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Conference Paper

Foreign Direct Investment and Agglomeration: Evidence from Italy

44th Congress of the European Regional Science Association: "Regions and Fiscal Federalism", 25th - 29th August 2004, Porto, Portugal

Provided in Cooperation with:

European Regional Science Association (ERSA)

Suggested Citation: Bronzini, Raffaello (2004) : Foreign Direct Investment and Agglomeration: Evidence from Italy, 44th Congress of the European Regional Science Association: "Regions and Fiscal Federalism", 25th - 29th August 2004, Porto, Portugal, European Regional Science Association (ERSA), Louvain-la-Neuve

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FOREIGN DIRECT INVESTMENT AND AGGLOMERATION: EVIDENCE FROM ITALY

by Raffaello Bronzini*

Abstract

A number of empirical works have analyzed the effect of agglomeration on multinational investment verifying whether the agglomerated areas attract foreign direct investment inflows. Despite the large amount of studies, there has been no systematic attempts to disentangle whether FDI are drawn by the concentration of firms within the same sector (specialization) or within different sectors (diversity). Furthermore, the question whether firms' size of the host area influences multinational investment is still unanswered. This paper provides an empirical evidence on the role of agglomeration economies in attracting foreign direct investments within Italian regions and provinces, distinguishing between specialization and diversity externalities, and on the role of firms' size in affecting 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 a strong evidence that specialized geographic areas attract FDI, whereas diversified areas draw FDI only for industrial sectors; finally there is little evidence that firm size has an impact on FDI, if anything, only big firms in Southern regions would seem to affect positively foreign investor decisions.

JEL classification: F21, R12, R30.

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

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1. Introduction¹

In the last years many empirical studies analyzed the effect of agglomeration economies on multinational investment verifying whether the agglomerated areas attract foreign direct investment (FDI) inflows². Although the empirical literature encompasses a large body of studies, up to now certain aspects of the link between agglomeration and the inflows of FDI have still been neglected. For example, to our knowledge there has not been a systematic assessment of the role of intra-industry and inter-industry externalities on FDI. In other words, whether FDI are attracted to some areas thanks to the agglomeration of firms producing similar goods or, on the contrary, thanks to the concentration of firms producing different goods and services. In the first case, foreign investors would be attracted 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 arise from the variety of industries within a geographic region being able to activate inter-industry knowledge spillovers and diversification economies (Jacobs, 1969).

A further aspect unexplored by the empirical analysis is whether the firms' 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 rapidly innovate or adopt new technology (Porter, 1990; Pyke et al., 1990). Along these lines, we expect that markets based on small firms can be conducive to productivity growth and consequently can draw foreign investors. On the other hand, several considerations can induce to believe that big firms are important to attract foreign investments. For example, foreign investors can be interested in acquiring large firms to rapidly expand their market shares. In addition, others argue that the location of big firms in some areas can stimulate FDI in the same areas since it favors forward and backward linkages or because, in a context of imperfect information, it signals the efficiency of the area (Mariotti and Piscitello, 1995;

¹ I thank [...]. The views expressed in the paper are personal and do not represent those of the Bank of Italy.

Ó Hualláchain et al., 1997; Wei et al. 1999). These aspects are particularly relevant to the Italian economy given the scarcity of big firms and, on the opposite, 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 on the role of the 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 sectoral specialized or sectoral diversified areas. In addition, the aim is also to contribute to understanding if the firms' size of the host area affects foreign investor choices.

To understand which type of economic structure is preferred by the international investors is more than an academic question. In order to implement the appropriate intervention, the policy-makers would like to know what are the forces driving inward FDI. In this respect, the analysis turns out to be particularly important to the Italian economy in that it is characterized by strong territorial inequalities.

The location theories argue that both domestic and foreign firms are located in the regions with more favorable factor endowments, thus the correlation between the incumbent firms and the foreign investment can 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 paid special attention 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 respects³. 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 the firms' size in affecting foreign investment. Second, this work is based on a new data base on FDI collected

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).

³ Previous works on Italian territorial data have been carried out by Mariotti and Piscitello (1994) and Basile (2001).

by Italian Foreign Exchange Office (Ufficio Italiano Cambi) for the Italian regions and provinces. For the regions data 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) could suggest that the 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 could be interested in investing within the areas endowed with substantial service industries, in order to benefit from a large and differentiated supply of inputs; thus a comprehensive analysis on agglomeration externalities should include services in the investigation.

