Knowledge spillovers and firm location: An analysis of Barcelona's 22@ district*

(Very preliminary version)

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Abstract:

The aim of this paper is to analyse location decisions of high technology firms inside an urban district specialised in knowledge related activities, known as 22@ in Barcelona. In order to explain which traits are really relevant to attract knowledge-based activities, we perform a multivariate regression analysis explaining intra-city firm location at the ZIP code level over the 2001-06 period. Data about new firms came from a recent 22@ business-census (2007) and contains detailed information about location determinants of those firms as well as firm characteristics. Additionally, we use data on firms located in the district in order to check three different questions: (i) which are the location amenities (including a host of attributes related to neighbourhood knowledge-spillovers) of the 22@ district as stated by different types of firms; (ii) whether the firms that place more value on these attributes are those that are disproportionately located in the 22@ district; and (iii) whether these firms tend to be more engaged in knowledge-transfer activities.

Keywords: industrial location, cities, knowledge spillovers, agglomeration economies
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1. Introduction

The aim of this paper is to analyse location decisions of high technology firms inside an urban district specialised in knowledge related activities, known as 22@ in Barcelona. This district has been widely transformed in recent years, both from a firm and urban point of view. Concretely, Barcelona's city council has designed a plan to develop a pole of high-tech activities in order to improve competitiveness of whole city and to generate an area specialised in such activities. This is why the project (and the area) is called 22@: while 22 refers to the city code of Poblenou district, @ refers to the technology orientation aimed to this area.

In order to explain which traits are really relevant to attract knowledge-based activities, we perform a multivariate regression analysis explaining intra-city firm location over the 2001-07 period. Data about new firms came from a recent 22@ business-census (2007) and contains detailed information about location determinants of those firms as well as firm characteristics. Additionally, we use data on firms located in the district in order to check three different questions: (i) which are the location amenities (including a host of attributes related to neighbourhood knowledge-spillovers) of the 22@ district as stated by different types of firms; (ii) whether the firms that place more value on these attributes are those that are disproportionately located in the 22@ district; and (iii) whether these firms tend to be more engaged in knowledge-transfer activities.

Nowadays, knowledge processes get benefit from the activities of other firms, public research centres and universities from all over the world (no matter where they are located) but, nevertheless, face-to-face interactions still are of great importance for firms and individuals (McCann and Simonen, 2005; Grabher and Stark, 1997). A very well known example of theses interactions is identified by the *milieu innovateur* (Aydalot, 1986), which represents the territorial area in which there are some interactions among firms and individuals that allow to learn from each other and from those interactions and also by sharing access to common resources. So this kind of spatial organisation is a great source of knowledge generation. As some scholars have shown (Audretsch and Feldman, 1996; Lundvall, 1993 and Storper, 1992) innovative capacity is shaped by firm access to knowledge sources, so knowledge intensive firms

will tend to locate close to those areas in order to benefit from such knowledge spillovers[1]. Of course, those knowledge flows are facilitated by the regional knowledge infrastructure (Black, 2006).

Obviously, this spatial proximity will depend on the knowledge characteristics (Breschi, 2000). If knowledge is (mainly) tacit, firms will tend to be spatially concentrated but if knowledge is (mainly) codified, there is no need for such concentration since it is possible to access this knowledge by non spatial ways (publications, licenses and so on). We assume that firms located in 22@ need to catch up this tacit knowledge in order to increase their innovation rate and, consequently, their productivity.

This paper contributes to the extant literature of firm location by analysing the specific case of firms inside an innovative spatial environment. Since it has been largely demonstrated that location determinants vary according to firm industry (due to differences in technology, products, production process and, among others, inputs and outputs requirements), it is important to perform this kind of detailed analysis. This type of analysis so relevant since high-tech activities are driving European economy and are expected to be main engines of growth in a nearby future, mainly for bigger metropolitan areas, like Barcelona. So, knowledge about location determinants of those activities is a key issue for major cities competitiveness.

The paper is organised as follows: in the second section we review empirical literature about location of high-tech firms and focus in 22@. In the third section we present survey's data and econometric methodology. In the fourth section we show and discuss main results about location determinants. Finally, fifth section concludes.

