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FOREIGN DIRECT INVESTMENT AND AGGLOMERATION: EVIDENCE FROM ITALY

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Abstract

A number of empirical studies have analyzed the effect of agglomeration on multinational investment, verifying whether the agglomerated areas attract foreign direct investment inflows. Despite the large number of papers, no systematic attempt has been made to disentangle whether FDI are attracted by the concentration of firms within the same sector (specialization) or within different sectors (diversity). Furthermore, the question whether firm size in the host area influences multinational investment is still unanswered. This paper provides empirical evidence of the role of agglomeration economies in attracting foreign direct investments within Italian regions and provinces, distinguishing between specialization and diversity, and of the role of firm size in foreign investors' choices. We employ a new territorial data set on foreign direct investment collected by the Italian Foreign Exchange Office for industrial and service sectors. We find strong evidence that specialized geographical areas attract FDI, whereas diversified areas do so only for industrial sectors; finally, there is little evidence that firm size has an impact on FDI since, if anything, only big firms in southern regions appear to have a positive effect on foreign investors' decisions.

JEL classification: F21, R12, R30.

Keywords: foreign direct investment, agglomeration economies, regional economics.

Contents

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1. Introduction[1]

In recent years many empirical studies have analyzed the effect of agglomeration economies on multinational investment, verifying whether the agglomerated areas attract foreign direct investment (FDI) inflows[2]. Although the empirical literature encompasses a large body of studies, up to now certain aspects of the link between agglomeration and inflows of FDI have been neglected. For example, to our knowledge there has been no systematic assessment of the role of intra-industry and inter-industry externalities on FDI, in other words, whether FDI are attracted to some areas by the agglomeration of firms producing similar goods or, on the contrary, by the concentration of firms producing different goods and services. In the first case, foreign investors would seek to capture industry specific externalities, such as the intra-industry knowledge spillovers that stem from the spatial concentration of firms within the same industry (Marshall, 1920; Krugman, 1991; Fujita et al., 1999). In the second case, the incentive to invest would stem from the ability of the variety of industries within a geographical region to activate inter-industry knowledge spillovers and diversification economies (Jacobs, 1969).

A further aspect unexplored by empirical analysis is whether firm size in the host areas affects FDI inflows. As some scholars argue, local markets based on small and medium enterprises can be more productive because local competition stimulates firms to innovate rapidly or to adopt new technology (Porter, 1990; Pyke et al., 1990). Along these lines, we expect that markets based on small firms will be conducive to productivity growth and consequently draw foreign investors. On the other hand, several considerations suggest that large firms are important in attracting foreign investments. For example, foreign investors may be interested in acquiring large firms in order to expand their market shares rapidly. Moreover, others argue that the location of large firms in some areas can stimulate FDI in the same areas by favouring forward and backward linkages or, in a context of imperfect

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[2] Among others: Coughlin et al. (1991), Wheeler and Mody (1992), Woodward (1992), Head et al. (1994, 1995), Braunerhjelm and Svensson (1996), Billington (1999), Wei et al. (1999), Basile (2001).

information, by signaling the efficiency of the area (Mariotti and Piscitello, 1995; Ó Hualláchain et al., 1997; Wei et al., 1999). These aspects are particularly relevant in the Italian economy given the scarcity of large firms and, by contrast, the crucial role played by the small and medium enterprises in certain parts of the country, as in the industrial districts or in the South.

This paper aims to contribute some empirical evidence of the role of agglomeration economies in attracting foreign direct investment inflows within Italian regions and provinces. In particular, we distinguish between sector specific and non-sector specific externalities to verify whether FDI move towards sector-specialized or sector-diversified areas. A further aim is to contribute to understanding whether firm size in the host area affects foreign investors' choices.

Understanding which type of economic structure is preferred by international investors is more than an academic question. In order to take appropriate action, policy-makers would like to know what forces drive inward FDI. In this respect, the analysis turns out to be particularly important for the Italian economy, which is characterized by strong territorial inequalities.

The location theories argue that both domestic and foreign firms are located in the regions with better factor endowment, so that the correlation between the incumbent firms and foreign investment may be due to factor endowment and not to agglomeration externalities (Head et al., 1995). The empirical models testing for agglomeration may lead to spurious results if no controls for factor endowment are utilized. Unlike the majority of existing studies on agglomeration and FDI, we took special care to control for the effect of factor endowment in the econometric model.

This paper adds to the existing literature on FDI and agglomeration in three respects[3]. First, it attempts to assess the role of different kinds of agglomeration externalities, within the same industry or among different industries, as well as the role of firm size in affecting foreign investment. Second, this work is based on a new database on FDI collected by the

[3] Previous work on Italian territorial data has been carried out by Mariotti and Piscitello (1994) and Basile (2001).

Italian Foreign Exchange Office (Ufficio italiano cambi) for the Italian regions and provinces. Data for the regions are also available by sector. The region-sector panel has the advantage of allowing to control for omitted or unobservable factors both at regional and sectoral level by introducing fixed effects in the FDI equation. Finally, we focus on manufacturing as well as on services. The interest of including the service industries is twofold: first of all, the spatial concentration of certain knowledge-intensive service sectors (e.g. finance industry; see Dekle, 2002) suggests that agglomeration economies can play a central role not only for the location choice of manufacturing firms, but also for firms supplying services. In addition, foreign investors may be interested in investing within areas endowed with substantial service industries, in order to benefit from a large and differentiated supply of inputs; thus a comprehensive analysis of agglomeration externalities should include services in the investigation.

The paper is organized as follows. In the next section we briefly review the theoretical and empirical literature on agglomeration and FDI. In the third section, the geographical distribution of FDI is explored through a descriptive analysis. The fourth section is devoted to discussing the empirical model. The results of the estimates and some extensions of the benchmark model are presented in section five. The final paragraph contains the concluding remarks and some suggestions for future research.

2. Related literature

2.1 *Theoretical background*

Since the pioneering work of Marshall (1920), economic theory has recognized that a common location of firms within the same industry can generate positive externalities. These types of benefits, called also MAR externalities from the works of Marshall, Arrow and Romer (see Glaeser et al., 1992), represent the main rationale for the birth and development of industrial districts, namely certain areas highly specialized in producing similar goods (Pyke et al., 1990).

The theory indicates three main sources of this type of agglomeration economies: knowledge spillovers, labour-pooling and input sharing. The first source is based on the idea that physical proximity facilitates the transmission of knowledge among firms and workers. The flow of ideas and the knowledge of new technologies apparently spreads more rapidly across firms that are concentrated in specialized areas, thanks to informal contacts and the mobility of workers across firms; consequently firms' productivity within these areas should grow more rapidly[4]. A second source evoked by the literature is related to the formation of specialized local labour markets. In this view, firms in the same industry are attracted to areas where skilled workers are available in large number in order to avoid labour shortages or bottlenecks. At the same time workers are attracted by firms' agglomeration, which reduces the likelihood of their remaining without work. Other things being equal, this mechanism reduces the risk premium embodied in wages, increasing the supply of specialized workers and benefiting the firms that pay a lower wage. Finally, as a further source of externalities the theory mentions the availability of a wide range of services and productive inputs within a geographically concentrated market. In such a case the benefits for the firms derive from the high specialization of input suppliers and from the lower transaction costs due to proximity.

Apart from the MAR externalities, economic literature emphasizes further types of positive externalities stemming from agglomeration that, unlike MAR economies, relate to firms belonging to different industries located within a common area. These types of external economies, called Jacobs externalities from Jacobs (1969), are based on the idea that the diversity and variety of spatially proximate industries promote the transfer of knowledge and productivity growth. According to this stream of research it is overall industrial variety and scale, rather than specialization in one industry, that boosts economic growth through the cross-fertilization of ideas and transmission of innovations from one industry to another. In such a case the emphasis is placed on the process of inter-industry transmission of knowledge.