The paper is organized as follows. In the next section we will briefly review the theoretical and empirical literature on agglomeration and FDI. In the third section, the FDI geographical distribution will be explored through a descriptive analysis. The fourth section will be devoted to discussing the empirical model. The results of the estimates and some extensions of the benchmark model will be 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, labor-pooling, and inputs sharing. The first source is based on the idea

that physical proximity would facilitate the transmission of knowledge among firms and workers. The flow of ideas and the knowledge of new technologies would spread out more rapidly across firms that are concentrated in specialized areas, thanks to the informal contacts and the mobility of workers across firms, consequently the growth of firms' productivity within these areas should be more rapid⁴. A second source evoked by the literature is related to the formation of specialized local labor markets. In this view, the firms of the same industry would be attracted to the areas where skilled workers are available in large number, in order to avoid labor shortage or bottlenecks. At the same time workers are attracted by firms' agglomeration in order to reduce the likelihood of remaining without work. Other things being equal, this mechanism would reduce the risk premium embodied in wage, increasing the supply of specialized workers and advantaging the firms that pay a lower wage. Finally, as 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 has emphasized further types of positive externalities stemming from agglomeration that, unlike MAR economies, regard firms belonging to different industries located within a common area. This type 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 the overall industrial variety and scale, rather than the specialization in one industry, that boosts the economic growth through the cross fertilization of ideas and the transmission of the 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 geographic area may affect productivity growth and consequently encourage FDI. On one hand some argue that local productive markets based on small firms experience rapid growth because local

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

competition encourages firms to innovate or rapidly adopt new technologies (Porter, 1990). Similarly, the literature on industrial district highlighted the efficiency gains of local productive systems based on small enterprises, mentioning the benefits of higher division of labor and the competition-collaboration relationships amongst small firms. In such a type of structure the flow of ideas will be rapid and likewise 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 can motivate foreign enterprises to invest within areas populated by big firms. For example, if foreign firms made cross border investment to expand their market shares or to acquire specific assets, as production technology or marketing know-how, they would be interested in the acquisition of big firms, which both may ensure larger market shares and possess larger stock of knowledge as compared with small enterprises. Moreover, some argue that big firms are particularly capable to activate forward and backward linkages, thus foreign suppliers of facilities can have interest in locating nearby large domestic enterprises to minimize transaction costs (Ó Hualláchain and Reid, 1997). Finally, others pointed out that foreign firms lack of information on domestic market, thus the presence of big firms may signal the efficiency of a particular area and consequently may attract investments from abroad (Mariotti and Piscitello, 1995; Wei et al. 1999). Whether small or big firms draw FDI inflows is a question that requires an empirical answer.

Some empirical evidence on 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).

2.2 The empirical literature on agglomeration and FDI

The theory on location choice suggests that foreign investment will be directed towards the countries or regions ensuring larger profits. Thus, in the empirical literature the FDI inflows are assumed as function of a set of host country or regional characteristics able

to affect either the revenues generated or costs incurred by firms⁵. Since agglomeration can generate positive externalities on firms, the empirical literature has verified whether agglomeration attracts FDI⁶. On the whole, the results display a positive effect of agglomeration economies within the geographic areas examined which, in the cited studies, vary from large areas like national countries or USA States to the smaller sub-national regions. Although a number of empirical works focused on agglomeration and FDI, the role played by diversity economies and firm size on FDI inflows has been largely neglected, thus the question whether foreign investors are attracted within diversified areas or where small or big firms prevail remains unanswered.

As regards the empirical analysis on 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 only sometimes sector specific. Among the works that use non-industry specific variables, we recall Coughlin et al. (1991) and Wei et al. (1999) that use proxies for density, respectively approximated by the manufacturing employment, or population, to land area ratio. Others consider the weight of 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) the degree of industrialization, in turn measured by the weight of manufacturing sector as percent of GDP. Other similar proxies for agglomeration include infrastructures endowments and FDI previously accumulated (e.g. Wheeler and Mody, 1992). On the other hand, certain studies consider explicit industry specific proxies for agglomeration more strictly related to the so-called MAR externalities. More specifically, Braunerhjelm and Svensson (1996) employ a sectoral specialization index, given by the ratio of sectoral employees to total manufacturing employees, while Head et al. (1994, 1995) the number of foreign plants already located in the area belonging to the same sector and country of origin.

