"Location Patterns of Creative Capital and Regional Disparities in Spain"

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Abstract

The 'creative class' as a source of growth has been afforded increasing attention in recent years. However, creative people are not distributed evenly across space, tending rather to concentrate in particular locations. The location decisions of these creative people have been forwarded as a significant factor in accounting for regional disparities in growth and development (Florida, 2002; Fritsch and Stuetzer, 2009). Inspired by the ongoing debate surrounding the creative class theory, this study investigates the spatial distribution of creative capital and its links with regional disparities by examining the geographical divergence of provincial income in Spain. Our findings indicate that although provinces with low levels of creative capital around 1996 experienced an increase in their creative employment in the years leading up to 2004, they still lag behind the northern (and, in particular, the north-eastern) provinces of Spain. More interestingly we report strong spillover effects among the leading and lagging provinces. This spatial pattern of creative capital also accounts for the north-south divide in Spain. Thus, our empirical evidence shows that the provinces with high levels of creative capital in northern Spain are more developed in terms of provincial income even when controlling for other determinants of the process, including industrial development, regional spillover effects and human capital development.

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Acknowledgements:

1. Introduction

The role played by the creative class as a factor of economic growth has recently come under examination (Lang and Danielsen, 2005; Boschma and Fritsch, 2007). Florida (2005) claims that creative people are a key driver of urban and regional development (see also Boschma and Fritsch, 2007) and he presents evidence that cities and regions whose populations show high levels of creativity grow faster. In this respect his creative capital theory differs markedly from that of human capital, which holds that education is the key to promoting regional economic growth (Florida, 2002; 2002a). And, indeed, more recently Florida has argued that the creative class theory outperforms the human capital theory in predicting urban economic development (Florida, 2005).

By contrast, Glaeser (2005) reports that human capital variables, when pitted against the creative class theory in a test of economic growth, outperform the creative class variables (see also Hoyman and Faricy, 2008). Similarly, a number of empirical studies conclude that cities and regions with more highly educated residents tend to grow faster than cities with smaller stocks of highly educated labor (Glaeser and Saiz, 2003; Marlet and Woerkens, 2007).

Despite these findings, examining the impact of creativity on regional differences remains a relevant objective. Here, the underlying idea is that the creative class is strongly linked to territorial considerations, because regions and cities have to attract highly skilled or creative human capital in order to attain higher levels of economic growth (Florida, 2005; Lucas, 1988; Chantelot et al., 2010). Creative capital has been identified as a critical resource for boosting innovation and economic competitiveness (Chantelot et al., 2010); hence, we need to be able to identify the geographical distribution of creative people in order to understand any regional differences. In an attempt at shedding further light on some of these questions, this study presents empirical findings from a case study conducted in southern Europe, more specifically in the state of Spain. It examines the spatial distribution of creative capital and its impact on regional disparities. We implement a two-step analysis: first, analyzing the dispersion of creative capital and offering explanations for the geographical rigidity of this pattern; and, second, determining whether this dispersion is a possible factor accounting for regional differences in Spain.

The following section provides a summary of the literature examining the creative class theory and its relation to regional development. In Section 3, the geography of employment and creative capital in Spain is described. The evolution in creative capital for the post-1996 period, and its performance, is visualized. Section 4 outlines the methodology employed and describes the data set. Section 5 reports our empirical findings concerning the geographical patterns of creative capital and regional divergences. Here, the spatial patterns and their interdependencies are discussed in testing the impact of the creative class on regional differences. Finally the last section concludes.

2. A review of the creative class theory

Many studies demonstrate that the quality of a region's workforce is a major determinant of that region's economic success (Glaeser, 2000; Florida, 2002; Simon and Nardinelli, 2002). The role of highly skilled workers is at the center of an emerging paradigm in economic development and is the subject of growing interest not only among economists, economic geographers and regional scientists (Mallender and Florida, 2007), but also among sociologists, and urban planners (Power and Scott, 2004; Hartley, 2005; Cooke and Lazzeretti, 2008, Lazzeretti et al., 2008). Regional development studies typically stress the need for both urban and rural regions to be open and attractive to human capital (Bollman, 1999; Petrov, 2008). Florida (2002a) claims that the ideas and creativity provided by highly skilled workers are the most important elements in the economic success of a region and that knowledge-based economic growth and local development are typically found in close association with the "clustering of creative people and human capital" (Lucas, 1988). Likewise, a number of studies highlight the close relation between local development and highly skilled human capital (Simon, 1998; Glaeser et al., 1992; Glaeser and Saiz, 2003; Henderson et al., 1995; Capone, 2006).

The creative class theory emphasizes the importance of place in attracting talented workers. Locations boasting the three Ts - technology, talent, and tolerance – will, it is argued, experience demographic and economic growth (Hoyman and Faricy, 2008). The theory, presented by Richard Florida in 'The Rise of the Creative Class' (2002a), is a multifaceted concept that describes a new class, an emerging sector of the economy, and an urban plan for economic growth and development. The presence of technology

clusters, talented populations, and tolerance attracts a significant number of creative workers, and the presence of this 'creative class' drives innovation and economic growth (Florida, 2002a; Hoyman and Faricy, 2008).

The creative class is typically described as a group of individuals that are either highly educated or engaged in creative (scientific, artistic, or technological) activities (Florida, 2002a; 2005; Petrov, 2008). At the core of this creative class we find "people in science and engineering, architecture and design, education, arts, music and entertainment, whose economic function is to create new ideas, new technology and/or new creative content" (Florida, 2005). Around this creative core is "a broader group of creative professionals in business and finance, law, health care and related fields" (Florida, 2002a). An important sub-group within this creative core comprises bohemians - the artistically creative, including 'authors, designers, musicians, composers, actors, directors, painters, sculptors, artists, printmakers, photographers, dancers, artists, and performers' (Florida, 2002a; Fritsch and Stuetzer, 2009). Florida stresses that the creative class is above all innovative and consequently highly productive (Florida, 2002a; Marlet and Woerkens, 2007).

