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Bringing International Production Linkages into the Picture

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Abstract

The attractiveness of a country for foreign direct investors stems from domestic factors but also from its interconnectedness with the global economy. While knowledge spillovers and domestic inter-industry linkages have been examined by the literature on FDI location, international linkages have been neglected due to data constraints. Using global input-output data, this paper investigates the role of backward and forward production linkages between countries for location choices of first-time greenfield FDI investors in the EU along with traditional agglomeration forces. In line with the literature it is found that firms tend to co-locate with other firms from the same country and industry. Most importantly, inter-industry linkages between the source and the host country emerge as an important attraction factor while the same does not hold for domestic inter-industry linkages.

Keywords: foreign direct investment, multinational enterprises, location choice, agglomeration, international linkages

JEL classification: F21, F23, R30

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1. Introduction

Foreign direct investment (FDI) has become the major pillar of internationalisation for firms (Sauvant, 2005) and attracting foreign direct investment forms part of many countries' trade and investment policies. Attracting FDI is deemed beneficial for its impact on job creation and aggregate investment and also because it supports structural upgrading and technology spillovers to other parts of the economy. Foreign direct investment, for example, is found to have played an important role in the catch-up process of the Central and Eastern European EU Member States (e.g. Landesmann and Stehrer, 2006; Damijan et al., 2013).

While many countries have specific FDI promotion programmes which are designed to attract foreign multinational enterprises (MNEs), empirical research on the location of FDI suggests that in general other factors tend to be more important (for a comprehensive survey see Bloningen, 2005). In particular, there is ample evidence that agglomeration forces play a major role for the location decisions of MNEs. Crozet et al. (2004) for example find a dominant influence of agglomeration economies, which in the FDI location literature is typically proxied by the presence of other firms, for FDI in France but very limited evidence for any effect of (regional) policy incentives while Kinoshita and Campos (2003) and Du et al. (2008) find that agglomeration economies and institutions are key factors for the location of FDI. However, the latter result is in contrast with the finding by Bloningen and Piger (2014) whose Bayesian estimation techniques attribute a very low inclusion probability for legal and political institutions as an explanatory factor for location decisions. Further evidence for the importance of agglomeration externalities relative to other factors comes from UNCTAD's World Investment Prospect Survey (UNCTAD, 2009) which suggests that 'following my competitors' is one of the main factors for firms' location decisions.

On the basis of its relevance for FDI location choice, this paper incorporates several agglomeration factors established in the empirical literature into a multinomial choice model. To capture agglomeration factors we follow the literature in including previous FDI investments in potential host countries as a measure for knowledge spillovers (agglomeration externalities). A second set of agglomeration variables are domestic inter-industry linkages in the potential host country which we proxy by backward and forward linkages retrieved from input-output data. In addition our model introduces the role of international inter-industry linkages as a new potential determinant of FDI. These international inter-industry linkages are potentially relevant for FDI investors because they reflect and potentially even affect the co-ordination costs of offshoring. In particular, we expect that well established trade links between the investor's economy and the host economy signal lower costs of offshoring to new investors. Hence, our argument is that in addition to traditional agglomeration factors stressed in the New Economic Geography (NEG) literature, offshoring and international production linkages also contribute to the potential concentration of production capacity in a selected number of EU Member States (see IMF, 2013; Stöllinger and Stehrer, 2015).

The subject of analysis are investment decisions of MNEs from six 'core' European countries (Austria, Belgium, France, Germany, Italy and the Netherlands) across all EU Member States over the period

2003-2012. All six investor countries, which will be referred to as European core countries, are important sources of FDI for other EU Member States. The main methodological framework for identifying the determinants of FDI location is the conditional logit model developed by McFadden (1974). As a robustness check, we will also employ a nested logit model. Moreover, the analysis will be repeated at a more disaggregated level by replacing EU Member States with NUTS 2 regions as the potential locations for FDI investors.

In order to avoid confusing agglomeration effects resulting from the presence of other firms and firms' own investment histories, our empirical analysis is restricted to 'first movers'. First movers are firms which invest for the first time in a particular industry in a particular country. We also restrict the analysis to greenfield FDI projects (and major extensions of existing facilities) in order to avoid aggregation bias by mixing different modes of FDI.

This paper therefore adds to the existing literature along two dimensions. First of all, we investigate exclusively greenfield investment projects that are related to production. Production-related projects are defined as investment projects that lead to the creation of new production capacity. We disregard all other projects such as representative offices, logistic centres or customer services facilities. Put differently, we focus exclusively on the business function production within companies' value chains. De facto, all projects entailing the creation of new production capacity are undertaken by manufacturing firms in our sample. However, our approach is different from a simple differentiation between manufacturing and services firms because the limitation to production-related projects disregards a large number of projects by manufacturing firms.

Secondly, the analysis of the location decisions of FDI investors incorporates international inter-industry linkages as potential attraction factors. The linkages between the investor's economy and a potential host economy capture the production interdependences between the two countries. The hypothesis to be tested in this context is whether existing linkages between source and host country reduce the coordination costs of offshoring and are thus relevant for the location decision of potential investor firms. To our knowledge the combined role of agglomeration effects and of international linkages for the location decision of FDI projects has not been investigated in the literature before.

The paper is structured as follows. Section 2 provides a snapshot of the related literature. Section 3 explains the methodology including the definition of variables and the econometric specification. Section 4 describes the data followed by the empirical results which are presented in Section 5. Section 6 concludes.

2. Related literature and theoretical motivation

In line with other empirical contributions on location choices of MNEs this paper uses elements suggested by the New Economic Geography (NEG) literature to be relevant for firms' location decisions. This is particularly true for the agglomeration variables. To motivate the inclusion of intra-industry linkages recourse to models of offshoring is taken.

The major theoretical arguments for why firms tend to agglomerate in certain locations have already been formulated by Marshall (1920). These ideas have been formalised by the New Economic Geography (NEG) literature (e.g. Krugman, 1991a; Fujita et al., 2001) which identifies three major advantages for firms to 'cluster' together in close proximity: *(i)* the spread of new ideas and innovations across firms, typically referred to as knowledge spillovers or agglomeration externalities, *(ii)* the availability of specialised labour and *(iii)* backward and forward linkages to local markets (e.g. Fujita et al., 2001).

NEG theory stresses in particular the role of inter-industry linkages for firm location (Fujita et al., 2001). In the model by Krugman and Venables (1995) manufacturing firms produce with increasing returns to scale and they sell not only to consumers but also to other firms. This implies that there are vertical (inter-industry) interactions between firms. Assuming that there are (non-prohibitive) trade costs, the region with a larger manufacturing sector will find it easier to attract additional manufacturing activity because it offers a larger market for the suppliers of intermediate goods. The larger market of intermediates thus acts as an attraction factor and will lead to further agglomeration. In turn, the greater variety of intermediate inputs translates into lower production costs for the final good producers thereby reinforcing the agglomeration of production in locations with some initial advantage.

However, these advantages of agglomeration are not boundless because they are counteracted by differences in wages levels between the core region and the periphery. This trade-off between efficiency gains from agglomeration and lower wage costs also depends on trade costs. The advantage of being close to intermediate suppliers (backward linkages) and close to customers (forward linkages) vanishes as trade costs decline because goods can be shipped cheaply from even remote places. In the extreme case, if trade costs go to zero, it does not matter where inputs are supplied from or which market the output is sold to. In such a situation the lower wages prevailing in the region with the smaller manufacturing sector, i.e. the periphery, will induce firms to locate there.

Studies on the geographic agglomeration of economic activity typically focus on domestic factors and domestic linkages have also been incorporated by the empirical literature on location choice. In a time of strongly reduced trade costs and ever more granular trade flows, however, also a country's (or region's) interconnectedness, i.e. its international linkages should be relevant for FDI investors. An important form of interconnectedness which is of particular interest for our purpose is the integration of economies into international production networks which according to Baldwin (2011; 2013) characterises 21st century trade. In international production networks the production process is not necessarily bundled in a specific location any more. Rather, the production activities (or a firm's value chain more generally) are geographically dispersed giving rise to offshoring of certain activities.[1] The offshoring literature (e.g. Feenstra and Hanson, 1996; Grossman and Rossi-Hansberg, 2008; Baldwin and Robert-Nicoud, 2014) identifies similar factors as the NEG literature as being relevant for the offshoring decision: changes in trade costs and wage differentials. The relevant trade costs are the co-ordination costs of offshoring which *'comprise the cost of organising tasks in different nations, e.g. the cost of exchanging coordination information'* (Baldwin and Robert-Nicoud, 2014, p. 54). In the model by Grossman and Rossi-Hansberg (2008) production requires the input of low-skill tasks and high-skill tasks. Firms have the possibility to offshore low-skill tasks by setting up a foreign subsidiary thereby benefiting from lower wages abroad. The decision to offshore tasks then depends on the difference between domestic and foreign wages on the one hand and the cost of offshoring (which are assumed to be task-specific) on the other hand. The implication of an internationally dispersed production process is trade in intermediates. Clearly, such trade in intermediates and resulting international inter-industry linkages are created by FDI activities but for first-time FDI investors (which are the ones whose location decisions will be investigated) the existence of such linkages can be expected to act as a signal for attractive investment locations. Hence, a simple way to incorporate costs of offshoring into an empirical location choice model is to associate them with existing international linkages of potential offshoring destinations (i.e. potential host countries for FDI). Assuming that investor-host-country linkages are essential for the proper functioning of global value chains, the existence of strong linkages between the source and the host country of FDI should imply reduce costs of offshoring. At least they signal lower costs of offshoring for new FDI investors.[2] In an adaptation of the logic behind the offshoring decision from *whether to offshore* to *where to offshore to* we hypothesise that strong linkages between the investor country and a potential host country make the latter more attractive as a destination for FDI. The assumption that existing inter-industry linkages affect offshoring costs creates an analogy between domestic inter-industry linkages stressed in the NEG literature and host-source inter-industry linkages implied by models of offshoring. Alternatively, the relevance of international linkages may also be motivated within the framework of the NEG literature: if trade costs are low enough, firms will be equally attracted by international production linkages as they are attracted by domestic linkages.

For the empirical implementation of these theoretical considerations we can draw on a vast literature on agglomeration and FDI location. Like any other firm, MNEs are assumed to maximise profits. On top of the optimal input decisions, MNEs also have to make a location decision for their FDI projects. This decision is the subject of the theory of location choice. With regard to FDI decisions it suggests that MNEs will choose the location which offers the highest profits under the assumption that it can transfer its technology abroad so that it operates with the same production function in any potential location. Despite this assumption on the transferability of technology, profits of MNEs may vary across locations due to location specific factors (such as agglomeration).

An early analysis of agglomeration effects in FDI activities is Woodward (1992) who uses McFadden's conditional logit model (1974) to estimate the effects of various state and county variables on the location decisions of Japanese start-up firms across US states and counties. One of the explanatory

1 The phenomenon of geographically dispersed production has many names, including inter alia international production integration, production sharing, fragmentation of production and vertical integration.

2 Note, that there is a nuance in this. Established inter-industry linkages may themselves reduce co-ordination costs or they may simply reflect lower co-ordination costs. Our data does not allow us to differentiate between the two interpretations but we sympathise with the first view. Moreover, it also has to be kept in mind that international inter-industry linkages by definition constitute trade flows. Therefore the existing linkages could more generally reflect lower trade costs.

variables he uses is 'manufacturing agglomeration' which is proxied by the number of manufacturing establishments in the respective county. He finds positive and statistically significant effects of this agglomeration variable in all of his specifications. The interpretation of this result is that firms expect to benefit from co-location with other firms in the same industry (even if this means more competition) because of knowledge spillovers.