⁵ 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.

⁶ 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).

A second consideration regards how the empirical works disentangle the effect of agglomeration from the effect of the geographic distribution of productive factor endowment. As Head et al. (1995) insightfully pointed out, both domestic firms and foreign investors may be attracted to the regions with more favorable factors' endowment. Therefore, the 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 of 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 of the shipping industry. For this reason the endowment effect could be conducive to spurious results on agglomeration effect.

In order to overcome such a 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 proxy for agglomeration. They argue that the geographic distribution of the 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 geographic fixed effects to control for unobserved characteristics related to industries and geographic areas. In our paper we carefully deal with this issue by an opportune standardization of the dependent variable.

3. The data

Before starting with the econometric analysis, we present the FDI data employed in this paper as well as some stylized facts about the geographic pattern of FDI in Italy. The data measure the gross foreign direct investment inflows, by each region and province, used to compile the balance of payment⁷. The data span the period between 1994 and the first

⁷ The 20 Italian regions correspond to Nuts 2-regions of Eurostat classification (*Groups of counties* in the UK and *Régions* in France). The 95 Italian provinces correspond to Nuts 3-regions of Eurostat classification (*Counties* in the UK and *Départements* in France).

semester 2000 and are compiled by the Italian Foreign Exchange Office (Ufficio Italiano Cambi)⁸. An initial characteristic emerging from our data is the elevated territorial concentration of FDI. The first three regions (Piemonte, Lombardia, Lazio) account for about 60% of the national stock accumulated during the period (Tab. 1). This result can 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 that absorb, as a whole, over half of the total FDI.

Of course, these results might depend on the economic size of the regions, or provinces, thus a more appropriate measure of FDI concentration must be one that rules out the size effect of the geographic area. For this reason, we compared the regional and provincial FDI concentration with the corresponding value added concentration. The exercise is carried out by Lorenz curves and Gini indexes computed for regional and provincial FDI, and reported in Figure 1. The FDI seem cluster in space even if we control for the 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-sectors provincial FDI. The higher spatial concentration at provincial level can be due to the strong attractive power of metropolitan areas. The hypothesis is supported by the FDI concentration in services that appears higher than in manufacturing: the Gini indexes were 0.59 and 0.45 respectively. Finally, the territorial disparities seems to be rising over time: from 1994 to 1998 all the Gini indexes show a small increase.

As a further step of the descriptive analysis, we investigate the influence of the space on the attraction of FDI by running spatial autocorrelation test. The purpose of the verification is to capture if 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 a competitiveness among near provinces, for which the investments assume dissimilar values. In order to test for spatial autocorrelation, it is necessary first to measure the geographical distance among provinces by the spatial weight matrix, of which the generic element w_{ij} represents a measure of the distance between

⁸ More information on the FDI data can be found in appendix.

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 inverse of the kilometric distances between each pairs of provinces. In the following, in order to test for the spatial autocorrelation we run the Moran I test using the two matrices described above⁹. The verification will be 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 the provincial FDI: the spatial autocorrelation is positive and statistically significant with both contiguity and distance matrices; similar conclusions are derived by breaking down the foreign investments by countries of origins. However, the phenomenon involves the southern provinces, but not those of the Center-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 Center-North.

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

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

⁹ 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, n. 1-2 (1997). The test of Moran I is carried out under the hypothesis of normality of the statistic Z .

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

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

$$FDI_{i,j} = y_{i,j}^* \quad \text{if } y_{i,j}^* > 0$$

$$= 0 \quad \text{if } y_{i,j}^* \leq 0$$

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; $i=1, \dots, 20$ and $j=1, \dots, 15$ 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 dummies¹⁰.