2. Location of high technology firms: the case of 22@

In recent years location patterns of new firms have been paid a considerable amount of efforts and attention by scholars. Those contributions have showed which the main

[1] See Glaeser et al. (1992) for an analysis of knowledge spillovers.

spatial characteristics that explain location decisions of new firms are[2]. This literature has also shown that there are some industry specificities on firm's location patterns that, usually, have been linked to technological level of the industry, rather to specific manufacturing activities. Therefore, location analyses that take into account differences in technological level of new entrants are so common. Among them, we do have those of Arauzo and Viladecans (2008) for Spanish metropolitan areas; Autant-Bernard et al. (2006) for French regions; Audretsch et al. (2005) for German cities; Egeln et al. (2004) for Germany; Cantwell and Piscitello (2002) for Italian, German and UK regions; Carrincazeaux et al. (2001) for French departments; Love and Roper (2001) for UK, German and Irish regions; Piergiovanni and Santarelli (2001) for French regions; Bade and Nerlinger (2000) for West-German districts; Bergeron et al. (1998) for the US; Licht and Nerlinger (1998) for German Laender and Galbraith (1985) for California.

Previous contributions allow summing up which kind of spatial environment do need those knowledge intensive firms. Firstly, location decisions of high-tech firms are clearly shaped by the spatial distribution of knowledge infrastructures (Audretsch et al., 2005; Carrincazeaux et al., 2001; Bade and Nerlinger, 2000) like universities, public and private R&D centres and technical colleges, among others. Nevertheless, there seem to be some particularities depending on public and private R&D institutions (Licht and Nerlinger, 1998) since the former have a positive influence over firm location decisions while the influence of the laters is not clear. Secondly, interactions between firms and public organisations are needed in order to develop a cluster of high-tech firms as well with the existence of highly diversified scientific capabilities. Those interactions are related not only for guarantee efficiency of those firms but also for attracting them to a specialised cluster, as Autant-Bernard et al (2006, p. 184) point out for the biotech system in France: "*Rather than the quantitative potential of public- and private-sector research in the region, it is the diversity of available scientific competencies and the capacity to develop public/private interactions that favour the establishment of biotech start-ups in the region*". Thirdly, when dealing with the specific case of spin-offs, Egeln et al. (2004) show that those firms not only locate close to their parent institution and that they seem clearly influenced by demand factors. The key issue for their final location is if they maintain close relations with their parent institution and if in this

[2] See Arauzo et al. (2008) for a detailed review of this empirical location literature.

institution there is a qualified technical staff. In these circumstances they will tend to locate close to this institution, but otherwise they will move away.

It is important to notice that most of previous high-tech requirements exist at 22@, so it appears to be an optimal location for high-tech firms. Obviously, there are other location requirements not directly related to knowledge infrastructures like accessibility, land prizes and public services, for instance.

3. Data and methodology

Our database comprises 128 firms located in 22@ district since 2001 until May 2007 (given the survey was carried out in May 2007, in this year results provide fewer firms than in previous years). Additionally, we will compare those "new" firms with incumbents firms in order to highlight a different firm profile before and after 22@ started.

Although formally 22@ project started in 2000, we assume that firms adjust their location decisions to public urban planning, so we have used data also for firms located there since 1995 for descriptive purposes[3]. Since 22@ was very well known some years before, it seems reasonable to consider that firms located in the area from 1995 were conscious of the urban and economic transformation that was being designed. Nevertheless, in some of our calculations we have differentiated our data in two groups of firms: those located from 1995 to 2000 and those located from 2001 to 2007.

Graph 1 shows entry of new firms during the whole period analysed (1995-2007). At first sight it seems clear that 22@ is a successful project since number of entries is increased year after year, mainly in more recent periods.[4]

[INSERT GRAPH 1 UPON HERE]

[3] Firms located between 1995 and 2000 are 73, while firms located between 2001 and 2007 are 128 (201 between 1995 and 2007).
[4] By early 2008, the governing body of 22@ estimates that about 21 firms (that included 6,200 jobs, approximately) were close to decide to locate at 22@.

Additionally, the industrial mix of 22@ is rapidly changing from a traditional manufactured-basis to a service-oriented one. This transformation is of great importance since 22@ has been more manufactured oriented than the whole city of Barcelona. Concretely, while manufactures weighted 26.6% in 1996, they were only 10.0% in Barcelona. Recent data from 2005 shows that, while manufactures in 22@ have diminished by 8 points until 18.1%, in Barcelona they have lost only 3 points (until 6.9%). Consequently, service activities have considerably increased in 22@ (from 71.2% to 80.1%) while they weight roughly the same in Barcelona (from 83.6% to 84.3%).

