

Entrepreneur location decisions across industries

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Abstract In this paper we analyse whether entrepreneur location decisions differ across industries and identify the factors determining the choice of location between rural and urban environments. Firm location is based on a new taxonomy developed over the influential three dimensions of Hayter's (1997) approach. The paper uses data from sample of one thousand Portuguese firms. We present a stylized theoretical model to determine how these new five dimensions influence firm's location and test the model through a logistic regression. Our results show that that the location decisions depend on the sector of activity, type of area (urban vs. rural) and the characteristics of the entrepreneur. We find that companies engaged in knowledge intensive business services prefer to locate in urban areas. From an institutional point of view, firms prefer to locate in rural areas.

Keywords Entrepreneurship · Location decisions · Rural vs urban

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Introduction

This paper studies firm location based on a new taxonomy developed over the influential three dimensions of Hayter's (1997) approach. The new five dimensions are: resources and support infrastructures; local dynamics; Affectivity and incentives; knowledge; and models of reference. The paper uses data from a sample of one thousand firms, which belong to different activity sectors and are located in different regions of Portugal.

We present a stylized theoretical model to determine how these new five dimensions influence firm's location and test the model through a logistic regression. The dependent variable is binary the firm either locates in rural or urban areas.

The results show that the factors underlying the decision locations of companies vary by sector of activity, and the characteristics of its founder. Companies engaged in knowledge intensive business services prefer to locate in urban areas, while when institutional factors are important firms prefer to locate in rural areas.

Entrepreneurs, according to Schumpeter (1934) have a crucial role in economic development. They are responsible for the creation and implementation of new combinations of resources, creating new and/or expanding existing markets. The advent of the endogenous growth theory brought renew the interest on entrepreneur's role in economic development (Low and MacMillan 1988). This resulted in a new wave of research that placed "the individual capacity to confront risk" at the centre of economic analysis (Groot et al. 2004). The capacity to cope with risk was central in the study of entrepreneurs (Knight 1921; Lucas 1978; Kihlstrom and Laffont 1979; Kahneman and Tversky 1979; Jovanovic 1982; Parker 1996, 1997).

Hence, entrepreneurial activities, alongside all the factors underpinning their existence, and their influence on regional economic development, have been the object of study by a diverse range of authors (Birley 1985; Kirchoff and Phillips 1988; Storey 1994; Arauzo and Manjón 2004). Entrepreneurship appears to represent a mechanism for economic development and capable of guaranteeing the supply of goods and services to the community while simultaneously generating employment and consequent wealth, ensuring governments design policies in efforts to support such activities (Audretsch and Fritsch 2002). As regards the relationship between entrepreneurs and economic growth, many authors have dealt with their contribution to creating jobs and advancing innovation (Wennekers and Thurik 1999; Thurik and Wennekers 2004; van Stel 2006; Welter and Lasch 2008).

More recent definitions of entrepreneurship deal with the concept as launching a new economic activity (Davidsson et al. 2006). While entrepreneurs are subject to analysis at the individual level, they operate at the organisational (Shane and Venkataraman 2000), economic, social and institutional levels (Veciana and Urbano 2008). Kirzner (1973) argues that entrepreneurs drive the balance in marketplaces with their activities essential to competitiveness. Hence, competitiveness is inherent to entrepreneurial processes (Fuller-Love 2009; Schindehutte and Morris 2009; Fuentes et al. 2010; Chiles et al. 2010).

McClelland (1961) also turns his attentions to entrepreneurial personality characteristics and identifying the individual characteristics tending to result in the production of innovative businesses. According to this author, entrepreneurship is interrelated with this desire for personal self-realisation, which ends up transposed into business dealings

in which risks of a diverse and different nature are taken and with the potential of attaining economic success due to their own competence and not by random luck.¹

Given the importance of entrepreneurship for regional development, attention is inevitably drawn to location issues: the factors behind the decisions taken by business founders (bringing about the entrepreneurial activities) in choosing a specific location for their company (Von Thünen 1826; Marshall 1890; Weber 1909; Christaller 1933; Hayter 1997; Trullén 2001; Parker 2004; Autant-Bernard et al. 2006; Van Praag and Versloot 2007; Ferreira et al. 2010; Lafuente et al. 2010).

Regarding the dichotomy between rural and urban locations, various researchers have defended the position that entrepreneurial companies prefer locations in major urban environments (Smith 1776; Marshall 1920; Hoover 1948; Myrdal 1957; Jacobs 1969; Krugman 1981, 1991). Furthermore, there is an increasing level of commitment for the revitalisation of rural areas nurturing entrepreneurship (OECD 2006). In Portugal, interest in the study of entrepreneurship, and more specifically in rural areas, stems from the major asymmetries between urban and rural locations (Figueiredo et al. 2002; Silva 2006).

Despite the existence of diverse studies on the advantages and disadvantages (North and Smallbone 1995; Keeble 1998; Dawe and Bryden 1999; Bryden and Hart 2001; Agarwal et al. 2009) and the factors driving company location options (Elgen et al. 2004; Meyer 2003; Audretsch et al. 2005; Autant-Bernard et al. 2006), there are still remarkably few sectoral studies.

The present study seeks to fill this gap in the literature. It aims at analyzing whether entrepreneur location decisions differ across industries and identify the factors determining the choice of location between rural and urban environments. It focuses on three classes of location decisions based on Hayter's (1997) influential approach: behavioural, institutional and neoclassical.

We first present a literature review around the themes of entrepreneurship and business location approaches. Then we present the methodology and results and finally the conclusions.