The main factor participating in creativity is human capital and, as such, it can be considered a form of capital, what Florida (2005) refers to as 'creative capital'. Seen from this perspective, a major driving force of economic development is this set of creative people, or the creative class (Florida, 2005; Petrov, 2008). This notion, however, extends beyond traditional representations of highly skilled workers or knowledge workers (Petrov, 2008). The basic tenets of the human capital and the creative class approaches differ from those in the standard economic geography literature in that they assume that it is people, not firms, that lead the way (see Marlet and Woerkens, 2007). Creative, well-educated people choose desirable places in which to live; companies are attracted to these places by their creative, educated work forces (Boarnet, 1994; Marlet and Woerkens, 2007). Thus, human capital theory is concerned with the creation and use of knowledge by the skilled and highly educated in those cities and regions (Marlet and Woerkens, 2007). Contemporary theories of modern growth hold that technology drives economic growth, and that it is the accumulation of human capital that accounts for differences in the levels of this technology and consequently for differences in economic growth. Although the most conventional measure of human capital is an individual's level of education, this new approach requires the appraisal of an individual's intrinsic creative potential to generate

new ideas, technologies, business models, cultural forms and whole new industries, which is how the "creative class" emerged as a concept in the work of Richard Florida (Dinescu and Grigorovici, 2008). It is argued that in addition to the skill level, the creative ability of the labor force (or of the creative class) is an essential component of the endogenous development of urban areas (Anderson, 1985; Florida, 2002; 2002a). The creative class theory, although disputed by many (Glaeser, 2005; Markusen, 2006), has found support in a number of critical empirical studies that seek to measure creativity and its impact on regional economic competitiveness (Florida and Gates, 2001; Florida, 2002; 2002a; McGranahan and Wojan, 2007). These studies also demonstrate that quality of place (interpreted as a function of diversity and openness) represents one of the most important factors in attracting creative capital (Florida, 2002a; 2005) and, as such, acts as a powerful force of urban and regional economic growth and development (Petrow, 2008).

The main criticism of Florida's approach is that creativity and human capital are interconnected (Glaeser, 2005; Fritsch and Stuetzer, 2009), which weakens any definition of creative people in empirical analyses made on the basis of occupation.

Indeed, many of the occupations regarded by Florida as being creative require a relatively high level of educational qualification and Glaeser (2005) shows that there tends to be a highly positive correlation between the share of people with creative occupations and the share of people with a higher level of education. Thus, Florida's critics argue that creativity simply measures the impact of qualification and human capital on economic development (Fritsch and Stuetzer, 2009). Marlet and Woerkens (2007) similarly claim that creativity is basically the same as human capital, but show that designing categories for people that are not necessarily highly educated, yet who play a key role in economic production, is useful in achieving a better understanding of regional economic growth (Marlet and Woerkens, 2007). They argue that Florida does not support his creative class theory with much empirical analysis, pointing out that while some of the individuals in Florida's creative class are indeed not highly educated, the majority are (Marlet and Woerkens, 2007). Additionally, there would appear to be a lack of evidence regarding the direction of causality between the creative class and economic growth in thriving urban areas – i.e., does the creative class foster growth or does growth attract a creative labor force (Glaeser, 2005; Shearmur, 2007; Petrov, 2008)? Other critics call into question the impact of people in artistic occupations (bohemians) on economic development (Lang and Danielsen, 2005; Markusen, 2006),

doubting the existence of a causal relationship (Fritsch and Stuetzer, 2009). Hoyman and Faricy (2008) find the widespread adoption of creative class–based policies somewhat surprising given that the academic literature provides little evidence in support of the relationship between creative clusters and actual economic indicators.

Finally, Goonewardena (2004) argues that cities have always been creative and diverse, and so creative capital cannot be responsible for the new economic growth of the 1990s (cited in Hoyman and Faricy, 2008).

Despite these criticisms, the majority of evidence seems to support the positive impact of creative people on economic development. In addition, the creative class is reported to be spread unevenly, which makes it important to understand the factors that account for its varied geography (Mallender and Florida, 2007). The concentration of creative people in just a few locations can be considered a factor in the clustering of economic activity. This is particularly true of those activities with a high demand for highly qualified labor, such as research and development, design and marketing and the high-tech industries (Arora et al., 2000; Florida, 2005; Fritsch and Stuetzer, 2009). Florida's theory is thus very much in line with Jacobs' ideas (1970, 1985) concerning the role of cities and with the basic hypotheses underpinning new economic growth theory (Romer, 1986, 1993; Lucas, 1988, cited in Fritsch and Stuetzer, 2009). For instance, Lucas (1988) recognizes the role of great cities, which localize human capital and information, create knowledge spillovers, and become engines of economic growth (see also Mallender and Florida, 2009). Based on the importance of highly skilled workers in explaining the relation between inequality and economic growth, several studies have examined whether this growth is heterogeneous (Paci and Usai, 2001; Castella and Domanech, 2002; Ahmed, 2009). Karlsson et al. (2009) observe that the critical input for the knowledge economy – human capital – is strongly concentrated geographically, much more so than most other types of economic resources and activities. In other words, they conclude that human capital exhibits strong tendencies to agglomerate in certain locations (see also Berry and Glaeser 2005) and that human capital levels are diverging. They conclude that this concentration is likely to continue to occur in certain regions only (Florida, 2002; Berry and Glaeser, 2005).

Overall, as derived from modern growth theories as well as from recent developments in the creative class theory, the way in which people are dispersed across space seems to be a vital element in understanding location-specific differences. On the one hand, human capital agglomerations are believed to parallel the level of regional development (Jacobs 1961, 1969; Lucas 1988; Glaeser 1994; Qian, 2008; Fujita, 1988; Krugman, 1991; Romer, 1990); on the other hand, individuals with specific levels of creativity cluster and spread out (i.e., the spillover of creative capital) coinciding once more with location-specific differences (Glaeser, 2005; Mallender and Florida, 2007; Marlet and Woerkens, 2007; Hoyman and Faricy, 2008). Thus, we believe the examination of location patterns of creative capital (seen as a form of human capital) and their association with Spain's regional disparities constitutes a valuable field of study.

3. The geography of creative capital in Spain

Spain comprises 52 provinces and 19 Autonomous Communities. Historically, the geography of Spain, despite some convergence, has been one of regional imbalance (Tortosa-Ausina et al., 2005; Pastor et al., 2010; Cuadrado et al., 1998; Villaverde, 2001; de la Fuente, 2002; Goerlich et al. 2002; Raymond, 2002; Lladós, 2002). For the 1961-1981 period, Leonida and Montolio (2001) highlight the fact that the richest provinces had lost positions in the distribution of income, but that they still formed a separate mode (showing persistence), indicating that there were few prosperous regions in Spain in that period. In the sub-period 1991-1997 a process of polarization was set in motion. Provinces with income levels above the Spanish average were found to be located, primarily, in the north of Spain, as a north-south divide became apparent during the nineties (Leonida and Montolio, 2001). As Maza and Villaverde (2009) stress, Spanish provinces form clusters presenting similar levels of income per inhabitant, with the north-eastern part of the country being the most developed and the southern and north-western parts being least developed. Overall the studies examining regional disparities in Spain concur that, despite some limited signs of convergence, the dual north-south structure is an ongoing inequality phenomenon of the country (Cuadrado et al., 1998; Villaverde, 2001; de la Fuente, 2002; Goerlich et al., 2002; Raymond, 2002; Lladós, 2002, Kerimoglu and Karahasan, 2011, Pastor et al., 2010).

