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Geographical Boundaries of External and Internal Agglomeration Economies

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8.1 Introduction

The literature on location choices of multinational enterprises (MNEs) highlight that the search for agglomeration economies is a key determinant of the process (for a review, see Iammarino and McCann 2013). Specifically, MNEs seek geographic proximity with other companies (e.g. Chang and Park 2005; Arauzo-Carod et al. 2010; Nielsen et al. 2017), mainly to access information and knowledge externalities, by co-agglomerating with subsidiaries of other MNEs and with local companies from which they can benefit in terms of information, knowledge and

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innovation (Mariotti et al. 2010). More recently, however, increasing attention has been paid to geographic proximity among different activities of the same parent company, i.e. to the intra-firm co-location, or internal agglomeration (Alcácer and Delgado 2016; Castellani and Lavoratori 2019b; Woo et al. 2019). In fact, since MNEs are by definition multi-unit firms, they need to coordinate the various units, and to monitor and control geographically dispersed activities to reach efficiency and gain in terms of competitive advantages (Howells and Bessant 2012; Buciuni and Finotto 2016).

Using 447 greenfield investments made by foreign multinational companies in Italy (during the period 1998–2012) at NUTS-3 level (the Italian province), the present chapter investigates the factors driving these new location decisions, with a special focus on external and internal agglomeration forces, and their spatial decay effects. Our conditional logit estimates confirm that both external and internal agglomeration economies play a role in driving foreign location choices in the province and that not controlling for internal agglomeration forces leads to overestimation of the effect of external ones. Moreover, augmenting the model with the spatial lags of both internal and external agglomeration economies, we find that internal agglomeration economies require a closer geographical proximity among the firm's operations and their effects do not cross the geographical boundaries of the province. Additionally, we find that Marshallian (specialisation) agglomerations require a stronger geographical proximity among units, whereas the benefits of diversity (Jacobsian) economies significantly extend beyond the province's geographical boundaries.

The reminder of the chapter is organized as follows. The next section illustrates our theoretical background on external and internal agglomeration factors driving the location decision of foreign MNEs, and on the role of the spatial decay effect. Section 8.3 describes the data. Section 8.4 presents our empirical strategy and Sect. 8.5 illustrates and discusses our empirical findings. Section 8.6 concludes with some suggestions for future research.

8.2 Theoretical Background

8.2.1 External Agglomeration Economies

The concept of agglomeration economies encompasses many interpretations and forms, and has been the subject of numerous empirical analyses (e.g. Ellison et al. 2010; Combes and Gobillon 2015). A traditional dichotomous classification distinguishes between Marshallian and Jacobsian economies (Glaeser et al. 1992). The former refers to the pioneering contribution of Marshall (1920) and its subsequent formalisation as the MAR (Marshall-Arrow-Romer) model. These economies are *external* to the enterprise, but internal to the industry, and concern the local formation of a specialised labour market, input-output linkages between customers and suppliers and the emergence of industry-specific knowledge spillovers. The Jacobsian economies (Jacobs 1969) are *external* to both the enterprise and the industry, as they derive from the variety of local activities in a specific area due to urbanisation processes. Indeed, diversity fosters wide-ranging, highly fungible knowledge spillovers, in addition to the circulation of ideas and innovation and their recombination across sectors. A complementary classification extensively adopted in the literature distinguishes between *sharing, matching* and *learning* effects (Duranton and Puga 2004; Boschma and Frenken 2011). *Sharing* effects include the advantages of sharing local indivisible assets and infrastructures, the sharing of business risks, the variety of inputs and industrial specialisation. *Matching* refers to the quality and quantity of matching between enterprises and workers in the labour market, while *Learning* effects concern the generation, diffusion and accumulation of knowledge.[1]

Concerning location choices of MNEs, an extensive range of theoretical and empirical literature assess the positive role of local agglomeration forces (e.g. Head et al. 1995; Mariotti and Piscitello 1995; Driffield and

[1]However, the evidence about the significance and the role of the different sources of agglomeration economies are still controversial and conflicting results have often been often obtained (e.g. Rosenthal and Strange 2004; Beaudry and Schiffauerova 2009; De Groot et al. 2009; Melo et al. 2009).

Munday 2000; He 2002; Barrios et al. 2006; Bobonis and Shatz 2007). Recent studies have shown that the agglomerative behaviour of MNEs does not merely mimic the agglomeration of economic activities in the host country, but follows a distinct model that leads to more spatial concentration of their activities in privileged areas (Mariotti et al. 2010; Alfaro and Chen 2014). Indeed, the MNEs' location decision process is strongly bounded in rationality as they suffer from a limited familiarity with the spatial environment, namely with those factors that ultimately influence the effectiveness of the location choice, such as the access to production factors, networks of suppliers, infrastructure and services, and local institutions. In order to reduce information costs and sunk costs connected to wrong location choices, MNEs often adopt a risk-averse approach by locating their subsidiaries in regional clusters and, especially, in metropolitan areas (Mariotti and Piscitello 1995; Henisz and Delios 2001). In fact, clusters generally have an international reputation of industrial excellence, securing the widest access to Marshallian economies, and metropolitan areas are the locus of Jacobsian economies, offering access to infrastructure hubs, human capital and other tangible and intangible resources (Glaeser et al. 1992; McCann and Acs 2011). Additionally, metropolitan areas also allow access to so-called 'archipelago economies' (Veltz 2000; Rodríguez-Pose and Zademach 2006), that is the benefits produced by global interconnectivity and by inclusion in the networks of economic, political and institutional power. As such, they perform the role of gateways for MNEs entering into a foreign country (Drennan 1992; Short et al. 2000; Taylor 2004).

