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"Geography of talent and regional differences in Spain"

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Abstract

Tentative empirical evidence suggests that the agglomeration of talent contributes to regional development. However, given that talented people are not evenly distributed across regions, this paper seeks to determine how the concentration of talent affects patterns of regional development. Here, we empirically evaluate the effects of the distribution of talent on regional differences by means of a detailed analysis of the 17 Autonomous Communities of Spain between 1996 and 2004. We hypothesise that regions specialising in strategic sectors that are creative and which can be assumed to enjoy rapid growth in productivity will experience faster rates of development and, in turn, that this concentration of talent will have a positive impact on the region's economic performance. Thus, we believe that this mechanism can explain the marked regional imbalances in Spain. Our findings confirm that regional differences, measured in terms of GDP per capita and by, - industrial and service- oriented production, are influenced by the Communities' talent bases as determined by, educational attainment and employment in assumed to be strategic for regional development, inasmuch as these sectors provide economic specialization.

JEL classification:. C33, O18, R11, J24.
Keywords**:** Talent, Regional differences, Panel data, Spain.

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1. Introduction

Talent –defined as- high skilled workers is an emerging paradigm at the heart of the debate in in economic development and a subject of growing interest among not only economists, economic geographers and, regional scientists (Mallender and Florida, 2007), but also sociologists, and urban planners (Power and Scott, 2004; Hartley, 2005; Cooke and Lazzeretti, 2008, Lazzeretti et al., 2008). Regional development is driven by changes in economic specialization and Karlsson and Johansson (2008) identify talent together with knowledge infrastructure, human capital, talent, creativity, knowledge generation, knowledge protection, knowledge accumulation, knowledge appropriation and knowledge flows, as well as the creative use of knowledge, as the basic drivers of such regional specialization and development. The purpose of this paper is to discuss the role of talent, measured here in terms of educational and occupational attainment, for furthering our understanding of regional differences in Spain.

Florida (2002a) claims that talent or high skilled human capital holds the key to success in this new era of economic growth. The ideas and creativity of this new class are, he argues, the most important element in the economic success of a firm or regions (Florida, 2002a). Seen from this perspective, knowledge based economic growth and local development today are found according to Lucas (1998), in association with the productivity gains brought with the "clustering of talented people and human capital". Other authors have similarly highlighted that local development is closely related to presence of high skilled human capital (Glaeser et al., 1992; Henderson et al., 1995; Capone, 2006).

Given this association between talent and economic development, and the fact that talent is spread unevenly, it becomes critical to understand the factors that account for its varied geography (Mallender and Florida, 2007). Indeed, economists have long stressed the link between the agglomeration of talent and regional development, reporting tentative empirical evidences that the agglomeration of human capital contributes to regional development. In this context, human capital forms a key element in the models designed by Fujita (1988) and Krugman (1991) as well as the new growth theories associated with the Romerian framework (1990), which formally highlights links between knowledge, human capital accumulation and economic growth. Seen in this light, the question we seek to answer is: "How do agglomerations of talent affect regional economic performance and associated regional differences?" Our specific aim, therefore, is to estimate the effect of talent on the inequality presented by Spanish regions.

Simply stated, this paper constitutes an empirical evaluation of the impact of talent on regional differentiation by means of a detailed analysis of the 17 Autonomous Communities of Spain between 1996 and 2004. To do this, we construct static, non-spatial panel data models. Our talent matrix contains two separate indicators: human capital and employment in selected occupations, including the high-tech sector, knowledge intensive services, real estate, architecture and engineering, R&D, advertising and market research, professional, scientific and technical activities, financial and insurance activities and creative activities (see appendix), which assumed to be strategic for regional growth in that they provide economic specialization. Our occupational indicator is measured as the percentage of employment in the selected sectors, while our education indicator is measured as the percentage of employment with a bachelor's degree or higher. In addition, we include two control variables: the percentage of employment in manufacturing industries and the percentage in service industries. We find that the economic performance indicators point to the significant positive impact of talent on regional economic activity. The concentration of talent in certain employment sectors plays a crucial role in accounting for regional differences, while the impact of highly educated employment is also crucial for economic activity.

In the following section, discussions in the literature examining the impact of the concentration of talent on regional development are briefly reviewed. In section III, the geography of talent, the characteristics of the Spanish regions and their levels of development are described. In section IV, our data and research methodology are outlined, while the concentration of economic activity and the spatial distribution of talent in Spain's Autonomous Communities are analysed. In section V, the models of talent and regional development are discussed and our findings are presented. The last section evaluates and discusses.

2. Theoretical Framework: Talent and Regional Development

Human capital and talent- high skilled workers- have long been linked to urban and regional growth and their presence considered key components of innovation, is essential for economic development. In this section we provide a brief summary of the voluminous literature on the effects of the concentration of talent on regional development. As discussed above, human capital and employment in selected occupations, deemed strategic for the economic performance of regions in that they provide economic specialization, comprise our measure of talent.

In recent decades, knowledge based and creative sectors have encouraged economic specialization. Thus, cities specializing in these industries characterized by their rapid productivity growth have undergone faster growth, attracting more college graduates from other regions (Karlsson et al., 2009). Thus, it would seem that knowledge based and creative sectors play an important strategic role in urban and regional economics and development. The skills and abilities of individuals to solve problems and to transfer knowledge are crucial for the knowledge economy. These skills are gradually developed in investment processes that involve both formal and informal education, as well as learning-by-doing, learning-by-using, and the accumulation of experiences (Karlsoon et al., 2009). The value of individual's skills and abilities have come to be viewed as his or her human capital (Karlsson et al., 2009). Growing interest in the knowledge economy has led to the development of new economic growth models, frequently referred to as the theory of endogenous growth, in which the production of knowledge is endogenously determined, and in which the spillover of knowledge plays a critical role in the growth process (Romer, 1986; Lucas, 1988). Lucas (1988) identified the role of human capital externalities in economic development and highlighted the clustering effect of human capital, which now embodies the knowledge factor. He recognized the role of great cities, which concentrate human capital and information, create knowledge spillovers, and become engines of economic growth (Lucas, 1988; Mallender and Florida, 2009). The new growth theory associated with Romer (1990) formally highlights the connection between knowledge, human capital, and economic growth (Florida, 2002). In the new endogenous growth models, human capital occupies a central role in spurring growth as knowledge spillovers and human capital externalities aid in delaying the tendency for diminishing returns to capital accumulation (Barro and Sala-i-Martin, 2004; Ahmed, 2009).

There are strong theoretical arguments, supported by tentative empirical evidence that the agglomeration of human capital contributes to regional development. Human capital theorists (Becker, 1964; Glaeser, 2005) argue that concentrations of educated people will produce high levels of long-term economic growth. The importance of human capital to regional economic growth has been well documented (Hoyman and Faricy, 2008). For years, human capital had been established by economists as a robust predictor of per capita income levels (Hoyman and Faricy, 2008). As mentioned by Qian (2008), Ullman (1958) had noted the importance of human capital in regional development half a century earlier. Eaton and Eckstein (1997) and Black and Henderson (1998) suggested that given spillovers in the accumulation of human capital, workers are more productive when they locate near others with high levels of human capital. Human capital has been shown to correlate with growth both in the service and knowledge economies (Barro 2001; Black and Lynch 1996; Zucker et al., 1998; Hoyman and Faricy, 2008). Barro (1991) provided evidence that human capital or education is a significant contributor to economic growth. Glaeser (1998, 1999, and 2000) provided empirical evidence of the association between human capital or talent and regional economic growth. Glaeser et al. (1995) found a strong relationship between human capital and city growth, showing that cities which begin with more educated populations exhibit higher rates of population growth over time (Florida, 2002). Simon and Nardinelli (1996) examined the connection between human capital and city growth in the US and the UK finding that the level of human capital in 1880 predicted city growth in subsequent decades. Simon (1998) and Glendon (1998) found a strong relationship between the average level of human capital and regional employment growth over a considerable time frame (Florida, 2002). Barro (1991), Rauch (1991), Glaeser (1994), (1998), (2000), Glaeser et al. (1995), Glendon (1998), Simon (1998) claimed that human capital is a crucial driving force of economic development. Other studies (Florida 2002; Lee et al., 2004; Acs and Armington, 2006; Audretsch et al., 2006; Mellander and Florida, 2007) show that human capital is associated with innovation or entrepreneurship, which further contribute to economic development (Schumpeter, 1934; Baumol, 1968 cited in Qian, 2008).