According to Prados de la Escosura and Roses (2009), human capital has provided a positive, albeit small, contribution to labor productivity growth thereby facilitating technological innovation, while broad capital accumulation and efficiency gains are complementary in Spain's long-term growth. In the period 1850-2000, Spain experienced a major transformation in the general level of qualifications of its labor force, with the proportion of Spanish workers having completed at least their secondary education more than doubling (from 36.4% in 1985 to 78% in 2002) (Prados de la Escosura and Roses, 2009). The number of jobs for the professionally trained levels also grew very rapidly in the years between 1850 and 2000 (Prados de la Escosura and Roses, 2009).

Table 1 shows that in general all of Spain's provinces increased their share of creative employment between 1996 and 2004. In both years, the highest share of creative employment out of total employment by province was observed in Barcelona, Zaragoza, Madrid and Vizcaya (see Table 1). Girona, Alicante, Castellon, Valencia, Alava and Guipúzcoa are notable in terms of their creative employment as a share of total employment in 2004. In terms of the creative capital development of Spain's provinces, Table 1 illustrates that Castellon and Valencia presented the highest rates of increase in their respective shares of creative employment between 1996 and 2004. The rise in creative employment as a share of total employment rose from 0.01 to 0.42% in Valencia, from 0.01 to 0.43% in Castellon, while in Madrid it rose from 0.27 to 0.52% (see Table 1). However, despite the changes in ranking according to creative employment, in 2004 the provinces remained in the same clusters as in 1996 (see Table 1).

In both years (1996 and 2004), if we take the ratios for Spain as a whole, Barcelona leads the way in terms of creative employment, while Madrid leads in terms of both highly educated employment and highly educated population, with Vizcaya occupying second place. The number of highly educated people as a share of total employment rose in Madrid from 15.97 to 21.07% between these years, in Barcelona from 9.85 to 14.04%, and from 15.68 to 16.98% in Vizcaya. The number of highly educated people as a share of the total population rose in Madrid from 7.89 to 10.95% between 1996 and 2004, from 4.76 to 7.07% in Barcelona, and from 7.22 to 8.88% in Vizcaya (see Table 1).

Based on their creative capital, Barcelona, Zaragoza, Madrid and Vizcaya constitute the first cluster in both 1996 and 2004. Based on highly educated employment, Madrid and Vizcaya constitute the first cluster in 1996 and in 2004, followed by Sevilla, Salamanca, Zaragoza and Barcelona in 1996 and by Granada, Barcelona, Navarra and Zaragoza in 2004 (see Table 1).

A number of differences can be observed in the trends presented by the dispersion of creative employment and highly skilled employment. For example, Granada and Salamanca only gained slightly in terms of their respective shares of highly educated employment while Girona, Alicante and Castellon improved their standing only in terms of creative employment. And while Girona, Alicante, Castellon and Valencia only made gains in terms of creative employment, Alava and Guipúzcoa made gains in terms of both creative and highly educated employment between 1996 and 2004 (see Table 1).

Table 1: The ranking of the Spanish provinces

provinces	increase rate of creative employment* 1996-2004	increase rate of total employment** 1996-2004	share of creative employment in total employment 1996 %	share of creative employment in total employment 2004 %	Share of employment with un. degree or higher*** in total employment 1996 %	Share of people with un. degree or higher** in total population 1996 %	Share of employment with un. degree or higher*** in total employment 2004 %	Share of people with un. degree or higher** in total population 2004 %
Almería	0.19	0.50	0.03	0.17	6.30	2.66	9.49	4.98
Cádiz	0.13	0.37	0.06	0.21	6.27	1.97	8.25	3.90
Córdoba	0.12	0.26	0.09	0.27	5.40	1.99	10.33	4.24
Granada	0.14	0.35	0.07	0.23	8.60	3.60	15.36	7.05
Huelva	0.11	0.50	0.06	0.20	3.86	1.39	5.41	2.82
Jaén	0.14	0.77	0.06	0.18	4.89	1.75	10.44	4.64
Málaga	0.18	0.62	0.07	0.31	6.58	2.80	8.43	4.02
Sevilla	0.11	0.39	0.11	0.29	10.53	3.86	12.96	6.09
Huesca	0.13	0.08	0.11	0.31	6.45	3.50	8.36	4.01
Teruel	0.16	0.13	0.06	0.26	3.43	2.20	7.57	3.14
Zaragoza	0.10	0.50	0.28	0.55	9.88	4.95	13.75	6.89
Asturias	0.11	0.28	0.11	0.32	7.19	3.36	9.11	5.08
Baleares	0.12	0.82	0.11	0.34	5.28	2.68	6.24	3.25
Las Palmas	0.27	0.25	0.04	0.33	4.42	2.00	8.82	4.67
Santa Cruz de Tenerife	0.28	0.44	0.03	0.29	6.74	3.18	11.36	5.87
Cantabria	0.07	0.28	0.05	0.14	7.12	3.16	8.39	4.39
Ávila	0.14	0.05	0.06	0.20	6.10	2.54	7.57	3.63
Burgos	0.14	0.57	0.11	0.37	5.28	2.99	10.87	6.17
León	0.03	0.22	0.06	0.20	6.44	2.96	9.03	4.57
Palencia	0.10	0.51	0.07	0.18	6.17	3.0	9.00	4.21
Salamanca	0.19	-0.12	0.04	0.25	10.14	5.24	12.55	6.61
Segovia	0.10	-0.19	0.05	0.17	7.53	4.04	11.71	6.06
Soria	0.07	0.69	0.09	0.19	5.77	3.14	9.58	5.15
Valladolid	0.08	0.03	0.12	0.32	9.21	4.68	10.50	6.52
Zamora	0.13	-0.29	0.04	0.15	6.22	2.64	9.20	4.19
Albacete	0.15	0.54	0.08	0.28	7.55	2.77	9.13	4.02
Ciudad Real	0.15	0.61	0.07	0.22	6.37	2.75	7.91	3.43
Cuenca	0.15	0.74	0.04	0.14	5.04	2.32	6.63	3.13
Guadalajara	0.13	0.82	0.08	0.23	6.58	3.14	12.25	5.90
Toledo	0.12	-0.15	0.07	0.26	5.15	2.32	6.80	3.15
Barcelona	0.08	0.37	0.32	0.67	9.85	4.76	14.04	7.07
Girona	0.13	0.43	0.16	0.44	6.91	3.53	8.25	4.62
Lleida	0.11	0.09	0.10	0.32	6.42	3.40	10.69	5.03
Tarragona	0.12	0.12	0.10	0.31	6.10	3.05	8.87	4.49
Alicante	0.10	0.35	0.17	0.43	5.66	2.65	9.97	4.79
Castellón	0.52	0.26	0.01	0.43	6.60	3.29	8.34	3.93
Valencia	0.53	0.41	0.01	0.42	8.33	3.95	13.76	6.82
Badajoz	0.10	0.15	0.04	0.18	6.11	2.07	7.80	3.37
Cáceres	0.19	-0.38	0.03	0.19	6.09	2.46	7.98	3.61
A Coruña	0.14	-0.23	0.07	0.28	6.92	3.40	11.19	6.19
Lugo	0.16	-0.49	0.04	0.24	3.42	2.00	9.35	4.94
Ourense	0.12	-0.42	0.07	0.26	6.62	3.54	12.68	5.84
Pontevedra	0.16	-0.02	0.07	0.32	5.83	2.89	7.71	4.29
Madrid	0.08	0.51	0.27	0.52	15.97	7.89	21.07	10.95
Murcia	0.13	0.64	0.08	0.24	7.88	3.41	9.68	4.68
Navarra	0.09	0.56	0.17	0.34	8.29	4.39	14.16	7.02
Álava	0.11	0.31	0.16	0.43	8.10	4.62	13.21	7.50
Guipúzcoa	0.09	0.32	0.15	0.40	8.67	4.19	13.63	7.76
Vizcaya	0.08	0.47	0.21	0.45	15.68	7.22	16.98	8.88
La Rioja	0.08	0.39	0.11	0.27	7.55	3.53	9.97	5.19