A pioneering study in the FDI location literature is Head et al. (1995) who examine foreign direct investments of 751 Japanese manufacturing firms in the United States. Within the framework of a conditional logit model they build agglomeration variables based on previous foreign direct investments by Japanese firms in the respective industry and region (US state). This variable allows them to identify a 'follow-the-leader' pattern of Japanese firms in their FDI activities in the United States. This follow-the-leader pattern is attributed to Marshallian knowledge spillovers, i.e. agglomeration externalities.[3] As agglomeration measure serves the stock of foreign investment projects in the host economy already undertaken by firms from the source country (in their case Japan) and industry. Obviously, if agglomeration effects are large enough to influence the decision where to invest, everything else equal, the number of previous investments, undertaken by compatriot firms in the same industry increase the locational attractiveness of a host country and consequently lead to further accumulation of projects. The results in Head et al. (1995) suggest positive and sizeable agglomeration effects among Japanese firms which are even larger for firms belonging to the same keiretsu. The number of US firms operating in the respective region and industry is included in the analysis in order to control for industry-specific endowment effects.

A large number of empirical studies confirm the positive relationship between the presence of foreign firms and the location choice of new FDI investors for several countries. Examples for studies of FDI location in European countries include Guimarães et al. (2000) for new firms in Portugal; Basile (2004) for FDI in Italy; Crozet et al. (2004) for France; Boudier-Bensebaa (2005) for FDI in Hungary; Barrios et al. (2006) for location choices of MNEs in Ireland and Devereux et al. (2007) for location choices of MNEs in the UK. These studies take the view of a specific host country, in the sense that they focus on the location of FDI within a specific country (inward view). In addition there are also studies investigating the location of FDI from an outward perspective, i.e. they analyse investment projects undertaken by MNEs from one specific source country in different countries such as Balsvik and Skaldebo (2013) for Norwegian investors and Procher (2011) for French investors.

With regard to the destination markets, this paper is related to Head and Mayer (2004) who study the location decisions by Japanese investors in the EU. Siedschlag et al. (2013) also investigate the location choice for FDI projects across European countries but they focus on projects involving R&D activity whereas we are interested in production-related projects.

The paper by Procher (2011) analyses investments by French firms both in Europe and globally. An interesting element in this paper is the differentiation between FDI investors in general and 'first movers', i.e. firms which undertake a foreign direct investment for the first time. This approach avoids mixing-up agglomeration effects and the influence of a firm's own past investments on FDI location choices.

[3] The location choice literature typically interprets the positive effect of past FDI projects realised in a particular host economy on location choice as the result of knowledge spillovers. There is, however, also another strand of literature which assigns this effect to herd bevaviour (see. e.g. Guillén, 2002).

The above mentioned literature includes past investments by MNEs as a measure of agglomeration externalities. There are also some contributions that use input-output linkages in the context of FDI location. The use of input-output linkages in this literature is twofold: on the one hand the linkages are used to put structure on spillover effects, on the other hand production inter-linkages are analysed as locational determinants by themselves (Jones and Wren, 2011). We will use backward and forward inter-industry linkages as location determinants by themselves as in Du et al. (2008) and Debaere et al. (2010). The latter paper undertakes a firm-level analysis of South-Korean FDI in China. Their contribution is closely related to our paper as it includes the agglomeration externalities variables together with forward and backward inter-industry linkages as relevant factors for location decisions of foreign direct investors. Debaere et al. (2010) distinguish between inter-industry linkages of the Korean FDI firm with upstream and downstream Korean FDI firms on the one hand and with all domestically operating firms on the other hand. They only find an effect on location choice for the inter-industry linkages to Korean FDI firms within China but not for the existing domestic inter-industry linkages to Chinese firms.

3. Methodology

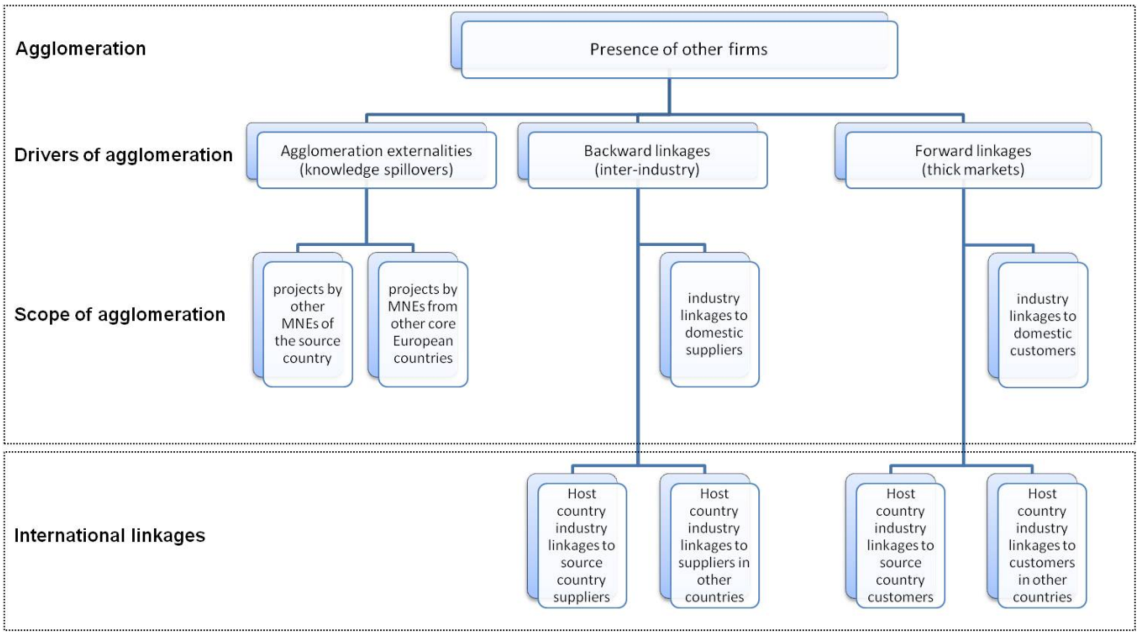
This section first presents the conceptual framework regarding the agglomeration effects and international linkages in the location choice model. Second, it outlines the conditional logit and the nested logit model which are the two choice models used to carry out the analysis.

3.1 AGGLOMERATION EFFECTS AND INTERNATIONAL LINKAGES

Our empirical model incorporates three types of agglomerations which are *(i)* agglomeration externalities (knowledge spillovers), *(ii)* backward inter-industry linkages and *(iii)* forward inter-industry linkages. In addition, the model accounts for international linkages as additional factors potentially relevant for the investment decisions of FDI investors. Figure 1 summarises the concept of agglomeration effects and international linkages effects.

At the most general level, agglomeration is associated with the presence of other firms (or markets) in the host economy. In the following the three agglomeration effects captured in the analysis will be shortly discussed.

Figure 1 / Schematic representation of agglomeration effects and international linkages



The first agglomeration effect, the agglomeration externalities or knowledge spillovers in Figure 1, are measured by the number of investment projects already existing at the industry-host country-level at the time an MNE is taking its investment decision. For any source country *s*, the stock of investment projects, *n*, in period τ in a destination market *c* and industry *i*, is defined as follows:

$$projects(\tau)_{i,c}^{s} = \sum\nolimits_{2003q1}^{\tau-1} d_{n(\tau),i}^{s} \, with \left\{ \begin{array}{ll} d_{n(\tau),i}^{s} = 1 & if \;\; project \, n \, is \, located \, in \, c \\ d_{n(\tau),i}^{s} = 0 & else \end{array} \right.$$

This (industry-level) count variable is created separately for the outward projects of the investor countries in each EU markets over the period 2003-2012. So $projects(\tau)_{i,c}^{s}$ is the number of investment projects from a source country *s*, say Austria, in a particular industry, *i*, say the chemical industry, in a particular host country, *c*, say Bulgaria that have been accumulated between period 1, (i.e. the 1st quarter of 2003) and period τ*-1,* say the 3rd quarter of 2010. The hypothesis in this context is that investors benefit from intra-industry knowledge spillovers among firms and thus we expect a positive effect of a high number of investment projects already undertaken in a country or region on its probability to be chosen as the location for a FDI project.

An interesting aspect in the context of these knowledge spillovers which has received relatively little attention to in the literature (a rare exception is Procher, 2011) is the 'national scope' of agglomeration externalities. Since we have observations for cross-border investment projects by six investor countries we can investigate whether the agglomeration effects are national or 'European' in scope or both. In the case of national agglomeration externalities, for example, Austrian FDI investors would care about previous investments by fellow Austrian companies but not by the investment activities of, for example, German or Italian investors.

To account for the possibility of 'European-wide' agglomeration externalities, a variable for the total of the six investor countries' projects in a respective industry and country is constructed in the same manner[4]:

$$projects(\tau)_{i,c}^{EU-6} = \sum_{s=1}^{6} \sum\nolimits_{2003q1}^{\tau-1} d_{n(\tau),i}^{s} \, with \quad \left\{ \begin{array}{ll} d_{n(\tau),i}^{s} = 1 & if \;\; project \, n \, is \, located \, in \, c \\ d_{n(\tau),i}^{s} = 0 & else \end{array} \right.$$

To distinguish between national agglomeration externalities and those of the remaining five core European countries, an agglomeration externalities variable for the 'other' five source countries is created:

$$projects(\tau)_{i,c}^{EU-5} = projects(\tau)_{i,c}^{EU-6} - projects(\tau)_{i,c}^{s}$$

Note that in order to avoid influences of contemporaneous investment projects we define the project stock variables as the sum of industry-host-specific projects up to the preceding period. Hence, for the FDI location decision of an Italian car manufacturer in the 3rd quarter of 2007, the national agglomeration externalities are proxied by the stock of projects undertaken by Italian investors in the transportation equipment industry until the 2nd quarter of 2007 in the respective host country.

The second driver of agglomeration is inter-industry linkages among firms. These include both forward and backward linkages which are derived from input-output tables. What is essential in the context of this paper is the geographic scope of the forward and backward linkages. In line with the schematic representation in Figure 1 the forward and backward linkages are limited to supplier-buyer relationships between firms operating in the host country. For example, domestic backward linkages in the Czech

4 The six investor countries are Austria, Belgium, Germany, France, Italy and the Netherlands.

food industry only reflect the intermediate goods that it buys from other Czech industries but not those sourced from abroad. The hypothesis stemming from core-periphery models is that firms have a tendency to locate where inputs suppliers (backward linkages) and downstream firms (forward linkages) are abundant.

Following Jones and Wren (2011) we construct these agglomeration variables by interacting the input-output linkages with the industry-level employment in the respective host country, $E_{i(c)}$. In order to capture both direct and indirect linkages between industries, the backward linkages are calculated using the coefficients of the Leontief inverse. The elements of the Leontief inverse are denoted by l_{ij} where *i* is the 'selling' sector and *j* is the 'buying sector'. For host country *c*, the typical element of the Leontief inverse, $l_{i(c),j(c)}$, measures the additional amount of output in industry *i* associated with a one unit increase of demand in industry *j*. The domestic backward linkages of any industry *j* for the host economy *c* are then defined as the sum of industry *j*'s backward linkages to other industries (excluding itself) weighted by the employment in the respective upstream industry:

$$BW_{j(c)} = \sum_{i \neq j} l_{i(c),j(c)} \cdot E_{i(c)}$$

Note that we do not include the diagonal elements in the Leontief inverse in order to measure the industry *j*'s 'backward dependence' on the rest of the economy (Miller and Blair, 2009). These backward linkages (as all other linkages variables) vary over time though the time subscripts are omitted here for ease of notation.

The equivalents to the coefficients of the Leontief inverse for the definition of the forward linkages are the coefficients of the output inverse suggested by Ghosh (Miller and Blair, 2009). In the Ghosh model sectoral gross production is related to the primary inputs.[5] The output inverse of the Ghosh model also captures direct and indirect linkages between industries. It can be derived in a similar way as the Leontief inverse though the 'column approach' has to be substituted with a 'row approach'. The typical element of the Gosh inverse, $g_{i,j}$, reflects the additional output in industry *j* associated with a one unit increase of value added in industry *i*. The domestic forward linkages of any industry *i* for the host economy *c* are then defined as the sum of industry *i*'s forward linkages to other industries (excluding itself) weighted by employment in the respective downstream industry:

$$FW_{i(c)} = \sum_{j \neq i} g_{i(c),j(c)} \cdot E_{j(c)}$$

Again, we omit the on-diagonal elements, i.e. the linkage of each industry with itself.