The quantitative analysis carried out here has two separate stages: in the first one there is a descriptive analysis that illustrates main characteristics of new firms located in 22@; and in the second stage, there is an econometric analysis that focus on how location factors are perceived by new firms according to their characteristics.

3.1 Descriptive analysis

We assume that new firms located in 22@ are more knowledge oriented than previous ones located in the same area (but before 22@ was designed and implemented), since technological patterns (in terms of skilled workers, industry, R&D activities, etc.) are increasing over time. So, we expect former incumbents firms to have lower technological intensity than new ones, even if we take into account that incumbents firms can shift to higher technological intensity. Data about R&D activities clearly show that firms located inside 22@ are increasing such activities. Concretely, while only 13.0% of firms located there during the eighties did R&D activities, during the nineties the percentage raised to 26.7% of firms and from 2000 the 43.2% of firms located there are engaged in R&D activities.

Table 1 shows a comparison of some firm characteristics (size, R&D, etc.) between firms that located there before 22@ started (initially only as a project) and before. Those results show that the entry of new firms at Poblenou area is (slowly) changing the profile of the whole quarter.

[INSERT TABLE 1 UPON HERE]

In Table 1 firms located in 22@ are divided into those being there before 1995 and those located there hereafter. Younger firms (e.g. those that located there knowing 22@ project) are bigger (both in m^2 and in employees), have a higher rate of high degree jobs, are more specialised in R&D industries and, consequently, spend more money on R&D activities.

Table 2 details situation since the project of 22@ was known. Concretely it shows main differences between firms located before the creation of 22@ project (roughly by 2000) and firms located when this was an ongoing project (before 2000). Main results indicate a (slightly) change of firm patterns located in 22@. Concretely, the number of firms entering in the second period is higher than firms entering in first period and, additionally, they are bigger in size (slightly in terms of workers but clearly in terms of land used), they are more engaged in R&D industries but, surprisingly, they employ a fewer percentage of skilled workers. This latter result could be a bit confusing but it is important to notice that the survey asked for "current" data about skill level of workforce, not about this data at the start-up period. We guess that once firms are well established they start to create mainly skilled jobs instead of non-skilled ones.

[INSERT TABLE 2 UPON HERE]

In any case, new firms located in 22@[5] create an important number of jobs and most of them belong to employees with a university degree.

One of the main questions of the survey was about determinants of location factors. Concretely, 201 firms were asked to rank several location factors according to their importance in their location decision process on a scale of 1 to 5, with '1' representing that the location factor was "not at all important" and '5' representing that the location factor was "very important".

[5] Data of Graph 2 is heavily influenced by the entry of Infra in 1997. This firm is a leading Information Technology firm and is the biggest one in 22@ (about 1,700 workers). Indra expected revenues for 2007 are more than 2 billion euros. Specifically Indra covers several areas: Defence and Security; Transport and Traffic; Energy and Industry; Telecom and Media; Finance and Insurance and Public Administration and Healthcare.

Among those factors we do have land availability, land prizes, physical distance to clients and suppliers, skill labour availability, physical distance to firms of the same industry, innovative environment, accessibility and public infrastructures, life quality and public services, among others. Table 3 shows how those location determinants were perceived by entering firms.

[INSERT TABLE 3 UPON HERE]

Previous results show how location decisions are mainly shaped by infrastructure accessibility and land availability and, in a lesser extent by knowledge of the environment, the existence of cheap land, the innovative environment, the quality of public services and the quality of life, while availability of skilled labour, proximity to suppliers and proximity to firms of the same industry are not strongly perceived by new firms as location determinants. But, of course, it is important to know also which the determinants of those locational preferences are.

3.2 Econometric analysis

Given the nature and characteristics of the data, the most appropriate modelisation seems to be an ordered logit model. The dependent variable is the rank given by firms to previously described location factors[6] and the independent variables are some characteristics of those firms that are hypothesized to explain the importance given to those location factors: whether the firm is a family business, R&D activities carried out by the firm, percentage of skilled workers, percentage of exports over sales and whether the firm cooperates on R&D activities.