According to the theory other features of the economic structure of a geographical area may affect productivity growth and so encourage FDI. On one hand, some argue that local productive markets based on small firms experience rapid growth because local competition

[4] An established empirical literature found strong evidence that knowledge spillovers are geographically bounded and remarkable in the high-technology sectors (Audretsch and Feldman, 1996; for a review Audretsch

encourages firms to innovate or rapidly adopt new technologies (Porter, 1990). Similarly, the literature on industrial districts highlights the efficiency gains of local productive systems based on small enterprises, mentioning the benefits of a greater division of labour and the competition-collaboration relationships amongst small firms. In such a structure the flow of ideas is rapid, as is the productivity growth (Pyke et al., 1990; Signorini, 2000). From this point of view, the regions where small firms prevail should attract more foreign investors. On the other hand, numerous factors may motivate foreign enterprises to invest within areas populated by large firms. For example, if foreign firms make cross border investment to expand their market shares or acquire specific assets, such as production technology or marketing know-how, they are interested in the acquisition of large firms, which may ensure larger market shares and possess larger stocks of knowledge than small enterprises. Moreover, some argue that large firms are particularly capable of activating forward and backward linkages, so that foreign suppliers of facilities may be interested in locating near large domestic enterprises to minimize transaction costs (Ó Hualláchain and Reid, 1997). Finally, others point out that foreign firms lack of information on the domestic market, so the presence of large firms may signal the efficiency of a particular area and consequently attract investments from abroad (Mariotti and Piscitello, 1995; Wei et al., 1999). Whether small or large firms draw FDI inflows is a question that requires an empirical answer[5].

2.2 *The empirical literature on agglomeration and FDI*

The theory of location choice suggests that foreign investment will be directed towards the countries or regions ensuring larger profits. Thus, in the empirical literature FDI inflows are assumed to be a function of a set of host country or regional characteristics capable of affecting either the revenues generated or costs incurred by firms[6]. Since agglomeration can generate positive externalities on firms, the empirical literature has verified whether

and Feldman, 2003).

[5] Some empirical evidence of the effect of specialization, diversity, and small firm externalities on firm productivity is provided, among others, by Glaeser et al. (1992), Henderson et al. (1995), Deckle (2002) and Cingano e Schivardi (2003).

[6] In general, the empirical models take the following form: $y_i=\beta' X_i$, where y_i represents the FDI localized in the country or region i and X_i is a vector of appropriate explanatory variables referring to the host area i. Coughlin (1998) presents a comprehensive survey of the empirical literature on FDI in USA.

agglomeration attracts FDI[7]. On the whole, the results display a positive effect of agglomeration economies within the geographical areas examined which, in the studies cited, vary from large areas like national countries or USA states to the smaller sub-national regions. Although a number of empirical works focus on agglomeration and FDI, the role played by diversity economies and firm size on FDI inflows has been largely unexplored; thus the question whether foreign investors are attracted within diversified areas or where small or large firms prevail remains unanswered.

As regards the empirical analysis of agglomeration and FDI two considerations are in order. First, in choosing the appropriate proxy for agglomeration the literature does not follow a unified approach. Instead, the models use different measures of agglomeration that are only sometimes sector-specific. Among the works that use non-industry-specific variables, we recall Coughlin et al. (1991) and Wei et al. (1999), who use proxies for density, respectively approximated by the ratio of manufacturing employment, or population, to land area. Others consider the weight of the manufacturing sector: Woodward (1999) and Basile (2001) use the total number of manufacturing establishments within the area, while Wheeler and Mody (1992) and Billington (1999) use the degree of industrialization, in turn measured by the weight of the manufacturing sector as a percentage of GDP. Other similar proxies for agglomeration include infrastructure endowments and FDI previously accumulated (e.g. Wheeler and Mody, 1992). On the other hand, certain studies consider explicit industry-specific proxies for agglomeration that are more strictly related to the so-called MAR externalities. In particular, Braunerhjelm and Svensson (1996) employ a sector specialization index, given by the ratio of sector employees to total manufacturing employees, while Head et al. (1994, 1995) use the number of foreign plants already located in the area belonging to the same sector and country of origin.

A second consideration relates to the method used in empirical papers to disentangle the effect of agglomeration from the effect of the geographical distribution of productive factor endowment. As Head et al. (1995) have pointed out, both domestic firms and foreign investors may be attracted to the regions with better factor endowment. Therefore, the

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[7] Among others: Coughlin et al. (1991), Wheeler and Mody (1992), Woodward (1992), Head et al. (1994, 1995), Braunerhjelm and Svensson (1996), Billington (1999), Wei et al. (1999), Basile (2001).

significance of agglomeration may capture the correlation between the location of domestic firms and FDI due to the endowment effect, instead of verifying the agglomeration externalities. For instance, if there is considerable availability of industry-specific inputs in a particular area, we can expect that firms in the same industry, both national and foreign, will be located in that region; e.g. the availability of ports will attract domestic and foreign firms in the shipping industry. For this reason the endowment effect could lead to spurious results for the agglomeration effect.

In order to overcome this problem Head et al. (1995), studying Japanese investment in United States, use the number of USA establishments in the corresponding sectors as control for industry-specific location factors and the number of incumbent Japanese plants of the same sector as a proxy for agglomeration. They argue that the geographical distribution of national establishments in a particular industry should incorporate all the relevant information on the distribution of inputs intensively used in that industry; thus they consider the distribution of domestic plants an appropriate control variable for factor endowment. Furthermore, they suggest introducing industry and geographical fixed effects to control for unobserved characteristics relating to industries and geographical areas. In our paper we deal carefully with this issue by using an appropriate standardization of the dependent variable.

3. The data

Before starting the econometric analysis, we present the FDI data employed in this paper as well as some stylized facts about the geographical pattern of FDI in Italy. The data measure the gross foreign direct investment inflows, by region and province, used to compile the balance of payments[8]. The data span the period from 1994 to the first semester 2000 and are compiled by the Italian Foreign Exchange Office[9]. An initial characteristic emerging from our data is the high territorial concentration of FDI. The first three regions (Piedmont, Lombardy, Lazio) account for about 60 per cent of the national stock accumulated during the period (Table 1). This result may be affected by the presence of the major urban systems within these regions; as Table 2 shows the concentration at the provincial level is greater than the concentration at the regional level, with the first three provinces absorbing, as a whole, over half the total FDI.

Of course, these results might depend on the economic size of the regions, or provinces, so that a more appropriate measure of FDI concentration would be one that rules out the size effect of the geographical area. We therefore compared the regional and provincial FDI concentration with the corresponding value added concentration. The exercise is conducted using Lorenz curves and Gini indexes computed for regional and provincial FDI and reported in Figure 1. The FDI seem to cluster in space even if we control for region or province size; in 1998 the Gini index was equal to 0.57 for all-sector regional FDI, rising to 0.68 for all-sector provincial FDI. The higher spatial concentration at provincial level may be due to the strong attraction of metropolitan areas. This hypothesis is supported by the FDI concentration in services, which appears greater than in manufacturing: the Gini indexes were 0.59 and 0.45 respectively. Finally, the territorial disparities seems to rise over time: from 1994 to 1998 all the Gini indexes show a small increase.

As a further step in the descriptive analysis, we investigate the influence of space on the attraction of FDI by running spatial autocorrelation tests. The purpose of this is to capture whether a certain variable, in this case FDI, follows a similar pattern over space. For example, a positive autocorrelation of FDI across provinces would indicate that provinces which are geographically close have low or high FDI all together; on the other hand a negative autocorrelation would suggest competitiveness among nearby provinces, for which investments have dissimilar values. In order to test for spatial autocorrelation, it is necessary first to measure the geographical distance between provinces by the spatial weight matrix, of which the generic element w_{ij} represents a measure of the distance between province i and j. For example, the matrix may assume the form of the contiguity matrix when $w_{ij} = 1$ if the provinces border and $w_{ij} = 0$ otherwise, or the form of a distance matrix when w_{ij} equals the

[8] The Italian regions correspond to Nuts 2-regions of Eurostat classification (*Groups of counties* in the UK and *Régions* in France). The Italian provinces correspond to Nuts 3-regions of Eurostat classification (*Counties* in the UK and *Départements* in France).

[9] More information on the FDI data can be found in appendix.

inverse of the kilometric distances between each pair of provinces. In the following, in order to test for the spatial autocorrelation we run the Moran *I* test using the two matrices described above[10]. The verification is carried out on the ratio of FDI to the provincial value added, both calculated as time averages.

The results of the Moran *I* test, reported in Table 3, reveal a global spatial dependence of provincial FDI: the spatial autocorrelation is positive and statistically significant with both contiguity and distance matrices; similar conclusions are obtained by breaking down foreign investments by country of origin. However, the phenomenon involves the southern provinces but not those of the Centre-North, for which the statistic appears insignificant. In other words, the empirical evidence would indicate stronger territorial polarization inside the southern area rather than within the Centre-North.