The main novelty of this paper is the inclusion of the host economy's international linkages. Of primary interest are the effects of the linkages between the host country and the source country (i.e. the investor's country of origin) on location choice.

5 The difference between the Ghosh model and the standard input-output model is that each element in each row of the transaction matrix is divided by the gross output of the sector associated with that row (normally, the technical coefficients in input-output models are calculated by dividing each element in each column of the transaction matrix with the gross output associated with the respective column).

The measure for the forward and backward linkages between the host and the source country are defined according to the same logic as the respective domestic linkages. The linkages are always viewed from the perspective of the host country, so that the backward linkages between the two countries capture purchases of intermediates from host country industry *j* from all other industries *i* in the source country *s*. Therefore the backward and forward linkages of an industry *i* in the potential host country *c* with the source country take the form:

$$BW_{j(c)}^{host-source} = \sum_i l_{i(s),j(c)} \cdot E_{i(s)}$$

$$FW_{i(c)}^{host-source} = \sum_j g_{i(c),j(s)} \cdot E_{j(s)}$$

As in the case of domestic linkages, the strength of these linkages is weighted with the employment in the respective industries in the source country. We expect that more intensive host-source industry linkages increase the attractiveness of a potential host country or region because they signal low co-ordination costs of offshoring for new investors. Potential endogeneity arising from the fact that FDI location decisions are likely to affect host-source linkages is mitigated by the fact that our analysis includes only location decisions by first-time investors.

For the sake of completeness, we also include inter-industry linkages between the host economy and all other EU Member States into the model. The linkages between the host economy and all other EU Member States (except for the source country), $BW_{j(c)}^{host-foreign}$ $FWforeign_{i(c)}^{host-foreign}$, are constructed in analogy to the other linkages variables.

As indicated by the separate rectangle for the international linkages in Figure 1, the host-source linkages are not considered to represent agglomeration effects. This is because, they do not capture location advantages linked to domestic activity but rather reflect the host country's (or host region's) interconnectedness and in particular its integration in international production networks. To some extent the host country's trade connectedness in intermediates as a determinant of FDI location choice rivals the role of domestic linkages as drivers of agglomeration. Put differently, the more FDI investors care about international linkages the less will domestic linkages matter for them – and vice versa.

The construction of the backward and forward linkages based on inter-industry linkages fits well to our interest in production-related projects. So, it is worth stressing again that the objects of analysis are only greenfield FDIs which add new production capacity. We deem this to be appropriate because the types of agglomeration forces that we try to capture stem from the actual production of goods. Therefore we deliberately ignore the large number of projects by manufacturing firms that consist of establishing a non-producing subsidiary such as a sales representation or a logistic centre. We believe this to be an extremely important differentiation.

The rational for confining the analysis to greenfield investment projects is that location decisions for different types of FDI may be guided by entirely different motives (Friedman et al., 1992, Soci, 2007). A key difference between greenfield investment and mergers and acquisitions (M&A), which are the two major modes of FDI, is that for M&A transactions only locations with existing production facilities, i.e.

locations with existing target companies, are potential choices. For greenfield investment projects the choice of locations is generally much larger. Moreover, M&A transactions are often motivated by a possible resale value of an existing asset and therefore have a shorter time horizon. In contrast, greenfield investments require the setting up of new facilities and therefore involve a longer-term planning horizon as considerable initial costs are involved (e.g. for entering a new market or supplying a new product or training an additional workforce). Therefore, combining various types of FDI potentially causes aggregation bias and *'obscures the underlying determinants of foreign location'* (Friedman et al., 1992, p. 405). This argument is also confirmed by Basile (2004) who finds important differences in the locational determinants, including knowledge spillovers, for greenfield FDI and M&A transactions in Italy. While both Friedman et al. (1992) and Basile (2004) conduct their analysis for the two modes of FDI separately we follow the advice of Soci (2007) and focus our analysis to greenfield investments – a choice that is also predetermined by data availability.

3.2 EMPIRICAL MODEL

Models of location choice can be estimated at different levels ranging from the country to the city level. Our main level of investigation is the country level. Despite the fact that Member States may seem quite large as the unit of analysis, we believe this to be an appropriate level of analysis. This is because when it comes to agglomeration, it is presumably harder to detect this phenomenon at a more aggregated than at a more disaggregated level. The choice of the main unit of analysis is also strongly influenced by the data on production linkages which is only available at the country level. It should also be mentioned that an analysis at the Member State level is comparable to analysing regions in large countries. In this sense, our approach is in line with studies on the location choice of FDI for countries such as China or the United States that use provinces or states as the unit of analysis. However, as a robustness check we also undertake the analysis at the level of NUTS 2 regions. Due to the above mentioned data constrains, these regional variants of the analysis will have to work with the backward and forward linkages at the national level. Moreover, a smaller number of control variables is available in this case. The FDI investment decisions analysed relate to projects undertaken by MNEs from six EU investor countries which are Austria, Belgium, France, Germany, Italy and the Netherlands.

To model these location decisions of MNEs a conditional logit model is used. McFadden (1974) demonstrated that the logit choice probabilities can be derived from individual maximisation problems.

The model assumes that the profits an FDI investor can generate from a project *n* realised in a country (or region) *j*, $\Pi_{n,j}$, consists of an observable part, $V_{n,j}$, and an unobservable part, $\varepsilon_{n,j}$. Profit maximising firms will choose the location with the highest expected profit. The probability of a country *c* to be chosen as the location for investment project *n* $Prob(Y_n = c)$ – or $P_{n,c}$ for short – is then simply the probability that the expected profits when locating project *n* in country *c* exceeds that of all other potential locations *j*. Hence

$$P_{n,c} = Prob(V_{n,c} + \varepsilon_{n,c} > V_{n,j} + \varepsilon_{n,j} \quad \forall\, j \neq c)$$

$$P_{n,c} = Prob(\varepsilon_{n,j} < V_{n,c} - V_{n,j} + \varepsilon_{n,c} \quad \forall\, j \neq c)$$

This expression for the probability of a country to be chosen as the location for investment project *n* can be shown to result in the logit choice probability if two conditions are satisfied. Firstly, the unobserved part of the profit function must be assumed to be of the type I extreme value (Gumbel distribution). Secondly, it must be independently and identically distributed. With these assumptions $P_{n,c}$ results in the logit choice probability:

$$P_{n,c} = \frac{e^{V_{n,c}}}{\sum_j^J e^{V_{n,j}}}$$

which forms the basis of our location choice model with J being the number of possible alternative location choices *j* and both *j* and $c \in J$.

The assumptions that the errors are independent and identically distributed are essential because they imply the assumption of independence from irrelevant alternatives (IIA). If the IIA-assumption holds, the choice between any two alternative locations is independent of all the other potential location choices. For example, from the investor's viewpoint the comparison between locating a project in Spain or in the Czech Republic is independent from whether or not it is possible to choose Hungary as the host country.[6]

A nice feature of the conditional logit model is that the profit function only needs to include factors that vary over destination countries as long as firms can move their technology internationally. Profit maximising behaviour implies that investors choose for their investment projects the destination which yields the highest profits compared to all other destinations (Head at al., 1999). Therefore the firm level profit function in equation (5.1) can be reduced to include only agglomeration variables and the international linkages variables as well as some other location-specific factors. All remaining destination specific-factors are captured by host country effects. Therefore the profit function $\Pi_{\mathrm{n,i,c}}$ can be written in the following form[7]:

(1) $$ln\Pi_{n,i,c} = \theta_c + lnA_{n,i,c} \cdot \varphi_1 + lnLINK_{i,c}^{DOM} \cdot \varphi_2 + lnLINK_{i,c}^{INT} \cdot \varphi_3 + lnX_{i,c} \cdot \beta_1 + lnX_c \cdot \beta_2 + \varepsilon_{n,i,c}$$

where time indices are suppressed in order to simplify notation. Equation (5.1) takes into account that any project *n* takes place in a specific industry *i* so that $\Pi_{n,i,c}$ are the firm's profits associated with locating an investment project *n* in country *c* taking into account the industry of the project. The matrix $lnA_{n,i,c}$ contains the set of agglomeration externalities (knowledge spillovers) described above and $lnLINK_{i,c}^{DOM}$ are the domestic backward and forward linkages. Both represent agglomeration forces. Apart from these agglomeration forces is the set of international inter-industry linkages comprised in the matrix $lnLINK_{i,c}^{INT}$. $lnX_{i,c}$ includes additional industry and destination-specific control variables, lnX_c are destination-specific control variables (which are discussed below) and θ_c are the host country specific effects that control for unobserved country characteristics.

Since all variables in equation (1) enter the expression in log-form, we add 1 to the number of investment projects in each of the agglomeration economies variables, $lnA_{n,i,c}$, in order to avoid the zero-problem.

6 In the estimating process we use clustered standard errors where the clusters are the investors. The reason for doing this is that our definition of first movers is a firm that has not invested yet in the same country in the same industry. Therefore there are a few firms that appear more than once in our sample. The clustered standard errors allow for correlation in the error term among the investment decisions by the same firm.

7 The log-log form of the profit function in equation (5.1) assumes a Cobb Douglas type production function.

Combining the expression for the probability of any country to be chosen as the host country for an investment project, $P_{n,c} = \frac{e^{V_{n,c}}}{\sum_j^J e^{V_{n,j}}}$, with the profit function in (1) yields:

$$(2) \qquad P_{n,i,c} = \frac{e^{\theta_c + lnA_{n,i,c}\cdot\varphi_1 + lnLINK_{i,c}^{DOM}\cdot\varphi_2 + lnLINK_{i,c}^{INT}\cdot\varphi_3 + lnX_{i,c}\cdot\beta_1 + lnX_c\cdot\beta_2}}{\sum_j^J e^{(\theta_j + lnA_{n,i,j}\cdot\varphi_1 + lnLINK_{i,j}^{DOM}\cdot\varphi_2 + lnLINK_{i,j}^{INT}\cdot\varphi_3 + lnX_{i,j}\cdot\beta_1 + lnX_j\cdot\beta_2)}}$$

As in the case of other maximum likelihood methods the conditional logit model uses the probabilities in equation (2) in a likelihood-function to estimate the coefficients of the explanatory variables and the country specific constants, θ_j. The probabilities of the individual countries to be chosen as the location for a firm's investment project are derived via a binary choice variable which represents the dependent variable. Hence, in this model framework the (left hand side) choice variable takes on the value 1 for the chosen location and 0 for all alternative destination countries that the investing company could have chosen.[8] Equation (2) will be estimated jointly for investment projects undertaken by firms in the six core European countries.

In addition to the agglomeration variables and the international linkages, the empirical model controls for various destination-specific factors. They can be grouped into different categories controlling for industry structures, the wage level, market size and growth, technology and human skills, policy support and economic institutions as well as a set of gravity variables. The discussion of these control variables refers to the country-level analysis.

Starting with the industry structure we follow Head et al. (1995) in controlling for the abundance of endowments required by the respective industry by including a proxy for the size of the industry which the project belongs to. In contrast to Head et al. (1995) we use industry value added instead of the number of firms (or establishments) for the simple reason that the latter proxy performs much better in the estimation process. Controlling for the potential effect of industry sizes in the host-countries is required for attributing the impact of the accumulated FDI project stock in the respective host economies on location choice to agglomeration effects. The value added variable is time, industry and host country specific.

On top of industry value added as a control variable for industry size and endowments we add a relative specialisation measure. Among the various alternatives for specialisation indicators we opt for the Krugman specialisation index (*K-spec*) introduced in Krugman (1991b) and used for example by Midelfart-Knarvik et al. (2000). This indicator is the absolute value of the differences in industries' shares in total manufacturing value added in an economy to that of some reference country or country group. For our purposes we use the absolute value of the differences between the industry shares in each potential host economy relative to that of the source country. The reason for including a measure for industry specialisation is that FDI investors may be inclined to invest in countries with an industry structure similar to that of the source country because they can expect more similar supply and demand conditions.

8 For the structure of the dataset this implies that the original dataset must be expanded by the number of possible alternative *J*. In our case *J=25* in the case of the country level analysis and *J*=221 in the case of the NUTS 2 level analysis. So for each investment project there are 25 respectively 221 rows in the dataset with the choice variable taking the value 1 in the row containing the chosen host country or region and 0 for the remaining *J-1* countries or regions.