This process of spatial over-concentration in the host country is further reinforced by MNEs' adoption of an imitative behaviour of their peers (e.g. Lieberman and Asaba 2006), likewise motivated by the need to reduce information costs and uncertainty. Indeed, MNEs integrate the observation of their predecessors' spatial behaviour into their decision-making process as important information about the quality of the regions in the host country: as a result, information spillovers and observational learning give rise to locational cascades, which foster the agglomeration of new entries with MNEs that have already made a location choice, wherever this is perceived as a successful operation (Caplin and Leahy 1998; Mariotti et al. 2010; Vicente and Suire 2007).

8.2.2 Internal Agglomeration Economies

Firms' location decisions are also influenced by their need to generate and preserve special linkages among activities (Woo et al. 2019). In fact, a "multinational firm's external organization should not be constituted to the detriment of its organizational coherence; it should, on the contrary, be completed by the implementation of relations of proximity internal to the firm, which we refer to as 'internal proximity'" (Blanc and Sierra 1999: 188). Inevitably, this presents a trade-off between the geographical dispersion of the firm's operations in search for the best external factors vs. the concentration of their facilities in the same place to preserve internal linkages and the related benefits (Blanc and Sierra 1999; Mariani 2002).

Traditional approaches in regional sciences and economic geography have distinguished between internal agglomeration economies related to horizontal integration (or internal economies of scale), lateral integration (or internal economies of scope) and vertical integration (Parr 2002). All these internal economies can be achieved through the *expansion* of the activities at the level of the single plant. Indeed, such an expansion can reduce transport costs and production costs due to the maximized use of physical space, land and (also indivisible) assets or production technologies that require processes to be physically close (Lavoratori et al. 2019). Thus, internal economies may be achieved through the geographic proximity of distinct units of the same firm, thanks to the possibility of sharing physical assets (plant and machinery), specialised people, teams, logistic and support services (Alcácer and Delgado 2016) and economies of scale and scope in other activities, such as procurement and branding (Rawley and Seamans 2015). Pursuing other lines of analysis, a small yet growing body of literature at the intersection between economic geography and management offers evidence on further drivers of internal agglomeration. Organisation and managerial costs can increase with the increase in the geographical dispersion of activities (Coase 1937). Coordination, monitoring and control of activities is a key aspect for competitive advantage of the company (Howells and Bessant 2012). Thus, intra-firm co-location can be a mechanism of coordination and control of complex and geographically dispersed organisational structures, more important for less experienced firms in operating internationally, and firms who rely relatively less on codified knowledge, because tacit knowledge and information transfer can be facilitated through co-location (Castellani and Lavoratori 2019b). Such a relationship between distance-based costs and agglomeration has been acknowledged also by the economic geography literature (e.g. McCann and Shefer 2004; Wood and Parr 2005). Several studies provide empirical evidence for the idea that distance-sensitive costs of monitoring/control and coordination may lead enterprises to seek greater geographical proximity between their units, particularly between their headquarters and subsidiaries (Kalnins and Lafontaine 2004, 2013; Berger and DeYoung 2006; Henderson and Ono 2008; Giroud 2013; Lu and Wedig 2013), as well as between units that carry out complementary activities, such as R&D and manufacturing (Mariani 2002; Ketokivi and Ali-Yrkkö 2009; Gray et al. 2015).

Other studies about intra-firm spillovers also highlight the beneficial effects of proximity and co-location as factors that facilitate the sharing of experience, information and tacit knowledge between different functional units of the enterprise that can be more difficult and costlier when the distance increases (Liberti and Mian 2009), with a positive impact on the latter's productivity, also thanks to the two-way exchange of local knowledge and experience (Rawley and Seamans 2015). This can be more relevant in engineering intensive industry (Ivarsson et al. 2016), or in relation to key development functions that represent a crucial source of ideas for maintaining innovative capabilities (Buciuni and Finotto 2016). Benefits from intra-firm co-location can also be different in relation to agglomeration typologies. In supply-side agglomeration settings (e.g. manufacturing), mechanisms of 'internal technology-based knowledge sharing' may prevail, while in demand-side settings (e.g. services or retail) 'internal operating resource sharing' mechanisms are more likely to be exploited (Woo et al. 2019).

Theoretical and empirical literature on internal agglomerations is still growing. Some studies are focused on specific industries (e.g. the biopharma in Alcácer and Delgado 2016), a limited geographical area such as a set of global cities (e.g. Belderbos et al. 2016; Castellani and Lavoratori 2019a), or on the location choice of R&D activities worldwide (Castellani and Lavoratori 2019b). Other studies investigate the spatial organization of global value chains and the location of new investments by MNEs, by developing multi-sector analyses referred to a level of geographical aggregation that seems too high for a correct detection of intra-firm co-location (e.g. the European regions in Defever 2012; or the Economic Areas in US in Alcácer and Delgado 2016).