Based on the role of talent in explaining the relationship between inequality and economic growth, various studies have sought to determine whether growth is heterogeneous (Paci and Usai, 2001; Castello and Domenech, 2002; Ahmed, 2009). The role of human capital is important since the distribution of income is mainly driven by the distribution of human capital across or within countries (Ahmed, 2009). Glomm and Ravikumar (1992), Saint-Paul and Verdier (1993), Galor and Tsiddon (1997) investigate the sources of inequality driven by inequalities in human capital distribution.

Human capital inequality negatively affects economic growth rates (Birdsall and Londoño, 1997; Lopez et al., 1998). A region's economy is a complex mix of varying types of geographical locations comprising different kinds of economic structures, institutions and infrastructure. The concentration of economic activity and human capital agglomeration is inevitable and desirable for growth, but the spatial differences in welfare levels that accompany them can be reduced. Policy assistance at regional levels can mitigate such inequalities in the creation and distribution of human capital (Ahmed, 2009).

Karlsson et al. (2009) note that the critical input to the knowledge economy – the human capital – is strongly concentrated in geographical space, much more so than most other types of economic resources and activities. Thus, they conclude that human capital exhibits strong tendencies to agglomerate in certain locations (Karlsson et al., 2009; Berry and Glaeser, 2005) argue that human capital levels are diverging and its concentration is likely to continue to occur in certain regions only (Florida, 2002; Berry and Glaeser, 2005). Talent appears to concentrate in cities, while cities play an important role in attracting, mobilizing, and organizing human capital for economic activity (Jacobs 1961, 1969; Lucas, 1988; Glaeser, 1994; Qian, 2008).

In short, the consensus in the literature appears to be that talent, a measure of human capital based on educational or occupational levels of attainment, is strongly associated with economic development but that it is a factor that displays an uneven spatial distribution. This paper seeks to add to this body of literature by examining the situation in a Southern European case study, namely the country of Spain. It sets out to identify regional differentiation associated with the concentration of talent in Spain's Autonomous Communities.

3. Spanish Autonomous Communities and Geography of Talent

Spain comprises 52 provinces and 19 Autonomous Communities. The crucial future of these regional communities is that they enjoy different levels of autonomy and, hence, there exists a clear differentiation in their competences at the local level. This makes a consideration of Spain's Autonomous Communities crucial as they may well hold important lessons for reducing regional imbalances. Indeed, many empirical studies have examined the regional inequality phenomenon in Spain, concluding that, despite some improvements, regional differentiation remains a marked phenomenon (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). Drawing on earlier findings, we begin this investigation of Spanish Geography by describing the historical evolution in the country's regional differences.

First and foremost, the size distribution of Spanish regions (in terms of their population) is a crucial factor. Thus, we see that its relatively larger regions are not uniform in terms of their economic performance. For instance, the performance of its regions with the highest populations Andalusia, Catalonia and Madrid and those with the highest population growth between 1981 and 2009 the Balearic and Canary Islands, Murcia, Valencia and Madrid, varied greatly in comparison to the Spanish average performance (as highlighted in Table 1 and discussed below). Similarly, Tortosa-Ausina et al. (2005) indicate that while Spanish regions are becoming more alike in terms of their productive characteristics, their welfare continues to present major differences in terms of the size of the dependent population (Tortosa-Ausina et al., 2005). They show that the slowdown in population movement has different origins. First, the deterioration in general economic conditions, which has affected all provinces, has led to a reduction in the possibility of finding a job elsewhere. Second, the new democratic political regime generated strong expectations of improvements in living conditions, thereby reducing the perceived need to emigrate. These expectations were fuelled by a rapid intense process of decentralization as provided for under Spain's democratic constitution passed in 1978. Finally, Spain's accession to the European Common Market, finalized in 1986, together with its declared support for territorial cohesion, further contributed to lowering the willingness to migrate because of investments received by the country's poorer regions from the EU's Structural Funds (Tortosa-Ausina et al., 2005).

Parallel to the size of the regions' respective populations, the highest levels of employment are also to be found in Catalonia, Andalusia and Madrid. Castile and Leon, the Balearic and Canary Islands, and Murcia reported the highest rates of employment growth between 1991 and 2008. In 1991, the highest share of industrial labour in the total regional labour force was recorded in the Basque Country, Catalonia, Navarra, Castile and Leon, La Rioja, while in 2009, Navarra, La Rioja, the Basque Country and Catalonia led this ranking. However, between 1991 and 2009, the greatest fall in the share of industrial labour was observed in Asturias, Catalonia, and the Basque Country, while the highest increase was recorded in Navarra and Extremadura. If we consider the spread of service employment, we find that 50% is concentrated in all regions of the country. The figures regarding the employment of high skilled human capital, both for 1996 and 2005, indicate that the highest share of talent *(people who work in strategic sectors*) in the total employment by region is observed in Madrid, the Basque Country and Catalonia.

In terms of the human capital development of Spain's regions, Table 1 illustrates that in 1991 Madrid had the most highly educated labour force, while in 2009 the Basque Country had replaced it. According to Prados de la Escosura and Roses (2009), human capital 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 rise in the proportion of workers holding a university degree and higher went from 15.97% in 1991 to 47.81% in 2009 in the Basque Country, and from 19.39% in 1991 to 40.82% in 2009 for Madrid (see Table 1). The number of jobs for the professionally trained levels has also grown very rapidly in the years between 1850 and 2000 (Prados de la Escosura and Roses, 2009).

The empirical literature examining inequality has mainly focused primarily on the convergence of economic factors, principally per capita income. The studies reviewed, as well as the authors' own study, point to convergence in per capita income among Spanish regions (Pastor et al., 2010). Similar findings are reported by Cuadrado et al. (1998); Villaverde (2001); de la Fuente (2002); Goerlich et al. (2002); Raymond (2002); Lladós (2002), although signs of stagnation in this convergence, and even divergence, have been detected since the mid-1990s, as well as the existence of "clubs" of regions. Marchante and Ortega (2006) analyzed the 1980–2001 period and found that disparities in regional GDP per capita remained constant. According to Pastor et al. (2010), in 1961 two regions recorded higher per capita income levels than Madrid (namely Catalonia and the Basque Country), while in 2001 Madrid led the ranking (Pastor et al., 2010). In 2007, Madrid was still the leader in terms of per capita income. In Maza and Villaverde's study (2009), provinces are reported as tending to form clusters with similar levels of income per inhabitant with the north eastern part of Spain being the most developed area and the south and north-west of the country being least developed. These authors highlighted the fact that there is a territorial imbalances in relative per capita income in Spain's provinces and that provinces with per capita income levels above (below) the national average tend to cluster (Maza and Villaverde, 2009). For the 1961-1981 period, Leonida and Montolio (2001) highlighted the fact that the rich provinces had lost positions in the distribution of income, but that they still created a separate mode (showing *persistence*), indicating that there were few rich regions in Spain in that period. In the period 1991 to 1997 there began a process of polarization of income level. The provinces were grouped in two income levels: below and above average, indicative of this process of income divergence and polarization. The latter provinces were found to be located, primarily, in the north of Spain, as north-south divide became apparent during the nineties (Leonida and Montolio. 2001).