Another very important aspect is the wage level. Since wages act as the counterbalancing forces for agglomeration dynamics in both NEG models and also in the offshoring literature it is useful to control for the wage level across potential host economies. We do this by including labour costs in the manufacturing sector.

The next set of variables consists of proxies for economic size and growth. Market size and economic growth are often among the most important determinants for FDI. Therefore we include population size, the real GDP per capita as well as real GDP growth into the empirical model.

Another important aspect in the context of FDI location and agglomeration in particular is the availability of skills and technology. We use the R&D expenditures per capita in the host economy to account for the effect of the available technology in the host economy and add the share of medium-skilled workers as well as the share of high-skilled workers in the workforce as a proxy for the availability of skill endowments.

While not the centrepiece of this study we still want to see whether in our sample policy incentives and institutions matter for the location decisions of FDI investors. Therefore we include the amount of state aid to industry and services provided by each host country to account for the potential impact of subsidies and the government effectiveness respectively. The latter reflects the perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.

Finally, a set of gravity variables are included which comprise the distance between the source and the host country, whether the two countries share a common official language, a common border and a dummy variable indicating whether the host and the source country had historically been part of the same country or empire.

We now return to the estimation procedure and the issue of the IIA-assumption. Using the example from above, the conditional logit model assumes that the probability of choosing Spain as the host country relative to the probability of locating in the Czech Republic should be independent from the probability of Hungary being chosen. However, if investors first decide on some subset of more similar countries, e.g. the new EU Member States, then this assumption is violated. In this case the possibility of investing in Hungary reduces the possibility of the Czech Republic being chosen as the host country but would remain unaffected by that of Spain. As a result the conditional probability of the FDI investor choosing Spain increases in the direct comparison between locating in Spain or in the Czech Republic. The nested logit model can deal with this complication. The basic idea is to group more similar alternatives – in our case possible host countries – into nests. We will follow Disdier and Mayer (2004) who investigate the FDI location choices of French investors across EU countries and build two nests: the first nest comprises the EU-15 while the second nest comprises the new EU Member States, i.e. those that joined the EU in 2004 or later.[9] Each of the two nests (i.e. the first decision level) comprises a number of alternatives which are the potential host countries (i.e. the second decision level). The nested logit model allows for correlation of errors between alternatives of the same nest. For example there may be correlation of errors between the Czech Republic and Hungary within the second nest and between

[9] Note that we cannot include Croatia due to the lack of input-output data.

Spain and Portugal in the first nest (see Cameron and Trivedi, 2010). This means that the IIA-assumption holds for pairs of alternatives within each of the nests but not between pairs of alternatives belonging to different nests (Greene, 2012). The probability of a country to be chosen as the host country for an FDI project now has two parts: the probability of choosing a particular nest and the probability of each alternative within a nest to be chosen. Formally, the choice probability for alternative *c* in the nested logit model is given by:

$$P_{n,c,b} = P_{n,c|b} \cdot P_b$$

where $P_{n,c|b}$ is the probability of location *c* to be chosen conditional on the nest *b* it belongs to being chosen and P_b is the probability that nest *b* is chosen. The first part is basically the conditional logit probability because the IIA-assumption holds within the nests:

$$P_{n,c|b} = \frac{e^{V_{n,c|b}}}{\sum_{j}^{J_b} e^{V_{n,j|b}}}$$

where $V_{n,j|b}$ is the expected observable profit associated with alternative *c* conditional on nest *b* being chosen. J_b indicates the number of alternatives in nest *b*.

The expression for the choice of the nests is more complicated because the expected profit associated with an FDI investor locating project *n* in the host countries in nest *b* depends on how strongly the errors of the alternatives within the nest are correlated. The strength of this correlation is captured by the dissimilarity parameter τ_b which is zero if the alternatives in the nest are perfectly correlated and one if they are independent. Based on the dissimilarity parameter τ_b the inclusive value, IV_b, can be established. The inclusive value basically corrects for the correlation of errors among the alternatives within a nest. The inclusive value is defined as:

$$IV_b = \ln \sum_{j \in b}^{J_b} e^{\left(\frac{\mathrm{V_{j,k}}}{\mathrm{\tau_b}}\right)}$$

The probability for choosing nest *b* is[10]:

$$P_b = \frac{e^{\tau_b \cdot IV_b}}{\sum_{b=1}^{B} e^{\tau_b \cdot IV_b}}$$

Hence the full expression for the choice probability of alternative *c* indicated above is:

$$P_{n,c,b} = \frac{e^{V_{n,c|b}}}{\sum_{j}^{J_b} e^{V_{n,j|b}}} \cdot \frac{e^{\tau_b \cdot IV_b}}{\sum_{b=1}^{B} e^{\tau_b \cdot IV_b}}$$

The nested logit model is estimated as a robustness test for the results obtained from the conditional logit model.

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[10] This is the version of the nested logit model without nest specific variables which is the case in our empirical specification.

4. Data

4.1 DATA SOURCES

The two most important data sources for this project are the fDi Markets database[11] collected and provided by Financial Times and the World Input-Output database (WIOD).[12]

The main data source for investment projects and hence the construction of the agglomeration externalities variable is the fDi Markets' crossborder investment monitor. This database records individual cross-border greenfield investment projects by industries and business functions from 2003 onwards. We use information on projects over the period 2003 to 2012. Data is available on a monthly basis but we use quarterly periods. This is done to reduce the potential influence of lags with which the projects are recorded in the database.

The fDi markets database only records new investment projects referred to as greenfield investments as well as major extensions of existing projects. This subset of FDI projects are more closely related to real investments – understood as additions to the capital stock – than the aggregate FDI stock which is for many countries dominated by mergers and acquisitions and inter-company financial flows. Another advantage of the fDi markets database is that it allocates the FDI projects to the ultimate destination country. This means that, for example, an Austrian investment in Romania involving a special purpose company located in Cyprus is still registered as an Austrian investment in Romania, while in the balance of payments, depending on the structure of the transaction, an Austrian investment in Cyprus and a Cypriote investment in Romania may be recorded.

One caveat is that the fDi markets database is less systematic compared to FDI data from official balance of payments data as the recorded projects reflect commitments or intentions of firms to undertake the respective investment projects. However, the database is cleared from projects that have not materialised and should therefore be reliable. It has also become a standard data source for UNCTAD's annual World Investment Report. More recently the database has also been used for research papers in a European context (e.g. Castellani and Pieri, 2013; Antonietti et al., 2015).

One complication is that the industry classification used in the fDi Markets database does not correspond exactly to standard international classifications such as NACE which is used by the WIOD. For many fDi industries, such as the semiconductor industry, a direct and unique match to the NACE Rev. 2 industry can be found. Unfortunately, this is not the case for other industries such as the category consumer goods which does not have a unique correspondence in the NACE classification. Where no one-to-one correspondence between fDi industries and NACE industries exists, the project is assigned to the appropriate NACE industry individually. The fDi industry 'space & defence' for example has no unique correspondence in the NACE classification and therefore had to be classified on a case by case basis. The investment project by Italian Selex Galileo – a company producing radar units and other

11 See: http://www.fdimarkets.com.

12 See: http://www.wiod.org/new_site/home.htm

electronic and information systems for the defence industry – undertaken in the UK is assigned to the computer, electronic and optical products industry (NACE Rev. 2 division 26). In contrast, the investment by Belgian company Herstal in Portugal is assigned to the motor vehicles industry (NACE Rev. 2 division 29) based on the information in the fDI database that the projects is linked to the production of '*Military armoured vehicles, tanks, & components*'. The correspondence between fDi Markets database and NACE industries according to the WIOD database is shown in Appendix 1.[13]

Having assigned all projects to the corresponding NACE industry divisions, we further aggregate some of the divisions in order to have a reasonable number of investment projects in all industry groups ending up with 14 industries. These are also listed in Appendix 1.

The second main database is the World Input Output Database (WIOD). WIOD provides global input-output tables across 40 countries including 27 EU Member States[14], most other major industrialised countries and some large emerging markets. Given the scope of the project we use all relevant information for calculating the linkage variables for the EU-27 – the potential host countries. The unique advantage of the WIOD database is that it allows calculating inter-industry linkages not only within an economy but also the corresponding linkages between the industries of trading partners. We exploit this information on the domestic and international sourcing structures of industries to calculate the forward and backward linkages of the 27 EU Member States as presented in the previous section.

All information from the World Input-Output Table is available for the period 1995-2011. Therefore, data for 2012 has to be imputed. Since the location choice model relies on differences between locations we simply assume that the sourcing structures have not changed between 2011 and 2012 and therefore use the input-output coefficients of 2011 for the year 2012. The Krugman specialisation index is equally calculated with value added data from WIOD's World Input-Output Table.

Some of the additional control variables are drawn from other data sources. We rely on Eurostat for data on labour costs (in euro per person), population, R&D expenditure per capita, employment by occupational attainment (according to ISCED), real GDP per capita and real GDP growth. Employment data for the years 2010-2012 is also obtained from Eurostat because the employment data in WIOD's Socio-Economic Accounts is available only until 2009. The gravity variables which include distance, common official language, common border and same country status are obtained from CEPII's GeoDist database (for details see Mayer and Zignano, 2011*)*. Information on state aid comes from the European Commission's State Aid Scoreboard Database. Government effectiveness, an overall measure for the role of institutions, is taken from the World Bank's World Governance Indicators (WDI) database.

It should also be noted that the data on forward and backward linkages from the WIOD database as well as most control variables are only available at an annual basis. Since the location decisions for investment projects take place at quarterly intervals, the annual data entry is used for each quarters of the year.

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13 The fact that the matching of projects to NACE industries is very time-consuming is also the reason why the sample was limited to only six investor countries where in principle we could have investigated greenfield investments by all EU Member States.

14 Croatia is not included in the WIOD.

All data for the analysis at the level of NUTS 2 regions come from Eurostat database except for the distance measures which are obtained from Eurostat's Web Index of Locations for Statistics in Europe.[15]

4.2 DESCRIPTIVES

The data sample stretches over the period 2003-2012 and consists of 3,058 production-related cross-border greenfield investment projects undertaken by firms in the six European core countries in EU Member States. Germany was by far the biggest investor country accounting for 1,340 or 44% of these investment projects.[16] The number of investment projects was constantly growing from 2003 to 2007, followed by a severe drop in 2009 due to the global economic crisis of 2008/2009. Since then the cross-border investment activity has somewhat recovered but remains clearly below the pre-crisis boom level (2005-2007). For the year 2012 only 163 projects are on record.

With regard to the host countries Poland emerges as the country which attracted the largest number of projects (393 projects) followed by Romania (361 projects) and Hungary (332 projects). France and Spain come in fourth and fifth position respectively.[17]

The distribution of projects across Member States indicates that two groups of countries attracted a high number of projects: large EU Member States on the one hand and the catching-up economies in Central and Eastern Europe on the other hand. This is shown in the left panel of Figure 2. The prominent role of the Central and Eastern EU Member States is unusual in FDI data and due to the fact that the FDI transactions in the sample are restricted to production-related greenfield investments.

The distribution of projects across host countries is strongly influenced by location decision of German firms due to their prominence in the sample. The overall distribution of projects therefore does not fully reflect the investment pattern of each source country and obviously there are some important differences in the location patterns and rankings of preferred destinations. For example, Spain is the prime location for French investors, Germany is the leading host country for Dutch MNEs and Hungary attracted the largest number of Austrian investment projects.