8.2.3 Spatial Decay Effect of External and Internal Agglomeration Economies

The rapid decay of agglomeration effects is a consolidated evidence in the regional science field (Duranton and Puga 2004; Rosenthal and Strange 2004; Cantwell and Piscitello 2005). Combes and Gobillon (2015) highlight that agglomeration effects arise within 100 kilometres, but the threshold can be lower. Indeed, a survey conducted by Drucker (2012) shows that in 60% of studies on agglomeration economies effects, this threshold is 20 kilometres or less; in over 80% of studies the threshold is less than 80 kilometres. However, the role of geographical proximity can vary across industries and type of agglomeration. Rosenthal and Strange (2003) find that specialisation economies strongly decline with an increase in distance among economic units, whereas diversification economies show a less clear pattern. Andersson et al. (2019) investigate the role of agglomeration economies within the cities of Stockholm, Gothenburg and Malmö. They uncover that the effect of specialisation economies arises in one squared kilometre around the company, but diversification externalities operate at a greater scale. Thus, these agglomeration forces may operate simultaneously, but at different geographical scales. A study based on the United Kingdom shows that diversification externalities play a role at a higher level of geographical aggregation—the city, whereas specialisation externalities operate at a smaller level in a closer neighbourhood to the firm, within the city (Lavoratori and Castellani, 2020), presenting a stronger spatial decay effect.

Moreover, this spatial decay effect of specialisation economies is even stronger in the case of creative and knowledge-intensive sectors where face-to-face interactions, sharing of ideas and information are crucial (van Soest et al. 2006; Andersson et al. 2019).

Although there is a well-developed literature on spatial decay effects regarding external agglomeration economies, there is a lack of studies that investigate these effects on internal agglomeration economies.

Previous studies have investigated the role of internal agglomeration economies (internal proximity or intra-firm co-location) at different levels of spatial aggregation: on the one hand, a high level of geographical aggregation, such as the US economic area and the EU NUTS-2 (Alcácer and Delgado 2016; Defever 2012); on the other, recent studies have adopted a more fine-grained approach, at city and NUTS-3 level (Castellani and Lavoratori 2019a, b; Belderbos et al. 2016; Lavoratori et al. 2019). All these studies find a positive effect of intra-firm co-location on domestic and foreign location decisions. It is not hard to believe that more aggregated levels of analysis can hide factors that operate at smaller geographical scales.

Indeed, Adams and Jaffe (1996) investigate the role of proximity with R&D labs on the productivity of manufacturing plants of firms operating in the chemical industry, looking at the transfer of knowledge across facilities within a firm and spillovers across firms. They show that the effects of parent firm R&D on plant-level productivity decline with an increase in geographical and technological distance between R&D labs and production plants. Lavoratori et al. (2019) investigate the role of co-location with other (manufacturing and knowledge-intensive business services (KIBS)) units of the same parent company, on the latter's location choice. Specifically, introducing the analysis of a spatial decay effect of internal agglomeration economies, they find that the probability of locating a new investment in a given province is positively influenced by the presence of the same parent company's manufacturing activities. When the firm's prior presence in the province concerns KIBS activities (e.g. computer and related activities, business activities like legal, accounting, tax, business and management consultancy, and management activities relating to holding companies), mechanisms of temporary proximity can substitute the need for permanent geographical proximity, because the exchange of knowledge and information between manufacturing and KIBS activities can be exploited through professional mobility and dedicated temporary interorganisational mechanisms (periodic meetings, project teams, etc.). Moreover, the probability of choosing a given province for a new manufacturing investment does not increase with the presence of other activities of the same parent company in contiguous provinces, thus confirming a strong spatial decay effect of internal agglomeration economies.

8.3 Data and Descriptive Statistics

Our research aims to empirically test the role played by agglomeration economies in the location choices by foreign MNEs at the sub-national level, disentangling the role of internal and external agglomeration forces. To this end, it was necessary to define a suitable empirical strategy. The analysis relies on data on greenfield investments made by foreign MNEs in Italy throughout 1998–2012, from the REPRINT database (for more details, see Mariotti et al. 2015). The database reports information about the location of new investments in manufacturing, along with the sector and home country of the parent companies. Moreover, the database contains the information on the other activities of the same parent companies, already located in Italy before the focal new investment. Specifically, we know the location and the activity of these prior investments (manufacturing vs. other activities, such as sales and marketing, maintenance and servicing, technical support, logistics and transportation), and we use this information as a stock for computing the firm's internal agglomeration measure.

We focus on the location choice of 447 new investments in manufacturing, undertaken by 384 MNEs during the period considered. Our geographical unit of analysis is the Italian province, corresponding to the NUTS-3 level of the Eurostat classification. Eurostat has established the Nomenclature of Units for Territorial Statistics (NUTS) as a hierarchy of geographical levels, for each European country. The current NUTS classification subdivides the economic European territory into 97 regions at NUTS-1 level, 270 regions at NUTS-2 level and 1294 regions at NUTS-3 level. NUTS-3 areas correspond to a population between 150,000 and

800,000 people (Eurostat 2011). Italy is divided into 110 provinces, with an average extension of 2746 square kilometres and an average distance capital-to-capital of provinces of 40 kilometres.

