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Abstract

The present study analyses the location of new economic activities in the 51 Greek prefectures (NUTS III level) as the outcome of agglomeration economies and other factors that are acknowledged as determinants of new firm location. Cross-section data referring to the location choices of firms in manufacturing, commerce, services and tourism within 2005 are used. Results indicate that agglomeration effects largely determine a region's attractiveness and appropriateness as an investment location. In addition, the effect of other factors such as demand, expected profit and cost conditions is identified as important. Interestingly, regional characteristics seem to affect in different ways the location of start-ups belonging to different industries.

Key words: start-ups, location, agglomeration economies, regional development, Greece

JEL classifications: R3, R1, L26, M13

1. Introduction

Regional economic growth and development is inexorably linked to entrepreneurial activity (Acs and Audretsch 2003; Porter 2003; De Groot *et al.* 2004; Turok 2004). It is now widely acknowledged that increased entrepreneurial activity coincides with the existence of competitive and dynamic economies able to survive and succeed in the contemporary era of worldwide competition. New enterprises are essential to the economic output of regions as not only do they appropriate existing resources, but also they harness new ideas and generate innovations (Baumol 2002). These associational positive effects have caused policy planners to place special emphasis on supporting entrepreneurial activity. This has lead to viewing clustering or the co-location of firms in a region as an ex ante successful mechanism of addressing regional problems (Martin and Sunley 2001). Nonetheless, as McCann and Sheppard (2003:656) stress '*regional policies formulated on the basis of these arguments, which are explicitly intended to influence firm location behaviour, are often built on very weak analytical frameworks*'. Elaborating on the micro-foundations of industrial clustering they provide important insights not only of the strengths but also of the limitations characterising the currently fashionable models of clustering (McCann and Sheppard 2003).

The theoretical discourse on industrial location theory (McCann and Sheppard 2003; Gordon and McCann 2000) and the analysis of entrepreneurship (Nijkamp and Poot 1998) suggest that a thorough understanding of the drivers of entrepreneurial activity, and especially at the regional level, is still missing. In a recent report prepared for the European Commission, it is acknowledged that available knowledge offers ambiguous conclusions as regards the driving forces of entrepreneurship across different countries, industries and time (ECORYS 2003).

Despite the obvious interrelationship between spatial characteristics and the regional facets of entrepreneurship (Audretsch *et al.* 2002), the basic conceptions of regional competitiveness and entrepreneurship are studied largely in the absence of a geographical framework (Sorenson and Audia 2000). Even within the economic geography strand, where the importance of the spatial context is particularly stressed, research largely focuses upon typical industrial districts and the study of their success and tends to overlook other regions that lie outside them (ECORYS 2003). Consequently, further research is needed in order to understand the effect of the spatial context upon entrepreneurial activity (Acs and Audretsch 2003; Breschi and Malerba 2001) with regional location patterns being a topic to which particular emphasis should be placed.

The present study contributes to the above discussion by analyzing the location patterns of different industries in the Greek regions. The main hypothesis analyzed here is that the effect of regional characteristics upon the location of new firms differs depending on the industry under study. In that sense, analysis focuses on the micro-regional determinants of entrepreneurship in Greece while we also distinguish between different industries in order to provide more informative findings regarding the industry – specific drivers of new firm location. Using data on the amount of capital invested in the 51 Greek prefectures (NUTS III level) within 2005 we have estimated location quotients referring to capital investments in four industries namely manufacturing, commerce, services and tourism. These location quotients are analyzed using different sets of regional characteristics approximating agglomeration economies and other factors that the available literature identifies as firm location determinants. Results indicate that agglomeration effects largely determine a region's attractiveness and appropriateness as an investment location. In addition, different effects are observed with regard to different industries thus providing support to the argument that agglomeration effects also depend on the industry under study.

2. Entrepreneurship and the region: some theoretical considerations

Entrepreneurship and the spatial concentration of economic activities have received increased interest over the past decade due to the possibilities they offer for a renewed public policy in local economic development (Castells and Hall 1994). Nevertheless, the spatial dimension of the entrepreneurial process is yet little analysed despite widespread consensus on that 'the regional context matters' (Sorenson and Audia 2000; Gordon and McCann 2000). This is particularly important in light of recent findings challenging the ability of policies supporting firm and household location to inhibit or even reverse the decline of certain regions (Polese and Shearmur 2006). Analysing the regional development processes observed in Europe, Hudson (2002) argues that these will lead to the creation of new and sharper forms of regional uneven development and a widening of regional differences in economic well-being.

Drawing from the observed general trend of firms and industrial activity to be spatially concentrated in certain locations (Gordon and McCann 2000), and the unanimous understanding of entrepreneurship as a complex notion with multiple empirical manifestations, entrepreneurship dynamics have been studied in various disciplines, ranging from economics and economic geography to sociology and psychology (Schutjens and Wever 2000; Audretsch et al. 2002; Gordon and McCann 2000). The dynamics of co-location or else, agglomeration economies, have been studied in economic theory, following the seminal works of Weber (1909/1929) and Marshall (1925), in economic geography with a special focus on cost reduction (Krugman 1991; Venables 1996) and in the sociological strand of literature largely evolving around Granovetter's (1985; 1991; 1992) work on the relationship between social networks of communication and information exchange that might transcend firm and industry boundaries, thus affecting their operation and performance. Yet, as Gordon and McCann (2000) argue, the role of localization and urbanization economies as the two distinct components of agglomeration dynamics are far from being fully comprehended especially at the regional context.

Based on the contributions of Weber (1909/1929) and Marshall (1925), the neoclassical economics strand of thought has placed emphasis upon the study of spatial growth as the outcome of agglomeration economies. Marshall's (1925) analysis focused on the benefits deriving from a specialised pool of labour at the local level, the increased local provision of non-traded inputs specific to an industry and the maximum flow of information and ideas. Later descriptions of agglomeration economies tend to follow Hoover's (1948) classification of agglomeration advantages classified in three groups, namely internal returns to scale, localisation economies and urbanisation economies. Internal returns to scale are observed at the firm level and involve production-cost efficiencies resulting from serving a larger market. Localisation economies are external economies observed at the sector level. They involve all firms belonging to a sectoral group, and result from a high level of local factor employment. Urbanisation economies are also external economies, which, however, benefit the operation of all firms in an area irrespective of sector (Gordon and McCann 2000). The most recent distinction of agglomeration economies refers to Marshall-Arrow-Romer externalities and Jacobs' externalities (Glaeser et al. 1992;

Henderson et al. 1995). This distinction involves a categorization of local knowledge spillovers and suggests that knowledge spillovers might be available to firms within an industry, that is in specialized agglomerations (Marshall-Arrow-Romer externalities), or to firms across a variety of industries, that is in diversified agglomerations (Jacobs externalities).

Theorists in the economic geography strand of thought have shown explicit interest in the study of the geographical aspects of concentration and location theory (Krugman 1991; Venables, 1996). Krugman (1991) identifies three types of externalities that might positively affect the clustering of firms drawing also from Marshall's analysis of the benefits of co-location. According to Krugman (1991) the first type of positive externality regards the concentration of specialised suppliers in an area which will result into economies of specialisation for the firms located in that area. The second one relates to the presence of a specialised labour pool while he identifies the third source of externalities as the technological externalities or knowledge spillovers, suggesting that knowledge and information might flow more easily when firms are co-located in an area. Krugman (1991) acknowledges that technological spillovers might only occur between high-tech industries and are not likely to influence agglomeration. Thus, he places particular emphasis on the role of increasing returns to scale, the input-output links of firms and a region's market potential as the underlying causes of the attractiveness of a given location to economic activities and, consequently, of industrial concentration and trade (Krugman 2000).