Source: authors' own calculations, * from SABI database, ** from INE, *** from IVIE
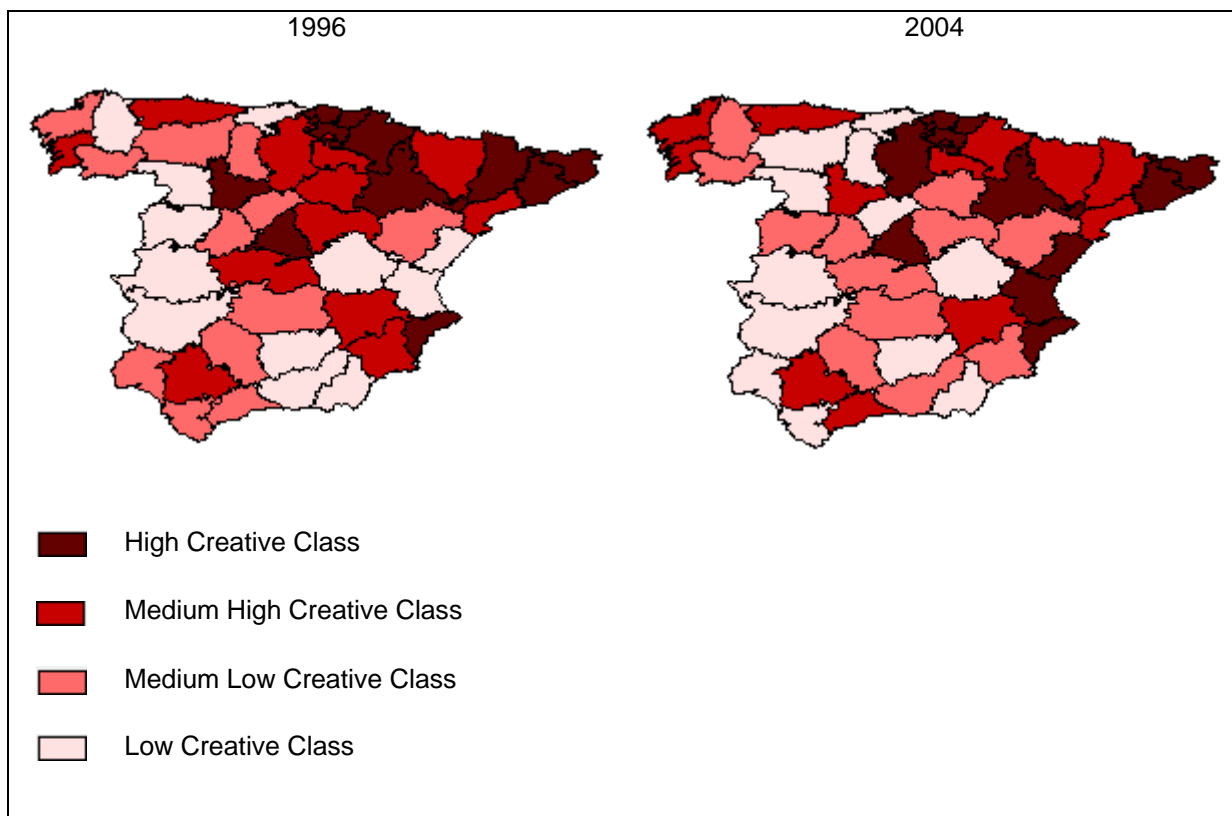
These preliminary, yet important findings, acquire greater value once combined with the spatial distribution maps of creative capital in Spain (see Figure 1). In both years the geographical dispersion of creative capital seems to concentrate chiefly in the north-eastern part of the country. Note that this pattern coincides largely with that of the map of Spain's main regional disparities (see Section 2 for the literature review and Section 5 for the findings of the paper validating this concern). More interestingly, the figures in Table 1 and the creative employment growth performances illustrated in Figure 2 show that the provinces with the lowest creative capital shares grew fastest during the 1996-2004 period. However, when combining this information with the coefficient of variation (Figure 3), the struggle suffered by these lagging provinces becomes apparent.[1] Overall (and returning to Figure 1) the north-south difference in terms of creative capital is a persistent feature of the maps: the north-eastern geography concentrates creative employment, while Madrid in the center of the country appears as an outlier. Indeed, even if we take into consideration the developments recorded in terms of creative capital, the north-south pattern of inequalities seems to be persistent.[2]

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[1] Coefficient of variation is simply $\frac{\sigma}{\mu}$ and is regarded as a convergence measure. A decrease in the measure is in favor of a more equal dispersion of the creative capital.
[2] See Section 4 for a detailed examination of regional spillovers.