The investments considered interest 81 out of the 110 provinces. Table 8.1 reports the geographical distribution of the investments. The top 10 provinces receive 46% of investments made in the period of analysis; these are localized in the northern and central part of Italy (e.g. Milan, Turin, Varese, Bergamo and Rome). Figure 8.1 graphically shows this spatial distribution.

The data also reveal that in 14% of cases (namely 63 cases out of 447), companies have other activities in manufacturing co-located in the same province in Italy, while the same parent companies have investments in other activities in 11.6% of cases.

8.4 Empirical Strategy and Variables

8.4.1 The Model

We develop a location choice model estimating a conditional logit model (McFadden 1974). Namely, the conditional logit (CL) models the profitability of choosing a location within a set of alternatives, and each location is associated with a profit. Thus, the model assumes that the firm chooses the location, in our case the province, that maximizes this profit. More formally:

$$\pi_{ifrst} = \sum \beta \text{Internal}_{frst-1} + \sum \delta \text{External}_{lst-1} + \gamma_r + \varepsilon_{ifrst}$$

However, the profit associated with each location is not directly observed, but we observe the characteristics of all possible alternative choices; in other words, the profit is a function of observed characteristics (Z_{fr}) and the error term ε_{fl}. Specifically, the probability that a location r

Table 8.1 Geographical distribution of manufacturing greenfield investments, by province

Province	No. FDIs	Percent	Province	No. FDIs	Percent
Milan	52	11.63	Belluno	3	0.67
Turin	44	9.84	Cuneo	3	0.67
Varese	19	4.25	Frosinone	3	0.67
Monza-Brianza	18	4.03	Pescara	3	0.67
Bergamo	15	3.36	Terni	3	0.67
Rome	15	3.36	Asti	2	0.45
Padova	12	2.68	Avellino	2	0.45
Brescia	11	2.46	Catania	2	0.45
Verona	10	2.24	Cremona	2	0.45
Vicenza	10	2.24	Foggia	2	0.45
Alessandria	9	2.01	Isernia	2	0.45
Lecco	9	2.01	Macerata	2	0.45
Pavia	9	2.01	Matera	2	0.45
Modena	8	1.79	Messina	2	0.45
Trento	8	1.79	Pesaro-Urbino	2	0.45
Bologna	7	1.57	Pordenone	2	0.45
Bolzano/Bozen	7	1.57	Salerno	2	0.45
Florence	7	1.57	Siracusa	2	0.45
Forl-Cesena	6	1.34	Sondrio	2	0.45
Livorno	6	1.34	Taranto	2	0.45
Lucca	6	1.34	Teramo	2	0.45
Pisa	6	1.34	Ascoli Piceno	1	0.22
Potenza	6	1.34	Benevento	1	0.22
Ancona	5	1.12	Caltanissetta	1	0.22
Biella	5	1.12	Campobasso	1	0.22
Genova	5	1.12	Chieti	1	0.22
Parma	5	1.12	Como	1	0.22
Ravenna	5	1.12	Cosenza	1	0.22
Udine	5	1.12	Enna	1	0.22
Venice	5	1.12	Imperia	1	0.22
Ferrara	4	0.89	La Spezia	1	0.22
Gorizia	4	0.89	Massa-Carrara	1	0.22
L'Aquila	4	0.89	Nuoro	1	0.22
Latina	4	0.89	Palermo	1	0.22
Lodi	4	0.89	Perugia	1	0.22
Mantova	4	0.89	Rimini	1	0.22
Naples	4	0.89	Siena	1	0.22
Novara	4	0.89	Vercelli	1	0.22
Piacenza	4	0.89	Viterbo	1	0.22
Reggio nell'Emilia	4	0.89	Total	447	100
Treviso	4	0.89			
Bari	3	0.67			