The location choices seem rather similar among countries: the provincial correlation of FDI by country of origin is positive and relatively high, especially for the USA, EMU and non-EMU (Table 4).

In summary, in this section foreign investment appear to be highly concentrated over space, especially when the data include the service sector. The effect could depend on the attractiveness of metropolitan areas for investors in services. Moreover, the geographical factor, namely the distance between provinces, seems to play a role in explaining investment distribution over the national territory: close provinces follow similar patterns. In the next section we investigate these aspects in greater detail.

4. The empirical strategy

4.1 *The regional model*

Economic theory suggests that a foreign firm decides to invest in the region that guarantees the highest expected profits net of any fixed costs, including sunk costs. From the

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[10] Moran (1948). For a discussion of the test see among others: Anselin (1988) and the special number of the International Regional Science Review, Vol. 20, No 1-2 (1997). The test of Moran I is carried out under the hypothesis of normality of the statistic Z.

empirical viewpoint, expected profits are not directly observable, but we can observe only the FDI realized in each region. In such circumstances data are censored and the appropriate statistical model for estimating a FDI equation is the Tobit estimated by the maximum likelihood method (Tobin, 1958):

$$y^*_{i,j} = \alpha_i + \alpha_j + \beta' X_{i,j} + \varepsilon_{i,j}$$

$$FDI_{i,j} = \begin{cases} y^*_{i,j} & if\ y^*_{i,j} > 0 \\ 0 & if\ y^*_{i,j} \leq 0 \end{cases}$$

where y* is a latent variable not directly observable; α denotes the regional and sectoral fixed effects; $X_{i,j}$ represents a vector of explanatory variables able to expand the expected profits; β indicates a vector of corresponding parameters to be estimated; $\varepsilon_{i,j} \sim N(0,\sigma_\varepsilon)$ is a stochastic normal error; i=1,…,20 and j=1,…,15 denote region and sector respectively; finally $FDI_{i,j}$ are foreign direct investment inflows.

The coefficients of the Tobit model simultaneously measure two different effects: the impact of the corresponding regressor on the probability that the region receives FDI and the impact of the corresponding regressor on the level of the FDI in the regions where they are positive (McDonald and Moffitt, 1980). The panel structure of the data is particularly useful because it enables us to control for unobservable or omitted factors through fixed effects at the sectoral and regional level. The fixed effects are represented by additive dummies[11].

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[11] This choice requires a brief discussion. The ML estimates of the coefficients of a Tobit model with fixed effects is not consistent for T fixed and N→∞ (see among others: Hsiao 1986, Baltagi 1995, Arellano and Honoré 2001). As in other non-linear models (logit, probit), in the Tobit the number of the parameters increases along with the number of observations, up to infinity, and it is not possible to change the model in order to rule out the fixed effect, as in linear models. For the Tobit model with fixed effects, Honoré (1992) proposes a semi-parametric estimator that is consistent and asymptotically normal. But, at the same time through a Monte Carlo experiment he demonstrates that the asymptotic distribution is a good proxy for the effective one only if N≥200. Besides, the results of Heckman (1981) suggest that the bias of the ML estimates of the Tobit model with additive dummies that control for fixed effects should not be overestimated. Indeed he shows, through the Monte Carlo method, that the bias of the ML estimates of a static probit model with fixed effect is negligible if N is not too larger than T (in the experiment N=100 and T=8). According to these results, Arellano (2000) suggests estimating by ML the non-linear model with fixed effects if the ratio N/T is finite and not too large. Since in our paper the dimension of the panel belongs to these classes (i=20 and j=15), following Braunerhjelm et al. (1996) we decided to use the additive dummies for the fixed effect and estimate the model by the ML method.

The dependent variable of the econometric model is FDI-intensity defined as the cumulated FDI divided by the value added, by each region and sector. The cumulated FDI are computed over the gross investment flows from 1994 to 2000; the value added refers to 1994, which is the starting year of foreign investment data. We preferred to cumulate the flows since foreign investment has a high time variability. For region i and sector j the FDI intensity is measured as:

$$(FDIVAD) = (\text{Cumulated FDI 1994-2000})_{i,j} / (\text{Value added 1994})_{i,j}$$

The reason for using this ratio as dependent variable is that it controls for the effect of productive factor endowment. Head et al. (1995) argue that regions with favorable factor endowment attract domestic as well as foreign investors. As a result the correlation between domestic firms and foreign investment, due to this endowment effect, may be confused with the effect of agglomeration economies, and a model testing for agglomeration without controls for endowment may lead to spurious results for the agglomeration effect. Head et al. suggest introducing proxies for the geographical distribution of inputs as a control for endowment effect.

In our model, the value added by region and sector is the control variable for factor endowment. In fact, the number of firms located in a given area should depend on factor endowment, consequently the value added will be larger in the regions with better endowment. In order to limit potential multicollinearity among regressors, the value added is used as scale factor, i.e. the control for endowment is carried out by dividing the FDI by the value added and taking this ratio as the dependent variable. Of course, this introduces a restriction in the model: to divide FDI by the value added is equivalent to restricting the coefficient of the value added to one in a log-linear regression model of FDI on value added. If the "true" coefficient were greater that one, the standardization could be conducive to model misspecification. In several regressions run to test this hypothesis the coefficient turned out to be non-statistically significant from one, hence the model does not seem to be affected by misspecification[12].

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[12] See below the section dedicated to robustness checks.

In the model the FDI-intensity also allows us to take account of the correlation between foreign investment and location of domestic firms due to investment by acquisition. In the data we cannot distinguish between greenfield investment and acquisitions: we expect the acquisition of domestic firms to follow the geographical pattern of incumbent firms, so by dividing FDI by the value added we also control for acquisitions as well as for endowment effect[13].

Following the theoretical insights discussed in section 2, the regional model estimated is the following:

$$(FDIVAD)_{i,j} = \alpha_1(Specialization)_{i,j} + \alpha_2(Density)_{i,j} + \alpha_3(Density\_Others)_{i,j} + \alpha_4(Diversity)_{i,j} + \alpha_5(Small)_{i,j} + \alpha_6(Big)_{i,j} + \alpha_i(Regional\ fixed\ effects) + \alpha_j(Sectoral\ fixed\ effects) \quad (1)$$

The equation includes different proxies for agglomeration externalities in the vector of explanatory variables $X_{i,j}$, namely MAR (specialization) and Jacob (diversity) externalities, as well as two variables measuring average firm size.

The first hypothesis tested is whether MAR externalities attract foreign investors. A common measure of MAR economies is a sector specialization index computed on industry employment (see Glaeser et al., 1992):

$$Specialization_{i,j} = (IS-1)_{i,j}/(IS+1)_{i,j};$$

where $IS=(N_{i,j}/\Sigma_j N_{i,j})/(N_{National,j}/\Sigma_j N_{National,\ j})$; and $N_{i,j}$ is employment in region i and industry j. In our case the index is standardized and constrained within the interval (–1, 1) (see Paci and Usai, 2000).

[13] Mariotti and Piscitello (1994) use a similar dependent variable for the same reason. The FDI intensity also allows account to be taken of all omitted factors that attract both foreign and domestic investors, e.g. labor costs.

To investigate in more detail the role played by the agglomeration of firms belonging to the same sector, we employ an alternative measure of MAR externalities strictly related to the geographical scope of agglomeration economies. More specifically, following Ciccone and Hall (1996), who claim that density is important to foster technological spillovers on the ground that spatial density enhances the transmission of ideas, we include a proxy for sector density:

$$Density_{i,j} = (N_{i,j}/Land_i)/(N_{National,j}/Land_{National});$$

where Land denotes the surface of the region. The index is greater than one if in region i activity j is denser than the national average. We expect both variables related to MAR economies to have a positive impact on FDI inflows.