Table 1: The Ranking of the Spanish Regions

	POPULATION		NUMBER in EMPLOYMENT		EMPLOYMENT in INDUSTRY				EMPLOYMENT in SERVICE SECTOR			
Autonomous Communities	1981	2009	1991	2008	% in total employment by region 1991	% in total State employment 1991	% in total employment by region 2009	% in total State employment 2009	% in total employment by region 1991	% in total State employment 1991	% in total employment by region 2009	% in total State employment 2009
Andalusia	6,429,151	8,150,467	1,847,343	3,149,700	14.98	2.22	8.76	1.46	54.52	8.07	68.10	11.36
Aragon	1,196,430	1,313,735	408,937	611,600	26.73	0.88	17.74	0.57	50.79	1.66	62.02	2.01
Asturias	1,128,986	1,058,923	332,519	451,500	26.90	0.72	13.62	0.33	52.32	1.39	66.93	1.60
Balearic Islands	655,134	1,070,066	254,541	509,800	13.16	0.27	7.63	0.21	65.46	1.33	72.24	1.95
Canary Islands	1,364,616	2,076,585	426,521	861,700	9.60	0.33	5.80	0.26	69.36	2.37	75.20	3.43
Cantabria	512,579	576,418	164,457	260,600	23.69	0.31	16.19	0.22	51.74	0.68	64.24	0.89
Castile and León	2,582,043	2,510,545	499,428	1,068,100	32.10	1.28	16.76	0.95	81.35	3.26	62.32	3.52
Castile La Mancha	1,647,876	2,022,647	790,638	842,900	14.08	0.89	15.93	0.71	28.29	1.79	59.79	2.67
Catalonia	5,948,177	7,290,292	2,240,086	3,494,600	33.97	6.10	17.89	3.31	50.70	9.10	62.40	11.54
Valencia	3,642,816	4,991,789	1,244,933	2,226,200	28.28	2.82	15.19	1.79	51.16	5.10	62.83	7.41
Extremadura	1,064,289	1,080,439	270,165	409,300	12.16	0.26	10.29	0.22	50.98	1.10	63.21	1.37
Galicia	2,809,201	2,738,930	901,421	1,200,100	17.23	1.24	16.17	1.03	45.01	3.25	62.50	3.97
Madrid	4,679,696	6,295,011	1,777,594	3,064,400	0.00	0.00	9.19	1.49	-	-	77.47	12.57
Murcia	953,852	1,443,383	316,654	627,600	21.61	0.55	12.06	0.40	52.11	1.32	60.26	2.00
Navarra	508,679	614,526	182,660	289,400	32.20	0.47	26.74	0.41	47.84	0.70	55.81	0.86
Basque Country	2,139,860	2,136,061	701,139	995,300	34.89	1.96	21.48	1.13	51.92	2.92	63.35	3.34
Rioja	254,201	315,718	91,578	146,700	31.81	0.23	23.79	0.18	46.22	0.34	57.12	0.44
Ceuta and Melilla	118,615	142,637	31,192	48,100	4.64	0.01	3.53	0.01	85.17	0.21	89.19	0.23

Table 1: The Ranking of the Spanish Regions (cont.)

	GDP per capita			TALENT*				EMPLOYMENT WITH UNIVERSITY DEGREE OR HIGHER	
				Talent by region/ total employment by region		Talent by region/ total talent in Spain		% in total employment by region	% in total employment by region
Autonomous Communities	**1996- euro**	**2007- euro**	**% change**	**1996**	**2005**	**1996**	**2005**	**1991**	**2009**
Andalusia	8,943	18,298	104.60	10.51	12.72	7.36	9.47	12.73	28.84
Aragon	12,973	25,749	98.49	17.68	17.86	5.07	4.75	13.84	33.60
Asturias	10,383	21,664	108.65	12.54	14.44	1.76	1.86	13.71	36.48
Balearic Islands	14,603	25,777	76.51	10.62	12.77	1.59	1.76	10.45	23.58
Canary Islands	11,539	20,949	81.55	11.33	16.59	0.83	3.46	13.76	27.41
Cantabria	11,030	23,679	114.69	13.50	13.35	0.45	0.33	12.80	37.38
Castile and León	11,376	22,698	99.53	11.49	12.43	3.32	3.33	9.35	34.35
Castile La Mancha	9,872	18,402	86.40	8.32	10.04	1.88	2.51	13.69	27.09
Catalonia	14,776	27,840	88.42	21.82	21.66	32.42	26.56	12.37	32.53
Valencia	11,431	21,567	88.67	12.35	14.61	4.30	10.96	11.44	28.24
Extremadura	7,666	16,198	111.31	6.61	9.70	0.55	0.70	11.72	26.61
Galicia	9,673	19,865	105.36	10.98	11.74	3.08	4.44	9.41	33.40
Madrid	15,745	30,863	96.02	24.67	25.47	26.84	20.41	19.39	40.82
Murcia	9,934	19,707	98.38	9.44	10.96	1.47	1.79	11.48	26.59
Navarra	15,255	29,744	94.98	18.58	18.26	1.79	1.52	15.02	38.87
Basque Country	14,221	30,650	115.52	22.59	22.04	6.71	5.70	15.97	47.81
Rioja	13,682	25,262	84.64	10.06	11.81	0.54	0.43	11.83	37.70
Ceuta and Melilla	10,100	21,583	113.69					17.15	32.85

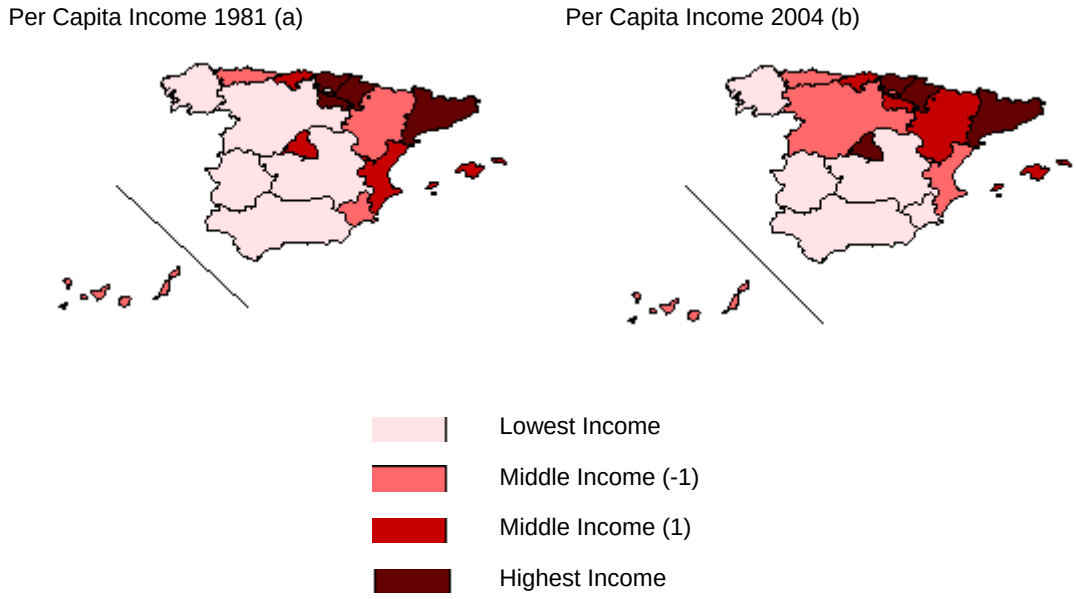
Source: **INE** (separate data are not available for Ceuta and Melilla, hence use of aggregated data)