Literature review

Business location factors

The location of business activities has attracted attention from researchers and over a long period of time (Arauzo and Viladecans 2006). Von Thünen (1826) approached location in his historical study on estate rents and defended how the factor distance represents the most important aspect to determining the level of rents. Marshall (1890) took up the theme within the framework of the economies of agglomeration and the industrial district while Weber (1909) attributed particular importance to minimising costs. According to Weber (1909), there were three factors determining the location of

¹ There has been a constantly rising level of interest in entrepreneurship due to its relevance to governments (NCOE 2001), business managers, directors and other decision makers (Galbraith 1985; Hansen 1987; Felsenstein 1996; Sternberg and Arndt 2001) as well as for the research community (Hisrich et al. 2007; Audretsch 2007; Mahubani 2008).

an industrial firm: the cost of transport, the cost of labour and the advantages associated with economic agglomeration (economies of scale). Hoover (1948) studied market spatial divisions combining this with companies' agglomeration and how the costs of transport shape the locations of businesses and companies. In turn, Lösch (1940) analysed the scale of markets and assumed them to be as homogeneous as demand and the costs of transport are proportional to the distance to be covered. Earlier, Christaller (1933) had contributed with his theory of central locations while making a crucial step in studying urban system structures.

According to Capello (2007), there are two groups of theories in what he terms "regional economics": (i) Theories of location: economic mechanisms causing the distribution of activities across space; (ii) Growth and regional development theories: centring on spatial aspects to economic growth and the territorial distribution of earnings.

In contrast, Hayter (1997) proposes analysing the location of economic activities through three different approaches: (i) neoclassical; (ii) institutional and (iii) behavioural.

The neoclassical approach (Grimes 2000; Ouwersloot and Rietveld 2000; Holl 2004) focuses on location theory and centres analysis on strategies for maximising profits and minimising costs (for example, transport costs, labour costs and external economies).

The institutional approach (Galbraith 1985; Felsenstein 1996; Arauzo and Viladecans 2006) maintains how it is important to consider how companies seek out locations appropriate to the institutional surroundings for meetings (clients, suppliers, commercial associations, regional systems, the government as well as other companies).

The behavioural approach takes into account situations of uncertainty and lack of information. In this behavioural perspective, and according to Arauzo and Manjón (2004), the factors of location are not uniform and hence diverge between different geographic areas. In these situations, entrepreneurs (as decision makers) base their conclusions on non-economic factors and thereby including the entrepreneur's own personality characteristics. This location decision making process is more common to small and medium sized companies who fundamentally decide on their location in keeping with the origins and experience of entrepreneurs in their respective sectors or the company financial positions. Table 1 summarises the three approaches to location that we shall proceed to study.

Table 1 summarizes Hayter (1997) approaches: (i) neoclassical; (ii) institutional and (iii) behavioural, breaking them down into individual factors according to the studies cited. In the next section we will use this information to model and estimate entrepreneur's location decisions.

Methodology

Stylized model

The stylized model adapts a simple growth model to derive a testable hypothesis for the location of firms. A representative entrepreneur has preferences over consumption C , and location of his business L . The entrepreneur's savings, defined as output Y net of

Table 1 Approaches to company location

Approaches	Factors	Studies
Behaviour (B)	B1: The founder, managers and employees want to live in this location B2: Proximity to the founder's residence B3: Climate B4: Good housing standards B5: Local community attitude to business B6: Recreational and leisure activities B7: The founder was born in the community B8: Good means of access B9. Entrepreneur financial capacity	Elgen et al. (2004); Meyer (2003); Audretsch et al. (2005); Autant-Bernard et al. (2006); Trullén (2001); Hayter (1997); Ferreira et al. (2010); Lafuente et al. (2010); Parker (2004); Van Praag and Versloot (2007).
Neoclassical (N)	N10. Distance between the company and urban centres N11. Distance to markets and the cluster scale N12. Road infrastructures N13. Geographic specialisation N14. Human resource skills and qualifications N15. Industrial real estate costs N16. Costs of labour N17. Population density N18. Level of local economic activity in the company location N19. Other physical infrastructures (railroads, airports, telecommunications, etc.) N20. Proximity to raw materials N21. Proximity to services	Grimes (2000); Ouwersloot and Rietveld (2000); Holl (2004); Costa et al. (2004); Hayter (1997); Ferreira et al. (2010); Lafuente et al. (2010).
Institutional (I)	I22. Company incubator I23. Access to knowledge generated by universities or research centres I24. Location close to administrative centres I25. Access to science parks I26. R&D incentives, employment creation or other incentives I27. Proximity to teaching institutions I28. Technological fairs I29. Renowned business leaders in the region	Galbraith (1985); Arauzo and Viladecans (2006); Felsenstein (1996); Hayter (1997); Ferreira et al. (2010); Lafuente et al. (2010).

consumption C and location costs δL , are allocated in capital investment K . The entrepreneur's utility over time is a function of consumption and location, and is given by the integral:

$$\text{Max}_{C,L} \int_0^{\infty} U(C, L) e^{-rt} dt \quad (1)$$

Where r is the rate of time preference, assumed, for the sake of simplicity, to be equal to the market real interest rate, and the function U is a well behaved [increasing and concave in both arguments] instantaneous utility function.

The entrepreneur maximizes the utility integral subject to the dynamics of capital accumulation given by the equality of savings and capital investment:

$$\dot{K} = Y - C - \delta L \tag{2}$$

We introduce in this basic growth model setup Hayter (1997) location factors: neoclassical N ; institutional I and behavioural B . Each one of these factors are vectors capturing the elements in Table 1; for example the vector B corresponds to $B=(B_1, B_2, \dots B_9)$. As discussed above behavioural factors capture the preferences of the entrepreneur, as a consequence it is only natural to assume they impact the instantaneous utility function. In the same vein, neoclassical N , and institutional I factors impact location costs. Finally all factors, B , N , and I , affect output.