Different types of agglomeration economies can arise from the diversity of the regional economic structure. As Jacobs (1969) points out, inter-sector knowledge spillovers may strengthen firm productivity, therefore industrially diversified regions could attract foreign investors. However, knowledge spillovers are not the only source of agglomeration economies related to sector diversity. For example, FDI can be attracted by sectorally diversified areas because the geographical concentration of firms producing different goods and services can reduce transaction costs and thus expand the profits of foreign investors located within the same area. Our econometric model is unable to distinguish between the two sources of externalities, so we consider both falling into a broad category of non-sector-specific agglomeration economies. Following Henderson et al. (1995) as measure of the so-called Jacobs externalities we employ the relative Hirschman-Herfindahl index:

$$Diversity_{i,j} = (Herfindahl_{i,j}/Herfindahl_{National,j});$$

where $Herfindahl_{i,j} = \sum_{j^* \neq j} s^2_{i,j^*}$; $s^2_{i,j^*} = (N_{i,j^*})/\sum_{j^* \neq j}(N_{i,j^*})$ and $j^*=1,\ldots 15$.

For the region i and sector j, the index is measured over all the industrial and service sectors except j and is decreasing with the relative diversity of the area compared with the national average. Higher indexes indicate less diversified areas, thus the economic theory predicts a negative sign for the corresponding coefficient.

For a deeper analysis of FDI and non-sector-specific agglomeration, besides *Diversity* we include another explanatory variable in the model, which represents an alternative measure of Jacobs economies; this variable is the global density of the region computed over all the industries other than j (relative to the national average):

$$Density\_Others_{i,j} = \sum_{j*} (N_{ij*}/Land_i)/\sum_{j*} (N_{National,j*}/Land_{National}); \text{ with } j* \neq j.$$

We expect *Density_Others* to be positively correlated with FDI.

An additional issue examined by this paper is if firm size in the host area can affect inward FDI. We employ two different explanatory variables to test for the firm size effect on FDI inflows:

Small = (Share of workers employed in small firms compared with the national share)$_{i,j}$;

Big = (Share of workers employed in large firms compared with the national share)$_{i,j}$;

where small firms are those with less than 200 employees and large firms are those with more than 1,000 employees[14].

4.2 The model for provinces

The provincial model differs from the regional one in three respects. First of all, since at provincial level FDI data are not available by sector, the econometric model is estimated on a cross-section of provinces for the whole economy, taking manufacturing and services together. Second, the provincial endowment of infrastructure is used as an additional explanatory variable. A number of empirical studies demonstrate that infrastructure is able to attract foreign investment as it reduces production and transportation costs (Coughlin, 1991; Wheleer et al., 1992; Wei et al., 1999; Basile, 2001). In the regional model the fixed effects

[14] In the robustness check we employ also different threshold values. See appendix for the sources of the data.

capture the role played by infrastructure as well as any other regional omitted variable. If we did not incorporate infrastructure, the provincial model could suffer from misspecification because of an omitted variable; therefore we added a measure of infrastructure among the regressors. Finally, as emerged from the descriptive section, FDI came out spatially correlated across provinces. Therefore, the provincial model incorporates the dependent variable spatially lagged to capture spatial dependence and avoid misspecification due to spatial autocorrelation. Since spatially lagged dependent variables are endogenous (Anselin, 1988), the model is estimated by instrumental variable using as instrument spatially lagged infrastructure[15].

The model estimated for provinces is the following:

$$(FDIVAD)_i = \alpha_1(FDIVAD\_Spatially\ Lagged)_i + \alpha_2(Density)_i + \alpha_3(Diversity)_i + \alpha_4(Small)_i + \alpha_5(Big)_i + \alpha_6(Infrastructure)_i + \alpha_h(Regional\ fixed\ effects) \quad (2)$$

where i=1,…95 are Italian provinces, *FDIVAD*, *Density*, *Small* and *Big* are calculated as in the regional model but are computed for industry and services together; *Infrastructure* is an index that measures total infrastructure; the spatially lagged dependent variable is equal to:

$$(FDIVAD\ Spatially\ Lagged)_i = \textstyle\sum_k (w_{ik}\ FDIVAD_k);$$

where the spatial weight $w_{ik}=(Bord_{ik}/\sum_{k\neq i}Bord_{ik})$ comes from the contiguity matrix ($Bord_{ik}=1$ if provinces i and k border and 0 otherwise). Finally, for provinces *Diversity* is computed over all sectors:

$$Diversity = (Herfindahl_i/Herfindahl_{National});$$

15 Anselin (1988) suggests using as instruments for the spatially lagged dependent variable some spatially lagged explanatory variables of the model. Spatially lagged infrastructures seem to us the appropriate instrument in that they are strongly correlated with spatially lagged FDI, with a coefficient equal to 0.78.

where Herfindahl$i=\sum_j s^2_{i,j}$; $s^2_{i,j}=(N_{i,j})/\sum_j(N_{i,j})$ and j=1,…15 are the same industrial and services sectors as in the regional model[16].

5. Results

5.1 Regional results

The models are estimated in log-linear form. Since some variables are not strictly positive, to allow the logarithmic transformation we add a unit constant to these variables: namely, to the dependent variable of the regional model that is sometimes equal to zero and to some explanatory variables[17]. Table 5 gives descriptive statistics of the regional sample.

The results of the regional model for all sectors are presented in Table 6; all the estimates include regional and sectoral fixed effects that always are statistically significant[18]. In the first six columns we present the results for the explanatory variables introduced in the model one at a time, columns (7)-(9) provide the estimates of the complete models. MAR externalities are proxied by either *Specialization* or *Density*, Jacobs externalities by *Diversity* or *Density_Others*; since the two proxies for density (*Density* and *Density_Others*) are correlated they are not used together. The econometric evidence suggests that MAR externalities strongly affect FDI inflows. The more a region is sectorally specialized or dense, the more the region will draw FDI in the same sector. On the contrary, there is no statistical evidence of the influence of Jacobs externalities: neither density of the other sectors nor sector diversity are significant. Similar findings are obtained from firm size, which is non-significant to explain the geographical pattern of FDI.

The industrial sectors could behave differently from services. For example, the role played by agglomeration forces, such as the effect of large metropolitan areas, could be

[16] More information on the data can be found in the appendix.

[17] The variables are *Specialization,* which assumes negative values, *Big,* which is sometimes zero, and *Small*, which although always strictly positive has been transformed for uniformity with *Big*.

[18] For example, the results of likelihood ratio tests for regional and sectoral effects within model (7) of Table 6 are respectively 183.8 and 90.7; both are jointly significant at more than 99 per cent.

stronger in services than in industrial sectors. To some extent, the evidence emerging from the descriptive section, showing a larger geographical concentration in services, supports this view. Therefore, we estimate the model only for the industrial sectors, obtaining rather different results (Table 7). MAR externalities continue to have a significant impact on foreign investment location; both *Specialization* and *Density* have statistically significant coefficients and the expected signs. Moreover, unlike for the whole economy Jacobs externalities seem to play a role within the industrial sectors. The coefficients of *Density_Others* and *Diversity* are statistically significant with the expected sign, although they are significant only when the models take MAR externalities into account. The result is confirmed by several robustness tests[19]. Since the restricted model neglects a significant variable, the results of larger models (models 7-9) in which all the significant explanatory variables are included seem more reliable. The outcomes achieved for the industrial sector are straightforwardly interpretable: foreign investors are attracted to regions with a diversified structure because of the benefits of being located near a large supply of inputs and services. However, diversity is important only conditionally on specialization. This result might suggest that investors first take sectoral specialization into account and then, among the sectorally specialized regions, invest within the more diversified: in that case the relationship between FDI and diversity would emerge together with specialization. Finally, the findings for firm size are in line with those previously obtained: neither small nor large enterprises influence FDI location choices.

5.2 Provincial results

The provincial model is estimated with regional dummies to control for unobservable geographical factors. Because of the high correlation between the proxies for firm size, *Small* and *Big* are inserted one at a time. We present first the results without the spatially lagged dependent variable and then the IV estimates including it.

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[19] It is worth noting that this result does not rely on collinearity between the variables: the simple correlation between diversity and specialization is not particularly high (–0.22; between diversity and density –0.55). Moreover, the results are not even due to the partial correlation between diversity and specialization, conditionally on regional and sectoral effects: in fact by estimating the model without regional, sectoral or both the effects we obtain qualitatively similar results. In addition, it does not depend on some particular region or

From Table 8 *Density* is strongly correlated with FDI geographical patterns, showing that larger amounts of FDI are located in denser areas. *Infrastructure* is significant, but only without the other regressor, a result that might depend on the correlation between infrastructure and density, which in turn shows that a denser area is also more endowed with infrastructure. *Diversity* and firm size would not seem to have an influence on the location of foreign firms: in almost all the specifications the related coefficients are statistically insignificant.