In order to better understand the characteristics of the data set and the econometric methodology, it is of so importance to notice that individuals were only required to rank how each one of location factors provided in the interview contributed to their location decisions, but nothing was asked to compare among those location determinants and no

[6] According to previous section the location factors analysed were the following: Proximity to consumers, Proximity to suppliers, Availability of skilled labour, Proximity to firms of the same industry, Land availability, Innovative environment, Infrastructure accessibility, Quality of life, Public services, Residence of firm owner and Knowledge of the environment.

additional explanations of them was provided (so, it is possible that interviewed individuals could catch a different meaning of the location factor)[7].

Measuring influence of those location factors over real location decisions allows using an ordered logit model. This type of discrete choice models is a specific case of multinomial logit model in which dependent variable is allowed to have more than two possible outcomes. Concretely, the five measures of location importance of location factors are ordered scales where 1 < 2 < 3 < 4 < 5. In any case, it is important to notice that distances between adjacent ranks (e.g., between 2 and 3) are unknown.

Following Greene (1999), there is a latent variable model:

$$y^* = \beta' + \varepsilon$$

where y^* is the unobserved dependent variable, x is a vector of explanatory variables, β is an unknown parameter vector and ε is the error term (with a standard logistic distribution). Given that y^* is unobserved, it is possible to observe:

$$\begin{aligned} y &= 0 \quad if \quad y^* \leq 0 \\ y &= 1 \quad if \quad 0 < y^* \leq \mu_1 \\ y &= 2 \quad if \quad \mu_1 < y^* \leq \mu_2 \\ &\vdots \qquad\qquad \vdots \\ y &= J \quad if \quad \mu_{J-1} \leq y^* \end{aligned}$$

where y is the frequency of attendance, μ is the vector of unknown parameter estimated with the β vector and J is the number of categories. The ordered logit model allows to estimate parameter vectors for β and μ. It is important to notice that the estimated μ shows dividing lines between Y = 0 and 1 (μ_0), Y = 1 and 2 (μ_1), Y = 2 and 3 (μ_2) and so on.

[7] See Bertrand and Mullainathan (2001) and Senik (2005) for a detailed analysis of methodological problems linked with using subjective variables.

Here we will analyse how firms' perception about the importance of several location factors is shaped by firms' characteristics. Concretely we will analyse following location determinants: Proximity to consumers, Proximity to suppliers, Availability of skilled labour, Proximity to firms of the same industry, Land availability, Innovative environment, Infrastructure accessibility, Quality of life, Public services, Residence of firm owner and Knowledge of the environment.

4. Main results

Table 4 shows the maximum likelihood estimation results for the ordered logit model. Given that we guess that previous results could be biased by firm's industry, we have performed specific estimations both for high-tech firms (the so-called @ firms) and for non high-tech firms (non @ firms), according to Barcelona's city council definition of high-tech activities.

[INSERT TABLE 4 UPON HERE]

Table 4 shows that firm's characteristics that explain their rates for several location determinants differ according to their technological level. Concretely, two main results should be highlighted: firstly, for non @ firms, firm characteristics used in this survey are clearly more important on explaining rank given by firms to location factors than for @ firms; secondly, rank given to some location factors can be explained according to the firm's characteristics, while others are not possible to explain with this information.

In any case, previous results show that, generally speaking, firms' characteristics obtained by the survey help little to explain how firms rate their location determinants, no matter the location determinant or the technological level of the firm.

Among those characteristics, only being a family business, percentage of skilled workers, percentage of exports over sales, cooperation on R&D activities and, to a lesser extent, R&D activities, seem to have locational influence over entrepreneurs' preferences.

Location determinants better explained by previous firm's characteristics are Proximity to consumers, Proximity to suppliers, Availability of skilled labour, Public services, Residence of firm owner and Knowledge of the environment. Additionally, it's not clear if firm's characteristics influence rank given to the rest of location determinants (Proximity to firms of the same industry, Land availability, Innovative environment, Infrastructure accessibility and Quality of life).

As expected, firm's characteristics influence in a different way the location determinants analysed here. Concretely, family business and percentage of exports over sales have a positive influence, while R&D activities and percentage of skilled workers have a negative incidence over entrepreneur's preferences. Additionally, firm cooperation on R&D activities influences both positively and negatively location determinants.