* Employment in selected sectors from **SABI** database (data not available for Ceuta and Melilla)

In addition to providing information about regional differences in Spain, Figure 1 illustrates the geographical distribution of income among the Autonomous Communities. Indeed, even taking into consideration developments in terms of regional income, the north-south pattern regional inequalities seems to be persistent with the leading communities of Catalonia, Madrid, Navarra and Basque Country remaining dominant. This phenomenon is similarly associated with the rise in the overall development of the communities, which is apparent from the figures recorded in Table 1.

In 1961, the per capita incomes of Andalusia, the Canary Islands, Castile and León, Castile La Mancha, Extremadura, Galicia and Murcia were half that of Madrid or lower (Pastor et al., 2010). In 1996, Extremadura's GDP per capita was still half of that Madrid's (see Table 1). In 2007, the Basque Country had caught up somewhat with Madrid in terms of GDP per capita but Madrid still led the ranking. These two Autonomous Communities were followed by Navarra and Catalonia. Extremadura, Andalusia, Castile La Mancha, Murcia and Galicia still had the lowest GDPs per capita despite some changes in the ranking and Extremadura's GDP per capita was still approximately half that of Madrid's in 2007. However, between 1996 and 2007, GDP per capita more than doubled for most of the regions, especially in the case of the less developed Autonomous Communities. And yet despite the changes in the regional rankings, the developed and less developed Autonomous Communities remained in the same clusters from 1996 to 2007, with the northern regions making obvious progress in terms of economic development (see Table 1).

Figure 1: Income Dispersion in Spain (*)



Source: INE
(*) Due to data concerns Ceuta and Melilla are not included
(a) In constant prices (Pesetas)
(b) In constant prices (Euros)

An examination of contemporary developments in the economic performances of the Autonomous Communities should broaden the perspective on these earlier figures. In the last decade, we can analyse the Autonomous Communities' performance by looking at the industry and service sectors' value added as well as at overall employment levels (relative economic activity level).[1] Table 2 shows the percentage working population, and the industrial and service oriented production for in Spanish regions.[2] Taking the Spanish average as 1.00 for each year, we compute the performance of each community with respect to this average.[3] This performance also contains information about the concentration of economic activity in Spain. Although a comparison of such an index over time provides little information about convergence, it nevertheless contains valuable information about the relative position of the regions' economic performances. Overall, the north-south pattern is reflected in the computed index. The dominant Autonomous Communities in the north of Spain still lead the economy. However, a number of interesting findings emerge. Notably, the Balearic and

1 See appendix for the geographical dispersion of industrial and service oriented production in Spain.
2 Ceuta and Melilla are not included because of concerns about the data. As the empirical model is constructed for the 1996- 2004 period, the concentration is also plotted for this same time span.
3 See appendix for the path taken by the index from 1996 to 2004.

Canary Islands, while presenting figures that are well below the Spanish average for employment and industrial production, enjoy relatively high service oriented production. Moreover, Extremadura, despite some improvements, continues to be the least developed region in the country. An alternative way of examining the picture is to focus on the path taken by this index among the developed and developing regions of Spain. Here, the information contained in Table 2 is complemented by Figures 3, 4 and 5 in the appendix. What is apparent is that no one uniform path has been taken by the leading and lagging communities. For instance, Navarra and the Basque Country, as leading communities in terms of employment and industrial production, seem to deviate from the mean and to have increased their relative standings. Meanwhile, communities such as Catalonia and Valencia have moved towards the Spanish average. Overall, we believe these figures increase concerns about the reasons underlying regional differences in Spain.

Based on a preliminary analysis of the dispersion in employment and production figures among the Autonomous Communities, the performance of Spain's outperformers and underperformers is clearly not uniform. This picture validates our decision to focus on the roots of this differentiation. In line with the central thesis of this paper, an evaluation of how talented people locate across the country should provide valuable information. Thus, not only the specific impact of human capital accumulation on regional differences but also the innovative and creative role of employment can be understood by examining this dispersion.

Table 2: Economic Activity of Spain's Autonomous Communities

	Working Population (% of total)		Industrial Production (per capita VA)		Service Oriented Production (per capita VA)	
	1996	2004	1996	2004	1996	2004
Andalucía	0.47	0.54	0.55	0.6	0.79	0.84
Aragón	1.3	1.4	1.19	1.16	1.03	1.05
Asturias	0.91	0.94	1.05	1.01	0.83	0.86
Balears (Illes)	0.56	0.47	0.68	0.56	1.53	1.26
Canarias	0.39	0.35	0.53	0.56	1.17	1.09
Cantabria	0.99	1.03	0.94	1.03	0.93	0.98
Castilla - La Mancha	0.93	1.02	0.96	1.05	0.88	0.93
Castilla y León	0.89	0.97	0.8	0.8	0.74	0.77
Cataluña	1.67	1.51	1.5	1.34	1.19	1.13
Com. Valenciana	1.31	1.22	0.99	0.97	0.94	0.93
Extremadura	0.35	0.46	0.51	0.55	0.66	0.74
Galicia	0.81	0.97	0.81	0.88	0.77	0.82
Madrid	0.92	0.75	1.13	0.99	1.54	1.55
Murcia	0.91	0.98	0.78	0.77	0.82	0.82
Navarra	1.83	2.06	1.73	1.73	1.11	1.09
País Vasco	1.52	1.8	1.5	1.67	1.1	1.2
Rioja (La)	1.67	1.78	1.34	1.33	0.97	0.94