Therefore we assume the following preferences, production function, and location costs:

$$U(C, L) = a \log C + b(B) \log L \tag{3}$$

$$Y = F(K, B, N, I) \tag{4}$$

$$\delta L = \delta(N, I) L \tag{5}$$

Substituting Eqs. (3)–(5) into Eqs. (1) and (2) yields the entrepreneur’s location problem. In order to solve it consider the problem’s Hamiltonian function H :

$$H = a \log C + b(B) \log L + \lambda [F(K, B, N, I) - C - \delta(N, I) L] \tag{6}$$

The first order conditions are:

$$H_C = 0 \Rightarrow \frac{a}{C} = \lambda \tag{7}$$

$$H_L = 0 \Rightarrow \frac{b(B)}{L} = \lambda \delta(N, I) \tag{8}$$

$$\dot{\lambda} - r\lambda = -H_K \Rightarrow \dot{\lambda} - r\lambda = -\lambda F_K(K, B, N, I) \tag{9}$$

In the steady-state $\dot{K} = \dot{\lambda} = 0$. The equilibrium capital is given by [denoted by an *]:

$$\dot{\lambda} = 0 \Rightarrow F_K(K, B, N, I) = r \Rightarrow K^* = k(r, B, N, I) \tag{10}$$

From Eqs. (7) and (8) into (2) we have the equilibrium consumption:

$$\dot{K} = 0 \Rightarrow C^* = \frac{a F(K^*, B, N, I)}{a + b(B)} \tag{11}$$

Inserting C^* into Eqs. (7) and (8) and solving for location yields:

$$L^* = \frac{b(B) F(K^*, B, N, I)}{[a + b(B)] \delta(N, I)} \tag{12}$$

Equation (12) provides a testable hypothesis for entrepreneurial location decisions. Note that Eq. (12) can be written for empirical estimation purposes as:

$$L^* = L(a, r, B, N, I) \quad (13)$$

Equation (13) says that entrepreneur's location decisions are influenced by preferences over consumption, the interest rate and behavioral, neoclassical and institutional location factors as in Table 1. Moreover, the format of Eq. (12) suggests us which relevant individual factors of each of the vectors may have greater influence in the location decisions. Notice that in Eq. (12) we have elements that affect the entrepreneur's preferences [given by the parameters a and $b(B)$]; elements that impact the production function $F(K^*, B, N, I)$, and elements that affect the location costs $\delta(N, I)$. Of course the identification of the individual factors pertaining to each one of the vectors can only be empirically determined. The next section uses the Exploratory Factorial Analysis to determine them and after that we estimate Eq. (13).

Data and sample

The statistical analysis process determines just which factors shape company location decisions and demonstrates how the profile of the entrepreneur (Table 2) influences company locations in rural surroundings. For analysis, we collated a 1,000-firm sample of convenience.

The sub-sample incorporated firms from different sectors: agriculture (100 firms), services (100 firms), and the manufacturing (200 firms) and extractive (50 firms) industries, and the construction sector (50 firms) and KIBS (Knowledge Intensive Business Services) (500 firms) (Table 3). We structured the sample in order to ensure that all 22 districts of mainland and archipelago Portugal were equally represented. We administered approximately 46 questionnaires in each NUT III region, with all questionnaires responded to by the founders either face-to-face or via telephone.

Measuring the variables

As regards our methodology, as the dependent variable for this study, we took the binary variable relative to the company location in either rural or urban environments and subject to binary logistic regression.

With the objective of identifying factors contributing towards the final company location decisions in the different sectors, founders were questioned as to the importance of a set of 29 factors explaining the choice of location using a five point Likert scale. The factorial analysis (FA) technique was applied to bundle these 29 variables into small factor groups. The KMO (Kaiser-Meyer-Olin) value is 0.883, which indicates a high level of appropriateness for this technique (Greene 2003).

With the objective of predicting, in probabilistic terms, the incidence of decisions to locate companies in rural environments based upon the profile of the entrepreneur and the factors determinant in the choice of business location, we made recourse to a logistical regression model.

The function deployed in logistical regression in order to estimate the probability of a determined outcome j ($j=1, \dots, n$) for the dependent variable being "successful", hence, companies opting to locate in rural environments $P[Y_j = 1] = \hat{\pi}_j$, may be expressed as: $\hat{\pi} = \frac{e^{x\beta}}{1+e^{x\beta}}$, in which $\hat{\pi}$ represents the vector of estimated

Table 2 Entrepreneur profile

Variables		<i>N</i>	%
Gender	Female	115	11.5 %
	Male	883	88.5 %
Age (years), Mean±SD (Minimum - Maximum)		42.5±8.2 (24–73)	
Academic qualifications	Basic education	135	13.5 %
	Secondary education	356	35.6 %
	Professional education	6	0.6 %
	Graduation	408	40.8 %
	Master	88	8.8 %
	PhD	7	0.7 %
Previous experience in the business area	No	260	26.0 %
	Yes	740	74.0 %
Born in this locality	No	438	43.8 %
	Yes	562	56.2 %
Grew up in this town	No	183	18.3 %
	Yes	817	81.7 %

probabilities, X is the matrix for independent variables and β is the vector of logistical regression coefficients (Greene 2003). Rendering this function linear through the *logit* transformation of the dependent variable obtains the logistical regression model under analysis:

Table 3 Characterization of companies

Sample characterization		<i>N</i>	%
Region	North	246	24.6 %
	Centro	316	31.6 %
	Lisbon	66	6.6 %
	Alentejo	206	20.6 %
	Algarve	50	5.0 %
	Madeira	34	3.4 %
	Azores	82	8.2 %
	Activity	KIBS	500
	Agriculture	100	10.0 %
	Services	100	10.0 %
	Manufacturing industry	200	20.0 %
	Extractive industry	50	5.0 %
	Construction	50	5.0 %
Turnover (thousands of euros), Mean±SD (Minimum - Maximum)		1067.2±2747.1 (25–50000)	
Age of the firm (years), Mean±SD (Minimum - Maximum)		7.0±6.4 (1–46)	

$$\text{Logit}(\hat{\pi}_j) = \beta_0 + \beta_1 \text{Control Variables}_j + \beta_2 \text{FACTOR 1} + \beta_3 \text{FACTOR 2} \\ + \beta_4 \text{FACTOR 3} + \beta_5 \text{FACTOR 4} + \beta_6 \text{FACTOR 5}$$

In this model, the control variables correspond to the entrepreneur's profile, gender, age, academic qualifications and prior experience in the business sector. The variables related with the different location factors in turn relate to those obtained through factorial analysis. Therefore, the independent variable inputs to the model are both qualitative and quantitative. The qualitative variables enter the model re-codified as dummy variables. The logistical regression parameters are estimated according to the maximum accuracy method.

Once adjusted, the logistical regression model evaluates the significance and quality of the adjusted model as well as the significance of the regression coefficients. The evaluation of the model's own significance is attained through the application of the test accuracy ratio comparing the accuracy of the null model (including only the constant term) with the accuracy of the complete model (including the constant term and all the explanatory variables). In order to test the quality of model adjustment, the -2LL (Log Likelihood) indicator was deployed.

The conclusion reached testified to the model's significance, implying that there is at least one independent variable linear related with $\text{Logit}(\pi_j)$. So as to identify which independent variable(s) significantly influence $\text{Logit}(\pi_j)$, we applied the *Wald* test. In this case, the objective involved testing whether a specific coefficient is null, conditioned by the values estimated for the other coefficients. The strength of the association between the independent variables and the dependent variable is evaluated through Nagelkerke's *pseudo - R²*. The interpretation of the model's parameters is achieved through betas. When these values become difficult to interpret, recourse is made to the exponential interpretation of these coefficients, thus, the odds and probability ratios.

Results

Identification of dimensions to location

Exploratory Factorial Analysis returned a KMO result of 0.883 having identified five dimensions relative to factors of location and explaining 77.8 % of scale variance (Table 4).

Table 5 presents the results stemming from the descriptive statistics applied to the five scale factors of location according to the respective company sector of economic activity.

For the majority of companies, the *resources and support infrastructures* (3.5 ± 0.9) dimension and the *models of reference* (3.0 ± 0.9) factor return the highest average level of scores with the *knowledge* (1.6 ± 0.7) dimension reporting the lowest average value. Agriculture is the sector registering the highest average for the *resources and support infrastructures* (4.5 ± 0.2) and 2 (4.4 ± 0.7) item. The KIBS sector, in turn, attains the highest average for the *affectivity and incentives* (3.6 ± 0.5) dimension. Meanwhile, in the case of knowledge about economic activities, the service sector (2.0 ± 1.2) returns

Table 4 Exploratory factorial analysis: factorial weightings

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Road infrastructures	0.90				
Distance between the company and urban centres	0.83				
Good means of access	0.80				
Human resource skills and qualifications	0.77				
Distance to the market and the scale of the cluster	0.75				
Industrial real estate costs	0.71				
Other physical infrastructures (railroads, airports, telecommunications, etc.)	0.66				
Entrepreneur financial capacity	0.65				
Level of local economic activity in the company location	0.64				
Local community attitude to business		0.84			
The founder was born in the community		0.79			
Labour costs		0.79			
Access to science parks		0.61			
Location close to administrative centres		0.52			
R&D incentives, employment creation or other incentives			0.87		
The founder, managers and employees want to live in this location			0.81		
Company incubator			0.70		
Recreational and leisure activities			0.66		
Proximity to services			0.65		
Access to knowledge generated by universities or research centres				0.88	
Proximity to teaching institutions				0.85	
Technological fairs				0.59	
Renowned business leaders in the region					0.84
Proximity to raw materials					0.81
Cronbach's Alpha	0.928	0.864	0.841	0.810	0.676

the highest average followed by the extractive (2.0 ± 0.1) and construction (2.1 ± 0.2) industries. The service sector is the area reporting the highest average result for the *model of reference* (4.4 ± 0.5) factor.

Table 5 Descriptive statistics for the five scale factors of location (1 – Not at all; 5 – highly important) according to sector of economic activity

	Activity												Total	
	KIBS		Agriculture		Services		Manufacturing		Extractive industry		Construction		M	SD
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD		
F1 - Resources and support infrastructures	3.5	0.9	4.5	0.2	3.3	1.1	2.9	0.5	3.7	0.1	3.7	0.2	3.5	0.9
F2 - Local dynamics	3.2	0.6	4.4	0.7	2.7	2.0	1.6	0.7	1.5	0.1	1.4	0.1	2.8	1.3
F3 - Affectivity and incentives	3.6	0.5	2.0	0.5	2.0	0.6	1.9	0.3	2.2	0.2	2.1	0.1	2.8	0.9
F4 - Knowledge	1.5	0.6	1.5	0.9	2.0	1.2	1.6	0.5	2.0	0.1	2.1	0.2	1.6	0.7
F5 - Models of reference	2.7	0.7	2.4	1.5	4.4	0.5	3.3	0.7	3.0	0.2	3.0	0.1	3.0	0.9

M mean; *SD* standard deviation

Thus, we then proceeded with the individual characterisation of the five identified dimensions to location decision making: i) Resources and support infrastructures; ii) Local dynamics; iii) Affectivity and incentives; iv) Knowledge; and v) Models of reference.