5. Conclusions

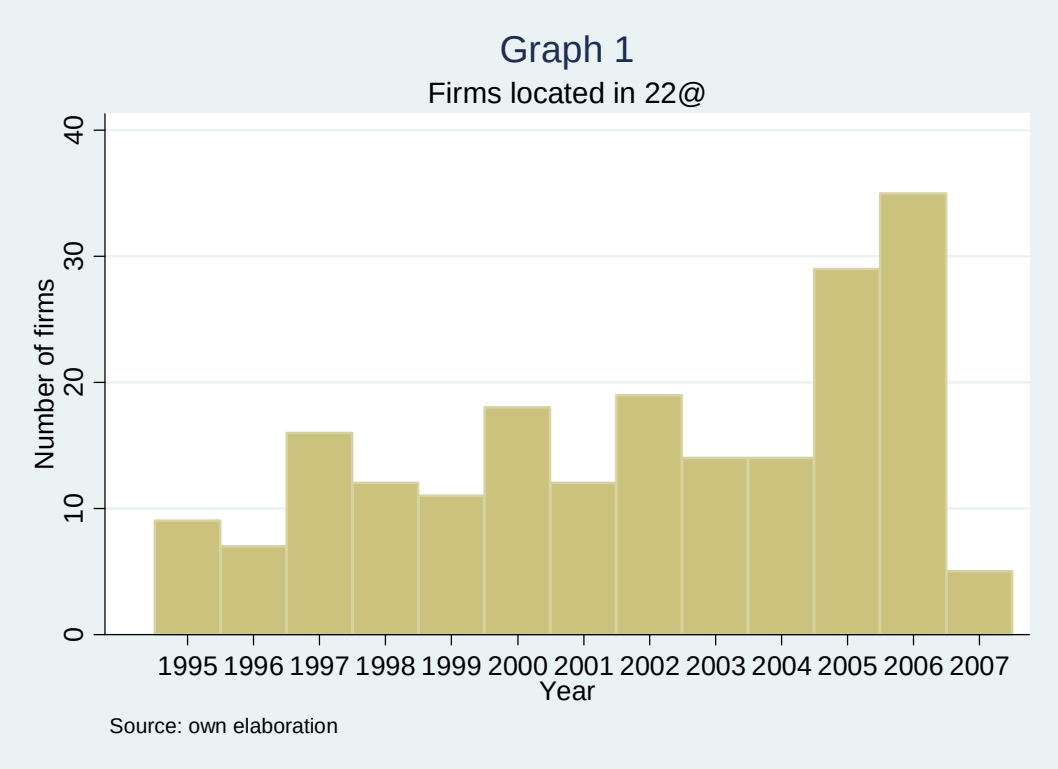
In this paper we have analysed the 22@ project developed at Poblenou quarter, in Barcelona. This project started approximately by 2000 and is about urban and economic transformation of an area traditionally specialised in mature manufacturing into a high-tech specialised activities.

We contribute to the extant literature on industrial location decisions by analysing how firms' locational preferences can be understood in terms of firms' characteristics. Additionally, we take into account non quantitative issues that have locational influence, as firm's owner location or site knowledge, usually non available for researchers.

Since this is an ongoing research project, there is a lot of work to be done, mainly about analysing why ranks given by high-tech firms (those so called @ firms) are less influenced by firms characteristics, compared with non high-tech firms (non @ firms). We guess that there are some intangible assets (which are of high importance for those

high-tech firms) that should be introduced into the analysis in order to better explain the importance given to previously analysed location determinants.

GRAPHS


Graph 1
Firms located in 22@
Number of firms
0
10
20
30
40
1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007
Year
Source: own elaboration

TABLES

TABLE 1
Descriptive statistics about firms at 22@ [a]

	1947-1994	1995-2007	TOTAL
Number of new firms	102	201	303
Mean size (workers)	19.3	41.2	33.9
HC intensity (% of high degree jobs)	26.3%	50.9%	46.2%
New firms belonging to R&D industries [b]	11,8%	23.4%	19.5%
Mean surface (m^2) of the plant	553	916	792
R&D Expenditures in 2006 (€)	131,727	306,400	259,536