Figure 1: Spatial Distribution of Creative Capital in Spain (per 10,000 employers)


| 1996 | 2004 |

High Creative Class

Medium High Creative Class

Medium Low Creative Class

Low Creative Class

Source: SABI

Figure 2: Performance of Spanish Provinces in terms of Creative Capital

(Annualized growth of creative employment 1996-2004)

53% -16%

13% - 15%

11% - 12%

3 % - 10%
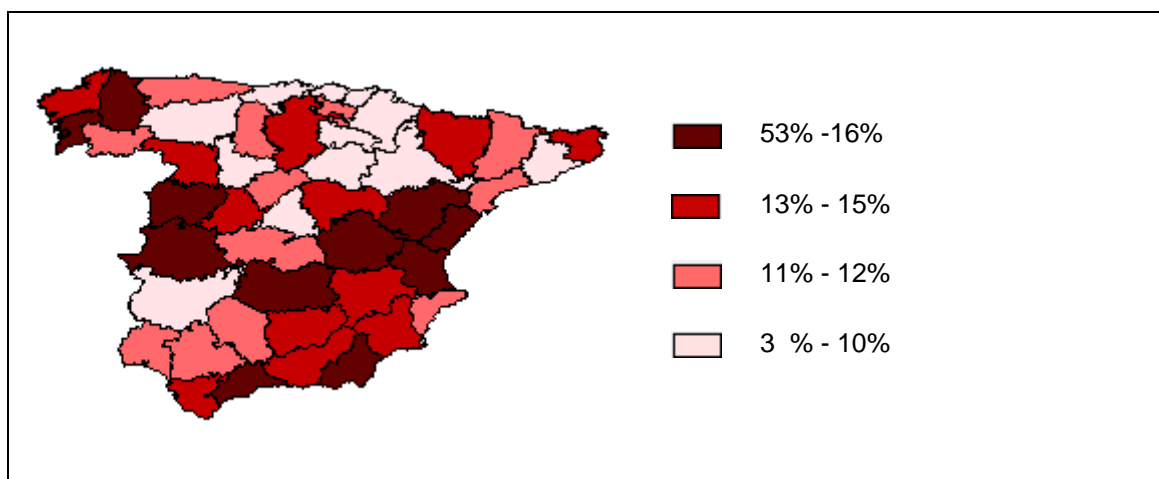
Source: SABI, authors' own calculations

Figure 3: Coefficient of Variation for Creative Capital in Spain
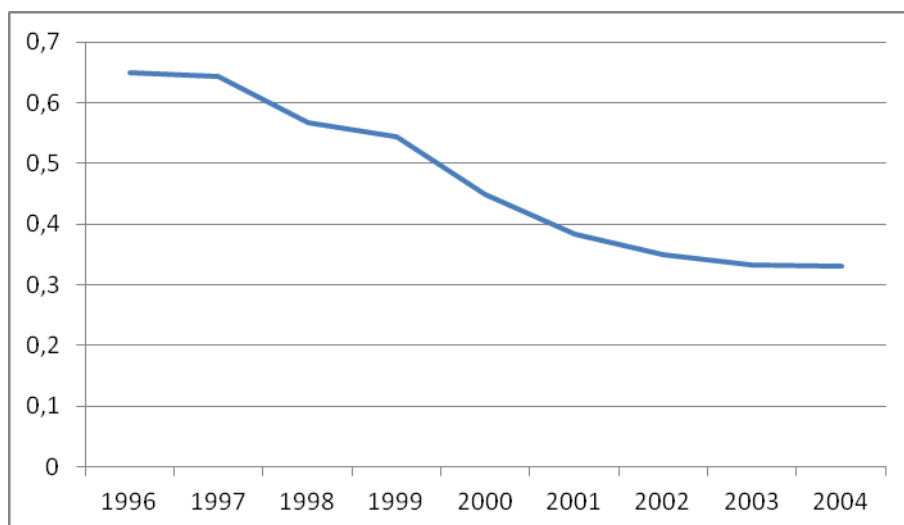
Source: SABI

4. METHODOLOGY

4.1. Spatial Data Analysis

We first analyze the spatial dispersion of creative capital by using various exploratory spatial data tools. We consider creative capital comprising high-tech, knowledge intensive services, real estate, architecture and engineering, research and development, advertising and market research, professional, scientific and technical activities, financial and insurance activities, and other creative activities such as publishing, software publishing, telecommunications, and computer programming occupations.

The first set of analyses is concerned with the spatial concentration and local patterns of creative capital in Spain. While there are various ways of visualizing the dispersion of creative capital, we choose to focus on the spatial concentration. First, we compute the spatial autocorrelation (see equation 1, Moran's *I*). While the measure explains general tendencies regarding regional interconnections, it fails to reveal local patterns. To overcome this, we use decomposed Moran scatter maps (diagrams) and carry out a study of significant local realizations to determine spillovers at this level. In so doing, we also compute the local indicator of spatial association - LISA (see equation 2 and

see Anselin, 1993) and, thus, we can decompose and analyze the significance of the spatial concentration of creative capital in Spain.

(eq.1)
$$Moran's\ I = \frac{w_{ij}}{n} \frac{\sum_i \sum_j w_{ij}(x_i - \bar{x})(x_j - \bar{x})}{\sum_i (x_i - \bar{x})^2}$$

(eq.2)
$$LISA = (x_i - \bar{x})\sum_j w_{if}(x_j - \bar{x})$$

4.2. Econometric Specification

The second analysis is concerned with examining the impact of the dispersion of creative capital on regional differences in Spain. We measure these regional differences by considering provincial GDP in Spain for the year 2004. Our main hypothesis is that even when controlling for the effects of industrial development (Ind), human capital development (HK) and local spillover of neighboring provinces (Spillover), creative capital (Crea) should explain the regional differences in per capita income (y) in Spain (see equation 3). The data for creative employment are drawn from the SABI data base and are as defined in the sub-section above. Per capita GDP data for 2004 are from the INE. Industrial development is defined as the share of manufacturing employment within total employment and human capital development is defined as the share of people with a university degree within the total population. In both instances the data are drawn from the INE.

(eq. 3)
$$y : (Crea, Ind, HK, Spillovers)$$

Equations 4 and 5 are the generalized models that include the X matrix comprising the control for regional differences in industrial and human capital development. Equation 4 is a spatial lag model (spatial auto-regressive model - SAR) which assumes that regional spillovers and spatial dependency works over the regional differences in per capita income. Equation 5, on the other hand, is the spatial error model (SEM) that indicates that provinces located close to one other will be influenced by common shocks and the spatial association works over the omitted variables in the model.