Figure 2 also shows the distribution of projects across NUTS 2 regions. Of the 270 NUTS 2 regions there are 221 regions where at least one project in our sample was located. Due to the fact that the fDi Markets database does not contain information for all projects on the region or city in which the project is located the sample for the regional analysis shrinks to 2,810 projects. The analysis is restricted to these 221 regions in which projects have been realised in our sample. In several of the larger Member States, the investment projects are rather unevenly distributed. This is for example the case in Poland or Spain. Interestingly, in several cases the regions which could attract the highest number of regions are border regions. This is for example true for the Polish region of Lower Silesia (Dolnoslaskie) where 80 projects were recorded – the highest number in our sample. The region with the second largest number of project is Catalonia in Spain with 76 project which is again a border region (with France). With 75 projects the Hungarian region of Western Transdanubia (Nyugat-Dunántúl), which borders both Slovakia and

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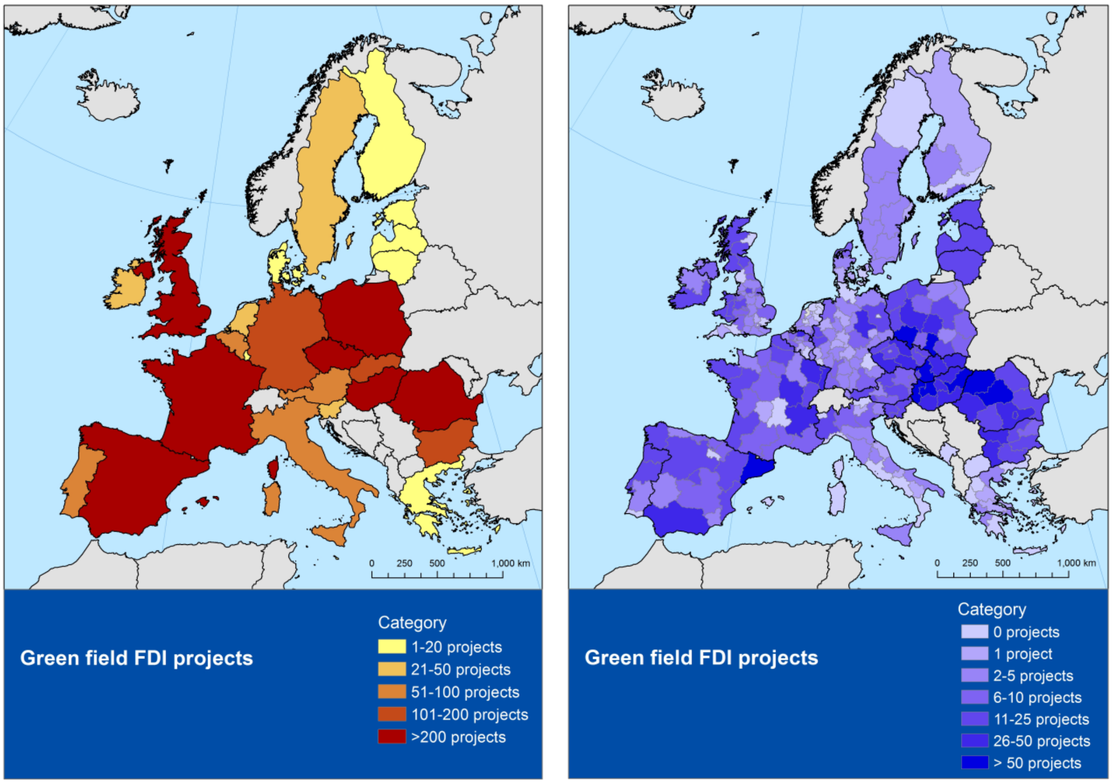
15 See http://epp.eurostat.ec.europa.eu/WebILSE/flatfiles.do

16 For details see Appendix 2.

17 The relatively low number of projects in Germany is influenced by the fact that Germany is the most important FDI investor country and cannot undertake any foreign investment projects in Germany itself.

Austria, ranks third followed by Western Slovakia (Západné Slovensko) and the Hungarian Northern Great Plain (Észak-Alföld).

Figure 2 / Number of greenfield investment projects by host country and regions



Note: Maps created with ArcGis ArcView.

The number of projects a country or region managed to attract as presented here is obviously influenced by the economic size of a country or region. In the econometric analysis size is controlled for by the value added of the respective industry and by population.

There is also a wide variation in the number of FDI projects across industries ranging from only 12 in the *coke, refined petroleum and nuclear fuel industry* to 668 projects in the *transport equipment industry.* Production-related greenfield FDI activity in the latter is again strongly dominated by German MNEs but it is also an important industry for MNEs from France and Italy. Other important industries include the chemical industry and the machinery industry as well as the non-metallic minerals industry. The latter is for example, the primary industry of Austrian greenfield FDI investors, whereas Belgian and Dutch investors were most active in the chemicals industry.

5. Results

5.1 COUNTRY LEVEL

All estimation results are based on the location decisions of first mover firms[18] which results in a sample of 2,117 location decisions.[19]. Table 1 presents the results for the country level using a conditional logit model.

The first specification in Table 1 includes – apart from the fixed set of control variables – only the agglomeration externalities, i.e. the number of investment projects already undertaken in each of the host economies in the respective industry by firms from the same source country (*projects*^{source}) and those by firms from the other five investor countries (*projects*$^{other\ EU\text{-}5}$). The estimated coefficient of *projects*^{source} is positive and statistically significant at the one per cent level. This implies that a larger pool of existing greenfield FDI projects already realised in a particular host country increases the probability of that destination to attract further investments. In our model framework this is due to agglomeration externalities. In terms of magnitude the estimated coefficient of 0.285 is in the same order of magnitude as in related studies though it is somewhat lower than for example the effect found by Head et al. (1995) for investments by Japanese MNEs in US states or the results for Norwegian investors in Balsvik and Todel Skaldebo (2013).

Since the conditional logit model is a non-linear estimator, the coefficients do not directly indicate the marginal effects. Following Head et al. (1995) we calculate the average probability elasticities associated with our estimated coefficients as $\hat{\beta} \cdot \frac{J-1}{J}$ where $\hat{\beta}$ is the estimated coefficient of the respective variable and J is the number of potential host countries of FDI which is *25*.[20] The average probability elasticity is simply the sum over all host-country specific average marginal effects. Therefore the average probability elasticity would indicate that a 10% increase in the number of projects from the same investor country in a particular industry in a particular host country increases the probability of that host country to be chosen as FDI location by 2.7%. The presence of firms from the other investor countries (*projects*$^{other\ EU\text{-}5}$) in a particular host country also increases the probability of a host country to be chosen as FDI location but with 0.127 the coefficient is considerably lower. This indicates that the agglomeration economies between investors from different countries are smaller than those between compatriot investors.

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18 Due to lack of data we cannot know whether a firm has already undertaken investment projects in any particular market before 2003.

19 Note that the number of 'first moves' exceeds the number of investing firms in the sample (1,913) which is due to the fact that our decision of first movers is a firm that invests for the first time in a particular industry in a particular country. Therefore, some firms appear more than once in the sample. We also estimated the conditional logit models with an alternative definition of first movers including each firms only once. The results in this case are qualitatively the same.

20 The average probability elasticity can be retrieved from the conditional logit's marginal effects which (for the direct elasticities) is $p_{nj} \cdot (1 - p_{nj}) \cdot \hat{\beta}_k$ where $\hat{\beta}_k$ is the estimated coefficient of explanatory variable *k*. Since the variables enter in log-form, the marginal effects are already semi-elasticities. To retrieve the elasticity for alternative *k*, the marginal effects are divided by the probability p_{nj} to yield $(1 - p_{nj}) \cdot \hat{\beta}_k$. The average over all alternatives is then obtained by summing up over all alternatives *J* and taking the average, i.e. $\frac{1}{J} \cdot \sum_{j=1}^{J} (1 - p_{nj}) \cdot \hat{\beta}_k$. Since the probabilities add up to one this results to $\frac{J-1}{J} \cdot \hat{\beta}$.

Table 1 / Determinants of location choice: conditional logit model, country level, 2003-2012

	Dependent variable:	**Location chosen (=1) versus Location not chosen (=0)**			
		(1)	(2)	(3)	(4)
Agglomeration effects	projects^{source}	0.2849***	0.2791***	0.2277***	0.2258***
		(0.049)	(0.049)	(0.050)	(0.050)
	projects$^{other\ EU\text{-}5}$	0.1269***	0.1010**	0.0987**	0.0972**
		(0.047)	(0.048)	(0.048)	(0.049)
	BW linkages		-0.1799**	-0.1535*	-0.1658*
			(0.090)	(0.091)	(0.092)
	FW linkages		-0.0748	-0.0590	-0.0608
			(0.048)	(0.049)	(0.051)
International linkages	BW linkages$^{host\text{-}source}$			0.2356***	0.2511***
				(0.088)	(0.093)
	FW linkages$^{host\text{-}source}$			0.2313***	0.2316***
				(0.060)	(0.064)
	BW linkages$^{host\text{-}foreign}$				-0.1324
					(0.123)
	FW linkages$^{host\text{-}foreign}$				-0.0524
					(0.084)
Industry structure	value added^{industry}	0.3720***	0.3500***	0.4104***	0.4091***
		(0.059)	(0.062)	(0.064)	(0.064)
	K-spec	-1.0520***	-1.0165***	-0.5661*	-0.5489*
		(0.322)	(0.321)	(0.330)	(0.330)
Wage level	labour costs	-2.3339***	-2.3178***	-2.2279***	-2.2673***
		(0.421)	(0.426)	(0.425)	(0.428)
Market size & growth	population	2.2230	2.1633	2.0300	2.0808
		(2.278)	(2.267)	(2.262)	(2.260)
	real GDP per capita	-0.0956	-0.0289	-0.1052	-0.0581
		(0.524)	(0.523)	(0.524)	(0.527)
	real GDP growth	-0.0155	-0.0127	-0.0124	-0.0107
		(0.014)	(0.014)	(0.014)	(0.014)
Technology and skills	R&D exp per capita	0.8813***	0.8910***	0.8804***	0.8617***
		(0.297)	(0.298)	(0.298)	(0.298)
	medium-skilled workers	-0.0059	-0.0029	0.0002	-0.0016
		(0.030)	(0.031)	(0.031)	(0.031)
	high-skilled workers	-0.0028	-0.0073	-0.0078	-0.0067
		(0.041)	(0.041)	(0.041)	(0.041)
Policy and institutions	state aid	-0.0656	-0.0737	-0.0908	-0.0905
		(0.066)	(0.067)	(0.067)	(0.067)
	gov't effectiveness	0.6357	0.7218	0.7279	0.7236
		(0.863)	(0.865)	(0.864)	(0.864)
Gravity type variables	distance	-0.0938	-0.0915	0.0183	0.0217
		(0.075)	(0.076)	(0.077)	(0.077)
	common language	0.2634*	0.2468*	0.0391*	0.0277
		(0.150)	(0.149)	(0.150)	(0.150)
	common border	0.5324***	0.5361***	0.3653***	0.3494***
		(0.088)	(0.087)	(0.091)	(0.092)
	same country	0.3987**	0.4358**	0.3995**	0.4128**
		(0.173)	(0.173)	(0.165)	(0.165)
	log-likelihood	-5409.86	-5377.46	-5357.71	-5356.67
	obs.	52575	52300	52300	52300
	cases	2103	2092	2092	2092
	nb. of clusters	1913	1908	1908	1908

Note: In all specifications the dependent variable is a binary variable which for each project takes the value 1 for the country where the project has been located and 0 for all other potential countries. Constants for alternatives included. Industry classification based on NACE Rev2. All variables except for dummy variables and variables expressed in shares enter the model in log-form. Same country = dummy for whether source and investor country used to be part of the same country/empire. ***, **, * indicate statistical significance at the 1%, 5% and 10% level respectively. Standard errors in parentheses. Standard errors are robust to clusters allowing for intra-firm correlation of errors.

This result on the scope of agglomeration externalities fits nicely with those in Crozet et al. (2004) who analyse French inward FDI and find that agglomeration economies between FDI investors with the same nationality are more than twice as large as those between FDI investors from different source countries. Procher (2011) in his analysis of French FDI, however, argues that the number of French firms present in the host economies has a similar effect than the presence of German firms.

Specifications (2) to (4) add the agglomeration effects related to domestic inter-industry linkages as well as the international inter-industry linkages. The discussion mainly focuses on specification (3) as it is the model that corresponds closest to our model framework. The coefficients of the two agglomeration economies variables remain unaffected qualitatively from the addition of further variables, although they get slightly smaller in magnitude. The effect of a 10% increase in the number of projects from investors from the same source on the probability of host economy to be chosen as FDI location is now on average 2.2%.