From the spatial autocorrelation tests carried out within the unconditional statistical model of section three, FDI were spatially correlated. From the conditional econometric model the spatial correlation disappears: in Table 9 the spatially lagged dependent variable is not significant in any model specifications. This result may be due to fact that regional dummies incorporate all the relevant information captured by the spatially lagged dependent variable. The other results of IV estimates are rather similar to those previously obtained: in particular, *Density* is the variable that emerges from the estimates as being strongly significant.

5.3 Extensions and robustness

The benchmark regional model has been extended in two directions. In particular, in order to capture any potentially heterogeneous relationship between some explanatory variables and FDI, we allow the coefficients of firm size, diversity and specialization to change across four geographical areas - North-West, North-East, Centre and South - by interacting the explanatory variables with geographical dummies.

On the whole, the empirical evidence provided in Tables 10-12 tends to reject the hypothesis of heterogeneity and largely confirms previous results. Only two exceptions are remarkable. First, the role of large firms in the South: in this case, large firms would seem to have a positive role in attracting FDI within southern regions. The result could be interpreted in terms of the positive signal emanating from the location of large firms within these regions, which are in turn capable of improving the reputation of an area affected by several

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sector. Similar results are obtained excluding Lombardy, which over the period absorbed almost half of total FDI, or energy products, which could behave differently from manufacturing sectors.

negative externalities. The second exception is represented by the MAR externalities, which have a positive and significant impact on FDI in North-West and South, but not in the other zones. Since the two former areas are those with the highest and lowest FDI by value added, respectively, it would seem that Mar externalities are effective in extreme cases, that is when FDI are very scarce or when they are particularly abundant.

The robustness of the results obtained from the baseline regional model has been tested in several ways. First of all, as pointed out above, the model could be misspecified if the relation between FDI and value added, due to factor endowment, were non-linear. Thus, we insert the log of the value added in the baseline model and obtain similar results for both the all-sector model (Table 13) and the industrial-sector one (Table 14). Next, as further robustness checks, we change the threshold values of firm size variables: from 200 to 50 workers for small firms and from 1,000 to 500 for large firms. In addition, since some regions, namely Lombardy, Piedmont and Lazio, and certain sectors, such as financial services and metal products, attract the majority of FDI accumulated from 1994 to 2000, we have estimated the models without these regions or sectors. The results for all sectors, reported in Table 13, and for industrial sectors in Table 14 remain qualitatively unchanged.

Finally, we further check for industrial sectors only. According to international methodology our data on FDI involve the initial transaction between domestic and foreign firms, such as acquisition of initial assets, together with all subsequent capital transactions between them, such as increases in shareholding or invested profits. The subsequent investment of incumbent foreign firms, located in a given region, could alter our results on agglomeration. If foreign firms account for a large share of total regional production, we could have a correlation between FDI and the proxies for agglomeration (e.g. specialization index) that depends on the successive investment of incumbent foreign firms, even without agglomeration externalities. In order to control for this effect in the baseline model of Table 7 we insert, as control variable, the number of workers in foreign firms located within each region in the initial period, by sector[20]. The employees of foreign firms turn out to be

[20] Data refer to 1994, the initial year of our FDI data base. The analysis is carried out only for industrial sectors given that data on employees in the foreign firms, provided by the Politecnico of Milan (Reprint database), are not available for services.

positively correlated with the dependent variable, but its inclusion in the model does not modify the results previously obtained for the other variables (Table 14).

6. Concluding remarks

In this paper we investigate the FDI inflows within the Italian regions and provinces over the period 1994-2000. From the descriptive analysis, foreign investments appear very territorially concentrated, particularly when we focus on provinces and services; most FDI are located in the Centre-North, whereas they are extremely low in the South. Additional statistical analysis has demonstrated that FDI are spatially autocorrelated across provinces: provinces geographically close follow similar patterns of FDI, exhibiting either low or high FDI together.

The econometric model aimed to capture the role of agglomeration economies and firm size in attracting FDI inflows. In particular, we test for different types of agglomeration externalities, such as the MAR-externalities related to the sector specialization of a geographical area and the Jacobs externalities linked to sector diversity.

We find strong evidence that MAR-externalities influence foreign investors' choice of location: the more a region is specialized and dense, the more it attracts foreign investment within the same sector[21]. Jacobs externalities are significant only within the industrial sectors, showing that manufacturing FDI would be drawn by the area with a more diversified supply of inputs and services. Finally, there is little evidence that firm size has an impact on inward FDI and, if anything, only large firms in the South seem to have a positive effect on foreign investors' decisions.

The empirical findings give support to the hypothesis that agglomeration economies attract FDI inflows. Nevertheless, more work needs to be done to better understand how agglomeration economies operate. For example, as regards MAR-externalities, it is not clear whether the power of attraction is due to the existence of technological spillovers among firms or to a local market of specialized workers or both. Further investigation exploring

[21] This result is consistent with the evidence provided by Forni and Paba (2002) of stronger intra-industry than inter-industry technological spillovers

these issues would make a valuable contribution to the debate on agglomeration externality and FDI[22].

[22] The paper of Barry et al. (2001) represents a first contribution in this direction.

Appendix

Data description

The data on FDI are provided by the Italian Foreign Exchange Office. Data are the amount of gross FDI inflows, by region and province, collected to compile the balance of payments. In our data, FDI include greenfield investments and acquisitions together. Greenfield investment refers to the construction of new production facilities, while acquisition is the purchase of existing assets. For acquisitions to be registered as direct investments they must comprise at least 10 per cent of the domestic firms' assets. At regional level, FDI are broken down into 15 one-digit sectors: energy products, iron production, non-ferrous metals production, chemical products, metal products, transport equipment, food and beverages, textiles and clothing, paper and printing, wood and other manufacturing products, construction, trade services, transport, finance, other private services. At provincial level data are not available by sector but only for the whole economy, including industry and services together. The data on employment by establishment come from Istat, *Census 1991*. The data on value added and on surface of the regions (provinces) come from Istat, *Regional Economic Accounts* and *Annual Report (2000),* respectively. Provincial value added comes from Istituto Tagliacarne (2001), *I dati sul reddito provinciale*. The index of total infrastructure takes into account the availability of different kinds of productive infrastructure such as roads, railways, telecommunications, ports and airports. The index is standardized by province size and is provided by the Istituto Tagliacarne (1998), *La dotazione di infrastrutture nelle province italiane*.

Tables and figures

Table 1

FDI BY REGION
(percentage values)

Region	Share of national total (2)	FDI as a GDP percentage (3)	Index of FDI as a GDP percentage Italy=100	FDI percentage changes: Averages 1994-99
Lombardy	44,6	1,5	216,5	19,0
Piedmont	8,3	0,7	94,8	15,7
Lazio	7,7	0,5	77,4	33,9
Veneto	5,1	0,4	55,6	38,5
Emilia-Romagna	4,0	0,3	45,7	5,0
Liguria	1,3	0,3	43,3	16,6
Tuscany	1,2	0,1	17,9	-10,4
Friuli-Venezia Giulia	0,7	0,2	29,0	21,7
Trentino-Alto Adige	0,5	0,2	23,7	-0,8
Valle d'Aosta	0,5	1,2	175,8	66,1
Campania	0,4	0,0	6,2	22,8
Marche	0,2	0,1	9,5	-7,7
Abruzzo	0,2	0,1	11,5	-32,1
Sicily	0,1	0,0	2,0	27,3
Sardinia	0,1	0,0	3,4	23,7
Umbria	0,1	0,0	5,1	13,7
Puglia	0,1	0,0	1,1	18,3
Molise	0,0	0,1	8,2	-39,7
Calabria	0,0	0,0	0,8	97,5
Basilicata	0,0	0,0	1,6	7,9
Not classified	24,8	..	..	..
Italy (1)	100	0,7	100	20,0

Source of data: UIC. – (1) The national total includes FDI not imputed to any region. – (2) The shares are calculated over the cumulated gross FDI inflows (1994-2000). – (3) Computed as time averages of cumulated FDI gross inflows (1994-2000).

