Standard errors clustered by industry

Table A13: Estimates using new investments only

Dep.var.: FDI in country	(1)	(2)	(3)	(4)	(5)
Same investor	1.082*** (0.111)				1.049*** (0.107)
Same business group		0.450*** (0.099)			0.284*** (0.094)
Same country and ind.			0.436*** (0.073)		0.367*** (0.067)
Same pre. FDI location, other country and ind.				0.960** (0.382)	0.920** (0.391)
Country FE	YES	YES	YES	YES	YES
Observations	24,650	24,650	24,650	24,650	24,650

Standard errors clustered by industry

Table A14: Estimates excluding FDI with “Sales, marketing and support” activity

Dep.var.: FDI in country	(1)	(2)	(3)	(4)	(5)
Same investor	1.700*** (0.114)				1.670*** (0.113)
Same business group		0.390*** (0.108)			0.220* (0.113)
Same country and ind.			0.500*** (0.067)		0.374*** (0.070)
Same pre. FDI location, other country and ind.				0.747* (0.397)	0.449 (0.448)
Country FE	YES	YES	YES	YES	YES
Observations	28,030	28,030	28,030	28,030	28,030

Standard errors clustered by industry

Table A15: Logit estimates with fixed effects

Dep.var.: FDI in country	(1)	(2)	(3)	(4)	(5)	(6)
Same investor	1.019*** (0.078)		0.977*** (0.078)		0.920*** (0.079)	
Same business group	0.597*** (0.077)		0.487*** (0.072)		0.494*** (0.071)	
Same investor same ind.		0.967*** (0.082)		0.919*** (0.082)		0.858*** (0.083)
Same investor other ind.		1.542*** (0.090)		1.524*** (0.096)		1.515*** (0.097)
Same business group same ind.		0.729*** (0.093)		0.556*** (0.093)		0.578*** (0.090)
Same business group other ind.		0.297** (0.122)		0.313*** (0.117)		0.289** (0.124)
Country FE	NO	NO	YES	YES	NO	NO
Year FE	NO	NO	YES	YES	NO	NO
Industry FE	NO	NO	YES	YES	NO	NO
Country-year FE	NO	NO	NO	NO	YES	YES
Industry-year FE	NO	NO	NO	NO	YES	YES
Observations	141,075	141,075	141,075	141,075	140,627	140,627

Standard errors are clustered by country-industry

Table A16: Logit estimates with fixed effects using 13 countries

Dep.var.: FDI in country	(1)	(2)	(3)	(4)	(5)	(6)
Same investor	1.811*** (0.074)		1.478*** (0.081)		1.389*** (0.083)	
Same business group	0.828*** (0.064)		0.606*** (0.066)		0.600*** (0.067)	
Same investor same ind.		1.791*** (0.076)		1.453*** (0.084)		1.358*** (0.086)
Same investor other ind.		1.992*** (0.077)		1.719*** (0.082)		1.703*** (0.085)
Same business group same ind.		0.982*** (0.076)		0.694*** (0.081)		0.690*** (0.080)
Same business group other ind.		0.533*** (0.092)		0.431*** (0.094)		0.420*** (0.097)
Country FE	NO	NO	YES	YES	NO	NO
Year FE	NO	NO	YES	YES	NO	NO
Industry FE	NO	NO	YES	YES	NO	NO
Country-year FE	NO	NO	NO	NO	YES	YES
Industry-year FE	NO	NO	NO	NO	YES	YES
Observations	618,111	618,111	618,111	618,111	612,566	612,566

Standard errors are clustered by country-industry