Existing empirical research regarding the formation of regional location patterns in Greece is limited. Louri (1988) and Louri and Anagnostaki (1994) utilize an Athens vs the rest of the Greece comparative model to analyse the spatial concentration of new manufacturing firms and find that urbanization economies largely explain the location of manufacturing industries in urban centres. These findings are also supported by evidence suggesting that the survival rates of firms increase through successful location choices (Fotopoulos and Louri 2000). Further, empirical findings regarding the spatial variation of new firm location in Greece indicate that agglomeration economies are present featured by population density, small firm structures, local economic conditions, local production links and regional specialization (Fotopoulos and Spence 1998; 1999).

3. Hypotheses

In line with the most recent distinction of agglomeration economies, we view urbanization economies as external economies that affect all firms, irrespectively of sector, and arise from urban size and density. Such economies are expected to generate positive effects to the regional concentration of economic activity unless diseconomies of scale, that is cost-disadvantages caused by the excessive concentration of population in an area, prevail (Carod and Antolin 2004; Campi et al. 2004). Here we approximate population concentration and urban size by population density and we test the following hypothesis:

> *H1: Start-up capital location might be affected by either positive or negative urbanization economies.*

The effect of localisation economies is analysed using a distinction between Marshallian and Jacobs' externalities. Following the works of Feldman and Audretsch

(1999), Duranton and Puga (2000), Campi et al. (2004), Carod and Antolin (2004) and Frenken et al. (2007), there is a need to distinguish between the effect of specialisation and diversity as determinants of regional location patterns. As regards Marshallian externalities these are viewed as external economies resulting from knowledge spillovers that are available to all firms within the same sector. Available knowledge suggests that Marshallian externalities should have a positive impact for the geographic concentration of economic activity in the case where economies of concentration are not exhausted, whereas a negative impact should indicate the case where external economies related to the concentration of firms within the same sector are exhausted (Carod and Antolin 2004). Here, Marshallian externalities are approximated by the proportion of a region's GDP generated from the secondary sector of the economy as regards manufacturing start-ups and the GDP generated from the tertiary sector of the economy as regards commerce, services and tourism start-ups. To the extent that past trends also matter significantly, we have also coded four dummy variables taking the value of 1 if the region has experienced an increase in each of the four industries under study during the past five-year period. With the use of these variables the following hypothesis is tested:

H2: Start-up capital location might be affected by either positive or negative Marshallian externalities.

Jacobian externalities arise from spillovers generated from an unrelated variety of economic activities and are viewed here as external economies available to all firms and stemming from the variety of industries in a region (Jacobs 1969). Usually, Jacobian externalities are also coincided with positive effects indicating a region's 'need' for unrelated variety spillovers (Frenken et al. 2007). As Mueller (2006) suggests, entrepreneurship flourishes unevenly across German regions and depends upon a variety of paths, which are as broad as the number of local entrepreneurial environments. Under the premise that the development of regions and peripheries is much dependent upon past trends (Carod and Antolin 2004), we assume that Jacobian externalities can be observed as either positive or negative effects subject to a region's profile and its degree of specialisation. To approximate Jacobian externalities we use a region's GDP generated from the secondary and the tertiary sectors of the economy and the dummy coded variables presented above and referring to investments trends that have affected the industrial structure of a region in the past. A note should be made at this point regarding the interpretation of these two sets of variables. These variables are subject to different explanation in each of the four industries analysed here. For example, the GDP generated from the secondary sector of the economy is taken to show the presence of either positive or negative Jacobian externalities when start-ups in the commerce, services and tourism industries are concerned. Similarly, past trends referring to manufacturing will be taken to show the plausible existence of Marshallian externalities when manufacturing start-ups are the dependent variable, as mentioned above, yet they will be taken to show the existence of Jacobian externalities when the commerce, services and tourism start-ups are the dependent variables. Using these two sets of variables the following hypothesis is tested:

H3: Start-up capital location might be affected by either positive or negative Jacobian externalities.

Apart from agglomeration economies, the empirical model estimated here also accounts for the effect of other factors that are theoretically and empirically identified as regional determinants of start-up location. These factors typically include expected demand, profits, cost and other factors. Empirical findings regarding the effect of expected demand and profit factors, usually approximated by variables such as growth in population and price-cost margin and sales growth, typically verify a positive impact on the concentration start-ups (Audretsch and Fritsch 1994a; Keeble and Walker 1994; Reynolds 1994; Guesnier 1994; Okamuro 2007). These findings suggest that a larger market and the probability of achieving higher profits in a grown region are positive determinants of the geographic concentration of economic activity. In contrast, typically negative effects on the geographic concentration of economic activity are expected as a result of cost factors, approximated by variables such as the wage level (Gerlach and Wagner 1994; Audretsch and Vivarelli 1996; Okamuro and Kobayashi 2006; Okamuro 2007). The negative effect of cost factors draws from the fact that the higher the related costs of starting a new business in a region, the less prone potential founders will be to undertake an investment in that region. Of the other factors usually included in regional start-up intensity models, the effect of industry structure, 'neighbour regions', state incentives to promote entrepreneurship and industry specific infrastructure are considered here as factors potentially capturing the effect of sectoral and regional characteristics. Previous evidence regarding the effect of industry structure suggest that the size of existing establishments in an industry is an important determinant of the location decisions of new firms. Both positive and negative effects might be exerted. In particular, when the size of existing establishments is relatively larger, a positive effect is to be expected on the start-up ratios suggesting the presence of internal scale economies whilst a negative sign will be taken to denote the case where smaller in size establishments favour start-up ratios (Audretsch and Fritsch 1994a; Audretsch and Vivarelli 1996; Okamuro 2007). The effect of neighbour regions is considered here under the premise that proximity to core cities and regions might explain the location of manufacturing activity in certain regions (Viladecans-Marsal 2004; Ezcurra et al. 2006). Such an effect would suggest that knowledge spillovers are geographically bounded but these boundaries do not necessarily coincide with administrative boundaries usually employed in empirical analyses. In turn, the interrelationships between adjacent regions could explain the location of economic activity in a given location. As regards the role of state incentives to promote entrepreneurship, a hypothesis is formulated in order to test existing findings, suggesting that state incentives to promote location do attract investments in specific geographic areas (Devereux et al. 2007). In relation to that hypothesis, we also test for the plausible effect of industry specific infrastructure, which in turn might suggest a certain level of regional industrialisation that usually has an effect on the location of new entrants (Devereux et al. 2007).

To account for the effect of these factors, an additional set of hypotheses is formulated and tested in the context of the present study. In particular, hypothesis H4 states that expected demand factors are assumed to exert a positive impact on the start-up ratio experienced by a region. Thus, we expect a positive sign for the per capita GDP variable, which is used here in order to approximate demand factors, with the corresponding hypothesis being:

H4: Start-up capital location might be positively affected by higher demand conditions.

Hypothesis H5 is used to test the effect of profit factors. We use value added in manufacturing, commerce and tourism and other services sectors as the variables approximating expected profit factors. The corresponding hypothesis is:

H5: Start-up capital location might be positively affected by higher expected profit conditions.

Hypothesis H6 is used to test the effect of cost factors. We use land demand to approximate cost factors and we expect a negative impact on the regional start-up capital ratios.

H6: Start-up capital location might be negatively affected by higher cost conditions.

The effect of industry structure is tested with hypothesis H7 and is expected to be either positive or negative. In the first case, a higher concentration rate is favoured by the presence of relatively larger establishments, in which case internal scale economies might be inferred, while in the second case higher concentration rates would result from the presence of smaller in size establishments. We use the average size of the manufacturing, commerce, services and the tourism sector establishments as proxies for the size of the four different industries under study. With the use of these variables we test the following hypothesis:

H7: Start-up capital location might be affected either positively or negatively by the presence of higher average size of own industry establishments.

Hypothesis H8 is used to test the effect of neighbour regions under the premise that close proximity and higher accessibility between regions favours the concentration of economic activity and might explain location decisions of new firms. We use a gravity index variable to approximate the effect of neighbouring regions and we expect a positive impact on the regional start-up ratios.

H8: Start-up capital location might be positively affected in regions with higher gravity index values.