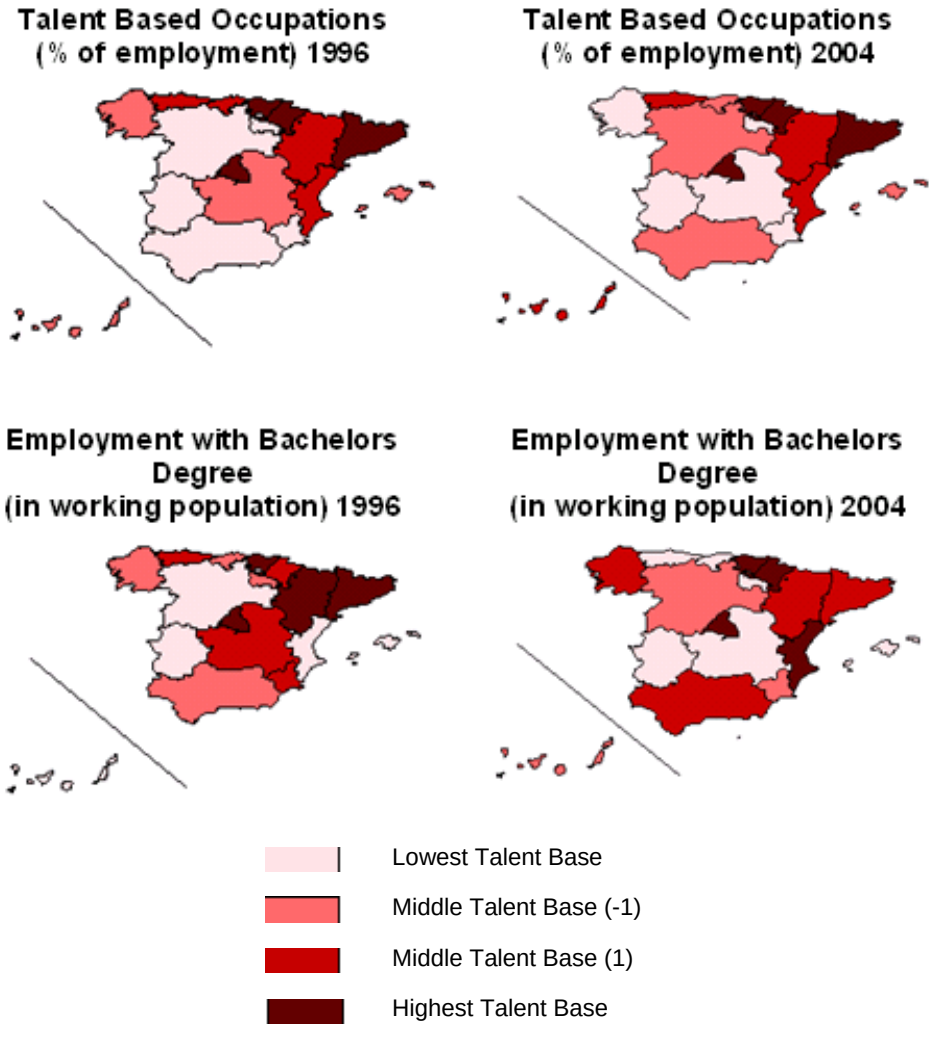
Source: INE, authors´ own calculations (*) Spain Average = 1.00

Both in 1991 and in 2009, taking the ratios for the whole of Spain, Catalonia stood out as a leader in terms of industrial employment and activities, while Madrid, Catalonia and Andalusia had the largest share of service employment. Meanwhile, in both 1996 and 2005, Catalonia and Madrid were ranked first in terms of employment *(talent)* in the strategic sectors selected for this study (see Table 1).

If we look just at the developed regions, Catalonia is ranked second and Madrid third in terms of population while Madrid has the largest service sector labor force followed by Catalonia. The proportion of highly educated people in total employment rose in Madrid from 19.30% in 1991 to 40.82% in 2009, in the Basque Country from 15.97% in 1991 to 47.81% in 2009, in Navarra from 15.02% in 1991 to 38.87% in 2009, and in Catalonia from 12.37% in 1991 to 32.53% in 2009. Catalonia is the country leader in terms of total employment, industrial employment and employment in the strategic sectors selected for this study.

According to the occupational indicator of talent, Catalonia, Madrid, the Basque Country and Navarra make up the first cluster *(highest talent base)* in both 1996 and 2004. According to the educational indicator of talent, Catalonia, Madrid, the Basque Country and Aragon make up the first cluster in 1996, while in 2004 Catalonia, Madrid, the Basque Country and Navarra comprise this first cluster (see Figure 2). In 2004, Catalonia, Madrid, the Basque Country and Navarra occupy the first cluster *(highest income)* in terms of income per capita (see Figure 1). Some differences can be observed between the trends in the dispersion of income and talent. Andalusia, Valencia and Murcia mark a sharp break in income and talent between the North and South of Spain. Castile La Mancha and Murcia both lost positions, while Andalusia gained positions from 1996 to 2004 in terms of both educational and occupational attainment. However, there was a trend towards the concentration of activity in a few regions with a similar concentration of income during the period.

Figure 2: Spatial Distribution of Talent in Spain



Source: SABI. IVIE

4. Data and Methodology

The theoretical debate summarized in section II can be formalized as Equation 1. Regional differences can be measured using three different indicators. Thus, while; per capita GDP shows the overall development made by the Autonomous Communities, industry and service oriented production value added figures (both in per capita terms) control for the differences in the production structures of the communities. If we examine the different factors affecting regional differences on the one hand, our focus will be on *HK* and *T* which represent the human capital (educational attainment) and talent (occupational attainment) levels, respectively. We expect these two indicators to positively affect the development of the Autonomous Communities in Spain. Although there are other region specific factors influencing these differences, we chose to include only the industry mix (*IM*) of the communities as a control for labour demand. [4]

[1] $y = f(HK, T, IM)$

In using Spanish data at the level of the Autonomous Communities for the period 1996-2004, we favoured a number of different panel data models.[5] Thus, our data are taken from three separate Spanish sources: INE, SABI and IVIE. As discussed above, Ceuta and Melilla are not included in the analysis for reasons of data availability and so, the number of cross sections is 17.

4 See Marlet and van Woerkens (2007).

5 The time span of the research is determined by the talent indicator. The talent based occupations variable is generated by using the SABI data base, which is available for 1996 – 2004. See appendix for details.

Equation 2 is a static, non-spatial panel data model, where y represents the three indicators used to evaluate regional differences: GDP (per capita), industrial production (per capita value added), and services oriented production (per capita value added), respectively. X represents the relevant talent indicator and Q is the share of manufacturing and service based employment used to control for the industry mix of the autonomous communities.[6] As discussed by Baltagi (2005), the one way error model is represented in Equation 1, where v_i is the individual specific error and $u_{i,t}$ is a remaining independent identically distributed error. Here the central discussion is related to the individual specific effect, v_i. In the case of a fixed effect model (FE), it is by construction a fixed parameter and will be correlated with the explanatory variables. In such a case, Baltagi (2005) proposes that the within transformation, also labelled the fixed effect transformation, is the right procedure. However, if one assumes that the individual specific effect is random and it cannot be correlated with the other exogenous variables, then use of an efficient GLS estimator will be more accurate. While the random effect (RE) estimator is also efficient. It may suffer from the consistency problem. Hence, it will be more informative to verify the consistency of the estimator by using a typical Hausman test (1978). [7]

[2] $y_{i,t} = \alpha + \beta X_{i,t} + \phi Q_{i,t} + v_i + u_{i,t}$

6 While a number of different social and economic indicators may be preferred, we limit the number of variables to avoid specification biases that might arise due to the relatively low number of observations. As an independent variable, we do not include employment; rather we prefer to observe GDP per capita.

7 Note that this test is not designed to compare the two models; rather it is implemented to decide between two estimators of the same model.

5. Empirical Findings

Estimation findings are given in Tables 3 to 5. In general, the results reported for the economic performance indicators signal the significant positive impact of talent on regional economic activity. This is in line with theoretical expectations. The concentration of talent based occupation in employment plays a crucial role in understanding regional differences. On another note, the impact of highly educated employment is also crucial for each economic activity. However, when the share of services in overall employment is included, the effect is observed to be negligible for the differences between service oriented production. We believe relatively well educated service sector employment already captures the indirect effect of educated employment on these two specific economic activity indicators. However, additional results reported for the differentiation of service sector value added as well as for regional GDP show that educated employment has a significant impact even when the share of the service sector employment is included.