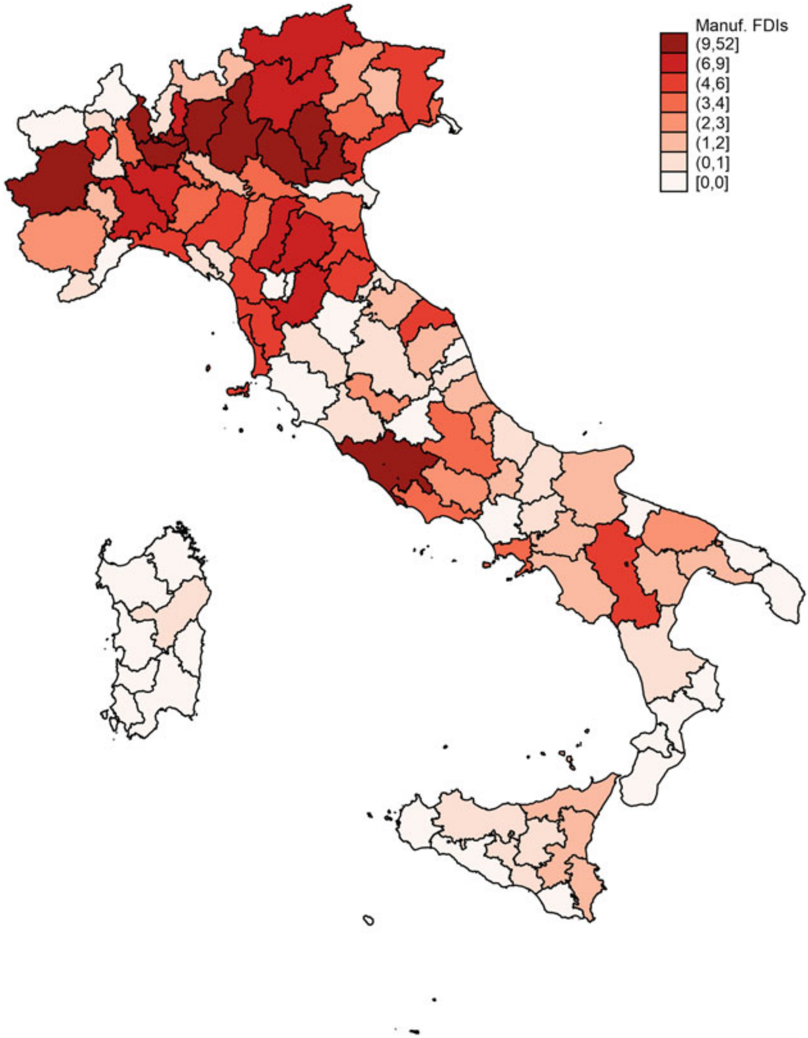

Fig. 8.1 Spatial distribution of manufacturing greenfield investments, by province. (Source: Authors' elaboration from REPRINT database)

results in the highest profitability for a new investment decision can be formally expressed by the following expression:

$$P_{fr}^{CL} = \frac{\exp\left(\beta Z_{fr}\right)}{\sum_{l=1}^{L} \exp\left(\beta Z_{fl}\right)}, \forall l \neq r \; (l = 1, \ldots, L)$$

The function is estimated using maximum likelihood techniques, and the results will be illustrated and discussed in the following sections.

8.4.2 The Variables

8.4.2.1 Dependent Variable: Location Choice of New Manufacturing Greenfield Investment

Our dependent variable is the location of a new greenfield investment i (in manufacturing activity) undertaken by firm f in sector s, in location r, at time t. The variable assumes value 1 for the location chosen, and zero for the other possible alternative locations. The 110 Italian provinces compose our location choice set.

8.4.2.2 External Agglomeration Economies

Specialization Economies. We measure the degree of industrial specialisation (Marshallian economies) in province r as the share of firms that operate in sector s (three-digit NACE Rev. 1.1) in province r in 2001 on the share of firms operating in sector s in Italy. More formally,

$$\text{Specialisation}_{rs} = \frac{N_{rs} / \sum_{s} N_{rs}}{\sum_{r} N_{rs} / \sum_{r} \sum_{s} N_{rs}}$$

where N_{rs} is the number of local firms operating in sector s in province r, provided by ISTAT (the Italian National Institute for Statistics).

Diversification Economies. We measure the degree of industrial diversification (Jacobsian economies) in each province r using the entropy index (Batty 1976):

$$\text{Diversification}_r = \left(\sum_s X_{rs} \log \frac{1}{X_{rs}} \right)$$

where $x_{rs} = N_{rs}/\Sigma_s N_{rs}$ *and* N_{rs} is the number of firms operating in sector s in province r in 2001, provided by ISTAT.

8.4.2.3 Internal Agglomeration Economies

Internal agglomeration captures the presence of other activities of the same focal firm f in province r at time t-1, either in manufacturing or in other non-manufacturing activities. Specifically:

(1) *Other_Manufacturing* is a dummy variable that equals one if other manufacturing activities of the same parent company are located in the province, and zero otherwise.
(2) *Other_Non-Manufacturing* is a dummy that equals one if other activities (non-manufacturing) of the same parent company are located in the same province, and zero otherwise.

Both these measures are computed using REPRINT data.

8.4.2.4 Spatial Lags of External and Internal Agglomeration Economies

In order to empirically test the spatial decay effect of both external and internal agglomeration economies, we generate the spatial lags of our variables. We adopted a spatial contiguity-based matrix in a first order of contiguity. A spatial matrix is a data structure that allows for geographical relationships (and dependences) among locations. Since we are interested in boundaries, we created a continuity-based matrix