Hypothesis H9 refers to state incentives to promote investments in certain locations. We use a dummy coded variable taking the value of 1 in the case of regions, which belong to the highest investment incentives zone as the relevant Greek Development Law defines these. We test the following hypothesis:

H9: Start-up capital location might be positively affected in regions belonging to the highest investment incentives zone.

Hypothesis H10 is used to test the potentially positive externalities deriving from the presence of industry specific infrastructure in a region. We use a dummy coded variable taking the value of 1 in the case of regions, which have industrial districts as a proxy of industry specific infrastructure in manufacturing and a dummy coded variable taking the value of 1 in the case of regions which have developed specific tourism infrastructure. To that extent the following hypothesis is tested only in the case of manufacturing and tourism start-ups:

H10: Start-up capital location might be positively affected in regions, which have developed industry specific infrastructure.

4. Empirical model and data

Operationalising entrepreneurship in an empirical context is a difficult task owing to the multiple facets of the concept (Storey 1991). Here, we use the amount of capital engaged by new firms (births) in order to analyse the effect of regional characteristics upon industrial location of start-ups belonging to four industries. The regional location of capital investments among the 51 Greek prefectures during 2005 is approached through the corresponding location quotient index computed, for each of the four industries, as follows:

$$LQ_{ir} = \left(\frac{N_{ir}}{N_{in}}\right) \Bigg/ \left(\frac{N_r}{N_n}\right) \qquad (1)$$

where LQ is the estimated location quotient for 2005, i refers to capital investments in manufacturing, commerce, services and tourism, N_{ir} is the volume of capital per industry i invested in region r, N_{in} is the total volume of capital per industry i in Greece, N_r is the total volume of capital invested in region r, and N_n is the total volume of capital invested in the country. Location quotients larger than one indicate that a region's share in attracting capital investments in a specific industry is larger than the corresponding share of the country.

In order to identify the regional characteristics that determine the location of capital investments in Greece we test the following specification for each of the four industries:

$$LQ_{ir} = \mathbf{\beta' x_i} + e_i \qquad (2)$$

where $\mathbf{x}$ is a vector of geographic, socio-economic and other region and industry-specific characteristics affecting the location of new firms for the industries under study, $\boldsymbol{\beta}$ a vector of parameters to be estimated and e an error term.

A note should be made at this point regarding the choice of a specialisation index as the dependent variable depicting regional variations in the intensity of start-up location. The regional differences in start-up ratios can also be analysed following either an 'ecological' (start-ups in relation to existing establishments) or a 'labour market' approach (start-ups in relation to labour force size), as defined by Audretsch and Fritsch (1994a,b) or the 'business stock model' and the 'labour force model', respectively, as defined by Keeble and Walker (1994). The first approach is usually employed for the analysis of start-ups in an industrial demography context while, the second approach is based on the presumption that start-ups are the product of local inhabitants, which decide to start new businesses in the area where they live (see for example Santarelli and Piergiovanni 1995). The second approach could also be appropriate in the context of the present study. Nonetheless, normalizing the number of start-ups in a region by the size of the labour force, results into significant correlation between the dependent variable and some of independent variables such as per capita GDP, population density and value added in manufacturing. Given the study's objective and of its focus on identifying the role of agglomeration economies, the exclusion of these independent variables would seriously constraint the appropriateness of the identified model and its analytical validity. Thus, the specialisation index is preferred here.

The hypothesis that regional and industry-specific characteristics exercise different effects upon the location of capital investments is tested using data for the regional location of a total amount of 333.678,7 thousand euros mobilized by 4,151 new firms established in Greece within 2005. Data on the regional location of capital are derived from a private company called ICAP, which maintains a database of all S.A. and Ltd. companies established by year. This edition provides basic information referring to the number of new firms per industry and the amount of capital invested at NUTS III level (prefecture). The ICAP directory uses the European Commission's definition regarding the birth of firms[1] and thus annual entries in the directory do not include firms that have been in any way created by existing firms, e.g. changes in the legal form, mergers, acquisitions, etc. Following the international practice ICAP records as new firms (one year of age) those officially established between January 1st and December 31st of each year. To that extent part of the sample refers to start-up capital investments the latter defined as investments by firms that have not published balance sheets within the year of their recorded birth.

Of the 4,151 new S.A. and Ltd. firms that have been established in the country within 2005, 13.4% involves manufacturing, 31.3% involves commerce, 50.3% involves services and 5.0% involves tourism companies. Correspondingly, of the total amount of 333.678,7 thousand euros invested, 13.8% involves manufacturing, 21.8% involves commerce, 56.1% involves services and 8.3% involves tourism. Utilizing the data referring to the regional location of capital invested per industry, we have

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[1] Regulation No. 2700/98 of 17 December 1998, L344, 18/12/1998, p. 49-80.

estimated location quotients at NUTS III level (51 Greek regions). Manufacturing investments have been realized in 43 prefectures, commerce investments in 46 prefectures, services investments in 47 prefectures and tourism investments have been realized in 33 prefectures. Figures 1 – 4 illustrate the location of start-up capital in the 51 Greek prefectures.

Data on regional characteristics, which are used as the explanatory variables of the analysis, are derived from the National Statistical Service of Greece (NSSG) and the Hellenic Centre for Investment (ELKE). The NSSG database has been used in order to derive information on the basic geographic and socio-economic characteristics of regions, while the ELKE's database has been used to acquire information on a number of other important characteristics such as the number of industrial parks, the number of research and development institutions operating in the area, etc. It should be noted here that the ELKE's database is officially available for the first time and in that context our research might only go forward using comparable data that might also be available in the future. On the other hand, data at the regional level regarding important indicators such as e-commerce and ICT structures, availability of regional venture capital funds etc, are not available at this point from an official organisation. An additional note should be made on that not all explanatory variables refer to 2005 – the date of realized capital investments included in the study – and this could be viewed as a limitation. Nonetheless, possible limitations are minimized to the extent that these variables refer to the macroeconomic figures of regions and such regional characteristics change at a low pace (Johansson and Forslund 2006) while, investment plans require at least a few years of preparation prior to their implementation. Table 1 summarizes descriptive statistics of all variables included in the analysis. See left-hand part of Table 1 for a description of the explanatory variables included in the final models. Descriptive statistics of the used variables are presented in the right-hand part of Table 1. The correlation matrix of the explanatory variables is shown in the Appendix.

5. Estimation procedures and results

The empirical estimation of a linear regression model as in equation (2) raises a number of issues that need to be addressed. First, an important issue arises in the case where the simple random sampling hypothesis is violated suggesting that spatial dependence occurs in the data (Anselin 1988; Kmenta 1997; Maddala 2001). In such a case the OLS estimates are inefficient and inconsistent even if still unbiased (Arbia 2006). The most commonly used test of spatial independence is the Moran's *I* spatial autocorrelation test (Moran 1950). The Moran's *I* is a global test for spatial dependence that does not assume an alternative hypothesis. Nonetheless, it is suggested for an exploratory analysis (Arbia 2006) while Anselin and Rey (1991) and Anselin and Florax (1995) prove that the Moran's *I* test has a slightly better power than the Lagrange multiplier test in small samples. Empirical studies using Moran's *I* in the case of small samples are reported by Florax and de Graaff (2004). Here, we test for spatial dependence in the OLS results of the start-up capital location equations for the four industries under study using the global Moran's *I* statistic. The statistic is computed using the following expression:

$$I_i = \frac{\sum_k \sum_j w_{kj} \left(C_{ik} - \overline{C}_i \right) \left(C_{ij} - \overline{C}_i \right)}{\sum_k \left(C_{ik} - \overline{C}_i \right)^2} \quad (3)$$

where C is start-up capital, i is the sector, k, j are the prefectures and $\overline{C}$ is the average. Our weight matrix, w_{kj}, is queen contiguity with values of unity assigned to a prefecture's neighbors and zero to others. Values of Moran's I greater than zero show positive spatial dependence while values less than zero show negative spatial autocorrelation. Results of Moran's I statistic, as shown in Table 3, reveal that the location of start-up capital in the four industries under study is not spatially dependent. These findings are in line with previous research evidence suggesting that spatial autocorrelation effects are sensitive to the scale of analysis and NUTS-III regions constitute a relatively high regional scale, unlike to show spatial autocorrelation effects (see Viladecans-Marsal 2004; Boschma and Weterings 2005; Van Stel and Nieuwenhuijsen 2004).