Table 2

FDI BY PROVINCE
(Cumulative FDI of the first 50 provinces over the years 1994-2000; percentage values)

OBS	Provinces	Regions	Shares	FDI as a percentage of GDP (averages over time)	Index of FDI as GDP percentage (Italy=100)
1	Milan	Lombardy	40.1	3.1	392.3
2	Rome	Lazio	7.5	0.7	93.2
3	Turin	Piedmont	7.3	1.2	155.4
4	Treviso	Veneto	2.6	1.3	157.4
5	Bergamo	Lombardy	1.3	0.6	73.2
6	Bologna	Emilia-Romagna	1.3	0.4	52.4
7	Genoa	Liguria	1.2	0.5	62.2
8	Brescia	Lombardy	1.2	0.4	55.5
9	Ravenna	Emilia-Romagna	0.9	1.0	129.2
10	Como	Lombardy	0.9	0.7	88.2
11	Modena	Emilia-Romagna	0.8	0.4	55.6
12	Vicenza	Veneto	0.7	0.3	43.3
13	Varese	Lombardy	0.7	0.4	45.5
14	Venice	Veneto	0.6	0.3	38.9
15	Florence	Tuscany	0.5	0.2	25.6
16	Aosta	Valle d'Aosta	0.5	1.5	190.9
17	Padua	Veneto	0.5	0.2	26.5
18	Verona	Veneto	0.5	0.2	27.0
19	Reggio Emilia	Emilia-Romagna	0.5	0.4	48.6
20	Trieste	Friuli-Venezia Giulia	0.3	0.4	50.7
21	Vercelli	Piedmont	0.3	0.7	86.0
22	Cuneo	Piedmont	0.3	0.2	28.4
23	Bolzano	Trentino -Alto Adige	0.3	0.2	26.2
24	Udine	Friuli-Venezia Giulia	0.2	0.2	22.8
25	Trento	Trentino -Alto Adige	0.2	0.2	25.2
26	Parma	Emilia-Romagna	0.2	0.2	26.0
27	Lucca	Tuscany	0.2	0.3	31.6
28	Alessandria	Piedmont	0.2	0.2	25.2
29	Naples	Campania	0.2	0.0	5.6
30	Latina	Lazio	0.2	0.2	23.3

(continued)

Tab. 2 (continued)

FDI BY PROVINCE

(Cumulative FDI of the first 50 provinces over the years 1994-2000; percentage values)

OBS	Provinces	Regions	Shares	FDI as a percentage of GDP (averages over time)	Index of FDI as GDP percentage (Italy=100)
31	Ancona	Marche	0.2	0.1	17.7
32	Belluno	Veneto	0.2	0.3	40.7
33	Lecco	Lombardy	0.1	0.2	23.7
34	Forlì	Emilia-Romagna	0.1	0.1	18.7
35	Teramo	Abruzzo	0.1	0.2	29.0
36	Pavia	Lombardy	0.1	0.1	15.7
37	Caserta	Campania	0.1	0.1	13.9
38	Pordenone	Friuli-Venezia Giulia	0.1	0.2	21.1
39	Livorno	Tuscany	0.1	0.2	20.3
40	Novara	Piedmont	0.1	0.1	15.8
41	Pisa	Tuscany	0.1	0.1	13.1
42	Piacenza	Emilia-Romagna	0.1	0.1	15.9
43	Siena	Tuscany	0.1	0.1	17.0
44	Perugia	Umbria	0.1	0.1	6.3
45	Biella	Piedmont	0.1	0.1	15.9
46	Palermo	Sicily	0.1	0.0	4.3
47	Prato	Tuscany	0.1	0.1	12.5
48	Sondrio	Lombardy	0.1	0.2	21.2
49	Rimini	Emilia-Romagna	0.1	0.1	11.3
50	Frosinone	Lazio	0.1	0.1	7.3
	Not classified		24.8	..	..
	Italy		100.0	0.8	100

Table 3

SPATIAL AUTOCORRELATION ACROSS PROVINCES: FDI TO VALUE ADDED RATIO

Area	N. of prov.	Moran I ($w_{i,j}$=contiguity)	Test – Moran Z (w_{ij}=contiguity)	Moran I (w_{ij}=distance)	Test – Moran Z (w_{ij}= distance)
Centre-North provinces	67	0.04	0.78	-0.01	0.51
South provinces	36	0.27	2.59***	0.14	3.70***
Total	103	0.16	2.72***	0.06	4.37***
Country					
USA	103	0.06	1.12	0.02	2.04**
Japan	103	0.03	0.61	0.02	2.01**
EMU	103	0.16	2.65***	0.06	4.61***
Non-EMU	103	0.15	2.48***	0.05	3.83***
Total	103	0.16	2.72***	0.06	4.37***

Notes: Moran I=$(n/So)\sum_i\sum_j w_{ij}(x_i-\mu)(x_j-\mu)/\sum_i(x_i-\mu)^2$. Where n=number of observations; So=$(\sum_i\sum_j w_{ij})$ is the weights' sum; x= (FDI/Value added); i, j=province; μ=mean of x; w_{ij} =spatial weights. Moran Test Z=[I-E(I)]/SD(I). Under normality of Z, the theoretical mean is E(I)=(-1/(n-1)); and SD(I) is the theoretical standard deviation; the reference distribution is the normal.
, * denote respectively significant at 5 and 1 per cent.

Table 4

CORRELATION MATRIX OF FDI/VALUE ADDED BY COUNTRY OF ORIGIN (1)

	USA	Japan	UME	Non-EMU
USA	1.00	0.65	0.80	0.60
Japan		1.00	0.46	0.29
EMU			1.00	0.65
Non-EMU				1.00

(1) Calculated on provincial data.

Table 5

DESCRIPTIVE STATISTICS FOR THE REGIONAL SAMPLE

Variable	Observation number	Mean	Std. Deviation	Coefficient of variation	Minimum	Maximum
FDIVAD	300	43.14	128.96	2.99	0.00	1,111.00
SPECIALIZATION	300	-0.07	0.24	-3.65	-0.83	0.65
DENSITY	300	0.89	0.78	0.88	0.02	5.12
DENSITY_OTHERS	300	0.90	0.63	0.70	0.18	2.96
DIVERSITY	300	1.17	0.21	0.18	0.86	1.82
SMALL	300	1.06	0.30	0.28	0.03	2.84
BIG	300	0.69	1.61	2.33	0.00	18.18
Log(1+FDIVAD)	300	2.10	1.77	0.84	0.00	7.01
Log(1+SPECIALIZATION)	300	-0.11	0.32	-2.87	-1.76	0.50
Log(DENSITY)	300	-0.50	0.95	-1.91	-3.81	1.63
Log(DENSITY_OTHERS)	300	-0.35	0.73	-2.08	-1.72	1.08
Log(DIVERSITY)	300	0.14	0.17	1.20	-0.15	0.60
Log(1+SMALL)	300	0.71	0.14	0.20	0.03	1.35
Log(1+BIG)	300	0.32	0.54	1.68	0.00	2.95

Table 6

REGION REGRESSION RESULTS– ALL SECTORS

Dependent Variable: Log(1+FDI/Value added)
Tobit Model – Maximum Likelihood Estimates

Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Log(1+SPECIALIZATION)	0.72*** (0.28)						1.02** (0.42)	0.82** (0.33)	
Log(DENSITY)		0.31** (0.16)							0.34* (0.19)
Log(DENSITY_OTHERS)			-2.51 (2.20)				2.44 (2.94)		
Log(DIVERSITY)				0.99 (1.59)				-0.51 (1.68)	-0.17 (1.69)
Log(1+SMALL)					-0.36 (0.57)		0.65 (0.70)	0.55 (0.68)	0.39 (0.69)
Log(1+BIG)						0.17 (0.16)	0.11 (0.18)	0.12 (0.18)	0.12 (0.18)
Log Likelihood	-443.2	-444.6	-445.9	-446.3	-446.3	-445.9	-442.4	-442.7	-444.3
Left censored observations	48	48	48	48	48	48	48	48	48
Number of observations	300	300	300	300	300	300	300	300	300

Standard errors in brackets. *, **, *** indicate significance at 10, 5 and 1 per cent, respectively. All the estimates include regional and sectoral dummies.