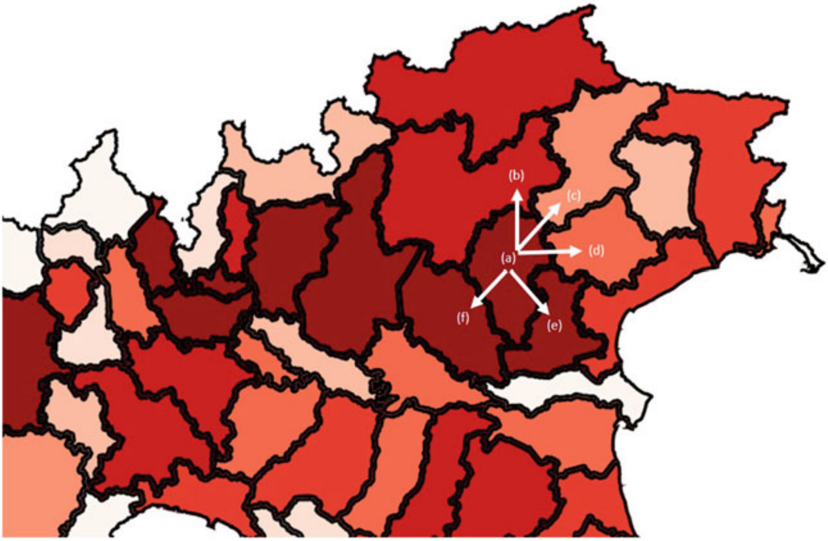

Fig. 8.2 Queen-based spatial contiguity matrix. (Source: Authors' elaboration)

looking at border-to-border proximity. Each value in the matrix is a binary measure: two provinces are neighbours if they share a common boundary (in this case the value is equal to 1), using the queen-contiguity technique.[2] This technique allows to consider spatial relations in several directions between the focal province and the surrounding provinces, such as vertical, horizontal and orthogonal. Figure 8.2 graphically presents this spatial pattern.

In the case of external agglomeration economies, we compute specialisation and diversification indexes in the contiguous provinces of each

[2]There are two approaches for computing a spatial weight matrix, namely (1) weights based on distance and (2) weights based on boundaries (contiguity). In the former, the weights (w_{ij}) are based on the distance between two geographical units i and j (between their centroids), using the inverse of squared distance, k-nearest neighbours, negative exponential or threshold distance techniques. In the latter, the contiguity relationship between two spatial units can be obtained following two main criteria: the rook contiguity, whether two units share a common border; and the queen technique whether two units share a common border or a point-length border (vertex). The rook is a more stringent definition of contiguity, and the choice depends on the purpose of the analysis and the phenomenon under investigation, as well as the irregularity in the spatial unit polygons.

focal province. Instead, in the case of internal agglomeration economies, we account for the presence of the parent company's activities in the provinces contiguous to the focal province, both in manufacturing and non-manufacturing activities (Lavoratori et al. 2019).

Finally, we control for a set of location-specific characteristics, such as the population density, the global connectivity of a province, whether the province includes primary (i.e. Milan and Rome) or secondary (i.e. Bologna and Turin) global cities. Namely, we follow the GaWC classification (Globalisation and World Cities Research Network, Taylor 2005). We also include Province fixed effects.

Tables 8.2 and 8.3 report descriptive statistics and correlation matrix.

8.5 Econometric Results

Results of our econometric analyses are reported in Tables 8.4. Specifically, Model (1) reports estimates from the location model with the only inclusion of location fixed effects (provinces) that control for any characteristics of the province, external agglomerations and (also unobservable) endowments that can affect a firm's location choices. In model (2) we estimate the location model introducing proxies for the external agglomeration economies, without location fixed effects. In model (3) we add the proxies for MNEs' internal agglomeration, i.e. the presence in the same province of other activities of the focal firm, with province fixed effects. In models (4) and (5) we jointly estimate both the external and the internal agglomeration economies, including other location factors. Finally, in model (6) we include spatial lags both for external and internal agglomeration forces.[3]

The estimates obtained in model (1), in which the province fixed effects measure external location factors, suggest that the latter (including external agglomeration economies) and the location endowment are strong drivers for the location of a new establishment. Thus, in

[3]As the same parent company may have several new investments during the considered period, in order to consider this multi-presence we cluster the standard errors by MNE. The coefficients are calculated as odds ratio to facilitate interpretations and comparisons.

Table 8.2 Descriptive statistics

Variable	*N*	Mean	SD	Min	Max
Choice	49170	0.0090909	0.0949128	0	1
Specialisation Economies	49170	0.0085547	1.00851	−0.8004187	45.23284
Diversification Economies	49170	1.69E-09	1.000001	−6.358377	1.604913
Other Manufacturing	49170	0.0172056	0.1300382	0	1
Other Non-Manufacturing	49170	0.0102705	0.1008227	0	1
Specialisation Contiguous Provinces	49170	0.1608655	2.527352	−5.970016	49.17066
Diversification Contiguous Provinces	49170	0.6570864	2.138994	−6.171317	6.64824
Other Manufacturing Contiguous Provinces	49170	0.0697376	0.2547069	0	1
Other Non-Mfg Contiguous Provinces	49170	0.0495424	0.2169998	0	1
Primary Global City	49170	0.0181818	0.1336099	0	1
Secondary Global City	49170	0.0181818	0.1336099	0	1
Population Density (log)	49170	5.141525	0.8102919	3.433987	7.865955

model (2) we substitute the province fixed effects with our proxies of external agglomeration economies, i.e. *Specialisation* and *Diversification*. The *Pseudo* R^2 (0.092) and the *Log-likelihood* (−1907.77), compared with the previous ones (*Log-likelihood* of −1717.919 and *Pseudo* R^2 of 0.1823, obtained in model 1), underline that our proxies capture province characteristics explaining MNEs' location choices. In line with most of the empirical studies on Marshallian and Jacobsian externalities, estimated coefficients of the variables *Specialisation* and *Diversification* are positive and significant in each specification, with a higher effect in the case of diversification (the odds ratio for the variable *Diversification* is