(eq. 4) $\ln pgdp = \alpha + \beta \ln crea + \delta X + \rho W \ln pgdp + \varepsilon$

(eq. 5) $\ln pgdp = \alpha + \beta \ln crea + \delta X + \lambda Wl\varepsilon + u$

5. EMPRICAL FINDINGS

Figure 1 shows the unequal structure of creative capital. To examine the roots of this dispersion we begin by examining its spatial associations. We expect to identify the geographical locations that exhibit regional spillovers, so that some locations may present clusters with high levels of creative employment, while others present low levels. First, a global spatial autocorrelation is computed for creative employment. The preferred weight matrix is an inverse distance weight matrix, which gives higher weight to close-lying locations.[3] The outcome of the spatial auto-correlation test is shown in Table 2 indicating that creative employment is spatially dependent across Spanish territory, and pointing to the possible spillover effects of creative capital. To understand this spillover, we decompose the Moran statistic and focus on the local patterns in 2004.[4]

Figure 4 provides initial data about the regional spillover effects of the creative capital. Additionally, in order to have some preliminary information about the relationship between local development and creative capital, Figure 4 also shows the decomposition of the spatial autocorrelation for per capita GDP. The creative capital map of Spain shows a cluster of provinces in the north east of the country that have a substantial level of creative capital, while there are a number of locations that are geographic outliers. However, the general pattern roughly describes an "L" shape of isolated provinces in terms of creative employment that cuts across the territory of Spain from the north west to the south east. This pattern is similarly evident if we consider the spillover of regional per capita income. In both instances, the creative capital and regional income patterns indicate some sort of interdependence between these two variables.

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[3] See Karahasan and Bazo (2011) for a discussion of different ways of calculating a weight matrix for the case of Spain.
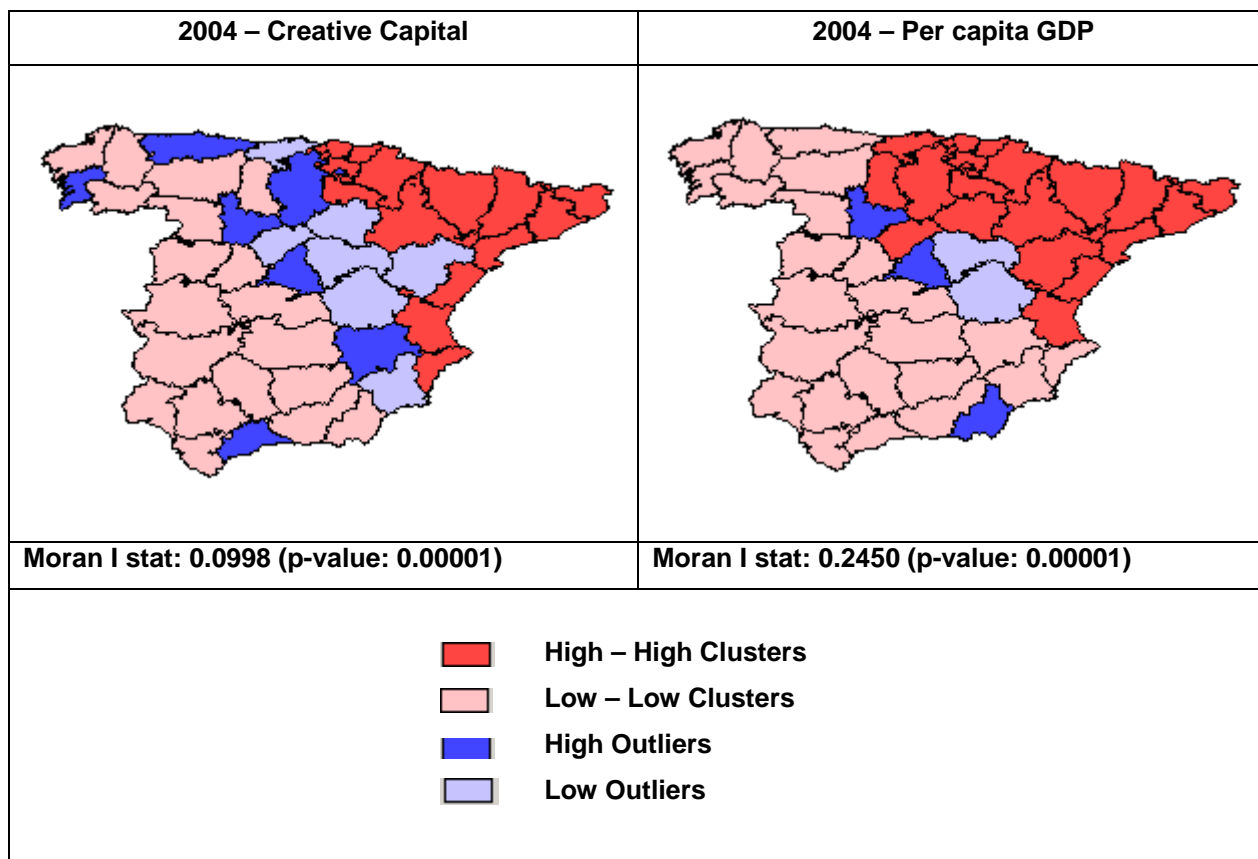
[4] Note that both the Moran scatter maps as well as the LISA calculations are conducted for the whole sample. However, since local patterns and spillover are persistent over time, we only report results here for 2004. The results for the other years are available from the authors upon request.

Table 2: Global Spatial Autocorrelation of Creative Capital in Spain

	Moran's I
1996	0.0703 *** (0.022542)
1997	0.0707 *** (0.022542)
1998	0.0839 *** (0.022542)
1999	0.0366 *** (0.022542)
2000	0.0705 *** (0.022542)
2001	0.0732 *** (0.022542)
2002	0.0768 *** (0.022542)
2003	0.0887 *** (0.022542)
2004	0.0998 *** (0.022542)

St. dev in ( ), *** represents significance at 1%

Figure 4: Regional Spillover of Creative Capital and Regional Differences

2004 – Creative Capital	2004 – Per capita GDP
Moran I stat: 0.0998 (p-value: 0.00001)	Moran I stat: 0.2450 (p-value: 0.00001)

🟥 **High – High Clusters**

🟪 **Low – Low Clusters**

🟦 **High Outliers**

🟦 **Low Outliers**

Source: SABI, INE, authors, calculations

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Having described the spatial relationship and having noted how regional spillovers work in Spain, it is useful to focus on local realizations. LISA values for all the provinces are, therefore, computed and reported for 2004. Here, positive LISA scores can be regarded as indicating a significant degree of clustering of the general locations. But more importantly the scores may also be considered as signaling significant externalities generated by the locations. These externalities seem to give rise to a general cluster comprising Barcelona, Girona, Zaragoza, Huesca, Castellon and Lleida in eastern and north-eastern sectors; while Caceres, Badajoz, Zamora and Huelva seem to suffer common negative shocks as a result of their respective locations. By contrast, Madrid, Spain's capital province, acts as an outlier, with high levels of creative capital surrounded by the state's lagging provinces.