A first surprising result is found for the inter-industry linkages in the host economy. These linkages turn out to be negative and in the case of the backward linkages the estimated coefficient is also statistically significant at least at the 10% level. This means that strong inter-industry linkages in a potential host economy are, if anything, a locational disadvantage. So the probability that an investor locates a project in a particular host economy declines with the strength of domestic backward linkages. This is in contradiction with the findings of Du et al. (2007) who find positive backward and forward linkages in the Chinese economy for FDI by US firms. However, Debaere et al. (2010), who investigate South Korean investments in Chinese regions, report negative though statistically not significant coefficients for the backward linkages in the Chinese economy. In their work only inter-industry linkages with other Korean firms present in China matter for the investment decisions.

Turning to the international linkages between the source and the host country ($BW\ linkages^{host\text{-}source}$ and $FW\ linkages^{host\text{-}source}$), we find positive and statistically significant effects on the probability of the host country to be chosen as location by FDI investors from the source country. For example, if Slovakia's transport equipment industry relies strongly on German inputs from German industries that are large (including the transport equipment industry itself) then Slovakia tends to become a more attractive FDI location for German car manufacturers and other producers of transport equipment. As pointed out earlier, we can attribute this positive effect of source-host inter-industry linkages to a signalling effect and to expected cost advantages. From the viewpoint of a new investor already well established supplier-buyer relationships among firms between the host and the source country indicate good offshoring opportunities and associated low co-ordination costs of offshoring. An alternative interpretation which would emerge from the NEG framework would be that transportation costs are so low that the availability of domestic suppliers and customers do not really matter much because inputs can be shipped from anywhere and output sold to other markets (including the investor's home market) at very low cost. Quantitatively, the effects of host-source backward and forward linkages on location choice are in the range of the national agglomeration externalities. A 10% increase in the backward linkage between host and source economy increases the probability to be chosen as the destination for an FDI project by 2.5%. The corresponding elasticity for the host-source forward linkages is 2.3%.

For the sake of completeness specification (4) incorporates also host country forward and backward linkages to all EU Member States other than the source country. However, in neither of the two cases a statistically significant coefficient is obtained.

There are also a number of control variables which deserve attention. The first one is the industry-level value added which serves as proxy for host country industry size and the endowments required by the respective industry. Arguably, the number of domestic firms would be the more logical variable to control for the endowments in the host economy. We also performed the analysis with the number of firms in each industry instead of value added. However, this variable did not turn out to be statistically significant which is why industry value added was maintained to control for endowments and size. Controlling for endowments is important because it could well be that FDI investors follow the same investment pattern as firms in general. The coefficient of industry value added is positive and statistically significant at the 1 per cent level. The magnitude of the coefficient is also large in comparison to the agglomeration externalities and the international linkages which indicates that this is an important control variable.

The measure for relative industry specialisation, the Krugman specialisation index (*K-spec*) turns out to affect location decisions negatively with the coefficient being statistically significant at the 10% level in specification (3). This implies that for the greenfield investments in the sample FDI investors rather select destinations with a distinct industry structure compared to their home country.

Given the theoretical motivations for our empirical model it is imperative to include the wage level into the analysis. A priori the role of wages for the attractiveness of a country is ambiguous. On the one hand, high wages may make a location more attractive if one associates wages with income and purchasing power in the economy. On the other hand, lower wages constitute a locational advantage because lower wages imply lower costs rendering the FDI investment ceteris paribus more profitable. This is the logic emphasised in the NEG literature and our results suggest that this effect indeed dominates. Lower wages (labour costs) increase the probability of a host country to attract greenfield FDI projects. The coefficient is very large exceeding the one for source country agglomeration economies by the factor 10. This result for wages together with the positive impact of host-source country linkages also hints on the motives for FDI. More precisely, the combined results suggest that many of the investment projects in our sample were driven by efficiency seeking motives for FDI.

It should be noted that the magnitude of our coefficient for the wage costs is considerably higher than those found in other studies such as Disdier and Mayer (2004) who investigate French investments across EU Member States. Close in magnitude to our results on wages is Basile (2004) who finds a negative and statistically significant coefficient for unit labour costs in his analysis of FDI across Italian regions. In this contribution both foreign acquisitions and of greenfield investments in Italian regions are analysed and it turns out that the coefficient in the greenfield investments is about twice the size. This suggests that the negative effect of the wage variable is influenced by the fact that our sample consists only of greenfield FDI. Interesting is also the result in Gauselmann and Marek (2012) who estimate a conditional logit model for FDI in transition economies. They find a positive effect of high wages on locational attractiveness in their general sample but a negative effect for investments by industrial firms. In our case the analysis is not only limited to industrial firms but even to projects specifically related to the build-up of production capacity. This focus on production-related projects therefore also contributes to the strong attraction effect found for lower wage costs.

The specificities of our sample also explain (at least partially) why none of our market size and growth variables turn out to be statistically significant. The fact that neither population, nor real GDP per capita and real GDP growth seem to affect the location of production-related greenfield FDI projects may be the mirror image of the results for the inter-industry linkages and the wage variable which all point towards a primacy of offshoring and efficiency seeking motives for this mode of FDI.

Among the control variables for technological capabilities and the availability of skills in the host economies only the R&D expenditures per capita turn out to be a relevant attraction factor. The magnitude of the coefficient, which is quite high, could suggest that in addition to efficiency seeking motive based on low wages costs there may also be some technology seeking projects.

The provision of subsidies (*state aid*) by potential host economies and the effectiveness of the government do not affect the location decision of foreign investors. The result for the ineffectiveness of government support policies is in line with the conclusion in Crozet et al. (2004) who find very little impact of regional policies for foreign investments in French regions. Institutional quality is more often found to influence the location choices of FDI investors. Disdier and Mayer (2004) for example find that more political rights and civil liberties increase a country's attractiveness. The reason for the differences found in their study and ours may of course be explained by the fact that a different indicator is used but also because their sample period is very different from ours ranging from 1980 to 1999. For other regions there are also a number of studies which find some effect for institutions. Du et al. (2008), for example, find that US firms prefer to locate in Chinese regions with higher protection of intellectual property rights and lower government corruption. Because of the many positive results in the literature concerning institutional quality we also tested alternative indicators such as the economic freedom indicator from the Heritage foundations, some of their sub-indicators such as property rights, freedom from corruption and investment freedom, or economic restrictions from the KOF index of globalisation. However, none of these indicators turned out to affect location choice in our sample. We assign this to the fact that FDI investors consider the quality of institutions across EU Member States as being sufficient for doing business so that the remaining differences are not decisive for their location choices.

In principle, the coefficients of the gravity type variables are all as expected. The only surprise may be the geographic distance between capitals of the involved countries which is positive and statistically not significant. This, however, is easily explained by the fact that the common border dummy already captures an important part of the distance effect. For common language the sign of the coefficient is also as expected but again it is not statistically significant. Countries are more likely to attract projects from a particular source country if they share a common border and this effect is statistically significant at the 1% level. The same is true if source and host country once formed one country or have historically belonged to the same empire. In our sample, this means for example that according to the estimation results firms from Austria are, ceteris paribus, more likely to invest in Hungary, Slovenia, the Czech Republic and Slovakia than in the other EU Member States since they once belonged to the Habsburg Empire.

These results were obtained based on the assumption that the probability of preferring one host country over another is independent of the availability of other alternatives (IIA-assumption). We now relax this assumption by switching from a conditional logit model to a nested logit model. We opt for two nests which are the EU-15 and the NMS.[21] Otherwise we leave the set-up of our empirical model unchanged. The results for specification (3) and (4) are summarised in Table 2.

21 For the full decision tree of the nested logit model see Appendix 4.

Qualitatively the results from the nested logit model do not differ from those of the conditional logit model. However, almost all estimated coefficients turn out to be larger in the nested logit model. This is true in particular for the variables of main interest. For example, the coefficient of the backward linkages between the host and the source country (*BW linkages$^{host\text{-}source}$*) is estimated to be 0.307 compared to 0.251 in the conditional logit approach. The size of the coefficients obtained from the nested logit model can be compared to those from the conditional model but the interpretation is slightly different (see Disdier and Mayer, 2004). The coefficients, adjusted for $\frac{J-1}{J}$ indicate the country's increase in the choice probability compared to all the other alternatives within the same nest. Since alternatives within a nest are assumed to be closer substitutes also the effect on the choice probability of a country within a nest against that of other countries belonging to the same nest should be relatively larger.

Table 2 / Location choice: nested logit model, country level, 2003-2012

	Dependent variable:	**Location chosen (=1) versus Location not chosen (=0)**			
	Variable	(3)		(4)	
Agglomeration effects	projects^{source}	0.3466***	(0.088)	0.3467***	(0.089)
	projects$^{other\ EU\text{-}5}$	0.1559*	(0.081)	0.1528*	(0.081)
	BW linkages	-0.2025	(0.137)	-0.2283	(0.139)
	FW linkages	-0.1192	(0.080)	-0.1348	(0.086)
International linkages	BW linkages$^{host\text{-}source}$	0.2623*	(0.138)	0.3072**	(0.148)
	FW linkages$^{host\text{-}source}$	0.2472***	(0.091)	0.2219**	(0.100)
	BW linkages$^{host\text{-}foreign}$			-0.2596	(0.201)
	FW linkages$^{host\text{-}foreign}$			-0.0199	(0.126)
Industry structure	value added^{industry}	0.5831***	(0.107)	0.5802***	(0.107)
	K-spec	-1.4689*	(0.780)	-1.4911*	(0.804)
Wage level	labour costs	-3.9503***	(1.067)	-4.0170***	(1.085)
Market size & growth	Population	1.9313	(3.760)	2.1156	(3.809)
	real GDP per capita	0.2109	(0.814)	0.2918	(0.823)
	real GDP growth	-0.0178	(0.022)	-0.0142	(0.023)
Technology and skills	R&D exp per capita	1.6476**	(0.667)	1.6366**	(0.671)
	medium-skilled workers	-0.0057	(0.049)	-0.0086	(0.050)
	high-skilled workers	-0.0001	(0.066)	0.0021	(0.066)
Policy and institutions	state aid	-0.1094	(0.107)	-0.1109	(0.107)
	gov't effectiveness	0.6579	(1.358)	0.6337	(1.370)
Gravity type variables	Distance	0.1308	(0.117)	0.1405	(0.119)
	common language	0.0544	(0.201)	0.0361	(0.204)
	common border	0.6773***	(0.204)	0.6653***	(0.206)
	same country	0.7511***	(0.287)	0.7774***	(0.293)
	log-likelihood	-5349.73		-5348.68	
	obs.	52300		52300	
	Cases	2092		2092	
	nb. of clusters	1908		1908	
	dissimilarity parameters				
	τ EU-15	1.5572	(0.302)	1.5760	(0.311)
	τ NMS	1.7912	(0.319)	1.8028	(0.328)

Note: In all specifications the dependent variable is a binary variable which for each project takes the value 1 for the country where the project has been located and 0 for all other potential countries. Constants for alternatives included. Industry classification based on NACE Rev2. All variables except for dummy variables and variables expressed in shares enter the model in log-form. Same country = dummy for whether source and investor country used to be part of the same country/empire. ***, **, * indicate statistical significance at the 1%, 5% and 10% level respectively. Standard errors in parentheses. Standard errors are robust to clusters allowing for intra-firm correlation of errors.

The dissimilarity parameters obtained in the nested logit model exceeds one for both nests which actually indicates that the model – though mathematically correct – is incompatible with profit maximisation. A log-likelihood ratio test, testing the restriction that the dissimilarity parameter is equal to one, is a common test for choosing between the conditional logit and the nested logit model. This test, however, can only be performed for models with non-robust standard errors. If we re-estimate the two models with non-robust standard errors, this log-likelihood test would favour the nested logit model.

5.2 REGIONAL LEVEL

We have argued above that we consider countries to be an appropriate level of analysis. In order to rule out the possibility that the effects on location choice that were found for the agglomeration factors and the international linkages only exist at the national level we repeat the estimations using NUTS 2 regions as the possible locations for FDI investors.