- i) Resources and support infrastructures: the first dimension includes factors both behavioural (B8, B9) and neoclassical (N10, N11, N12, N14, N15, N16, N18, N19) in origin. The sectors of activity with the closest relationship to this factor are agriculture, the extractive and construction industries. These are sectors of activity with a level of competition strongly influenced by access to infrastructures (transport and accessibility) and resources (human, financial and economic).
- ii) Local dynamics: the second dimension consists of a blend of behavioural (B5, B7), neoclassical (N16) and institutional (I25) factors. All the factors are associated to this dimension despite belonging to the three different approaches posited by Hayter (1997), and thereby clearly demonstrating the importance of local dynamics to company location options. Of the sectors subject to analysis, they bear most relevance to the agricultural and KIBS sectors.
- iii) Affectivity and incentives: the third dimension returns an aggregation of behavioural (B1, B4, B6), neoclassical (N21) and institutional (I22, I26) factors. KIBS firms form the standout sector in this category. Given the knowledge intensive nature of such companies, factors such as incentives, the existence of incubators and the proximity to services are fundamental to their business development strategies.
- iv) Knowledge: the fourth item contains only institutional factors (I23, I27, I28). This is the only dimension structured in accordance with the institutional approach by Hayter (1997). Furthermore, we find that all the sectors analysed attribute a low level of importance to this factor with KIBS firms returning the lowest level of

- attributed importance. This is characteristic of the lack of strategic vision of Portuguese firms and hindering innovation and the change needed to the Portuguese competitive paradigm.
- v) Models of reference: the fifth dimension includes one neoclassical (N20) factor and one institutional (I29) factor. Within this framework, the service sector is particularly significant and highlighting how the existence of business leadership models of reference is an important fact to the location of firms in this sector.

Predicting company locations

Table 6 presents the results relative to the descriptive statistics, correlations and factors of variance inflation for all the variables incorporated into the study. Given that all variables return VIF results of below ten, we therefore do not encounter problems stemming from independent variable multicollinearity.

Table 7 sets out our results from the logistical regression calculations. In addition to the above cited independent variables we include interaction terms among the 5 locations factors, plus some control variables for the firm owner and his firm. Business owner education influences the company and entrepreneurs with higher education display a lesser tendency towards opening their firms in the countryside and higher propensity towards urban locations. We may correspondingly state that firm variables returning statistically significant influences on the location of companies in rural locations are region, activity and company length of service. The companies located in the North, Centro, Alentejo and Algarve regions displaying a greater propensity towards rural locations and lower propensity towards urban locations. Construction, agricultural and extractive companies report higher propensities to take up rural locations in comparison with KIBS sector firms, i.e., KIBS prefer to locate in urban areas, as opposed to construction, extractive industry and agriculture firms. The older the firm, the greater is the probability to locate in rural areas, while younger firms prefer to locate in urban areas.

As regards the factors of location, we report how for factors 1 and 5, the greater the score, the lower the propensity towards locating the company in a rural area, the lower the scores, the higher the propensity towards locating in urban areas. Furthermore, in the case of factors 2 and 4, the greater the score, the greater the propensity to adopt rural locations and lower scores are associated with urban location. These findings are in line with the authors that focus on advantages and costs associated with urban and rural locations (North and Smallbone 1995; Keeble 1998; Dawe and Bryden 1999; Bryden and Hart 2001; Agarwal et al. 2009). Knowledge is associated with urban locations, as it happens with KIBS. The explanation lies in the fact that universities and technological parks are located in cities. Concerning other activities such as agriculture, it is natural they locate in the countryside.

The analysis of the interaction terms shows a statistically significant interaction between factor 1 (Resources and support infrastructures) with firms' age and trade volume; between factor 2 (Local dynamics) with region North and trade volume and between factors 3 (Affectivity and incentives) a 4 (Knowledge) and firms' age. The results suggest that the higher the factor 1 scores, the lower is the importance of firms' age for rural location; however the higher the scores, the higher the propensity of firms

Table 6 Descriptive statistics and correlation coefficients for all study variables