[a] The date groups (1995-2000 and 2001-2007) are referred to the year in which the firm was located at 22@ (no matter their age), but the firm characteristics are from 2006.
[b] Barcelona city council designed a so-called "@ activities" made by the following two-digit industries: Publishing, printing and reproduction of recorded media; Manufacture of office machinery and computers; Manufacture of radio, television and communication equipment and apparatus; Manufacture of medical, precision and optical instruments, watches and clocks; Post and telecommunications; Financial intermediation, except insurance and pension funding; Insurance and pension funding, except compulsory social security; Activities auxiliary to financial intermediation; Computer and related activities; Research and development; Other business activities; Education; Recreational, cultural and sporting activities.
Source: own elaboration

TABLE 2
Descriptive statistics about new firms [a]

	1995-2000	2001-2007	TOTAL
Number of new firms	73	128	201
Mean size (workers)	41.0	41.2	41.2
HC intensity (% of high degree jobs)	63.7%	44.2%	50.9%
New firms belonging to R&D industries [b]	15.1%	28.1%	23.4%
Mean surface (m^2) of the plant	650	1,069	916

[a] The date groups (1995-2000 and 2001-2007) are referred to the year in which the firm was located at 22@ (no matter their age), but the firm characteristics are from 2006.
[b] Barcelona city council designed a so-called "@ activities" made by the following two-digit industries: Publishing, printing and reproduction of recorded media; Manufacture of office machinery and computers; Manufacture of radio, television and communication equipment and apparatus; Manufacture of medical, precision and optical instruments, watches and clocks; Post and telecommunications; Financial intermediation, except insurance and pension funding; Insurance and pension funding, except compulsory social security; Activities auxiliary to financial intermediation; Computer and related activities; Research and development; Other business activities; Education; Recreational, cultural and sporting activities.
Source: own elaboration

TABLE 3
Descriptive statistics about location determinants*

	1 (not at all important)	**2**	**3**	**4**	**5 (very important)**
Costs					
Cheap land	38,81	10,45	15,92	22,39	12,44
Qualitative issues					
Proximity to consumers	49,25	12,94	11,44	9,45	16,92
Proximity to suppliers	57,21	12,94	11,44	10,95	7,46
Availability of skilled labour	60,70	10,95	11,44	13,43	3,48
Proximity to firms of the same industry	52,74	14,93	13,93	10,45	7,96
Land availability	25,87	9,45	19,40	25,87	19,40
Innovative environment	35,32	13,43	17,41	20,90	12,94
Infrastructure accessibility	15,92	10,95	21,39	27,86	23,88
Amenities					
Quality of life	20,40	14,93	31,34	21,89	11,44
Public services	26,37	15,92	23,88	22,89	10,95
Other issues					
Residence of firm owner	64,19	4,48	7,46	10,45	13,43
Knowledge of the environment	30,85	7,96	23,88	20,40	16,92

* The data indicates the percentage of each answer.
Source: own elaboration

TABLE 4
Determinants of location factors (2001-2007)[a]

	Location determinants										
@ firms	**CON**	**SUP**	**SKI**	**IND**	**LAN**	**INN**	**INF**	**QUA**	**PUB**	**RES**	**ENV**
Familiar firm	2.3270**	2.7238**	0.2835	1.7910	0.2290	0.0475	1.1159	1.5510	-0.5661	2.0287	1.0100
	(1.1226)	(1.1487)	(1.0341)	(1.1394)	(0.9847)	(1.0846)	(1.0787)	(1.0120)	(0.9597)	(1.3099)	(0.9853)
R&D investments	-0.9670	-0.9320	0.3262	-0.0968	0.8732	0.0652	0.0113	-1.5261*	0.5580	-1.7951	0.6996
	(0.9592)	(0.9515)	(0.9016)	(0.8954)	(0.8766)	(0.8865)	(0.7981)	(0.8941)	(0.8308)	(1.1646)	(0.8500)
% Skilled workers	0.1421	-0.5477	1.8255	-1.5452	-1.0148	0.4054	0.2454	1.2940	0.2550	1.1687	-0.1513
	(1.2827)	(1.2616)	(1.1864)	(1.2236)	(1.0575)	(1.1428)	(1.0654)	(1.0852)	(1.0172)	(1.2708)	(1.0887)
% Exports	-0.0590	-0.0295	-0.0354	0.0039	-0.0064	0.0184	-0.0088	0.0060	0.0066	0.0216	-0.0035
	(0.0643)	(0.0306)	(0.0238)	(0.0169)	(0.0136)	(0.0155)	(0.0136)	(0.0150)	(0.0140)	(0.0206)	(0.0178)
Cooperation	0.3820	0.3260	0.4448	-0.4531	0.5708	-0.3595	1.4830**	0.0836	-0.2052	-0.4104	-0.0253
	(0.8254)	(0.7852)	(0.7606)	(0.7133)	(0.7372)	(0.7431)	(0.7426)	(0.7063)	(0.7057)	(0.9011)	(0.7209)
Number of observations	31	31	31	31	31	31	31	31	31	31	31
Log likelihood	-34.1772	-33.8306	-39.9705	-41.9020	-46.1963	-46.1027	-44.4219	-45.9384	-47.9543	-32.0107	-45.7155
LR chi2(5)	9.44	10.31	6.71	4.94	2.63	2.20	6.57	4.46	1.52	4.78	2.88
Pseudo R2	0.1214	0.1323	0.0774	0.0556	0.0277	0.0233	0.0688	0.0463	0.0156	0.0695	0.0305