¹⁰ 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 $N \rightarrow \infty$ (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, going to infinity, and it is not possible to change the model in order to

The dependent variable of the econometric model is the 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 present an elevated time variability. For region i and sector j the FDI intensity is measured as:

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

The motivation for using such ratio as dependent variable is that it controls for the effect of productive factors' endowment. Head et al. (1995) argued that regions with favorable factor endowment will attract domestic as well as foreign investors. As a result the correlation between domestic firms and foreign investment, due to this endowment effect, can be confused with the effect of agglomeration economies and a model testing for agglomeration without controls for endowment may lead to spurious results on agglomeration effect. Head et al. suggest introducing proxies for the geographical distribution of inputs as 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 factors' endowment, consequently the value added will be larger in the regions with more favorable 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 restrict the coefficient of the value added to one in a log-linear regression model of FDI on value added.

rule out the fixed effect, as in linear models. For the Tobit model with fixed effects, Honoré (1992) proposes a semi parametric estimator 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 $N \geq 200$. Besides, the results of Heckman (1981) suggest not overestimating the bias of the ML estimates of the Tobit model with additive dummies that control for the fixed effects. Indeed he shows, through 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 bigger 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 big. 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 ML method.

If the “true” coefficient were greater than 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 misspecification¹¹.

In the model the FDI-intensity also permits taking account of the correlation between foreign investment and location of domestic firms due to investment by acquisitions. In the data we cannot distinguish between greenfield investment and acquisitions: we expect the acquisition of domestic firms will follow the geographic pattern of incumbent firms, thus through dividing FDI by the value added we also control for acquisitions as well as for endowment effect¹².

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

(1)

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

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 the average firms' 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 the industry employment (see Glaeser et al. 1992):

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

¹¹ See below the section dedicated to robustness checks.

¹² Mariotti and Piscitello (1994) use a similar dependent variable for the same reason. The FDI intensity allows also to take account of all omitted factors that attract both foreign and domestic investors, e.g. labor costs.

where $IS = (N_{i,j} / \sum_j N_{i,j}) / (N_{National,j} / \sum_j N_{National,j})$; and $N_{i,j}$ is the 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).

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 geographic scope of agglomeration economies. More specifically, following Ciccone and Hall (1996) who claimed that density is important to foster technological spillovers on the ground that spatial density enhances the transmission of ideas, we include a proxy for sectoral density:

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

where $Land$ denotes the surface of the region. The index will be greater than one if in region i the activity j is denser than the national average. We expect that both variables related to MAR economies will 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) pointed out, inter-sectoral knowledge spillovers may strengthen firm productivity, therefore industrially diversified regions could attract foreign investors. However, knowledge spillovers are not the unique source of agglomeration economies related to the sectoral diversity. For example, FDI can be attracted by sectorally diversified areas because the geographic concentration of firms producing different goods and services can reduce the transaction costs and thus expand profits of foreign investors located within the same area. Our econometric model is unable to distinguish between the two sources of externalities, rather 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 $Herfindahl_{i,j} = \sum_{j^* \neq j} s_{i,j^*}^2$; $s_{i,j^*}^2 = (N_{i,j^*}) / \sum_{j^* \neq j} (N_{i,j^*})$ and $j^* = 1, \dots, 15$.

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

In order to deepen the 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; such a 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 the firms' size of the host area can affect inward FDI. We employ two different explanatory variables to test for firm size effect on FDI inflows:

$$Small = (\text{Share of workers employed in small firms relative to the national share})_{i,j};$$

$$Big = (\text{Share of workers employed in big firms relative to the national share})_{i,j};$$

where small firms are those with less than 200 employees and big firms are those with more than 1,000 employees¹³.

4.2 The model for provinces

The provincial model differs from the regional one in three respect. 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 together manufacturing and

¹³ In the robustness check we employ also different threshold values. See appendix for the sources of the data.

services. Second, the provincial endowment of infrastructures is used as additional explanatory variable. A number of empirical works demonstrated that infrastructures are able to attract foreign investment, being able to reduce production and transportation costs (Coughlin, 1991; Wheeler et al., 1992; Wei et al., 1999; Basile, 2001). In the regional model the fixed effects capture the role played by infrastructures as well as any other regional omitted variable. If we did not incorporate infrastructures, the provincial model could suffer from misspecification because of omitted variable; thus we added a measure of infrastructures 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 for capturing spatial dependence and avoiding misspecification due to spatial autocorrelation. Since spatially lagged dependent variables are endogenous (Anselin, 1988), the model is estimated by instrumental variable using as instrument the spatially lagged infrastructures¹⁴.