Table 7

REGION REGRESSION RESULTS –INDUSTRIAL SECTORS (1)

Dependent Variable: Log(1+FDI/Value added)
Tobit Model – Maximum Likelihood Estimates

Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Log(1+SPECIALIZATION)	0.67** (0.34)						1.72*** (0.59)	2.49*** (.79)	
Log(DENSITY)		0.28 (0.20)							1.15** (0.53)
Log(DENSITY_OTHERS)			-0.76 (4.10)				13.71** (6.29)		
Log(DIVERSITY)				2.89 (4.42)				-24.15** (9.51)	-19.55* (11.05)
Log(1+SMALL)					-0.22 (0.67)		1.16 (0.84)	1.10 (0.83)	0.98 (0.86)
Log(1+BIG)						0.22 (0.20)	0.20 (0.23)	0.23 (023)	0.21 (0.23)
Log Likelihood	-299.4	-300.4	-301.4	-301.2	-301.3	-300.8	-296.4	-295.6	-298.3
Left censored observations	42	42	42	42	42	42	42	42	42
Number of observations	200	200	200	200	200	200	200	200	200

(1) Manufacturing + energetic products. Standard errors in brackets. *, **, *** indicate significance at 10, 5 and 1 per cent, respectively. All the estimates include regional and sectoral dummies.

Table 8

PROVINCE REGRESSION RESULTS

All sectors– OLS estimates with regional dummies
Dependent variable: Log(FDI/Value added)

Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Log(DENSITY)	0.71*** (0.17)					0.63*** (0.20)	0.71*** (0.21)
Log(DIVERSITY)		-1.47 (0.94)				0.09 (0.85)	-0.38 (0.89)
Log(1+SMALL)			-13.13*** (4.13)			-7.55 (4.82)	
Log(1+BIG)				0.57 (0.35)			0.20 (0.38)
Log(INFRASTRUCTURES)					1.37** (0.59)	-0.48 (0.69)	-0.11 (0.75)
Regional dummies	yes	yes	yes	yes	yes	yes	yes
R2	0.69	0.62	0.66	0.62	0.64	0.68	0.68
Number of observations	95	95	95	95	95	95	95

White-Standard errors in brackets. *, **, *** indicate significance at 10, 5 and 1 per cent, respectively.

Table 9

PROVINCE REGRESSION RESULTS

All sectors– IV estimates with regional dummies
Dependent variable: Log(FDI/Value added)

Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Log(DENSITY)	0.61*** (0.21)					0.73*** (0.24)	0.78*** (0.25)
Log(DIVERSITY)		-1.02 (0.99)				0.08 (0.96)	-0.09 (1.06)
Log(1+SMALL)			-11.32** (4.77)			-5.16 (4.98)	0.13 (0.45)
Log(1+BIG)				0.45 (0.32)			
Log(INFRASTRUCTURES)					0.87 (0.89)	-1.17 (1.11)	-1.13 (1.03)
Log(IDEVAG_SPATIAL LAG.)	-1.31 (1.22)	-1.42 (1.31)	-0.62 (1.16)	-1.08 (1.15)	-1.05 (1.47)	-1.48 (1.68)	-1.70 (1.57)
Regional dummies	yes	yes	yes	yes	yes	yes	yes
R2	0.64	0.56	0.66	0.61	0.62	0.61	0.56
Number of observations	95	95	95	95	95	95	95

White-Standard errors in brackets. *, **, *** indicate significance at 10, 5 and 1 per cent, respectively.

Table 10

EXTENSIONS: GEOGRAPHICAL AREA AND FIRM SIZE

Region regression results - All sectors
Dependent variable: Log(1+FDI/Value added)
Tobit model – ML estimates

Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)
Log(1+SPEC)				0.82** (0.33)		1.07** (0.41)
Log(DENSITY)					0.34* (0.19)	
Log(DENSITY_OTHERS)						2.97 (2.92)
Log(DIVERSITY)				-0.52 (1.65)	-0.16 (1.66)	
NORTH-WEST*Log(1+SMALL)	-1.09 (1.15)		-1.67 (1.24)	-0.92 (1.27)	-1.03 (1.28)	-0.86 (1.27)
NORTH-EAST* Log(1+SMALL)	0.05 (1.58)		0.58 (1.60)	1.18 (1.60)	1.02 (1.61)	1.38 (1.61)
CENTER* Log(1+SMALL)	1.69 (1.27)		1.59 (1.39)	2.41* (1.42)	2.20 (1.43)	2.63* (1.44)
SOUTH* Log(1+SMALL)	-1.03 (0.87)		-0.07 (0.97)	0.55 (1.01)	0.38 (1.01)	0.62 (1.01)
NORTH-WEST *Log(1+BIG)		-0.30 (0.31)	-0.47 (0.33)	-0.52 (0.33)	-0.51 (0.33)	-0.55 (0.33)
NORTH-EAST * Log(1+BIG)		0.66 (0.45)	0.68 (0.46)	0.54 (0.46)	0.57 (0.46)	0.57 (0.46)
CENTER * Log(1+BIG)		-0.22 (0.31)	-0.05 (0.34)	-0.06 (0.34)	-0.07 (0.34)	-0.04 (0.34)
SOUTH * Log(1+BIG)		0.60** (0.25)	0.59** (0.28)	0.57** (0.28)	0.57** (0.29)	0.55* (0.28)
Log Likelihood	-444.5	-442.0	-440.4	-437.1	-438.7	-436.6
Left censored observations	48	48	48	48	48	48
Number of observations	300	300	300	300	300	300

Standard errors in brackets. *, **, *** indicate significance at 10, 5 and 1 per cent, respectively. All the estimates include regional and sectoral dummies. North-West, North-East, Centre and South are dummies equal to one if the region belongs to the corresponding area.

Table 11

EXTENSIONS: GEOGRAPHICAL AREA AND DIVERSITY

Region regression results - All sectors
Dependent variable: Log(1+FDI/Value added)
Tobit model – ML estimates

Explanatory Variables	(1)	(2)	(3)
Log(1+SPEC)		0.88*** (0.33)	
Log(DENSITY)			0.37* (0.19)
Log(1+SMALL)		0.54 (0.68)	0.40 (0.69)
Log(1+BIG)		0.11 (0.17)	0.12 (0.18)
NORTH-WEST * Log(DIVERSITY)	-1.40 (3.35)	-4.21 (3.48)	-3.58 (3.48)
NORTH-EAST * Log(DIVERSITY)	-3.01 (3.61)	-3.66 (3.58)	-3.56 (3.60)
CENTER* Log(DIVERSITY)	-3.49 (4.01)	-5.65 (4.06)	-5.28 (4.08)
SOUTH* Log(DIVERSITY)	4.80** (2.29)	3.50 (2.32)	3.80 (2.32)
Log Likelihood	-443.6	-439.6	-441.2
Left censored observations	48	48	48
Number of observations	300	300	300

Standard errors in brackets. *, **, *** indicate significance at 10, 5 and 1 per cent, respectively. All the estimates include regional and sectoral dummies. North-West, North-East, Center and South are dummies equal to one if the region belongs to the corresponding area.

Table 12

EXTENSIONS: GEOGRAPHICAL AREA, SPECIALIZATION AND DENSITY

Region regression results - All sectors
Dependent variable: Log(1+FDI/Value added)
Tobit model – ML estimates

Explanatory Variables	(1)	(2)
Log(DIVERSITY)	-0.01	-0.34
	(1.68)	(1.66)
Log(1+SMALL)	0.33	0.39
	(0.69)	(0.68)
Log(1+BIG)	0.12	0.11
	(0.17)	(0.17)
NORTH-WEST * Log(1+SPEC)		1.24**
		(0.49)
NORTH-EAST * Log(1+SPEC)		0.57
		(0.77)
CENTRE* Log(1+SPEC)		-0.53
		(0.67)
SOUTH* Log(1+SPEC)		1.02**
		(0.45)
NORTH-WEST * Log(DENSITY)	0.49*	
	(0.29)	
NORTH-EAST * Log(DENSITY)	0.22	
	(0.44)	
CENTER* Log(DENSITY)	-0.28	
	(0.37)	
SOUTH* Log(DENSITY)	0.51*	
	(0.26)	
Log Likelihood	-442.34	-439.96
Left censored observations	48	48
Number of observations	300	300

Standard errors in brackets. *, **, *** indicate significance at 10, 5 and 1 per cent, respectively. All the estimates include regional and sectoral dummies. North-West, North-East, Centre and South are dummies equal to one if the region belongs to the corresponding area.