Table 3: Local Measures to Understand the Spillover of Creative Class (2004)

	LISA	Z-score	P -value		LISA	Z-score	P - value
Barcelona	1.0083***	5.988	0.0000	**Madrid**	-0.439***	-4.0301	0.0001
Girona	0.8818***	5.0599	0.0000	**Guip·zcoa**	-0.113	-0.8734	0.3824
Zaragoza	0.2842***	3.0647	0.0022	**Cuenca**	-0.0599	-0.4592	0.6461
Caceres	0.2183***	2.6446	0.0082	**Teruel**	-0.0614	-0.3751	0.7076
Badajoz	0.2087**	2.4509	0.0143	**Soria**	-0.0522	-0.3055	0.76
Zamora	0.2218**	2.4143	0.0158	**Pontevedra**	-0.0549	-0.2294	0.8186
Huelva	0.1979**	2.176	0.0296	**Valladolid**	-0.0425	-0.2106	0.8332
Huesca	0.1911**	2.0033	0.0451	**Segovia**	-0.032	-0.1004	0.92
Castellon	0.2005*	1.9419	0.0521	**Burgos**	-0.0273	-0.0534	0.9574
Lleida	0.1851*	1.7023	0.0887	**Asturias**	-0.0269	-0.0434	0.9654

Source: SABI, authors' calculations

The pattern detected when we compare the spatial concentration is more clearly marked if we examine the direct relation between creativity and regional difference measures. Combining Figure 4 and Table 3 sheds some light on the relationship between a location's creative capital and its per capita GDP, while Figure 5 is illustrative of their direct association. All serve to underline that Spanish provinces with high levels of creative capital have relatively high levels of per capita income. To increase the degree of certainty about this functional relationship, we proceed to estimate a set of models that test the hypothesis concerning the impact of creative capital on regional differences in per capita income.

Figure 5: Relationship between Creative Capital and Regional Divergence (2004)
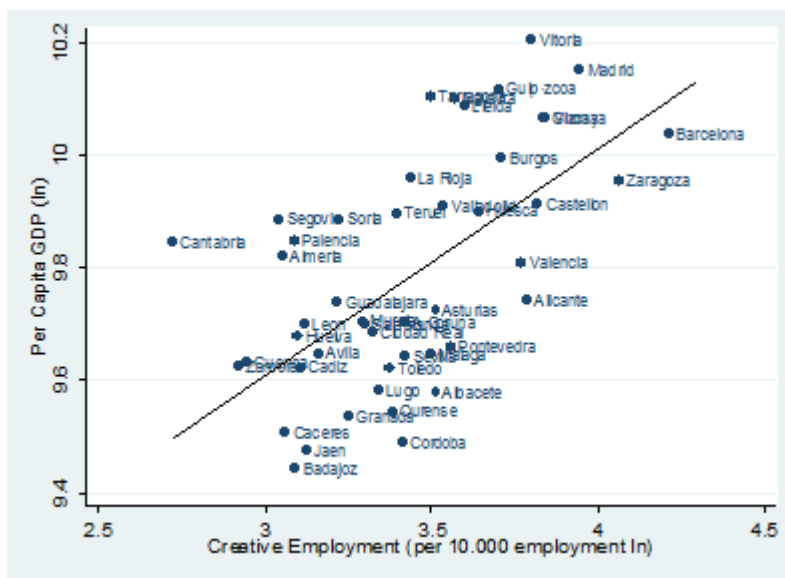
Source: INE, SABI

The results reported in Table 4 are the estimates for the 47 provinces of Spain.[5] In all models the impact of creative capital is tested by controlling for potentially different dimensions of regional divergence. Note that all models take into account possible regional spillovers as they include the spatial lag or the error parameter, which are all statistically significant in line with our expectations and previous spatial data findings. Moreover the creative capital variable influences regional per capita differences in models I, II, IV and V. This validates our concerns about the vital impact of employment on creative work lines. Even when we control for industrial development and local spillovers, creative capital endowment significantly affects the regional differences (as visualized previously in Section 3). However, for models III and VI, when we take into account the impact of the human capital endowment of the provinces as well, our results indicate the decreasing impact of creative capital. It would appear that this is related to the expected joint-movement between human capital development and the deepening of creative capital, as discussed in Section 2. Moreover, when the spatial dispersion of the human capital bases of the provinces are investigated in detail, the endowment as well as the growth patterns of creative capital and human capital development are found to be similar (see appendix). Note that this similarity is stronger in the case of the endowments. Finally, a comparison of the models shows spatial lag models to be superior to the spatial error models based on the information criteria.

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[5] The Balearic and Canary Islands, as well as the two small provinces in North Africa (Ceuta and Melilla), are not included as they do not lie within the territorial borders of the country.

Thus, all these findings point once more to the strong and significant impact of creative capital endowments on regional differences in Spain.

Table 4: Econometric Results

Dependent Variable: Per Capita Gross Domestic Product 2004 (2004 GDP in €)						
	Spatial Lag Models			Spatial Error Models		
	Model I	Model II	Model III	Model IV	Model V	Model VI
Creative Capital	0.292*** (0.059)	0.226*** (0.069)	0.134* (0.072)	0.273*** (0.068)	0.227*** (0.076)	0.121 (0.085)
Share of Manufacturing Emp.	-	0.095* (0.054)	0.092* (0.050)	-	0.084 (0.063)	0.096 (0.060)
Share of Population with BA Degree	-	-	0.186*** (0.068)	-	-	0.182** (0.078)
ρ	0.916*** (0.058)	0.898*** (0.071)	0.905*** (0.066)	-	-	-
λ	-	-	-	0.898*** (0.071)	0.868*** (0.092)	0.864*** (0.095)
R^2	0.41	0.47	0.53	0.18	0.23	0.27
BP-Test (P-value)	0.001 (0.9960)	0.843 (0.66)	0.715 (0.86)	0.0004 (0.98)	0.113 (0.94)	0.247 (0.97)
AIC	-48.775	-49.731	-54.631	-48.631	-47.905	-50.963
SC	-43.225	-42.330	-45.380	-44.930	-42.354	-43.562

Standard errors in ( ), *, **, *** represents significance at 1%, 5% and 10% respectively

6. CONCLUSION

The relationship between creative class theory and Spain's regional imbalances is not casual. Here, while not ignoring the debate concerning the creative capital theory, we have focused basically on events in Spain between 1996 and the first years of the new millennium. In common with the empirical findings of other studies (Maza and Villaverde, 2009; Pastor et al., 2010; Cuadrado et al., 1998; Villaverde, 2001; de la Fuente, 2002; Goerlich et al., 2002; Raymond, 2002; Lladós, 2002), we report that the disparities between Spain's regions, despite some improvement, are also valid for the dispersion of creative capital. Thus, there is a marked territorial imbalance in provincial income, employment education levels and creative capital in Spain.