We redo all the project stock variables at the level of NUTS 2 regions. For the inter-industry linkages (both domestic and international), however, we can only work with the national variables because both the international input-output data and the industry-level employment data are only available at the national level. Also, the regional model will have to be much more parsimonious with respect to control variables because not all information is available for NUTS 2 regions. We still try to get variables for all categories of controls, however, for the industry structure we can only use employment for the entire industrial sector instead of industry-specific employment or value added which was used for the model at the national level.

To control for market size we keep GDP per capita which here is at purchasing power parities (PPP) and population. Also available at the NUTS 2 level are industrial wages which are again proxied by the labour costs in the industrial sector. To control for skills, the share of medium-skilled and high-skilled workers in the workforce are used again but there is no proxy for technology because R&D data at the NUTS 2 level is too sketchy in order to be used in the analysis. Finally, we again use state aid and government effectiveness to account for the potential impact of state support policies and institutions though these indicators are defined at the national level. In these cases we deem these permissible as government institutions and subsidies are typically (though not exclusively) designed and provided by central governments.

Table 3 portrays the results of both the conditional logit and the nested logit model for the regional location choice model.

We take some comfort from the fact that our main results from the country level analysis are fully confirmed. Agglomeration economies (knowledge spillovers) among FDI investors from the same country ($projects^{source}$) continue to act as an attraction factor. The size of the coefficient is considerable larger than suggested by the country level results. Given the uneven distribution of projects across regions within many EU Member States, this result is not very surprising. The concentration of projects in selected regions can be explained by the fact that the spread of knowledge spillovers is geographically limited. Therefore they can be expected to be stronger within NUTS 2 regions than within the entire country. Admittedly, the analyses at the national and the regional level are not fully comparable because there are important differences with respect to the control variables included.

Table 3 / Location choice: conditional logit and nested logit model, regional level, 2003-2012

	Dependent variable:	**Location chosen (=1) vs Location not chosen (=0)**			
	Modell:		**conditional logit**		**nested logit**
		(1)	(3)	(4)	(4)
Agglomeration effects	$projects^{source}$	0.4879***	0.4447***	0.4429***	0.4906***
		(0.060)	(0.061)	(0.061)	(0.120)
	$projects^{other\ EU\text{-}5}$	0.0191	-0.0086	-0.0105	-0.0205
		(0.050)	(0.051)	(0.051)	(0.055)
(national)	BW linkages		-0.2612***	-0.2761***	-0.3008***
			(0.091)	(0.092)	(0.111)
(national)	FW linkages		-0.1090**	-0.1163**	-0.1371*
			(0.049)	(0.050)	(0.073)
International linkages	BW $linkages^{host\text{-}source}$		0.3257***	0.3547***	0.4017***
(national)			(0.088)	(0.093)	(0.133)
	FW $linkages^{host\text{-}source}$		0.1880***	0.1726**	0.1699**
			(0.063)	(0.068)	(0.075)
	BW $linkages^{host\text{-}foreign}$			-0.1450	-0.1777
				(0.125)	(0.153)
	FW $linkages^{host\text{-}foreign}$			0.0050	0.0199
				(0.087)	(0.095)
Industry structure	$employment^{industrial\ sector}$	0.2782	0.4202	0.5104	0.7478
		(0.401)	(0.406)	(0.413)	(0.550)
Wage level	labour costs	0.0363	0.0693	0.0700	-0.0023
(national)		(0.261)	(0.271)	(0.271)	(0.309)
Market size	population	2.1651	2.1963	2.3322	1.9415
		(1.516)	(1.531)	(1.529)	(1.680)
	GDP at PPP per capita	-0.8860*	-0.6676	-0.7049	-0.7477
		(0.485)	(0.493)	(0.495)	(0.569)
Technology and skills	medium-skilled workers	-0.0172	-0.0143	-0.0153	-0.0196
		(0.020)	(0.020)	(0.020)	(0.022)
	high-skilled workers	0.0317	0.0286	0.0281	0.0296
		(0.025)	(0.025)	(0.025)	(0.025)
Policy and institutions	state aid	-0.1213*	-0.1439**	-0.1437**	-0.1464*
(national)		(0.068)	(0.069)	(0.069)	(0.086)
	gov't effectiveness	0.3667	0.4854	0.4957	0.4653
		(0.856)	(0.855)	(0.855)	(0.870)
Gravity type variables	distance	-0.6225***	-0.3344***	-0.3252***	-0.3075***
		(0.059)	(0.075)	(0.077)	(0.086)
(national)	common language	0.3265**	0.0737	0.0597	-0.0013
		(0.147)	(0.149)	(0.149)	(0.140)
	log-likelihood	-9166.40	-9096.02	-9095.32	-9092.85
	obs.	373871	372317	372317	372317
	nb. of alternatives	211	211	211	211
	nb. of clusters	1792	1787	1787	1787
	dissimilarity parameters				
	τ EU-15				0.9013
	τ NMS				1.2625

Note: In all specifications the dependent variable is a binary variable which for each project takes the value 1 for the country where the project has been located and 0 for all other potential countries. Constants for alternatives included. Industry classification based on NACE Rev2. All variables except for dummy variables and variables expressed in shares enter the model in log-form. Same country = dummy for whether source and investor country used to be part of the same country/empire. ***, **, * indicate statistical significance at the 1%, 5% and 10% level respectively. Standard errors in parentheses. Standard errors are robust to clusters allowing for intra-firm correlation of errors.

One difference with respect to the agglomeration externalities in the regional model is that it does not suggest an impact of the presence of FDI investors from other countries on the locational attractiveness of regions.

Regarding the domestic inter-industry linkages and the international linkages we find the same pattern as before: the probability of a region to be selected as the destination by a FDI investors increases with the strength of the inter-industry linkages between the host and the source country. This holds for both the international forward and the backward linkages. The same is not true for the domestic linkages which in the regional specification even turn out to be highly statistically significant implying that strong domestic backward and forward linkages make a region less attractive for FDI investors.

Most control variables deliver rather disappointing results though in most cases this is in line with our findings for the national level. An important difference in the regional analysis is that the wage variable is not statistically significant anymore. This is somewhat surprising because the wages were highly significant in the country level model and the result also fit well with the pattern of the international linkages variables. A potential explanation for this difference is that investors consider the wage level when deciding between countries but for the actual region the wage level is less important. For example, Austrian investors may be attracted by low wages in Hungary but they do not necessarily choose the Hungarian region with the lowest wage level.

Somewhat of a surprise is the negative coefficient found for the state aid variable. Since the variable refers to the country level, the result has to be interpreted with care. Keeping this in mind, the negative sign would indicate that higher subsidies provided by the government reduce the regions probability to attract FDI greenfield projects. As pointed out above, finding government support policies to be ineffective is quite common but the negative effect is not expected. One potential – though in this context speculative – explanation is that eligibility for EU Cohesion Funds makes a region more attractive and that EU governments provide national subsidies mainly for non-eligible regions.

Among the gravity variables the distance measure, which now indicates the difference between the capital of the source country and the capital city of the NUTS 2 region on the side of the destination country, turns out to be statistically significant with the expected negative sign.

The nested logit model at the regional level maintains the nest structure employed at the national level, i.e. EU-15 countries and the new EU Member States define the two nests.[22] This is in line with Disdier and Mayer (2004) and can be motivated by the results in Basile et al. (2009) who find that European multinationals potentially consider regions across different countries as relatively closer substitutes than regions within the country. Compared to the coefficients from the conditional logit model, the nested logit model delivers again larger coefficients. Otherwise there are no important differences between the two models. The sole difference is that the employment in the industrial sector becomes statistically significant at the 10% level.

Overall, the regional location choice model confirms the findings from the country-level analysis.

22 A logical alternative would be to use the countries as nests but this model does not convergence, presumably due to the large number of nests implied by this structure.

6. Conclusions

In this paper we investigated the role of agglomeration forces and international linkages for the location decisions of MNEs from six European investor countries. The subject of the location decisions are production-related greenfield FDI projects. The analysis is undertaken at the country level and at the regional (NUTS 2) level. The results suggest that the presence of firms both from the investor's own country and from other investor countries is an important determinant for location choices. A larger number of past projects realised in a particular location therefore increases the probability for a potential host country (or region) to attract further investments. In our theoretical framework this reflects knowledge spillovers among firms which is one reason why firms tend to co-locate with compatriot firms from the same industry. The presence of FDI firms from other investor countries, however, is found to affect location decisions only at the national level.

The second type of agglomeration forces in our model, the backward and forward linkages among firms operating in the host economy, delivers a surprising result: strong domestic forward and backward linkages are suggested to make a location less attractive for FDI investors. This is surprising because it runs counter the idea that firms locate close to suppliers and customers in order to benefit from cheaper inputs and higher demand. Importantly, the opposite is found for the international linkages: backward and forward host-source country linkages act as an attraction factor which we associate with lower co-ordination costs of offshoring. These international linkages cannot be considered to be agglomeration factors in the usual sense as they do not reflect the degree of economic activity in the host country. Rather they are indicative of a country's position in international production networks and its interconnectedness more generally. Nevertheless, international linkages also contribute to the concentration of FDI projects in host countries which already have strong inter-industry linkages with any source country.

Taken together, the pattern of the agglomeration effects and the effects from the international linkages suggests that offshoring activities and efficiency-seeking motives dominate the location choice for production-related cross-border projects. This interpretation then also explains why the domestic inter-industry linkages as well as market size are basically irrelevant (or even counterproductive) for FDI location choices. Additional support for this interpretation is provided by the negative effect of wage costs on a country's probability to be chosen as the host for FDI projects even though this is only found at the country level.

All in all the pattern of coefficients fits the predictions of offshoring models and also the logic of NEG models in situations where the advantages of domestic linkages – one of the main agglomeration factor in the domestic economy – are dominated by the effect of the wage differentials. NEG predicts that this constellation is more likely when trade costs are low. Therefore this result is quite plausible. The fact that backward and forward linkages between host and source country improve the locational attractiveness of the former also fit to the story because with low trade costs FDI investors may then continue to rely on their supplier and buyer networks in their home market. Offshorable activities like production will continue to be moved to those host countries which have already well established supply-buyer relations with the source country because they signal lower co-ordination costs of offshoring costs.

The results we obtain depend to some extent on the particular sample we studied which only consists of FDI projects that create new productive capacity. But this choice was made deliberately because it established a closer link to the production linkages which are a key element in this investigation. Moreover, production-related FDI projects are important as they are often large and therefore add significantly to a country’s aggregate investment. Moreover they contribute to the expansion of production and export capacity. This particular choice of FDI projects therefore also allows us to link our results to the debate about de-industrialisation and growing concentration of manufacturing production in some countries within the EU. For this debate, the fact that production-related investments are most likely the result of offshoring activities, is clearly important and contradicts – for this particular subset of FDI projects – the common belief that FDI in Europe is mainly motivated by market potential in the respective host economies.

The positive impact of the presence of other FDI investors in a country represents a form of path dependency. The same is also true for the attraction effect of strong host-source industry-linkages. In combination with the finding that both support policies as well as institutions have little effect on location choices (or are even counter-productive as in the case of state aid in the regional variant) indicates that any policy attempts to counter the concentration of production capacity in Europe will have to be very wisely designed in order to be successful.