The model estimated for provinces is the following:

(2)

$$(FDIVAD)_i = \alpha_1(FDIVAD_Spatially\ Lagged)_i + \alpha_2(Density)_i + \alpha_3(Diversity)_i + \alpha_4(Small)_i + \alpha_5(Big)_i + \alpha_6(Infrastructures)_i + \alpha_h(Regional\ fixed\ effects)$$

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

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

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 the all sectors:

¹⁴ Anselin (1988) suggests using as instruments for spatially lagged dependent variable some explanatory variables of the model spatially lagged. Infrastructures spatially lagged seemed to us the appropriate instrument given that they are strongly correlated with FDI spatially lagged, with coefficient equal to 0.78.

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

where $Herfindahl_i = \sum_j s_{2i,j}^2$; $s_{2i,j} = (N_{i,j}) / \sum_j (N_{i,j})$ and $j=1, \dots, 15$ are the same industrial and services sectors of the regional model¹⁵.

5. Results

5.1 Regional results

The models have been estimated in log-linear form. Since some variables were not strictly positive, to allow the logarithmic transformation we added a unit constant to these variables: namely, to the dependent variable of the regional model that sometimes was equal to zero and to some explanatory variables¹⁶. Table 5 gives some 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 significant¹⁷. 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 of the same sector. On the contrary, there is no statistical evidence of the influence of Jacobs externalities: neither density of the other sectors nor sectoral diversity are significant. Similar findings are drawn from firm size, that comes out non-significant to explain the geographic pattern of FDI.

¹⁵ More information on the data can be found in appendix.

¹⁶ The variables are *Specialization* that assumes negative values, *Big* that sometimes is zero, and *Small* that, even though it always is strictly positive, it has been transformed for uniformity with *Big*.

¹⁷ 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.

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 stronger in services than industrial sectors. To some extent, the evidences emerged from the descriptive section, by showing a larger geographic concentration in services, would support this view. Therefore, we have estimated the model only for the industrial sectors obtaining rather different results (Tab. 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 the whole economy within the industrial sectors Jacobs externalities seem to play a role. The coefficient 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 tests¹⁸. 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 industrial sector are straightforwardly interpretable: foreign investors are attracted to the 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 such a 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 big enterprises have influence on FDI location choices.

5.2 Provincial results

The provincial model has been estimated with regional dummies to control for geographic unobservable factors. Because of the high correlation between the proxies for

¹⁸ 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 have obtained qualitatively similar results. In addition, it does not depend on some particular

firm size, Small and Big are inserted one at a time. We present first the results without the dependent variable spatially lagged and then the IV estimates including it.

From Table 8 Density results strongly correlated with FDI geographic patterns showing that larger amounts of FDI are located in denser areas. Infrastructures are significant but only without the other regressor. A result that could depend on the correlation between infrastructures and density, which in turn shows that a denser area is also more endowed with infrastructures. Diversity and firm size would not seem to have an influence on location of foreign firms: in almost all the specifications the related coefficients come out 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 does not result significant in any model specifications. This results can be due to fact that regional dummies incorporate all the relevant information captured by 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 strongly significant from the estimates.

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 allowed the coefficients of firm size, diversity and specialization to change across four geographic areas - North-West, North-East, Center and South - by interacting the explanatory variables with geographic 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 the big firms in the South: in this case big firms would seem to have a positive role in attracting FDI within Southern regions. The result could be

region or sector. Similar results are obtained excluding Lombardy that over the period has absorbed almost half

interpreted in terms of the positive signal emanating from the location of big firms within these regions, which are in turn capable of improving the reputation of an area affected by several negative externalities. The second exception is represented by the MAR externalities that 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 the 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 we pointed out above, the model could be misspecified if the relation between FDI and value added, due to factor endowment, was non linear. Thus, we inserted the log of the value added in the baseline model and we obtained similar results for both the all-sector model (Tab. 13) and for industrial-sector one (Tab. 14). Next, as further robustness checks, we have changed the threshold values of firm size variables: from 200 to 50 workers for small firms and from 1,000 to 500 for big firms. In addition, since some regions, namely Lombardia, Piemonte and Lazio, and certain sectors, as finance services and metal products, attract the majority of the total FDI accumulated from 1994 to 2000, we have estimated the models without these regions or sectors. The results for all the sectors, reported in Table 13, and for the industrial sectors in Tab.14 remain qualitatively unchanged.