Table 3: Role of Talent in Dispersion of Industrial Production

	Model I		Model II		Model III	
	FE	**RE**	**FE**	**RE**	**FE**	**RE**
Talent Based	0.046*	0.046*	0.017*	0.019*	0.018*	0.016*
Occupations (%emp.)	(0.005)	(0.005)	(0.006)	(0.005)	(0.003)	(0.002)
Employment with	-	-	4.403*	4.255	1.164	1.315*
University Degree (% emp.)			(0.579)	(0.571)	(0.407)	(0.396)
Employment in	-	-	-	-	9.496*	9.072*
Manufacturing (% of emp.)					(0.806)	(0.581)
Employment in	-	-	-	-	0.642*	0.676*
Services (% of emp.)					(0.201)	(0.172)
# of observations	153	153	153	153	136	136
F-Wald Test	82.63	421.94	93.02	192.35	233.46	1044.42
(p-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Hausman Test	0.14		3.61		3.64	
(p-value)	(0.71)		(0.16)		(0.46)	

* ** *** represents significance at 1%, 5% and 10% respectively. Robust standard errors for coefficient estimates are in ( )

Table 4: Role of Talent in Dispersion of Service Oriented Production

	Model I		Model II		Model III	
	FE	**RE**	**FE**	**RE**	**FE**	**RE**
Talent Based Occupations (% emp.)	0.030* (0.004)	0.031* (0.004)	0.005 (0.004)	0.010* (0.004)	0.004 (0.003)	0.007** (0.003)
Employment with University Degree (% emp.)	-	-	3.721* (0.458)	3.314* (0.456)	1.039** (0.428)	-0.281 (0.426)
Employment in Manufacturing (% of emp.)	-	-	-	-	6.088* (0.774)	1.401* (0.339)
Employment in Services (% of emp.)	-	-	-	-	0.789* (0.217)	1.911* (0.175)
# of observations	153	153	153	153	153	153
F-Wald Test	37.91	3954.26	74.96	152.93	127.77	38427.53
(p-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Hausman Test	0.07		4.56		113.07	
(p-value)	(0.79)		(0.10)		(0.00)	

* ** *** represents significance at 1% 5% and 10% respectively. Robust standard errors for coefficient estimates are in ( )

Table 5: Role of Talent in Dispersion of per capita GDP

	Model I		Model II		Model III	
	FE	**RE**	**FE**	**RE**	**FE**	**RE**
Talent Based Occupations (% emp.)	1.275* (0.104)	0.883* (0.069)	0.563* (0.099)	0.475* (0.091)	0.144* (0.044)	0.415* (0.090)
Employment with University Degree (% emp.)	-	-	0.791 (0.080)	0.695* (0.087)	0.099** (0.038)	0.580* (0.082)
Employment in Manufacturing (% of emp.)	-	-	-	-	0.769* (0.088)	-0.176*** (0.096)
Employment in Services (% of emp.)	-	-	-	-	0.726* (0.062)	0.440* (0.098)
# of observations	153	153	153	153	153	153
F-Wald Test	149.79	6747.77	221.54	9284.25	550.22	2980.34
(p-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Hausman Test	25.39		2.12		769.20	
(p-value)	(0.00)		(0.35)		(0.00)	

* ** *** represents significance at 1% 5% and 10% respectively. Robust standard errors for coefficient estimates are in ( )

6. Conclusion

The concentration of talent and related social and economic properties of locations have been examined from distinct theoretical points of view. While different channels can be defined, in the end a common expectation is postulated that talent is unevenly distributed among regions and that this unequal distribution creates differences in the economic performances of these locations. From these general arguments, this study has focused on Spain's 17 Autonomous Communities and validates the fact that talent is unevenly distributed among the regions. This uneven distribution has a marked impact on differences in the economic activity levels, measured in terms of industry and service value added as well as in terms of regional GDP (all in per capita terms).

We believe our results can be considered important from a number of different perspectives. First, the spatial dispersion of the talent base and of the economic activity indicators present identical geographically patterns. Second, the dispersion in talent based employment follows a trend towards a more equal distribution. However, an improvement in the distribution of employment among those holding a university degree cannot be detected. Finally, our panel data results reveal the overall connection between the talent bases and the economic performance of regions, providing clear evidence that talent is a vital element in accounting for regional differences. From this perspective, it would not be naive to propose that the promotion of talent based occupations (and/or jobs) and educational attainment in a region will have both direct and indirect consequences on regional development.

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APPENDIX

Table 6: Description of the independent and dependent variables

Variable	*Measure*	*Source*
Independent ***Talent components***		
Talent based occupations *(occupational attainment)*	Percentage of talent based employment in the selected sectors, in total employment by Autonomous Communities of Spain from 1996 to 2004 (the data are not available for Ceuta and Melilla)	'Sistema Anual de Balances Ibéricos' (**SABI**) **database***
Human capital *(educational attainment)*	Percentage of employment with a bachelor's degree and higher in total employment by Autonomous Communities of Spain from 1996 to 2004	Instituto Valenciano de Investigaciones Económicas **(IVIE)**
Explanatory/ Controls		
Manufacture based employment	Percentage of manufacture employment in total employment by Autonomous Communities of Spain from 1996 to 2004	Instituto Nacional de Estadística **(INE)**
Service based employment	Percentage of service sector employment in total employment by Autonomous Communities of Spain from 1996 to 2004	Instituto Nacional de Estadística **(INE)**
Dependent		
GDP per capita	Per capita income (GDP) per year by Autonomous Communities of Spain from 1996 to 2004	Instituto Nacional de Estadística **(INE)**
Industrial VA	Per Capita Industry Value Added per year by Autonomous Communities of Spain from 1996 to 2004	Instituto Nacional de Estadística **(INE)**
Service VA	Per Capita Service sector Value Added per year by Autonomous Communities of Spain from 1996 to 2004	Instituto Nacional de Estadística**(INE)**

* Data classified at four-4 digit level for selected occupations, represent talent indicator and, are only available from the SABI database. Given data availability for all variables selected, data can be collected from 1996 to 2004. Panel data models are constructed for 9 year period only.

Table 7: Selected occupations-talent based- for purposes of research

Sectors	Codes-CNAE*
High-tech	
Manufacture of basic pharmaceutical products	2441. 2442. 2330
Manufacture of computers and peripheral equipment	3001. 3002. 3230
Manufacture of electronic components	2466. 3110. 3120. 3130. 3210. 3230
Manufacture of communication equipment	1740. 2442. 2924. 3162. 3220. 3230. 3310. 3320. 3340. 3650. 5274
Manufacture of instruments and appliances for measuring. testing and navigation	2924. 2943. 2956. 3110. 3162. 3210. 3230. 3310. 3320. 3340. 3350. 3530. 3650. 3663
Installation of industrial machinery and equipment	2521. 2615. 2623. 2640. 2681. 2821. 2822. 2840. 2871. 2875. 2911. 2912. 2913. 2914. 2921. 2922. 2923. 2924. 2932. 2942. 2943. 2951. 2952. 2953. 2954. 2955. 2956. 2971. 3001. 3002. 3110. 3120. 3130. 3162. 3220. 3230. 3310. 3320. 3330. 3340
Manufacture of machinery for mining. quarrying and construction	2952. 3410. 3541
Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers	3420
Manufacture of engines and turbines. except aircraft. vehicle and cycle engines	2911. 2960. 3430. 3530. 3611
Manufacture of tubes. pipes. hollow profiles and related fittings. of steel	2772
Manufacture of irradiation. electromedical and electrotherapeutic equipment	3310
Manufacture of magnetic and optical media	2465
Manufacture of electric motors. generators and transformers	3110. 3162
Manufacture of electricity distribution and control apparatus	3120
Manufacture of batteries and accumulators	3140
Manufacture of other electronic and electric wires and cables	3130
Manufacture of wiring devices	2524. 3120. 3130
Manufacture of electric lighting equipment	3150. 3161. 3162
Manufacture of electric domestic appliances	2956. 2971
Manufacture of non-electric domestic appliances	2972