Appendix

APPENDIX 1: INDUSTRY CLASSIFICATIONS

Table A 1 / Correspondence between fDi industries and NACE Rev. 2 divisions

fDi-Industries	NACE Rev. 2 division	NACE industry description
Aerospace	30	Manufacture of other transport equipment
Alternative/Renewable energy	20	Manufacture of chemicals and chemical products
	35	Electricity, gas, steam and air conditioning supply
Automotive Components	29	Manufacture of motor vehicles, trailers and semi-trailers
Automotive OEM	29	Manufacture of motor vehicles, trailers and semi-trailers
Beverages	11	Manufacture of beverages
Biotechnology	21	Manufacture of basic pharmaceutical products and pharmaceutical preparations
	26	Manufacture of computer, electronic and optical products
Building & Construction Materials	23	Manufacture of other non-metallic mineral products
Business Machines & Equipment	26	Manufacture of computer, electronic and optical products
Ceramics & Glass	23	Manufacture of other non-metallic mineral products
	28	Manufacture of machinery and equipment n.e.c.
Chemicals	20	Manufacture of chemicals and chemical products
Coal, Oil and Natural Gas	19	Manufacture of coke and refined petroleum products
	35	Electricity, gas, steam and air conditioning supply
	20	Manufacture of chemicals and chemical products
Communications	26	Manufacture of computer, electronic and optical products
Consumer Electronics	26	Manufacture of computer, electronic and optical products
Consumer Products	32	Other manufacturing
	26	Manufacture of computer, electronic and optical products
	20	Manufacture of chemicals and chemical products
	25	Manufacture of fabricated metal products, except machinery and equipment
	28	Manufacture of machinery and equipment n.e.c.
	31	Manufacture of furniture
	22	Manufacture of rubber and plastic products
Engines & Turbines	28	Manufacture of machinery and equipment n.e.c.
Food & Tobacco	10	Manufacture of food products
	12	Manufacture of tobacco products
Healthcare	26	Manufacture of computer, electronic and optical products
	20	Manufacture of chemicals and chemical products
Industrial Machinery, Equipment & Tools	28	Manufacture of machinery and equipment n.e.c.
Leisure & Entertainment	32	Other manufacturing
Medical Devices	32	Other manufacturing
	26	Manufacture of computer, electronic and optical products
	31	Manufacture of furniture
Metals	25	Manufacture of fabricated metal products, except machinery and equipment
	24	Manufacture of basic iron and steel and of ferro-alloys
Minerals	23	Manufacture of other non-metallic mineral products
Non-Automotive Transport OEM	29	Manufacture of motor vehicles, trailers and semi-trailers
	30	Manufacture of other transport equipment
	32	Other manufacturing
Paper, Printing & Packaging	17	Manufacture of paper and paper products
	18	Printing and reproduction of recorded media

Table A 1 (cont'd) / Correspondence between fDi industries and NACE Rev. 2 divisions

fDi-Industries	NACE Rev. 2 division	NACE industry description
Real Estate	23	Manufacture of other non-metallic mineral products
	25	Manufacture of fabricated metal products, except machinery and equipment
	35	Electricity, gas, steam and air conditioning supply
Pharmaceuticals	21	Manufacture of basic pharmaceutical products and pharmaceutical preparations
Plastics	22	Manufacture of rubber and plastic products
Rubber	22	Manufacture of rubber and plastic products
Semiconductors	26	Manufacture of computer, electronic and optical products
Space & Defence	30	Manufacture of other transport equipment
	26	Manufacture of computer, electronic and optical products
	29	Manufacture of motor vehicles, trailers and semi-trailers
	25	Manufacture of fabricated metal products, except machinery and equipment
Textiles	15	Manufacture of leather and related products
	14	Manufacture of wearing apparel
	13	Manufacture of textiles
Transportation	49	Transport and storage
Warehousing & Storage	35	Electricity, gas, steam and air conditioning supply
Wood Products	16	Manufacture of wood and of products of wood and cork, except furniture
	31	Manufacture of furniture

Table A 2 / List of industries used in the location choice models

Nb	Industry
1	Food, Beverages and Tobacco
2	Textiles, Textile Products and Leather
3	Wood and Products of Wood and Cork
4	Pulp, Paper, Printing and Publishing
5	Coke, Refined Petroleum and Nuclear Fuel
6	Chemicals and Chemical Products
7	Rubber and Plastics
8	Other Non-Metallic Mineral
9	Basic Metals and Fabricated Metal
10	Electrical and Optical Equipment
11	Machinery, Nec
12	Transport Equipment
13	Manufacturing, Nec; Recycling
14	Electricity, Gas and Water Supply

APPENDIX 2: DATA ON PRODUCTION-RELATED INVESTMENT PROJECTS

Table A 3 / Production-related investment projects by core EU countries in the EU-27, 2003-2012

year	Austria	Belgium	France	Germany	Italy	Netherlands	Total
2003	34	11	54	120	44	32	295
2004	52	13	60	149	49	30	353
2005	43	17	49	182	47	33	371
2006	46	34	48	206	53	43	430
2007	50	29	76	159	52	26	392
2008	46	28	75	145	44	47	385
2009	28	16	33	75	26	19	197
2010	21	12	34	94	25	26	212
2011	27	13	36	135	25	24	260
2012	10	10	36	75	22	10	163
2003-2012	357	183	501	1340	387	290	3058
share	11.7	6.0	16.4	43.8	12.7	9.5	100.0

Source: fDi Markets database, own calculations.

Table A 4 / EU core countries' production-related investment projects undertaken in the EU-27 by destination country, 2003-2012

destination / source	Austria	Belgium	France	Germany	Italy	Netherlands	total
Austria		1	2	73	15	4	95
Belgium	4		19	44	7	17	91
Bulgaria	23	15	18	35	38	11	140
Czech Republic	26	11	18	126	13	10	204
Denmark	1			10		1	12
Estonia	7	1	1	3		2	14
Finland		1	2	6	2	1	12
France	18	35		155	48	34	290
Germany	42	15	41		32	47	177
Greece			1	4	4	2	11
Hungary	78	6	26	188	21	13	332
Ireland	2	3	12	7	2	4	30
Italy	1	11	23	16		9	60
Latvia	1	1	2	9	2	2	17
Lithuania	2	1	2	10	1		16
Luxembourg		1			3		4
Malta	1			3	2		6
Netherlands		4	6	11			21
Poland	31	24	57	192	67	22	393
Portugal		2	17	28	3	2	52
Romania	57	20	78	131	49	26	361
Slovakia	31	11	21	68	20	15	166
Slovenia	7		6	12	1		26
Spain	8	11	89	95	34	28	265
Sweden	1		3	11		12	27
UK	16	9	57	103	23	28	236
total	357	183	501	1340	387	290	3058

Source: fDi Markets database, own calculations.

Table A 5 / EU core countries' production-related investment projects in the EU-27 by industry, 2003-2012

Industry description	Austria	Belgium	France	Germany	Italy	Netherlands	total
Food, Beverages and Tobacco	12	19	59	65	33	63	251
Textiles and Leather	14	7	15	28	32	6	102
Wood and Cork	31	3	4	13	8		59
Pulp and Paper	31	10	4	26	22	9	102
Coke, Ref. Petroleum, Nucl. Fuel	6		4	1		1	12
Chemicals	26	39	83	179	27	56	410
Rubber and Plastics	33	26	46	131	49	21	306
Other Non-Metallic Mineral	84	10	56	66	31	2	249
Basic and fabricated Metals	15	17	16	111	39	25	223
Electrical and Optical Equipment	26	21	23	124	36	37	267
Machinery	44	7	53	153	34	15	306
Transport Equipment	22	18	124	401	65	38	668
Manufacturing, Nec; Recycling	11	5	12	34	10	14	86
Electricity, Gas and Water Supply	2	1	2	8	1	3	17
Total	357	183	501	1340	387	290	3058

Note: Industry classification based on NACE Rev 2.
Source: fDi Markets database, own calculations.

APPENDIX 3: STYLISED STRUCTURE OF THE WORLD INPUT-OUTPUT TABLE

The general structure of the World Input-Output Table of the WIOD for the three country case (neglecting the industry dimension) is shown in Figure A 1.

Figure A 1 / Structure of the World Input-Output Table of the WIOD (3 countries, 1 industry case)

		Country A Intermediate *Industry*	Country B Intermediate *Industry*	Rest of World Intermediate *Industry*	Country A Final domestic	Country B Final domestic	Rest of World Final domestic	Total
Country A	*Industry*	Intermediate use of domestic output	Intermediate use by B of exports from A	Intermediate use by RoW of exports from A	Final use of domestic output	Final use by B of exports from A	Final use by RoW of exports from A	Output in A
Country B	*Industry*	Intermediate use by A of exports from B	Intermediate use of domestic output	Intermediate use by RoW of exports from B	Final use by A of exports from B	Final use of domestic output	Final use by RoW of exports from B	Output in B
Rest of World (RoW)	*Industry*	Intermediate use by A of exports from RoW	Intermediate use by B of exports from RoW	Intermediate use of domestic output	Final use by A of exports from RoW	Final use by B of exports from RoW	Final use of domestic output	Output in RoW
		Value added	Value added	Value added				
		Output in A	Output in B	Output in RoW				

Take, for example, a firm in country A (source country) that undertakes an investment in country B (host country) in a certain industry. WIOD contains information on the inter-industry linkages of this industry in country B with all industries in the source country (country A). From the perspective of the host country, the (employment weighted) purchases of this industry in country A from all industries in country A represent the host-source backward linkages. Likewise, the (employment weighted) sales from this industry in host country B to the industries in source country A represent the host-source forward linkages.

APPENDIX 4: STRUCTURE IN NESTED LOGIT MODEL

Figure A 2 / Nest structure in nested logit model

	Nest	Alternative	cases	positve decisions
Decision	EU15	Austria	1844	64
		Belgium	1954	41
		Denmark	2092	7
		Finland	2092	12
		France	1794	200
		Germany	1186	125
		Greece	2092	7
		Ireland	2092	24
		Italy	1792	32
		Luxembourg	2092	3
		Netherlands	1890	14
		Portugal	2092	31
		Spain	2092	151
		Sw eden	2092	21
		UK	2092	146
	NMS	Bulgaria	2092	96
		Czech Republic	2092	147
		Estonia	2092	11
		Hungary	2092	255
		Latvia	2092	13
		Lituania	2092	15
		Malta	2092	6
		Poland	2092	295
		Romania	2092	227
		Slovakia	2092	130
		Slovenia	2092	19
		total	***54144***	***2092***

APPENDIX 5: CONDITIONAL LOGIT MODEL – MARGINAL EFFECTS

Appendix Table A.6 shows the marginal effects implied by the coefficients in Table 1 in the main text.

Table A 6 / Conditional logit model – marginal effects, country level, 2003-2012

	Dependent variable:	Location chosen (=1) versus Location not chosen (=0)			
		(1)	(2)	(3)	(4)
Agglomeration effects	projects^{source}	0.2735 ***	0.2679 ***	0.2186 ***	0.2168 ***
	projects$^{other\ EU-5}$	0.1219 ***	0.0970 **	0.0948 **	0.0933 **
	BW linkages		-0.1727 **	-0.1473 *	-0.1592 *
	FW linkages		-0.0718	-0.0566	-0.0584
International linkages	BW linkages$^{host-source}$			0.2261 ***	0.2411 ***
	FW linkages$^{host-source}$			0.2220 ***	0.2223 ***
	BW linkages$^{host-foreign}$				-0.1271
	FW linkages$^{host-foreign}$				-0.0503
Industry structure	value added^{industry}	0.3572 ***	0.3360 ***	0.3940 ***	0.3928 ***
	K-spec	-1.0099 ***	-0.9759 ***	-0.5435 *	-0.5270 *
Wage level	labour costs	-2.2405 ***	-2.2250 ***	-2.1388 ***	-2.1766 ***
Market size & growth	population	2.1341	2.0768	1.9488	1.9976
	real GDP per capita	-0.0918	-0.0278	-0.1010	-0.0557
	real GDP growth	-0.0149	-0.0122	-0.0119	-0.0103
Technology and skills	R&D exp per capita	0.8461 ***	0.8553 ***	0.8452 ***	0.8272 ***
	medium-skilled worker	-0.0057	-0.0027	0.0002	-0.0015
	high-skiled workers	-0.0027	-0.0070	-0.0075	-0.0065
Policy and institutions	state aid	-0.0629	-0.0707	-0.0871	-0.0869
	gov't effectiveness	0.6103	0.6929	0.6988	0.6946
Gravity type variables	distance	-0.0901	-0.0878	0.0176	0.0208
	common language	0.2529 *	0.2369 *	0.0376	0.0266
	common border	0.5111 ***	0.5147 ***	0.3507 ***	0.3354 ***
	same country	0.3827 **	0.4183 **	0.3835 **	0.3963 **

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