	SD	VIF	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1 Location in rural communities	0.31	0.46																								
2 Female	0.12	0.32	1.21	-0.05																						
3 Business ownership (years)	42.47	8.22	1.44	-0.02	-0.07																					
4 Higher education	0.50	0.50	3.49	-0.35	0.20	-0.06																				
5 Minimum education	0.14	0.34	5.24	-0.03	-0.14	0.01	-0.40																			
6 Business owner experience	0.74	0.44	2.28	-0.03	-0.10	0.14	-0.11	0.23																		
7 Company length of service (years)	6.99	6.39	2.55	-0.24	0.20	0.37	0.39	-0.19	0.12																	
8 Norte	0.10	0.30	7.29	0.06	-0.12	0.01	-0.17	-0.13	-0.56	-0.21																
9 Centro	0.10	0.30	5.99	-0.04	-0.12	0.01	0.00	0.35	-0.19	-0.23	-0.11															
10 Alentejo	0.20	0.40	8.98	-0.03	-0.18	0.02	-0.50	0.43	0.30	-0.31	-0.17	-0.17														
11 Algarve	0.06	0.22	3.93	0.33	-0.08	0.00	-0.23	-0.09	0.14	-0.14	-0.08	-0.08	-0.11													
12 RAM - Autonomous Region of Madeira	0.06	0.22	3.95	0.32	-0.08	0.03	-0.23	-0.09	0.14	-0.14	-0.08	-0.08	-0.11	-0.05												
13 RAM - Autonomous Region of Azores	0.25	0.43	1.54	-0.13	-0.01	-0.03	0.01	-0.23	-0.11	-0.10	0.13	-0.04	0.03	-0.09	-0.10											
14 Construction	0.32	0.47	1.47	0.07	0.02	0.01	0.04	0.01	-0.01	-0.07	-0.12	0.11	-0.05	0.03	0.07	-0.39										
15 Agriculture	0.21	0.40	1.17	0.22	-0.01	-0.04	0.01	-0.05	0.01	0.06	0.05	0.00	-0.16	0.13	0.09	-0.29	-0.35									
16 Services	0.06	0.22	1.15	0.05	0.02	0.03	-0.03	0.18	0.06	0.04	-0.08	0.12	-0.03	-0.01	0.01	-0.13	-0.16	-0.12								
17 Manufacturing	0.03	0.18	1.29	-0.04	-0.02	0.00	0.00	0.15	0.07	0.03	-0.06	-0.06	0.10	-0.02	0.01	-0.11	-0.13	-0.10	-0.04							
18 Extractive industry	0.08	0.27	1.23	-0.11	-0.01	0.03	-0.06	0.06	-0.02	0.13	0.09	-0.10	0.05	-0.04	-0.05	-0.17	-0.20	-0.15	-0.07	-0.06						
19 Turnover > €200,000	0.62	0.49	2.78	0.15	-0.31	0.07	-0.52	0.31	-0.05	-0.45	0.26	0.26	0.39	0.18	0.18	-0.01	-0.03	-0.04	0.00	0.07	0.08					
20 F1 - Resources and support infrastructures	3.47	0.87	3.08	-0.34	-0.04	0.06	0.29	-0.51	-0.23	0.07	0.39	-0.07	-0.35	0.05	0.05	0.24	-0.06	-0.10	-0.11	-0.08	0.01	0.03				
21 F2 - Local dynamics	2.78	1.25	5.39	-0.31	0.11	0.00	0.53	-0.56	-0.51	0.21	0.44	-0.01	-0.47	-0.25	-0.25	0.15	-0.03	-0.02	-0.12	-0.09	0.04	-0.21	0.61			
22 F3 - Affinity and incentives	2.78	0.92	8.03	-0.31	0.28	-0.02	0.72	-0.55	0.05	0.55	-0.28	-0.28	-0.49	-0.15	-0.15	0.06	-0.02	0.02	-0.03	-0.03	-0.05	-0.65	0.31	0.49		
23 F4 - Knowledge	1.60	0.71	2.37	0.00	-0.09	0.06	0.14	-0.33	-0.12	-0.11	-0.05	0.19	-0.02	0.13	0.13	0.12	0.07	0.01	-0.11	-0.10	-0.10	0.15	0.34	0.28	0.07	
24 F5 - Models of reference	2.97	0.93	3.63	-0.20	-0.15	0.04	0.05	0.44	0.07	-0.17	-0.21	0.52	0.16	0.01	0.01	-0.09	0.05	0.01	0.08	0.05	-0.10	0.29	0.08	-0.07	-0.15	0.39

M mean; *SD* standard deviation; *VIF* variance inflation factor

Table 7 Logistical regression: dependent variable – rural location; Odds Ratio (Marginal effects)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Female	1.05 (0.01)	2.84 (0.15)	0 (-0.18)	0.93 (-0.01)	3.11 (0.16)	0.69 (-0.04)
Business owner age (years)	1.02 (0)	0.98 (0)	1.01 (0)	1.04 (0)	1.06 (0.01)	1 (0)
Higher education	0.36 (-0.14)*	0.27 (-0.02)	0.38 (-0.09)	0.29 (-0.15)**	0.2 (-0.17)**	0.22 (-0.17)**
Minimum education	0.13 (-0.08)	0.62 (-0.01)	0.64 (-0.04)	0.29 (-0.11)	0.19 (-0.09)	0.1 (-0.10)
Business owner experience	0.57 (-0.08)	0.73 (-0.01)	0.37 (-0.11)	0.46 (-0.1)	0.46 (-0.09)	0.59 (-0.06)
Company length of service (years)	0.93 (-0.01)	3.04 (0.02)**	0.89 (-0.01)	2.05 (0.08)*	1.06 (0.01)	1.13 (0.01)
Norte	4.7 (0.27)*	5.92 (0.58)	7.13 (0.94)**	4.97 (0.82)	11.6 (0.99)	0.02 (-0.27)
Centro	2.34 (0.41)**	6.2 (0.53)	2.75 (0.39)	4.6 (0.75)	13.23 (1)	0.21 (-0.14)
Alentejo	2.88 (0.56)**	3.93 (0.26)	3.81 (0.65)	3.04 (0.56)	15.94 (1)	0.27 (-0.11)
Algarve	3.32 (0.68)**	5.23 (0.68)	4.54 (0.81)*	4.58 (0.81)	15.45 (0.94)	0.32 (-0.08)
RAM – Autonomous Region of Madeira	5.08 (0.33)	3.44 (0.03)	3.96 (0.2)	0.77 (-0.03)	9.52 (0.91)	5.43 (0.3)
RAM – Autonomous Region of Azores	3.39 (0.22)	0 (-0.03)	0.65 (-0.03)	8.19 (0.4)	13.98 (0.96)	0.36 (-0.08)
Construction	3.66 (0.72)**	4.24 (0.04)	5.38 (0.87)**	5.03 (0.84)**	10.25 (0.44)	17.39 (0.57)*
Agriculture	3.85 (0.74)**	2.23 (0.02)	53.81 (0.73)*	5.7 (0.88)**	4.61 (0.82)**	61.43 (0.77)**
Services	0.83 (-0.02)	0.55 (-0.01)	0.63 (-0.04)	4.98 (0.28)	0.24 (-0.09)	0.33 (-0.09)
Manufacturing	0.83 (-0.03)	0.57 (-0.01)	0.59 (-0.04)	3.41 (0.19)	0.31 (-0.09)	0.43 (-0.08)
Extractive industry	4.47 (0.8)**	9.38 (0.1)	6.42 (0.9)**	5.84 (0.87)**	28.15 (0.65)*	46.54 (0.74)**
Turnover >€200,000	1.09 (0.01)	0.07 (-0.04)	0.26 (-0.12)	0.93 (-0.01)	0.63 (-0.05)	0.64 (-0.05)
F1 - Resources and support infrastructures	0.11 (-0.3)**	0.02 (-0.06)	0.05 (-0.28)**	0.11 (-0.26)**	0.09 (-0.24)**	0.13 (-0.22)**
F2 - Local dynamics	1.54 (0.18)**	1.24 (0.12)**	1.06 (0.27)	1.44 (0.10)**	1.39 (0.11)	1.39 (-0.11)