Manufacture of other electrical equipment	2924. 2943. 3120. 3130. 3162. 3210
Manufacture of fluid power equipment	2912. 2913
Knowledge intensive services	
Sea and coastal passenger water transport	6110
Sea and coastal freight water transport	6110
Inland passenger water transport	6120
Inland freight water transport	6120
Passenger air transport	6120. 6220
Freight air transport	6210. 6220
Space transport	6230
Postal activities under universal service obligation	6411
Other postal and courier activities	6412
Regulation of the activities of providing health care. education. cultural services and other social services. excluding social security	7512
education	6323. 8010. 8021. 8022. 8030. 8042. 9234. 9262
health and social work activities	7521. 8511. 8512. 8513. 8514. 8531. 8532.
arts. entertainment and recreation activities	7514. 9231. 9232. 9233. 9234. 9240. 9251. 9252. 9253. 9261. 9262. 9272
Real Estate	
Buying and selling of own real estate	7012
Renting and operating of own or leased real estate	7020
Real estate agencies	7031
Management of real estate on a fee or contract basis	7032
Architecture and Engineering	
Architectural activities	7420
Engineering activities and related technical consultancy	7420
Technical testing and analysis	7430
R&D	
Research and experimental development on biotechnology	7310

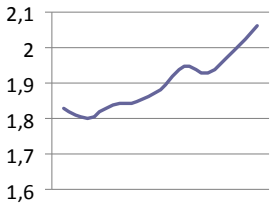
Other research and experimental development on natural sciences and engineering	7310
Research and experimental development on social sciences and humanities	7310. 7320
Advertising and market research	
Advertising agencies	7440
Media representation	7440
Market research and public opinion polling	7413
Professional, scientific & technical activities	
Legal activities	7411
Accounting. bookkeeping and auditing activities; tax consultancy	7412
Activities of head offices	7415
Public relations and communication activities	7414
Business and other management consultancy activities	0501. 7414
Other Professional, scientific and technical activities	
Specialised design activities	7484
Photographic activities	7481. 9240
Translation and interpretation activities	7483
Other professional. scientific and technical activities n.e.c.	6340. 7414. 7420. 7460. 7484
Financial and insurance activities	
Central banking	6511
Other monetary intermediation	6512
Activities of holding companies	6523. 7415
Trusts. funds and similar financial entities	6523
Financial leasing	6521
Other credit granting	6522
Other financial service activities. except insurance and pension funding n.e.c.	6522. 6523
Life insurance	6601
Non-life insurance	6603

Reinsurance	6601. 6602. 6603
Pension funding	6602
Risk and damage evaluation	6720
Creative activities	
Publishing of books. periodicals and other publishing activities	2211. 2212. 2213. 2215. 2222. 7240
Software publishing	7221. 7240
Motion picture. video and television programme production. sound recording and music publishing activities	2214. 7240. 7484. 9211. 9212. 9213. 9220
Programming and broadcasting activities	6420. 7240. 9220
Telecommunications	6420
Computer programming. consultancy and related activities	7210. 7222. 7230. 7240. 7260. 3002
Information service activities	7230. 7240

* Spanish National Classification of Economic Activities

Figure 3: Performance of Autonomous Communities - Working Population from 1996 to 2004 (% of total Population) Spain Average=1.00

Navarra



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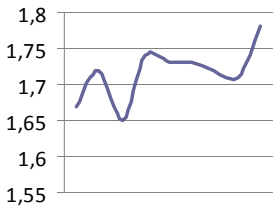

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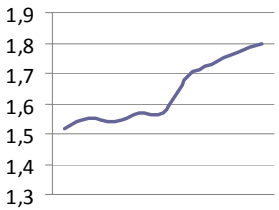

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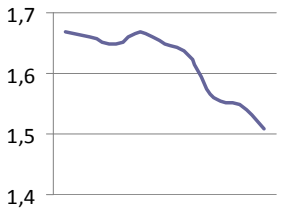

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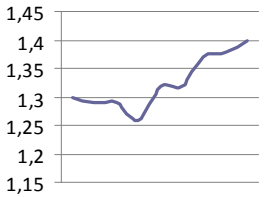
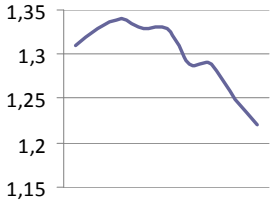


Comunidad Valenciana



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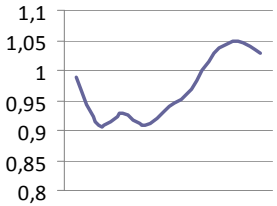
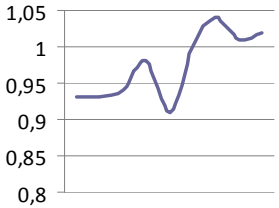


Castilla - La Mancha



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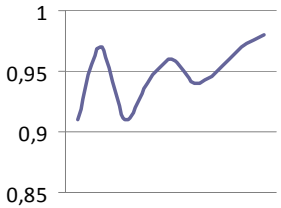

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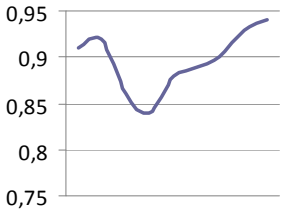
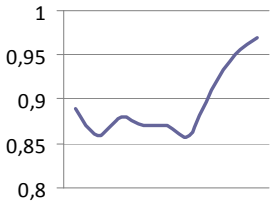


Castilla y León



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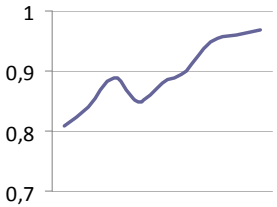

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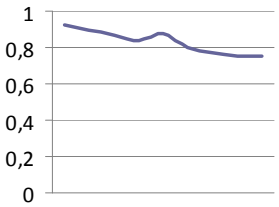

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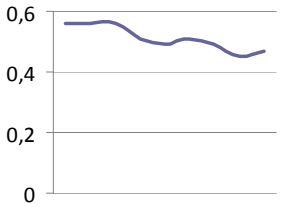

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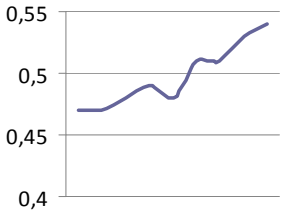

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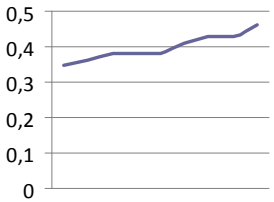

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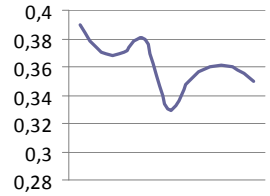


Figure 4: Performance of Autonomous Communities Industrial Production from 1996 to 2004 (Per capita VA) Spain Average=1.00