Table 8.3 Correlation matrix

		1	2	3	4	5	6	7	8	9	10	11	12
1	Choice	1											
2	Specialisation Economies	0.104	1										
3	Diversification Economies	0.055	0.125	1									
4	Other Manufacturing	0.091	0.053	0.073	1								
5	Other Non-Mfg	0.101	0.043	0.066	0.306	1							
6	Specialisation Contiguous Provinces	0.038	0.337	0.088	0.038	0.036	1						
7	Diversification Contiguous Provinces	0.054	0.101	0.181	0.067	0.078	0.233	1					
8	Other Mfg Contiguous Provinces	0.018	0.043	0.078	0.252	0.146	0.092	0.139	1				
9	Other Non-Mfg Contiguous Provinces	0.015	0.043	0.095	0.157	0.126	0.089	0.181	0.426	1			
10	Primary Global City	0.094	0.039	0.122	0.114	0.214	0.066	0.179	0.021	0.009	1		
11	Secondary Global City	0.069	0.068	0.134	0.072	0.044	0.029	−0.090	0.008	−0.005	−0.019	1	
12	Population Density (log)	0.078	0.103	0.274	0.110	0.132	0.109	0.240	0.055	0.080	0.324	0.090	1

Table 8.4 Location of new manufacturing greenfield investments—Conditional Logit Model

	Mod_1	Mod_2	Mod_3	Mod_4	Mod_5	Mod_6
External Agglomerations						
Specialisation Economies		1.3056***		1.2725***	1.2534***	1.2327***
		(0.0483)		(0.0419)	(0.0389)	(0.0403)
Diversification Economies		3.0865***		2.4823***	1.7075***	1.5428***
		(0.2908)		(0.2231)	(0.1354)	(0.1203)
Internal Agglomerations						
Other Manufacturing			3.9936***	6.2229***	4.6284***	4.5076***
			(1.0836)	(1.7699)	(1.3388)	(1.3030)
Other Non-Manufacturing			2.5753***	4.3943***	2.6364***	2.5269***
			(0.6678)	(1.1472)	(0.7287)	(0.6976)
Spatial Lags						
Specialisation Contiguous Provinces						1.0178
						(0.0264)
Diversification Contiguous Provinces						1.1035***
						(0.0304)
Other Mfg Contiguous Provinces						1.0299
						(0.3138)
Other Non-Mfg Contiguous Provinces						0.982
						(0.2458)
Controls						
Population Density (log)					1.5304***	1.4666***
					(0.1050)	(0.0982)

(continued)

Table 8.4 (continued)

	Mod_1	Mod_2	Mod_3	Mod_4	Mod_5	Mod_6
Primary Global City					1.5596*	1.2349
					(0.3589)	(0.3117)
Secondary Global City					3.3920***	4.4606***
					(0.5720)	(0.8441)
Fixed effects (NUTS-3)	yes	no	yes	no	no	no
No of observations	49,170	49,170	49,170	49,170	49,170	4,9170
No of MNEs	384	384	384	384	384	384
Pseudo R^2	0.1824	0.0920	0.2021	0.1331	0.1578	0.1618
Log-likelihood	−1717.919	−1907.777	−1676.473	−1821.432	−1769.491	−1761.245

Note: The dependent variable is the location decision of a new manufacturing investment *i* in Province *r*, considering all the 447 investments present in REPRINT database. Choice set: 110 provinces. Total number of observations 49,170 (= 447*110). The coefficients are reported as *odds ratio*. Standard errors are clustered by firm and reported in parentheses. Asterisks denote confidence levels: $*p < 0.10$, $**p < 0.05$ and $***p < 0.01$

3.0865 compared to 1.3056 for the variable *Specialisation*). In model (3), the inclusion of our proxies for internal agglomeration economies (*Other Manufacturing* and *Other Non-Manufacturing*), together with province fixed effects, increase the fit of the model in comparison to model (1); indeed, the *Log-likelihood* increases to −1676.47, and the *Pseudo* R^2 to 0.2021, thus underlining the relevance of internal agglomeration factors driving location choices. Specifically, the MNEs' location choice of a new manufacturing plant in a given province is strongly driven also by the presence of other activities of the same parent company. Indeed, the variable *Other Manufacturing* presents a coefficient of 3.994, strongly significantly different from zero at $p < 0.01$. These findings confirm that MNEs tend to co-locate subsequent activities in a close proximity to existing ones in order to benefit from internal economies of scale and scope, as well as substitution mechanisms for coordination and control, for sharing and transferring knowledge and information among activities. In models (4) and (5) we jointly consider external and internal agglomeration factors, including other province characteristics. In both cases, the inclusion of variables accounting for the presence of other activities of the same parent company in the province significantly increase the model fit, confirming the role of internal agglomeration economies as a driver of MNEs' location choice; in fact, the *Log-likelihood* goes up from −1907.77 in model (2) to −1821.43 in model (4) and to −1769.49 in model (5); likewise, the *Pseudo* R^2 goes up from 0.0920 to 0.1331 and 0.1578, respectively. Moreover, controlling for internal agglomeration economies reduce the coefficients of external characteristics, suggesting the importance of looking at both internal and external factors in location decision studies.