Table 7 (continued)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
F3 - Affectivity and incentives	1.46 (0.05)	2.08 (0.01)	1.33 (0.03)	28.46 (0.39)	1.23 (0.02)	1.38 (0.03)
F4 - Knowledge	2.04 (0.1)**	1.95 (0.01)	1.63 (0.05)	1.97 (0.08)*	7.12 (0.71)	2.12 (0.08)*
F5 - Models of reference	0.72 (-0.05)	0.78 (0)	0.82 (-0.02)	0.6 (-0.06)*	0.64 (-0.04)	0.06 (-0.31)
F1*Female		0.19 (-0.03)				
F1*Business owner age (years)		1.01 (0)				
F1*Company length of service (years)		0.64 (-0.01)**				
F1*Norte		0.21 (-0.02)				
F1*Centro		0.28 (-0.02)				
F1*Alentejo		0.8 (0)				
F1*Algarve		0.56 (-0.01)				
F1*RAM		1.22 (0)				
F1*RAA		11.45 (0.04)				
F1*Turnover>€200,000		2.58 (0.01)**				
F2*Female			7 (0.18)			
F2*Business owner age (years)			1 (0)			
F2*Company length of service (years)			1.02 (0)			
F2*Norte			0.1 (-0.21)*			
F2*Centro			0.65 (-0.04)			
F2*Alentejo			0.48 (-0.07)			
F2*Algarve			0.36 (-0.1)			

Table 7 (continued)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
F2*RAM			0.91 (-0.01)			
F2*RAA			1.04 (0)			
F2*Turnover>€200,000			0.66 (-0.05)**			
F3*Female				1.02 (0)		
F3*Business owner age (years)				0.99 (0)		
F3*Company length of service (years)				0.79 (-0.03)**		
F3*Norte				0.26 (-0.16)		
F3*Centro				0.39 (-0.11)		
F3*Alentejo				0.7 (-0.04)		
F3*Algarve				0.34 (-0.13)		
F3*RAM				1.56 (0.05)		
F3*RAA				0.38 (-0.11)		
F3*Turnover>€200,000				1.06 (0.01)	0.4 (-0.09)	
F4*Female					0.97 (0)	
F4*Business owner age (years)					0.91 (-0.01)	
F4*Company length of service (years)					0 (-0.54)	
F4*Norte					0 (-0.56)	
F4*Centro					0 (-0.72)	
F4*Alentejo					0 (-0.67)	
F4*Algarve						

Table 7 (continued)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
F4*RAM					0.05 (-0.3)	
F4*RAA					0 (-0.73)	
F4*Turnover> €200,000					1.49 (0.04)**	
F5*Female						1.13 (0.01)
F5*Business owner age (years)						1 (0)
F5*Company length of service (years)						0.92 (-0.01)
F5*Norte						7.21 (0.21)
F5*Centro						3.57 (0.14)
F5*Alentejo						4.11 (0.15)
F5*Algarve						4.52 (0.16)
F5*RAM						1.15 (0.01)
F5*RAA						1.46 (0.04)
F5*Turnover>€200,000	0.517	0.600	0.572	0.531	0.551	1.25 (0.02)
Pseudo R ²	-299.20	-248.26	-265.32	-290.80	-278.27	0.547
-2 LL						-280.75

* $p < .05$; ** $p < .01$; LL log likelihood

with a turnover above 200,000€ to locate in rural areas. These results show that firms with different knowledge needs have different location preferences.

With regards to factor 2 (Local dynamics) interactions, the higher the scores the lower the importance of region North for rural location; increments in the scores of factor 2 are associated with lower importance of North region in the rural location decision, and increasing scores of factor 2 are associated with firms with turnover above 200,000€ to decrease the propensity to locate in rural areas. These results are specific to the region North, in all other regions the results were statistically significant. For region North the entrepreneur's origin, community's appreciation of business and entrepreneurs (components of factor 2), have no impact on location in rural areas. Entrepreneurs prefer to locate in their native region and in urban areas given their local informal networks (Lafuente et al. 2010) and availability of infrastructure, human capital, innovations and trade volume.

As per factor 3 (Affectivity and incentives) the higher its scores the lower the importance of firm's age on location in rural areas. Increments in the scores of factor 4 (Knowledge) increase the propensity of firms with turnover above 200,000€ to locate in rural areas. Again, firms in region North have a peculiar behavior. Analyzing factors 3 and 4 we can see that this new generation of entrepreneurs has no problem accessing information and knowledge, given their academic ties and utilization of new technologies. In this sense they have no trouble locating in rural areas, taking advantage of their low costs (Shearmur and Doloreux 2008).