Finally, we carried out a further check for industrial sectors only. According to international methodology our data on FDI involve the initial transaction between domestic and foreign firms like the initial assets' acquisition, together with all subsequent capital transactions between them like the rise of participation share or the invested profits. The succeeding investment of incumbent foreign firms, located in a given region, could alter our results on agglomeration. If foreign firms accounted for a large share of the 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 inserted, as control variable, the number of workers in foreign firms

of the total FDI, or the energetic products that could have a different behavior from manufacturing sectors.

located within each region in the initial period by sector¹⁹. The employees of the foreign firms turned out to be positively correlated with the dependent variable, but its inclusion in the model did not modify the results previously obtained for the other variables (Tab. 14).

6. Concluding remarks

In this paper we have investigated the FDI inflows within the Italian regions and provinces over the period 1994-2000. From the descriptive analysis, inward foreign investments appear very territorially concentrated, particularly when we focus on provinces and services; geographically most FDI are located in the Center-North while in the Southern regions they are extremely low. 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 was aimed at capturing the role of the agglomeration economies and of the firms' size in attracting FDI inflows. In particular we tested for different types of agglomeration externalities, such as the MAR-externalities related to the sectoral specialization of a geographic area and the Jacobs-externalities linked to the sectoral diversity.

We find strong evidence that MAR-externalities influence foreign investors location choice: the more a region is specialized and dense, the more it attracts foreign investment within the same sector²⁰. 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, if anything, only big firms in Southern regions would seem to have a positive effect on foreign investors decisions.

¹⁹ 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 data base), are not available for services.

²⁰ This result is consistent with the evidence provided by Forni and Paba (2002) of stronger intra-industry than inter-industry technological spillovers

The empirical findings give support to the hypothesis that the 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 attractive power derives from the existence of technological spillovers among firms or from a local market of specialized workers or from both. Further investigations aiming at exploring these issues would represent a valuable contribution to the debate on the agglomeration externality and FDI²¹.

²¹ The paper of Barry et al. (2001) represents a first contribution towards this direction.

Appendix

Data description

The data on FDI are provided by the Italian Foreign Exchange Office (Ufficio Italiano Cambi). 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 all 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% of the domestic firm assets. At regional level FDI are broken down by 15 one-digit sectors: energetic products, ferrous production, non-ferrous production, chemical products, metallic products, transport equipment, food and beverage, textile and clothing, paper and printing, wood and other manufacturing products, construction, trade services, transports, finance, other private services. At provincial level data are not available by sector but only for the whole economy, including industry and services all 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. The index of the total infrastructures takes into account the availability of different kinds of productive infrastructures like roads, railways, telecommunication, ports, and airports. The index is standardized by the province dimension and it is provided by the Istituto Tagliacarne (1998), *La dotazione di infrastrutture nelle province italiane*.

Tables and figures

Tab. 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
Lombardia	44,6	1,5	216,5	19,0
Piemonte	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
Toscana	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
Sicilia	0,1	0,0	2,0	27,3
Sardegna	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).

Tab. 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	Milano	Lombardia	40,1	3,1	392,3
2	Roma	Lazio	7,5	0,7	93,2
3	Torino	Piemonte	7,3	1,2	155,4
4	Treviso	Veneto	2,6	1,3	157,4
5	Bergamo	Lombardia	1,3	0,6	73,2
6	Bologna	Emilia-Romagna	1,3	0,4	52,4
7	Genova	Liguria	1,2	0,5	62,2
8	Brescia	Lombardia	1,2	0,4	55,5
9	Ravenna	Emilia-Romagna	0,9	1,0	129,2
10	Como	Lombardia	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	Lombardia	0,7	0,4	45,5
14	Venezia	Veneto	0,6	0,3	38,9
15	Firenze	Toscana	0,5	0,2	25,6
16	Aosta	Valle d'Aosta	0,5	1,5	190,9
17	Padova	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	Piemonte	0,3	0,7	86,0
22	Cuneo	Piemonte	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	Toscana	0,2	0,3	31,6
28	Alessandria	Piemonte	0,2	0,2	25,2
29	Napoli	Campania	0,2	0,0	5,6
30	Latina	Lazio	0,2	0,2	23,3

(continues)

Tab. 2 (continues)