Table 13

ROBUSTNESS: REGION REGRESSION RESULTS – ALL SECTORS

Dependent Variable: Log(1+FDI/Value added)
Tobit Model – Maximum Likelihood Estimates

Explanatory Variables	Including the value added	Changing threshold for Small	Changing threshold for Big	No Lombardy	No Piedmont	No Lazio	No financial services	No metal products
Log(1+SPEC)	2.35***	0.90***	0.82**	0.87**	0.79**	0.92***	0.81**	0.76**
	(0.52)	(0.33)	(0.32)	(0.35)	(0.34)	(0.34)	(0.32)	(0.33)
Log(DIVERSITY)	-0.38	-0.49	-0.59	-0.42	-0.02	-0.65	-0.23	-0.37
	(1.64)	(1.67)	(1.69)	(1.78)	(1.76)	(1.69)	(1.63)	(1.67)
Log(1+SMALL)	0.49		0.62	0.64	0.48	0.63	0.58	0.80
	(0.66)		(0.72)	(0.71)	(0.71)	(0.70)	(0.66)	(0.68)
Log(1+BIG)	0.12	0.13		0.12	0.08	0.19	0.08	0.19
	(0.17)	(0.17)		(0.18)	(0.19)	(0.19)	(0.17)	(0.18)
Log(VALUE ADDED)	-0.89***							
	(0.23)							
Log(1+SMALL_50)		0.82						
		(0.63)						
Log(1+BIG_500)			0.16					
			(0.22)					
Log Likelihood	-436.45	-442.21	-442.69	-423.97	-422.88	-418.78	-403.40	-410.20
Left censored observations	48	48	48	48	48	48	47	46
Number of observations	300	300	300	285	285	285	280	280

Standard errors in brackets. *, **, *** indicate significance at 10, 5 and 1 per cent, respectively. All the estimates include regional and sectoral dummies. *Small_50* and *Big_500* are calculated with the share of firms below 50 employees and above 500 respectively.

Table 14

ROBUSTNESS: REGION REGRESSION RESULTS –INDUSTRIAL SECTORS (1)

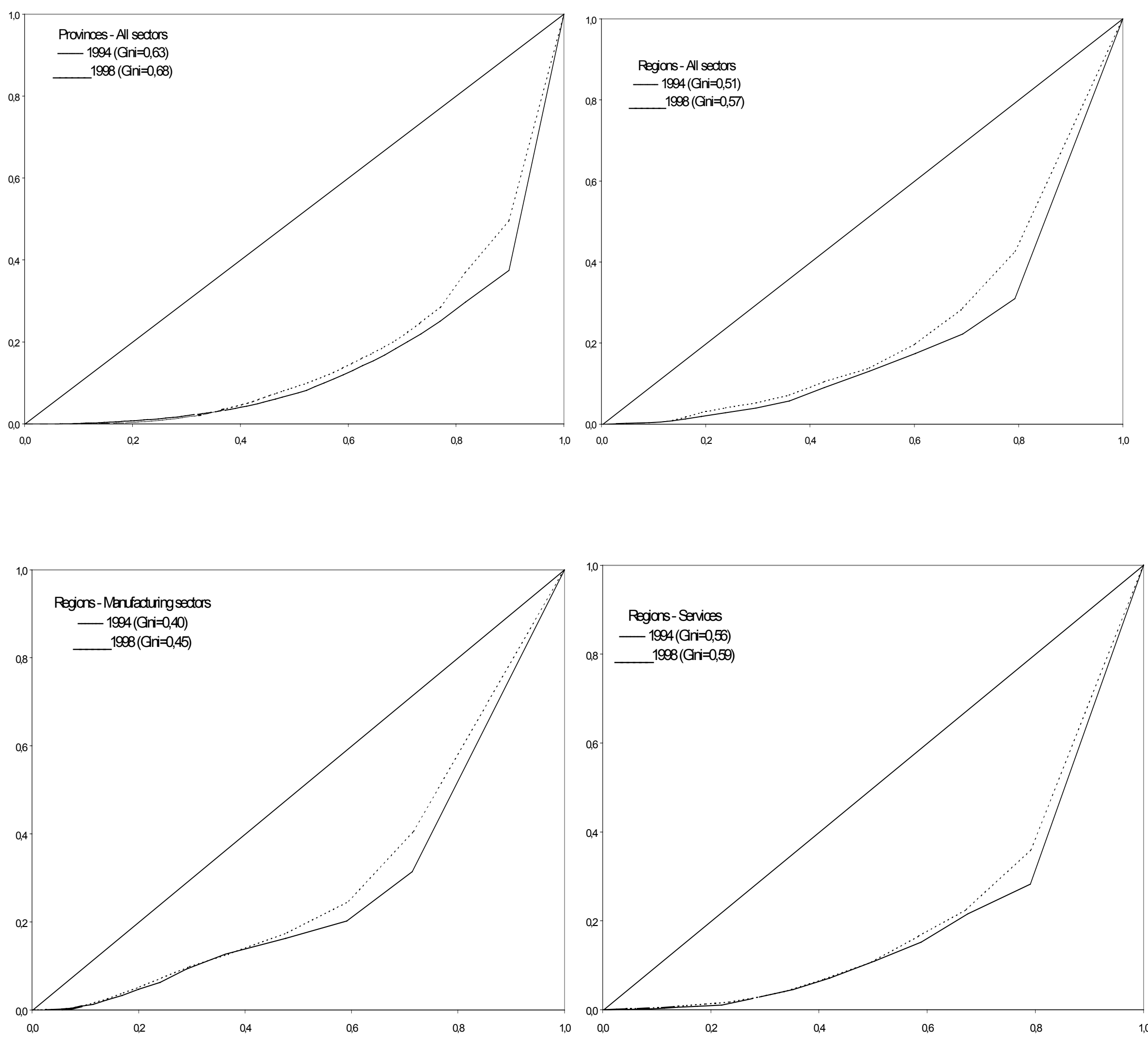
Dependent Variable: Log(1+FDI/Value added)
Tobit Model – Maximum Likelihood Estimates

Explanatory Variables	Including value added	Including foreign firms' workers	Changing threshold for Small	Changing threshold for Big	No Lombardy	No Piedmont	No Lazio	No metal products
Log(1+SPECIALIZ)	3.83***	2.19***	2.63***	2.54***	2.70***	2.53***	2.97***	2.51***
	(0.87)	(0.78)	(0.79)	(0.79)	(0.85)	(0.85)	(0.84)	(0.83)
Log(DIVERSITY)	-21.11**	-22.53**	-24.93***	-25.19***	-25.66**	-24.67**	-28.99***	-25.08**
	(9.21)	(9.41)	(9.47)	(9.60)	(10.06)	(10.37)	(10.06)	(10.20)
Log(1+SMALL)	0.95	1.14		1.31	1.26	1.09	1.09	1.55*
	(0.80)	(0.81)		(0.88)	(0.87)	(0.87)	(0.84)	(0.83)
Log(1+BIG)	0.25	0.19	0.23		0.22	0.18	0.30	0.35
	(0.21)	(0.22)	(0.22)		(0.23)	(0.24)	(0.24)	(0.23)
Log(VALUE ADDED)	-0.93***							
	(0.27)							
Log(1+FOREIGN FIRMS' WORKERS)		0.10*						
		(0.05)						
Log(1+SMALL_50)			1.27*					
			(0.75)					
Log(1+BIG_500)				0.36				
				(0.30)				
Log Likelihood	-290.05	-293.66	-295.02	-295.36	-281.87	-282.66	-278.20	-261.95
Left censored observations	42	42	42	42	42	42	42	40
Number of observations	200	200	200	200	190	190	190	180

(1) Manufacturing + energy products. Standard errors in brackets. *, **, *** indicate significance at 10, 5 and 1 per cent, respectively. All the estimates include regional and sectoral dummies. *Small_50* and *Big_500* are calculated with the share of firms below 50 employees and above 500 respectively. *Foreign firms' workers* are the number of employees in the foreign firms or domestic firms participated by foreign firms.

Fig. 1

FDI CONCENTRATION ACROSS PROVINCES E REGIONS: LORENZ CURVES
(calculated over the share of value added)



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