A second important issue regarding the econometric estimation of equation (2) relates to the possible presence of sample selection bias caused by the zero start-up capital values reported for a number of regions in 2005. The use of a random cross-section set of data generates a question as to the selection of just a portion of the sample, that is excluding regions with zero start-up capital, that might lead to biased estimates. In order to test for the presence of selection bias we used a two-stage process as proposed by Heckman (1979). In the first stage, a discrete selection model (Probit) is estimated to account for the location or not of capital investments in industry i per region r. Thus, at this stage the dependent variable is a binary one taking the value of 1 if capital investments occurred in industry i in region r. The second stage consists of an OLS estimation of the start-up capital equation only in the case of regions that have non-zero amounts of capital investments. At this second stage, the inverse of Mill's ratio, λ, is also estimated in order to control for possible selection bias[2]. Results from the second stage equation do not provide evidence of sample selection bias, as the λ parameter is statistically insignificant in the case of all industries analysed here. More specifically, $\lambda = 1.995$ $(p = 0.1546)$ in the case of manufacturing start-up capital location, $\lambda = -0.808$ $(p = 0.2228)$ in the case of commerce start-up capital location, $\lambda = -0.001$ $(p = 0.9985)$ in the case of services start-up capital location, and $\lambda = 8.6742$ $(p = 0.3875)$ in the case of tourism start-up capital location. In view of these results a sample selection model cannot be chosen.

Available literature suggests that in the case where the observed data contain a cluster of zeros a censored regression model is most appropriate (Maddala 1983; Amemiya 1984; Greene 1997). The most familiar case regards the Tobit model, which in its general form involves (Greene 1997):

A latent underlying regression of the form:

$$y_i^* = \beta'\mathbf{x_i} + e_i, \ e_i \sim \mathrm{N}\left[0, \sigma^2\right] \tag{4}$$

and an observed dependent variable of the form:

$$\begin{aligned}
&\text{if } y_i^* \le L_i, \text{ then } y_i = L_i \text{ or unobserved (lower tail censoring)} \\
&\text{if } y_i^* \ge U_i, \text{ then } y_i = U_i \text{ or unobserved (upper tail censoring)} \\
&\text{if } L_i < y_i^* < U_i, \text{ then } y_i = y_i^* = \beta'\mathbf{x_i} + e_i
\end{aligned} \tag{5}$$

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[2] The inverse of Mill’s ratio, i.e. the λ parameter is estimated as $\lambda = \rho * \sigma$, where ρ is the correlation of the residuals in the first and second stage equations and σ is the standard error of the residuals of the second stage equation (Heckman 1979).

and can be applied in this case in order to acquire consistent estimates of the associated parameters (Greene 1997). In the classical normal regression model, the conditional mean function is $\mathrm{E}\left[y_i|\mathbf{x}_i\right]=\beta'\mathbf{x_i}$. But, if y_i is restricted to the range $\left[L_i,U_i\right]$ the conditional mean becomes:

$$\mathrm{E}\left[y_i|\mathbf{x}_i, L < y_i < U\right]=\beta\mathrm{N}\mathbf{x}_i+\sigma_i\frac{\phi_L-\phi_U}{\Phi_U-\Phi_L} \tag{6}$$

where $\phi_j=\phi\left[\left(j-\beta'\mathbf{x_i}\right)/\sigma_i\right]$, $\Phi_j=\Phi\left[\left(j-\beta'\mathbf{x_i}\right)/\sigma_i\right]$, and $j=L_i,U_i$. With censoring in only one tail, either L_i will be $-\infty$ or U_i will be $+\infty$, in which case, ϕ_j will equal 0 and Φ_j will be 0 (for L_i) or 1 (for U_i). For the Tobit model, then (Greene 1997):

$$\mathrm{E}\left[y_i^*|\mathbf{x_i}\right]=L_i\Phi_L+U_i\left(1-\Phi_U\right)+\left(\Phi_U-\Phi_L\right)\beta\mathrm{N}\mathbf{x}_i+\sigma_i\left(\phi_L-\phi_U\right) \tag{7}$$

Again, it should be noted that in the case of censoring in only one tail, one of the densities is 0, and one of the tail probabilities is either 0 or 1. The marginal effects in the Tobit model when censoring is at the left, at 0, are estimated as (Greene 1997):

$$\mathrm{E}\left[y|\mathbf{x}\right]=\Phi\left(\beta'\mathbf{x}/\sigma\right)\left[\beta'\mathbf{x}+\sigma\phi\left(\beta'\mathbf{x}/\sigma\right)/\Phi\left(\beta'\mathbf{x}/\sigma\right)\right] \tag{8}$$

Here, a Tobit model with lower tail censoring is identified. Results of the censored regressions estimated for the four industries under study are summarized in

Tables 3 – 6. The estimated models have been corrected for heteroskedasticity and include all variables[3] in relation to the proposed hypotheses. Thus, Column 1 in each of the Tables 3 – 6 presents the results of estimating the full model identified by the hypotheses set forth in the third part of the paper. Due to significant correlation between the gravity index variable (which is used here in order to test the effect of neighbour regions) and the population density variable, the effect of this variable is tested separately while excluding the population density variable from the estimated model. Results of this test are presented in column 2 in Tables 3 - 6. Finally, in order to test for the robustness of the estimated coefficients, the full model proposed here has been estimated again while including only significant ($p<0.01$, $p<0.05$) and almost significant ($p<0.10$) variables of models 1 – 2. Since Tobit models do not include an R^2 measure, we have used a modified version of the McKelvey-Zaviona statistic to calculate a pseudo R^2 for the estimated models, as recommended by Veall and Zimmerman (1994). As expected, the models' overall fit improves in all cases (column 3 in Tables 3 – 6).

Results of the final models considered here are presented in column 3 of Tables 3 – 6 and are discussed below for each industry under study. The last column of each Table presents marginal effects, which show the magnitude of the effect exercised by statistically significant variables upon the concentration of location and have thus been estimated with regard to model 3 in all cases. As regards the interpretation of the marginal effects, it should be noted that marginal effects show how much the probability of location will change if the independent variable changes by a marginal amount from its sample mean. For dummy independent variables, the

[3] For continuous variables the natural logarithm is used in the estimations.

marginal effects are analyzed as discrete or relative changes when the respective dummy takes its two different values, 0 and 1, respectively (Greene 1997).

Regional location of start-up capital in manufacturing – Urbanization economies as proxied here by population density do not seem to affect the location of manufacturing start-up capital. Thus, H1 cannot be inferred to hold. As regards localization effects these are featured as statistically significant and negative in nature. In particular, negative Mashallian type localization effects are observed and thus H2 can be inferred to hold with a negative sign, while the negative effect of favorable past development trends in the services sector suggests the presence of negative Jacobian type localization effects. Thus, H3 can also be inferred to hold with a negative sign. Of the other factors, profit and cost conditions have been found to significantly affect the location of manufacturing start-up capital with the anticipated signs and thus hypotheses H5 and H6 can also be inferred to hold. Finally, the effect of industry specific infrastructure has been found significant albeit negative in nature. This is a not an anticipated finding suggesting that the presence of industrial parks in an area might be indicative of over-concentration of manufacturing activities. In any case this finding renders further research.