In keeping with the aforementioned results, we conclude that the variables generating a significant influence on the establishment of businesses in rural areas are the region's characteristics, the founder's formation, the sector of activity, and the type of location. The results show that firms located in the Centro, Alentejo and Algarve regions are more likely to locate in rural areas. Entrepreneurs with higher education are less likely to establish their businesses in rural areas. In addition, companies in the construction, agriculture, services and manufacturing and mining sectors are more likely to locate in rural areas compared to firms in the knowledge-intensive service sector. Regarding the factors important in the decision to locate firms are: i) the founder, managers and employees wishing to live there; ii) proximity to the founder's residence, iii) climate, and iv) community attitude towards the business community. The results also show that the higher the significance of behavioural factors, the less likely it is that a company is located in rural areas. In turn, an increased emphasis on institutional factors influences the location of businesses in rural areas.

The results of the logistic regression estimations for each sector are presented in Table 8. We did not include control variables for business owner and for the firm because of multicollinearity issues in some sectors. The results show that for the KIBS the higher the age the lower the propensity for the firm to locate in rural areas and its owner to have higher education. In the extractive industry, given the entrepreneur's experience, the firms is more likely to locate in rural areas. For KIBS sectors, agriculture, service, manufacturing and extractive industry, the higher the scores of factor 1 the lower the propensity to locate in rural areas. Regarding to KIBS, manufacturing and extractive industry, the higher the scores of factor 2, the lower the propensity to locate in rural areas; while for agriculture the higher the scores of factor 2, the higher the propensity to locate in rural areas. The results indicate that the

Table 8 Logistical regression by sector: dependent variable – rural location; Odds Ratio (Marginal effects)

	KIBS	Agriculture	Services	Manufacturing	Extractive industry
Female	0.53 (0.00)	1.06 (0.01)	1.03 (0.01)	1.27 (0.05)	1.97 (0.14)
Business owner age (years)	0.75 (−0.01)*	0.97 (−0.01)	0.99 (0.00)	1.04 (0.01)	0.97 (−0.01)
Higher education	0.05 (−0.01)*	0.96 (−0.01)	0.91 (−0.02)	1.55 (0.08)	0.53 (−0.13)
Business owner experience	2.87 (0.00)	0.7 (−0.09)	1.19 (0.03)	2.14 (0.13)	7.00 (0.45)*
Company length of service (years)	1.15 (0.00)	0.97 (−0.01)	1.02 (0.00)	0.97 (−0.01)	0.96 (−0.01)
F1 - Resources and support infrastructures	0.32 (−0.12)**	0.60 (−0.12)*	0.94 (−0.01)	0.51 (−0.13)*	0.74 (−0.17)*
F2 - Local dynamics	1.2 (0.00)	0.63 (−0.11)	0.82 (−0.04)	1.14 (0.03)	1.07 (0.02)
F3 - Affectivity and incentives	1.73 (0.00)	1.34 (0.07)	0.85 (−0.03)	0.97 (−0.01)	0.36 (−0.23)
F4 - Knowledge	1.22 (0.00)	0.74 (−0.07)	1.13 (0.02)	1.12 (0.02)	0.66 (−0.1)
F5 - Models of reference	0.16 (−0.09)*	1.79 (0.14)*	0.49 (−0.13)*	1.11 (0.02)	0.85 (−0.15)*
Pseudo R^2	0.417	0.174	0.149	0.047	0.091
−2 LL	−59.00	−42.30	−54.52	−112.73	−29.70

* $p < .05$; ** $p < .01$; LL log likelihood

entrepreneur's profile, characteristics and experience are important determinants of location in rural areas (Van Praag and Versloot 2007; Ferreira et al. 2010).

Final considerations

This paper studies firm location using data from a sample of one thousand Portuguese firms, belonging to different activity sectors and located in different regions. Taking into account Hayter (1997) approach the data was submitted to a statistical multivariate analysis, namely an exploratory factorial analysis, identifying five different dimensions related with the localizations of firms. The five dimensions, can be considered a new taxonomy. The new five dimensions include: resources and support infrastructures; local dynamics; Affectivity and incentives; knowledge; and models of reference.

In order to predict the company locations, we used a logistic regression having as dependent variable the firm location in rural areas versus that in urban ones. The results showed that the factors underlying the location decisions of companies vary by sector of activity. We conclude that companies engaged in knowledge intensive business services prefer to locate in urban areas (e.g., Eberts and Randall 1998; Poehling 1999; Wernerheim and Sharpe 2003). When the factors are institutional in nature, firms prefer to locate in rural areas. Our research demonstrates that the location decisions of firms depend on the sector of activity, type of area (urban vs. rural) and the characteristics of its founder.

This paper contributes to the literature on entrepreneurship in rural areas, which helps formulating public policies to support entrepreneurship in these areas. Given that rural areas have a disadvantage relative to urban areas, entrepreneurs are either native to

these regions or have some kind of affinity to them; they are also younger. Public policies designed to stimulate firm location in rural areas would develop them and stimulate youth entrepreneurship.

It is important to stress that entrepreneurship is related to specific contexts. As we have seen the determinants of location in rural areas differ from the urban areas, the same holds true for entrepreneurs, they have distinct profiles. Public policies have to take into consideration two issues: 1) they have to know who are the local entrepreneurs; 2) they have to know what are the determinant factors of their location.

Finally, given the limited scope of research on firm location decisions, future research across a number of different approaches would help determine whether innovation capability and company performance are dependent on the entrepreneur's original location decision.

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