Looking at model (5), it is also worth mentioning that a greater degree of global connectivity increases the attractiveness of the province for foreign investments. Specifically, the latter effect is stronger when the province hosts a secondary global city (the variable *Secondary Global City* shows an odds ratio of 3.39) than a primary one (the odds ratio is 1.53), potentially due to lower congestion costs and space availability particularly important for manufacturing activities, but with a certain level of connectivity compared to other locations across the country.

The significant effect of *Population Density* supports the positive role of urbanisation economies.

Finally, we analyse the effect of external and internal agglomeration economies in the contiguous provinces on the location choices of MNEs. Specifically, we introduce the spatial lags of the explanatory variables (*Specialisation Contiguous Provinces, Diversification_Contiguous Provinces, Other Manufacturing_Contiguous Provinces* and *Other Non-Manufacturing_Contiguous Provinces*), measured as discussed in Sect. 8.4.2. Results are reported in Table 8.4, model (6).

Findings show that internal agglomeration economies present a strong spatial decay effect; indeed, the presence of the focal firm in the contiguous provinces does not have any significant effect on the probability of choosing the province for a new manufacturing investment, both in the same activity and in other non-manufacturing activities. This confirms that the benefits of co-location with manufacturing activity and related activities (such as logistics, distribution, retail) arise in a close geographical proximity, within the province boundaries. Conversely, external agglomeration forces due to specialisation economies do not seem to overcome province boundaries; in fact, the estimated coefficient of the spatially lagged specialisation does not come out significant, confirming that specialisation economies operate at a smaller geographical scale, because Marshallian mechanisms require a close spatial proximity across units. However, our results also show that *Diversification_Contiguous Provinces* has a significant odds ratio of 1.104, so a focal province contiguous to provinces characterised by a higher level of industrial diversity has a greater probability of being chosen for a new investment in manufacturing activities. Indeed, Jacobsian economies require a greater and diversified area to arise, and their effects can cross the boundaries of the province, thus operating at a bigger spatial scale than specialisation economies.

8.6 Conclusions

This chapter contributes to the agglomeration literature in two ways. First, we jointly consider the role of external and internal agglomeration economies as driving factors for location decision of new greenfield investments in manufacturing activities. Specifically, our findings from a conditional logit model show that (1) both external and internal agglomeration economies have a positive role on MNEs' location decisions and (2) external forces decrease once allowing for intra-firm co-location. Thus, failing to control for internal agglomeration factors can lead to overestimating the effects of the traditional external ones. Although we are not the first to disentangle inter-firm (external) vs. intra-firm (internal) agglomeration forces (Alcácer and Delgado 2016; Woo et al. 2019; Lavoratori et al. 2019), we add some evidence on their relative weights in influencing MNEs' location choices within a foreign country. Second, we focus on the spatial decay effects of such agglomeration forces. Indeed, results from the estimation of an augmented model that includes spatial lags show a strong spatial decay effect for intra-firm co-location with firm-owned activities located in contiguous provinces, in order to benefit from economies of scale and scope, as well as to benefit from co-location as a substitute mechanism of coordination and control on geographically dispersed activities. Moreover, while Marshallian (specialisation) agglomeration economies require a stronger geographical proximity among units due to the mechanisms that generate these externalities, the benefits of diversity (Jacobsian) economies seem to cross geographical boundaries more easily.

For future research, we suggest that the study of the relationship between MNEs' location choices and agglomeration would benefit from a closer examination of heterogeneity of firms (e.g. Mariotti et al. 2019). Strengths and weaknesses of new entrants and indigenous companies might be captured along several dimensions (e.g. innovativeness, profitability, competitiveness, growth); MNEs' location choices may be influenced by experience and learning stemming both from own previous entries and from imitation of other foreign companies' location choices (e.g. Shaver et al. 1997; Belderbos et al. 2011; Koçak and Özcan 2013), thus also impacting their survival likelihood in each local context.

Moreover, this study investigates spatial decay effects of agglomeration economies using a spatial contiguity technique in a first order of contiguity. It is worth mentioning that future research could explore external and internal agglomerations including additional spatial levels. On the one hand, the investigation of agglomeration effects can be extended looking at greater spatial scales (e.g. orders of contiguity greater than the first), in order to understand whether the effects can overcome the first boundaries, especially for the diversification economies. On the other hand, the investigation can be aimed at exploring spatial effects within a narrow unit of analysis, for example moving within the province, in order to understand whether internal and external (mainly specialisation) agglomeration can operate at scales much smaller than the province or the city (Andersson et al. 2019; Lavoratori and Castellani 2020). Finally, it would be interesting to investigate the role of geographical distance and decay effects disentangling the different components behind the agglomeration economies (e.g. labour, knowledge spillovers, as well as competition) and to explore the industry heterogeneity in the micro-foundation of such agglomerations (e.g. Faggio et al. 2017).

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