Regional location of start-up capital in commerce – Results regarding the determinants of commerce start-up capital show that urbanization economies and Marshallian type localization economies do not exert statistically significant effects. Thus, hypotheses H1 and H2 cannot be inferred to hold. As regards the Jacobian type localization effects these are significant and positive in nature suggesting that hypothesis H3 holds with a positive sign. Of the other factors analyzed, cost effects have been found negative and statistically significant indicating that hypothesis H6 holds. Results regarding the effect of the per capita GDP variable used here to approximate demand conditions (H4) are negative in nature. This is not an anticipated finding indicating that higher income might result into higher concentration of commerce thus causing negative location effects.

Regional location of start-up capital in services – Urbanization economies do not seem to affect the location of services start-up capital. Thus, hypothesis H1 has not been found to hold. Marshallian type localization economies are statistically significant and positive in nature and thus hypothesis H2 can be inferred to hold with a positive sign. Interesting results are observed regarding the presence and effect of Jacobian type localization economies. Positive effects are observed with regard to the secondary sector's GDP whereas the effect of favorable past trends in manufacturing is negative. A plausible explanation of this finding might relate to the existence of thresholds in the complementary among different sectors. Of the other factors, demand and profit conditions have been found to exert statically significant and positive in nature effects suggesting that hypotheses H4 and H5 can be inferred to hold with the anticipated signs.

Regional location of start-up capital in tourism – Tourism investments have not been found to be affected by urbanization economies and thus hypothesis H1 cannot be inferred to hold. As regards the localization economies only Mashallian type effects have been found to significantly affect the location of start-up capital in tourism. Thus, hypothesis H2 can be inferred to hold while hypothesis H3 has not been verified. Of the other factors included in the analysis, profit conditions have been found to exert positive and statistically significant effects indicating that hypothesis H5 can be inferred to hold. The effect of the per capita GDP variable have been found statistically significant but negative in nature which is not in line with hypothesis H4 regarding the effect of demand conditions. Again this finding points to that a different effect might underlie the presence of higher demand conditions such as possible congestion effects from the concentration of economic activity in a region.

6. Conclusion

The present study analyses the regional location of capital investments in Greece in an attempt to identify regional patterns that foster the location of certain industrial activities. In doing so the plausible complementarities and conflicts among industries might be observed so as to enhance our understanding on the dynamics underlying the co-location or clustering of new firms in a region. To that extent emphasis has been placed here on identifying the role of agglomeration economies while the effect of other factors, such as profit and cost conditions, demand and the size of the sector, as determinants of location dynamics have also been analyzed. The location of start-up capital in the 51 prefectures of Greece within 2005 is used as a case study in order to identify the regional characteristics that define a region's appropriateness and attractiveness as an investment location for certain industries. Data on investments refer to manufacturing, commerce, services and tourism, with which location quotients have been estimated and regressed upon a number of variables approximating the above-mentioned determinants.

Summarizing the results of the present study, a number of conclusions might be drawn. First, results regarding the role of urbanization economies, show that these do not seem to affect the location of start-up capital in any of the four industries analyzed here. A second point relates to the presence of Marshallian type localization economies that have been verified in the case of manufacturing (negative), service (positive) and tourism (positive) start-up capital location. A third conclusion relates to the presence and significance of Jacobian type localization effects, which have been observed in all industries except tourism. The fourth point relates to the diversity of the other factors affecting the location of start-up activity when different industries are concerned. Manufacturing stat-ups are affected by profit and cost conditions and by the availability of industry specific infrastructure. Commerce start-ups are affected by demand and cost conditions while services and tourism start-ups are affected by demand and profit conditions. The presence of some non-anticipated effects constitutes an area of further research as important insights might be provided through the analysis of alternative explanations pertaining to the effect of variables such as industry specific infrastructure (observed with a negative sign in the case of manufacturing start-ups) and per capita GDP (observed with a negative sign in the case of commerce and tourism start-ups). The last point relates to the no effect results of two variables namely the gravity index and the incentives zone variable, which render some further discussion. The gravity index variable has been found not to exert statistically significant effects in all industries analyzed here. This finding is consistent with the results of the spatial autocorrelation (spatial dependence) tests performed here and suggesting that no spatial scale effects are present. Again it should be noted that this outcome is probably due to the scale of analysis as NUTS III regions can be considered as large areas in terms of observing such effects (Boschma and Weterings 2005; Viladecans-Marsal 2004; Van Stel and Nieuwenhuijsen 2004).

The role of state incentives to promote the location of investments in the Greek regions has not been verified here. Nonetheless, it should be noted that this could well be the outcome of the available proxy variable. Available literature regarding the state's role in promoting entrepreneurship in Greece suggests that a wide range of initiatives, measures and types of investments might be conducive to the location of new firms and regional economic development (Psycharis 2008; Coccossis and Psycharis 2008; Lambrinidis et al. 2005; Petrakos and Psycharis 2004; Konsolas et al. 2001). A research framework that allows for the possible effects of such actions could be more illustrative of the state's role in the location of new firms and that constitutes and interesting line of further research in the field.

Overall, the results of the present study provide support to the argument that different industries are affected by different regional characteristics shaping the context of new firm location. The role of localization economies and other regional characteristics, which have been identified as important determinants of the regional patterns of firm location and clustering, suggests that complementarities and conflicts among industries do exist and shape the observed patterns of industrial location in Greece. Such findings might contribute to the policy design level as they enrich our knowledge of the mechanisms underlying the attractiveness of regions as location destinations and thus of the formation of regional clusters. In view of these findings it is suggested that development policies and initiatives in Greece should be designed in light of the complex interrelationships between regional characteristics, industry features and the general economic structure of regions. Nonetheless, further research is needed in the direction of assessing the effect of policy initiatives promoting the location of new firms.

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Figure 1. Regional location of manufacturing start-ups in Gree