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	Lombardia	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	Lombardia	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	Toscana	0,1	0,2	20,3
40	Novara	Piemonte	0,1	0,1	15,8
41	Pisa	Toscana	0,1	0,1	13,1
42	Piacenza	Emilia-Romagna	0,1	0,1	15,9
43	Siena	Toscana	0,1	0,1	17,0
44	Perugia	Umbria	0,1	0,1	6,3
45	Biella	Piemonte	0,1	0,1	15,9
46	Palermo	Sicilia	0,1	0,0	4,3
47	Prato	Toscana	0,1	0,1	12,5
48	Sondrio	Lombardia	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

Tab. 3

**SPATIAL AUTOCORRELATION ACROSS PROVINCES:
FDI TO VALUE ADDED RATIO**

Area	N. of prov.	Moran I (w_{ij} =contiguity)	Test – Moran Z (w_{ij} =contiguity)	Moran I (w_{ij} =distance)	Test – Moran Z (w_{ij} = distance)
Center-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***
Extra EMU	103	0,15	2,48***	0,05	3,83***
Total	103	0,16	2,72***	0,06	4,37***

Notes: Moran I= $(n/S_o)\sum_i\sum_jw_{ij}(x_i-\mu)(x_j-\mu)/\sum_i(x_i-\mu)^2$. Where n=number of observations; $S_o=(\sum_i\sum_j w_{ij})$ is the weights' sum; $x=(\text{FDI/Value added})$; $i, j=\text{province}$; $\mu=\text{mean of } x$; $w_{ij}=\text{spatial weights}$. 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 e 1 per cent.

Tab. 4

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

	USA	Japan	UME	Extra UME
USA		0,65	0,80	0,60
Japan			0,46	0,29
EMU				0,65
Extra EMU				

(1) Calculated on provincial data.

Tab. 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

Tab. 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

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

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 (0.23)	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.

Tab. 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.

Tab. 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.

EXTENSIONS: GEOGRAPHIC 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, Center and South are dummies equal to one if the region belongs to the corresponding area.

EXTENSIONS: GEOGRAPHIC 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.

EXTENSIONS: GEOGRAPHIC 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 (1.68)	-0.34 (1.66)
Log(1+SMALL)	0.33 (0.69)	0.39 (0.68)
Log(1+BIG)	0.12 (0.17)	0.11 (0.17)
NORTH-WEST * Log(1+SPEC)		1.24** (0.49)
NORTH-EAST * Log(1+SPEC)		0.57 (0.77)
CENTER* 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, Center and South are dummies equal to one if the region belongs to the corresponding area.

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 Lombardia	No Piemonte	No Lazio	No finance services	No metal products
Log(1+SPECIALIZ)	2.35*** (0.52)	0.90*** (0.33)	0.82** (0.32)	0.87** (0.35)	0.79** (0.34)	0.92*** (0.34)	0.81** (0.32)	0.76** (0.33)
Log(DIVERSITY)	-0.38 (1.64)	-0.49 (1.67)	-0.59 (1.69)	-0.42 (1.78)	-0.02 (1.76)	-0.65 (1.69)	-0.23 (1.63)	-0.37 (1.67)
Log(1+SMALL)	0.49 (0.66)		0.62 (0.72)	0.64 (0.71)	0.48 (0.71)	0.63 (0.70)	0.58 (0.66)	0.80 (0.68)
Log(1+BIG)	0.12 (0.17)	0.13 (0.17)		0.12 (0.18)	0.08 (0.19)	0.19 (0.19)	0.08 (0.17)	0.19 (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.

ROBUSTNESS: REGION REGRESSION RESULTS –INDUSTRIAL SECTORS (1)