Our preliminary set of results indicates that the north east of Spain comprises a cluster with a substantial level of creative capital. Moreover, the provinces with high levels of creative capital also present high levels of per capita income. And, more interestingly, our findings indicate that both regional income and regional creative capital have spillover effects that form persistent clusters with largely the same geographical distribution. This finding needs to be carefully interpreted since it contains valuable

information for the implementation of local policies, namely that measures implemented in a given location will have effects that spill over the territory. Overall the pattern of the clusters for regional income and creative capital is no coincidence. Our second set of findings shows that creative capital endowment significantly affects regional differences, even when we control for industrial development and local spillovers. Yet, when we do take into account the impact of human capital endowment, our results seem to point to a decreasing impact of the creative capital. We believe that this is not due to a lack of connection between creativity and regional differences, but rather it captures the connection between the level of human capital and education of the individuals in the creative class.

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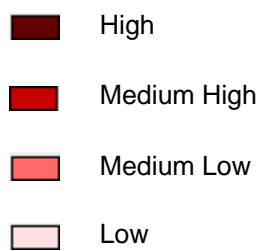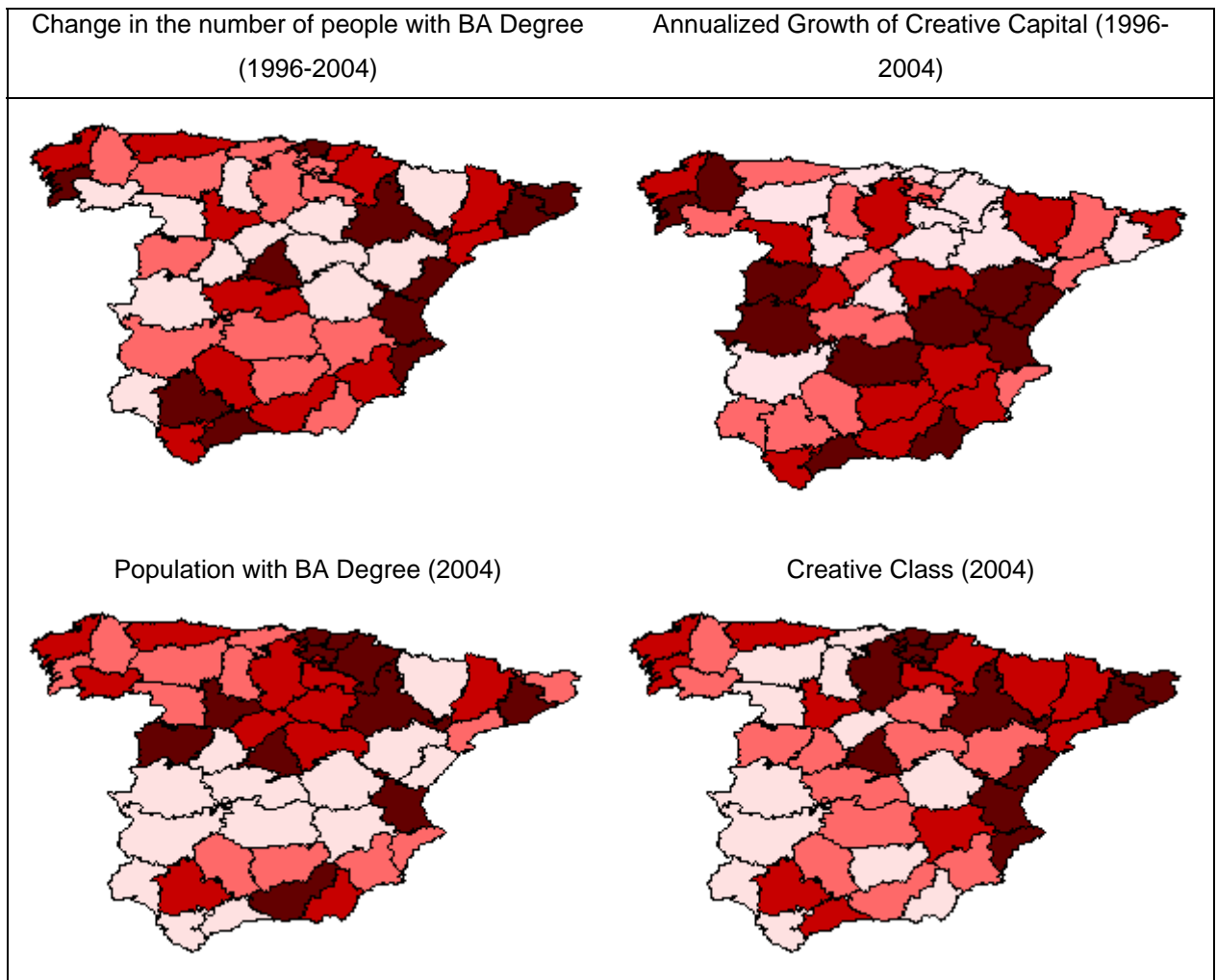
Appendices

Table A1: Description of the independent and dependent variables

Variable	Measure	Source
Independent		
Creative Employment *Explanatory/ Controls*	Creative employment in the selected sectors (according to CNAE * classifications) as a percentage of total employment by Provinces of Spain from 1996 to 2004 (the data are not available for Ceuta and Melilla)	'Sistema Anual de Balances Ibéricos' (**SABI**) database**
Human capital	Employment with a bachelor's degree or higher as a percentage of total employment by Provinces of Spain from 1996 to 2004	Instituto Valenciano de Investigaciones Económicas **(IVIE)**
	Population with a bachelor's degree or higher as a percentage of total population by Provinces of Spain from 1996 to 2004	Instituto Nacional de Estadística **(INE)**
Manufacture based employment	Manufacturing employment as a percentage of total employment by Provinces of Spain from 1996 to 2004	Instituto Nacional de Estadística **(INE)**
Service based employment **Dependent**	Service sector employment as a percentage of total employment by Provinces of Spain from 1996 to 2004	Instituto Nacional de Estadística **(INE)**
GDP per capita	Per capita income (GDP) per year by Provinces of Spain from 1996 to 2004	Instituto Nacional de Estadística **(INE)**

* Spanish National Classification of Economic Activities

** Data classified at four-digit level for selected occupations. Given data availability for all variables selected, data can be collected from 1996 to 2004, both inclusive.

Figure A1: Human Capital and Creative Capital Potentials

Change in the number of people with BA Degree (1996-2004)	Annualized Growth of Creative Capital (1996-2004)
Population with BA Degree (2004)	Creative Class (2004)

■ High

■ Medium High

■ Medium Low

□ Low

Source: INE, SABI, own calculations