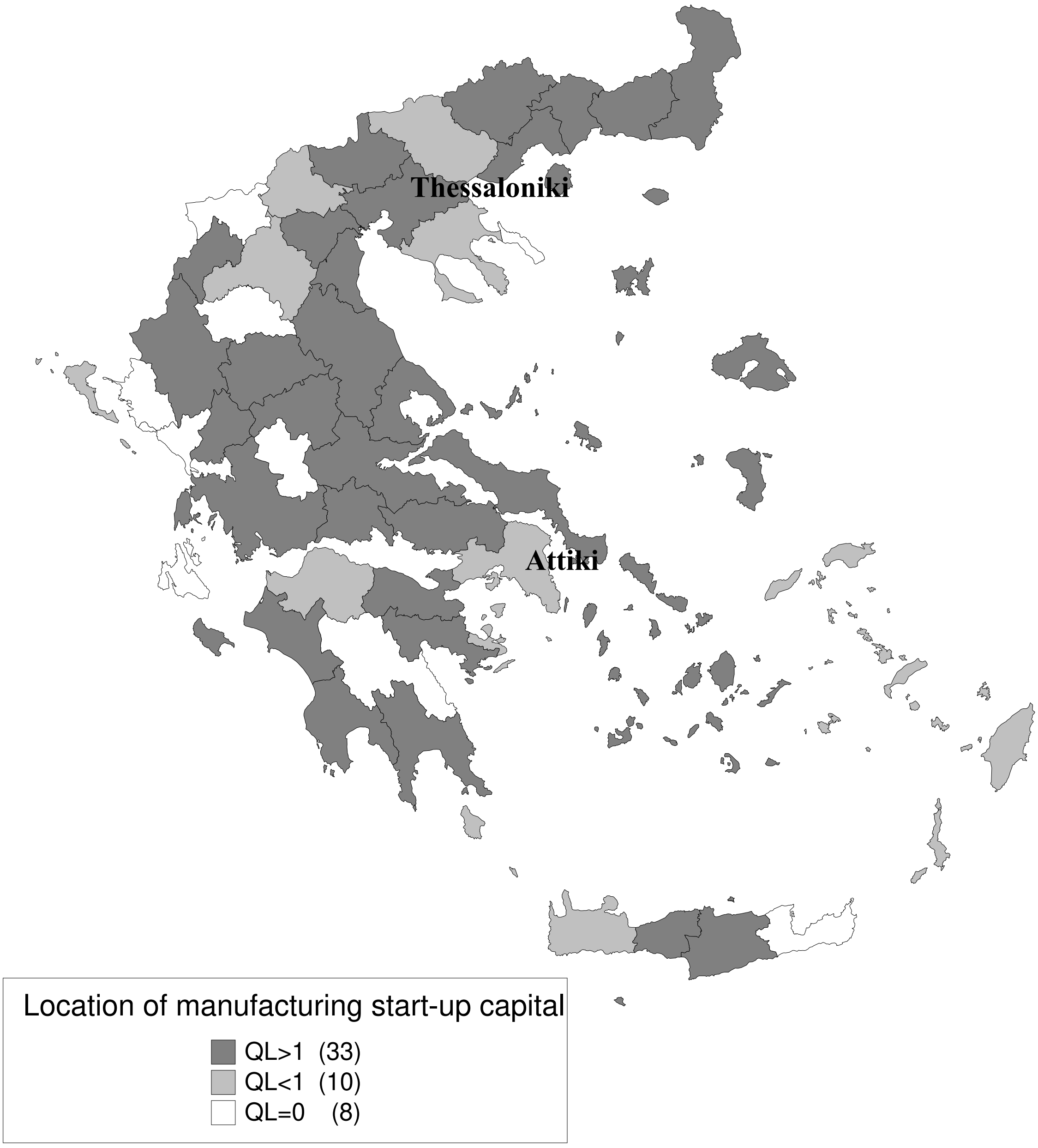

Figure2. Regional location of commerce start-ups in Greec

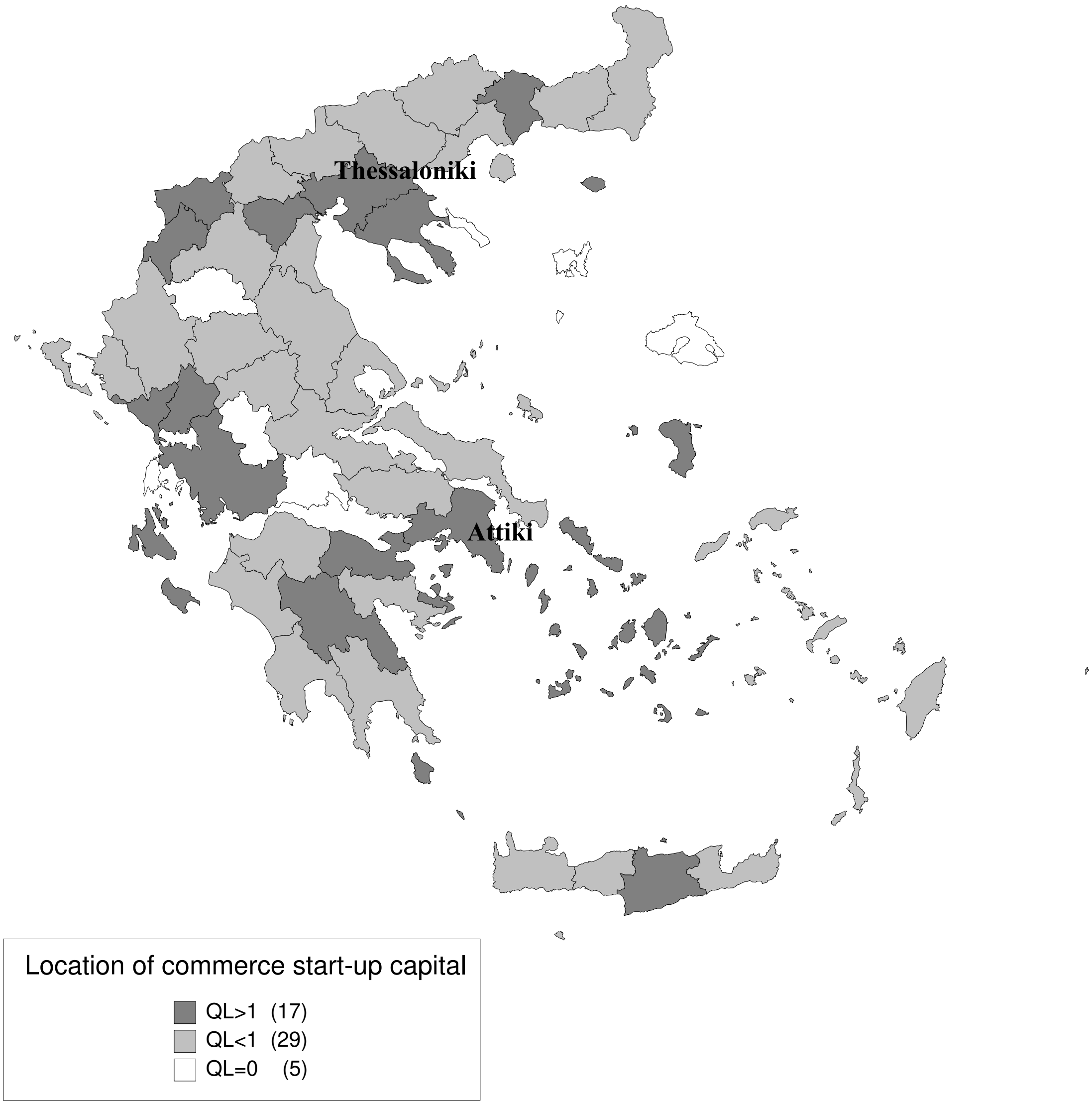

Figure 3. Regional location of service start-up capital in Greec

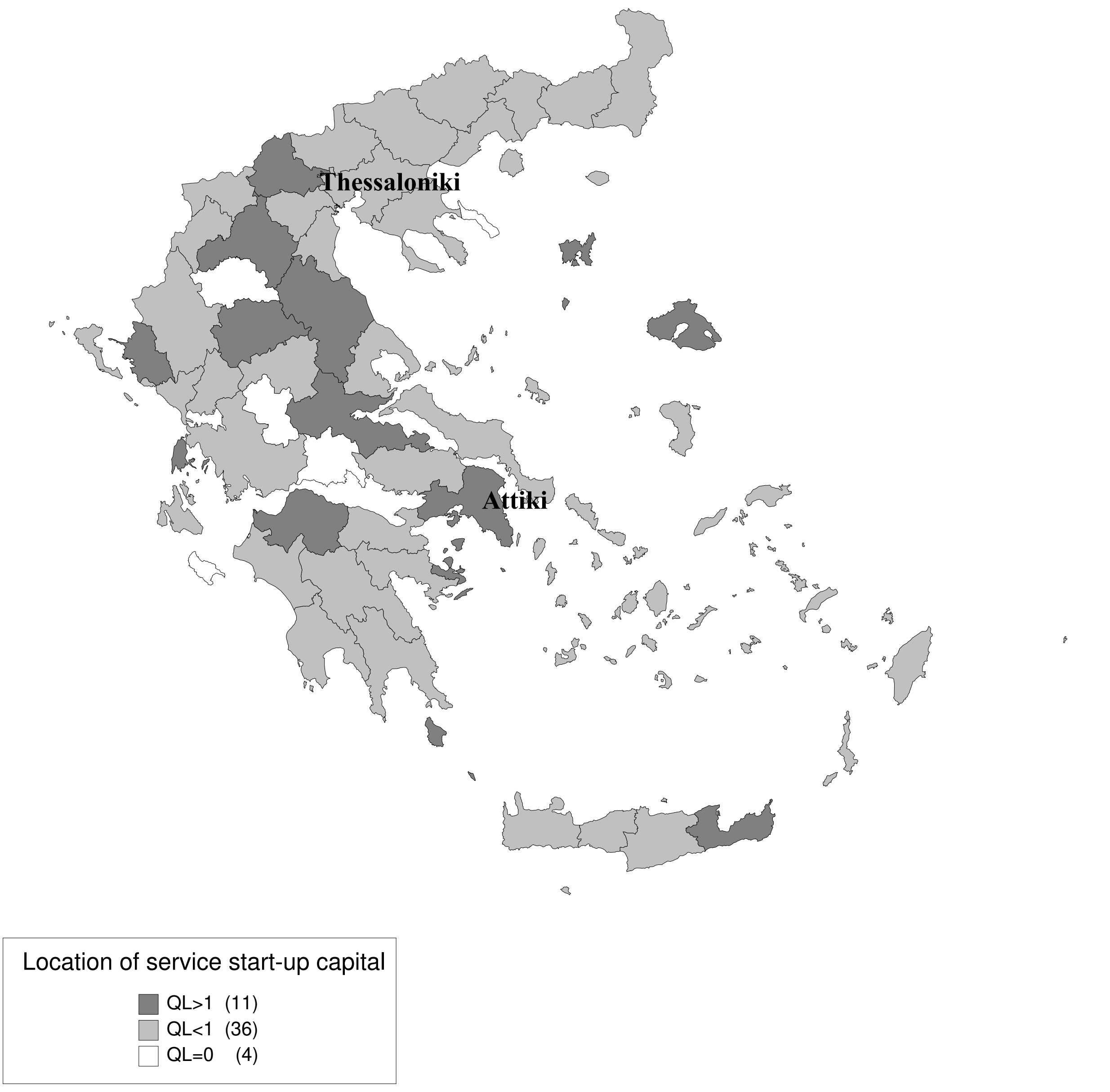

Figure 4. Regional location of tourism start-up capital in Greece

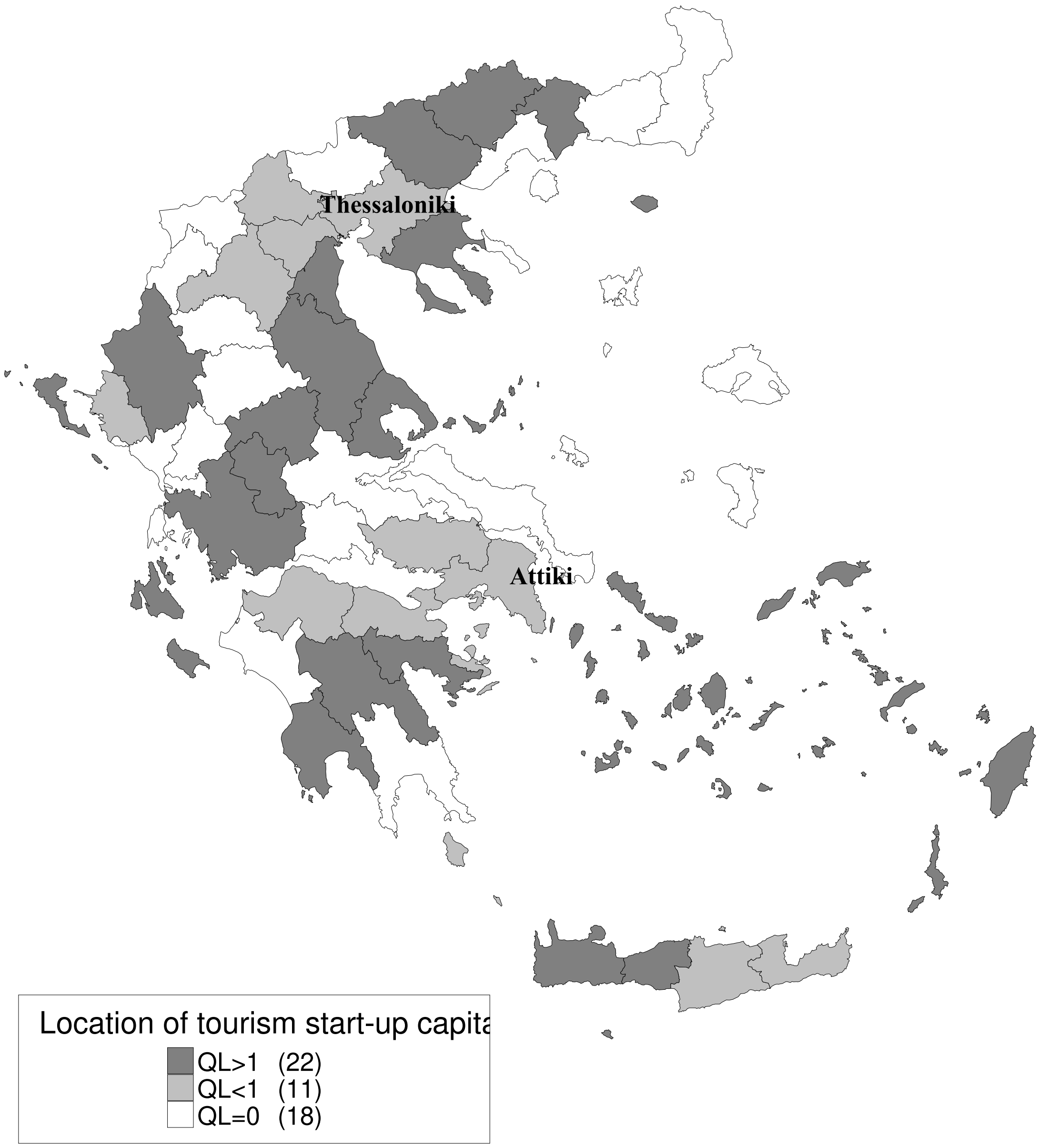

Table 1. Definition and descriptive statistics of the variables used in the analysis of regional capital location.

Variable	Definition	Descriptive statistics			
		Mean	**St. Dev.**	**Min**	**Max**
Dependent variables					
LQMC	Location quotient of manufacturing capital invested in region *r*	1,757	1,517	0,00	7,23
LQCC	Location quotient of commerce capital invested in region *r*	0,863	0,704	0,00	3,72
LQSC	Location quotient of services capital invested in region *r*	0,744	0,405	0,00	1,58
LQTC	Location quotient of tourism capital invested in region *r*	1,599	2,468	0,00	12,11
Explanatory variables					
Population Density	Population density, measured as inhabitants per Km^2	76,66	136,83	17,15	987,87
GDP Secondary	GDP of secondary sector, measured as the percentage contribution of secondary sector to the total GDP of a region	18,26	11,20	5,20	58,10