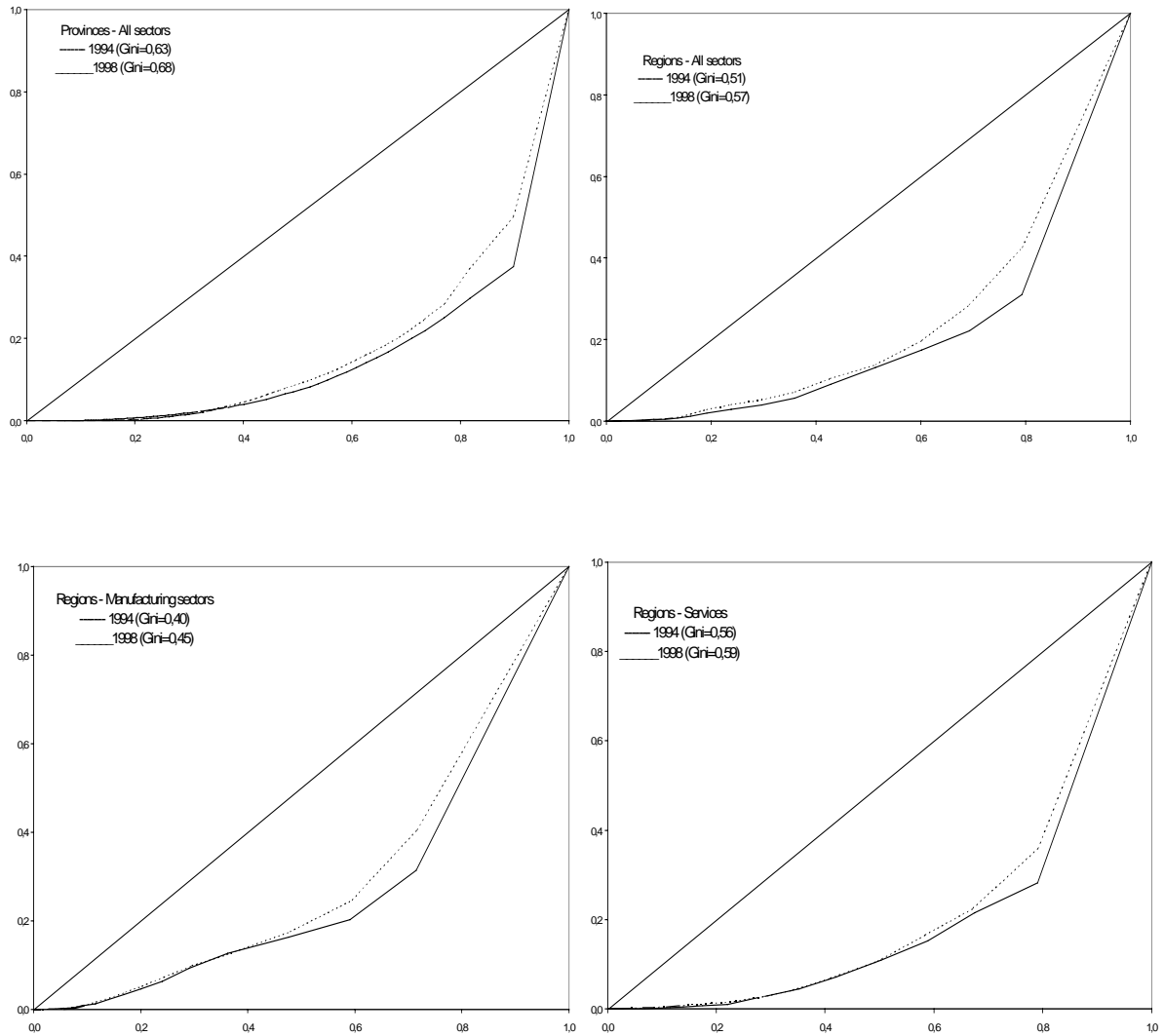
Dependent Variable: Log(1+FDI/Value added)
Tobit Model – Maximum Likelihood Estimates

Explanatory Variables	Including the value added	Including foreign firms' workers	Changing threshold for Small	Changing threshold for Big	No Lombardia	No Piemonte	No Lazio	No metal products
Log(1+SPECIALIZ)	3.83*** (0.87)	2.19*** (0.78)	2.63*** (0.79)	2.54*** (0.79)	2.70*** (0.85)	2.53*** (0.85)	2.97*** (0.84)	2.51*** (0.83)
Log(DIVERSITY)	-21.11** (9.21)	-22.53** (9.41)	-24.93*** (9.47)	-25.19*** (9.60)	-25.66** (10.06)	-24.67** (10.37)	-28.99*** (10.06)	-25.08** (10.20)
Log(1+SMALL)	0.95 (0.80)	1.14 (0.81)		1.31 (0.88)	1.26 (0.87)	1.09 (0.87)	1.09 (0.84)	1.55* (0.83)
Log(1+BIG)	0.25 (0.21)	0.19 (0.22)	0.23 (0.22)		0.22 (0.23)	0.18 (0.24)	0.30 (0.24)	0.35 (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 + energetic 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' employees* 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 the value added)



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