	Location determinants										
Non @ firms	**CON**	**SUP**	**SKI**	**IND**	**LAN**	**INN**	**INF**	**QUA**	**PUB**	**RES**	**ENV**
Familiar firm	0.2339	0.0177	0.4688	-0.0301	0.6237	0.1014	0.1557	0.1985	0.2048	1.1988**	1.2023**
	(0.5228)	(0.5301)	(0.5385)	(0.5464)	(0.4834)	(0.4779)	(0.4703)	(0.4735)	(0.4790)	(0.5440)	(0.5034)
R&D investments	0.8518	0.0008	-0.2386	-0.5793	0.7140	0.1476	0.4845	0.0267	0.4153	-0.2004	0.0882
	(0.5599)	(0.5705)	(0.5885)	(0.5319)	(0.4972)	(0.4654)	(0.4885)	(0.4861)	(0.4720)	(0.5964)	(0.5015)
% Skilled workers	-1.9486***	-2.7860***	-2.5221***	-0.4204	0.1132	0.6025	0.4398	-0.3480	-1.3735**	-1.6564*	-2.3729***
	(0.7483)	(0.9019)	(0.9051)	(0.6831)	(0.6359)	(0.6355)	(0.6208)	(0.6597)	(0.6306)	(0.8454)	(0.7349)
% Exports	0.0098	0.0403***	0.0441***	0.0016	-0.0103	0.0045	0.0128	0.0178	0.0226*	0.0293*	0.0297**
	(0.0188)	(0.0149)	(0.0155)	(0.0142)	(0.0137)	(0.0143)	(0.0132)	(0.0133)	(0.0133)	(0.0177)	(0.0145)
Cooperation	-1.4696**	0.1752	1.4880**	1.4035**	0.2905	0.4330	-0.3300	0.2177	0.0996	-0.9237	0.0442
	(0.7106)	(0.6657)	(0.6444)	(0.6048)	(0.5639)	(0.5724)	(0.5336)	(0.5826)	(0.5470)	(0.8004)	(0.5720)
Number of observations	85	85	85	85	85	85	85	85	85	85	85
Log likelihood	-105.0937	-95.4202	-87.1346	-106.5218	-130.0544	-130.101	-132.0594	-129.1212	-126.7844	-89.0212	-115.0854
LR chi2(5)	14.97	15.60	19.00	5.76	5.03	3.25	2.82	2.35	6.99	16.50	22.17
Pseudo R2	0.0665	0.0756	0.0983	0.0263	0.0190	0.0123	0.0106	0.0090	0.0268	0.0848	0.0878

[a] The dependent variable is the rank given to each one of the location determinants.

Note: CON (Proximity to consumers), SUP (Proximity to suppliers), SKI (Availability of skilled labour), IND (Proximity to firms of the same industry), LAN (Land availability), INN (Innovative environment), INF (Infrastructure accessibility), QUA (Quality of life), PUB (Public services), RES (Residence of firm owner) and ENV (Knowledge of the environment).

(***) Significance at 1%, (**) significance at 5% and (*) significance at 10%. Standard error between brackets

Source: own elaboration

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