GDP Tertiary	GDP of tertiary sector, measured as the percentage contribution of	68,51	11,52	34,80	90,00

	tertiary sector to the total GDP of a region				
Trend Manufacturing	Dummy variable, 1 if the region has experienced increase in the number of manufacturing firms within the past 5 years (2000-2004)	0,41	0,50	0	1
Trend Commerce	Dummy variable, 1 if the region has experienced increase in the number of commerce firms within the past 5 years (2000-2004)	0,47	0,50	0	1
Trend Services	Dummy variable, 1 if the region has experienced increase in the number of services firms within the past 5 years (2000-2004)	0,42	0,49	0	1
Trend Tourism	Dummy variable, 1 if the region has experienced increase in the number of tourism firms within the past 5 years (2000-2004)	0,22	0,42	0	1
Per Capita GDP	Per capita Gross Domestic Product, in euros	11.516,44	9.050,28	3.362,36	52.549,76
Profit Manufacturing	Value added in manufacturing, in thousand euros	318.630,65	1.376.915,21	2.050,00	9.762.110,00
Profit Commerce – Tourism	Value added in commerce and tourism industries, in thousand euros	1.083,29	4.807,31	280,00	34.480,00
Profit Services	Value added in other services, in thousand euros	1.482,02	5.460,05	790,00	39.080,00

Cost	Volume of new constructions per 10,000 population, in 1,000 m^3	34,37	13,22	16,00	82,00
Size Manufacturing	Manufacturing incumbent firms per 10,000 labour force	387,89	1518,43	3,17	11.012,30
Size Commerce	Commerce incumbent firms per 10,000 labour force	831,37	955,49	6,27	7.421,70
Size Services	Bank offices per 10,000 labour force as proxy for services sector size	149,18	241,31	7,00	1.359,00
Size Tourism	Hotel beds per 10,000 population as proxy for tourism sector size	98,14	138,09	4,00	620,00
Gravity Index**	Index calculated as $\sum_{i}^{j}\left(p_j/d_{ij}\right)$ where p_j is a prefecture's population and d_{ij} is time distance between the prefectures' centres	99,99	55,20	30,50	393,40
Incentives Zone	Dummy variable used as a proxy for the investment incentives applying to a region under the Development Law 3299/2004 (and its amendments), 1 if the region belongs to the highest investment incentives zone	0,16	0,37	0	1
Infrastructure Manufacturing	Dummy variable, 1 if the region has at least one industrial park, as a proxy for industry specific infrastructure in manufacturing	0,59	0,49	0	1

Infrastructure Tourism	Dummy variable, 1 if the region has at least one ski resort, as a proxy for industry specific infrastructure in tourism	0,29	0,46	0	1

*Descriptive statistics refer to the 51 Greek prefectures, which is the sample size in all cases. **Data on the gravity index have been adapted from Petrakos and Psycharis (2004).

Table 2. Spatial dependence tests for the location quotients of start-up capital

	Moran's I
Manufacturing	-0.6947 (0.1565)
Commerce	0.4382 (0.1155)
Services	0.0895 (0.5412)
Tourism	-0.7095 (0.5378)

Table 3. Censored regression equations: location of manufacturing start-up capital in Greece.

	Model 1		Model 2		Model 3		Marginal effects	
	β	**t-ratio**	***β***	**t-ratio**	***β***	**t-ratio**	***β***	**t-ratio**
Constant	5.284	2.213	5.192	1.552	1.915	1.692		
Population Density	-0.717	-1.559						
GDP Secondary	-0.796***	-3.167	-0.735***	-2.806***	-0.463*	-1.663	0.001*	1.661
Trend Manufacturing	0.612	1.320	0.461	0.994				
GDP Tertiary	-0.015	-0.857	-0.032	-1.453				
Trend Commerce	0.379	0.838	0.551	1.149				
Trend Services	-1.104**	-2.502	-1.351**	-2.493	-0.766*	-1.791	-0.001*	-1.668
Trend Tourism	-0.635	-1.222	-0.825	-1.545				
Per Capita GDP	5.968*	1.881	4.478	1.412	4.153	1.224		
Profit Manufacturing	0.803***	3.222	0.742***	2.851	0.506**	2.327	0.012*	1.896
Cost	-0.036**	-2.126	-0.036**	-2.041	-0.039**	-2.126	-0.0001*	-1.680
Size Manufacturing	0.093	0.633	0.036	0.155				
Gravity Index			-0.008	-0.904				
Incentives Zone	0.225	0.424	-0.132	-0.198				
Infrastructure Manufacturing	-1.028**	-2.224	-1.233***	-2.582	-1.279***	-2.792	-0.002**	-2.519
Log-L	-77.3559		-78.1176		-82.1191			
Pseudo-R^2	0.6650		0.5732		0.6492			

*significant at 10%, **significant at 5%, ***significant at 1%.

Table 4. Censored regression equations: location of commerce start-up capital in Greece.

	Model 1		Model 2		Model 3		Marginal effects	
	β	**t-ratio**	***β***	**t-ratio**	***β***	**t-ratio**	***β***	**t-ratio**
Constant	0.069	0.050	-0.279	-0.197	-0.243	-0.475		
Population Density	0.394	1.403						
GDP Tertiary	0.003	0.266	0.002	0.171				
Trend Commerce	0.223	1.001	0.220	0.980				
GDP Secondary	0.361**	1.988	0.427**	2.314	0.271**	1.985	0.027**	1.985
Trend Manufacturing	0.121	0.566	0.127	0.586				
Trend Services	-0.304	-1.366	-0.375*	-1.691	-0.202	-0.998		
Trend Tourism	-0.367	-1.422	-0.535*	-1.909	-0.286	-1.182		
Per Capita GDP	-3.488**	-2.117	-2.585*	-1.675	-2.092*	-1.658	-0.021*	-1.658
Profit Commerce – Tourism	-0.331	-1.575	0.054	0.307				
Cost	-0.028***	-3.163	-0.022**	-2.555	-0.021***	-2.640	-0.002***	-2.640
Size Commerce	-0.084	-0.651	-0.059	-0.457				
Gravity Index			-0.004	-1.275				
Incentives Zone	-0.331	-1.209	-0.418	-1.418				
Log-L	-49.1849		-49.3531		-51.5485			
Pseudo-R^2	0.3743		0.3890		0.4163			

*significant at 10%, **significant at 5%, ***significant at 1%.

Table 5. Censored regression equations: location of service start-up capital in Greece.

	Model 1		Model 2		Model 3		Marginal effects	
	β	**t-ratio**	***β***	**t-ratio**	***β***	**t-ratio**	***β***	**t-ratio**
Constant	-1.579	-2.394	-1.694	-2.430	-1.085	-2.272		
Population Density	-0.123	-1.007						
GDP Tertiary	0.004	0.690	0.002	0.351				
Trend Services	0.437***	3.901	0.399***	3.431	0.379***	3.773	0.038***	3.773
GDP Secondary	0.283***	3.047	0.289***	3.097	0.173**	2.513	0.017**	2.513
Trend Manufacturing	-0.170	-1.557	-0.180*	-1.657	-0.173*	-1.680	-0.001*	-1.680
Trend Commerce	-0.109	-0.940	-0.097	-0.837				
Trend Tourism	0.102	0.725	0.066	0.445				
Per Capita GDP	1.495*	1.854	1.318*	1.701	1.481**	2.124	0.015**	2.124
Profit Services	0.209**	2.027	0.202*	1.828	0.174***	2.612	0.001***	2.612
Cost	0.001	0.155	0.001	0.261				
Size Services	0.029	0.470	0.021	0.336				
Gravity Index			-0.001	-0.827				
Incentives Zone	0.100	0.755	0.034	0.232				
Log-L	-16.3518		-16.5127		-18.2772			
Pseudo-R^2	0.4502		0.4305		0.3302			

*significant at 10%, **significant at 5%, ***significant at 1%.

Table 6. Censored regression equations: location of tourism start-up capital in Greece.

	Model 1		Model 2		Model 3		Marginal effects	
	β	**t-ratio**	**β**	**t-ratio**	**β**	**t-ratio**	**β**	**t-ratio**
Constant	-0.295	-0.080	0.414	0.114	-2.715	-0.738		
Population Density	1.335	1.165						
GDP Tertiary	0.083*	1.936	0.108**	2.438	0.124***	3.320	0.076***	3.205
Trend Tourism	1.274	1.111	1.523	1.302				
GDP Secondary	0.006	0.207	0.006	0.214				
Trend Manufacturing	-1.212	-1.279	-1.203	-1.276				
Trend Commerce	0.108	0.108	0.026	0.027				
Trend Services	0.003	0.004	0.367	0.382				
Per Capita GDP	-1.754**	-2.280	-1.599**	-2.147	-1.455**	-2.085	-8.889**	-2.085
Profit Commerce – Tourism	1.518*	1.824	1.342*	1.933	0.586*	1.946	0.357*	1.927
Cost	-0.021	-0.568	-0.028	-0.799				
Size Tourism	0.587	1.278	0.675	1.448				
Gravity Index			0.015	1.221				
Incentives Zone	-1.355	-1.080	-0.735	-0.576				
Infrastructure Tourism	-0.768	-0.757	-1.139	-1.096				
Log-L	-90.0543		-89.9971		-94.6186			
Pseudo-R^2	0.7793		0.7598		0.7275			

*significant at 10%, **significant at 5%, ***significant at 1%.