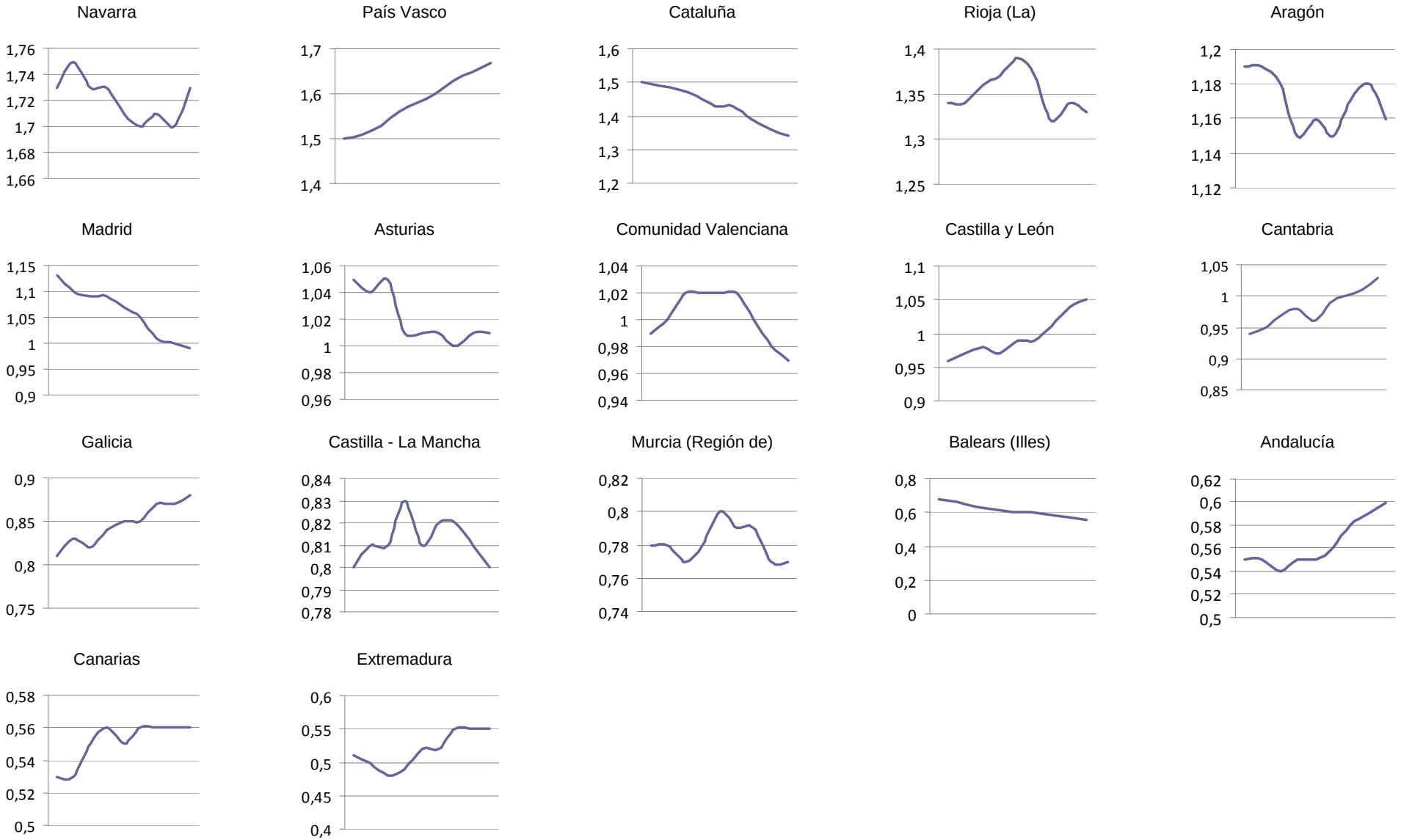
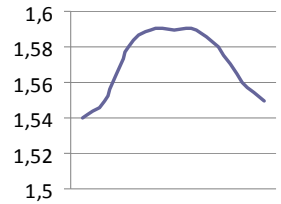


Figure 5: Performance of Autonomous Communities Service Related Production from 1996 to 2004 (Per capita VA) Spain Average=1.00

Madrid



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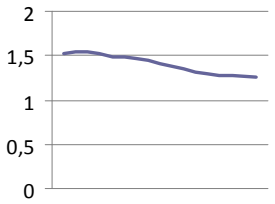

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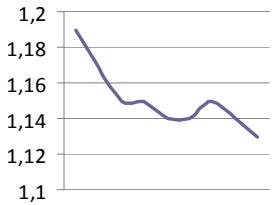

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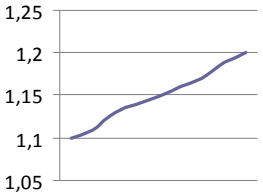

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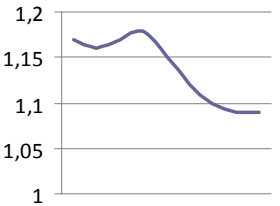

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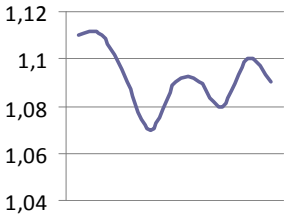

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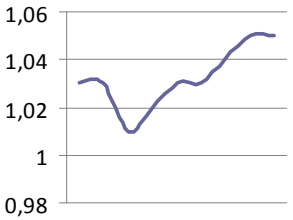

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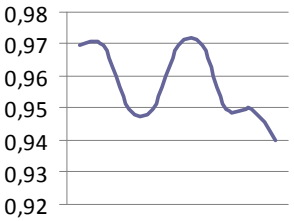

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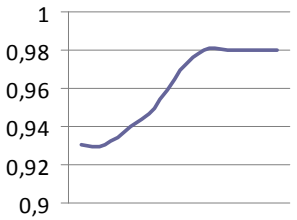

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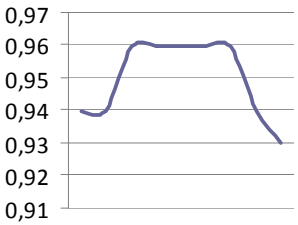
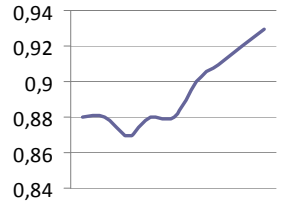


Castilla y León



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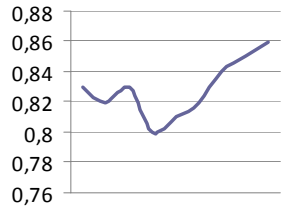

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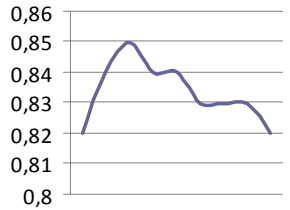
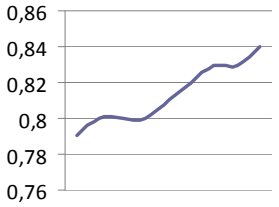
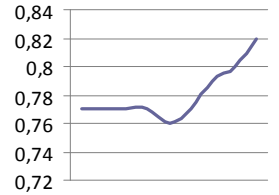


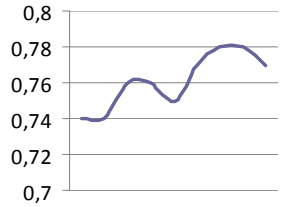
Andalucía



Galicia



Castilla - La Mancha



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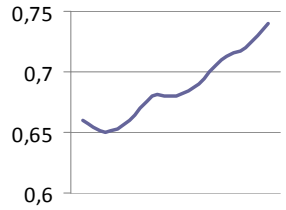
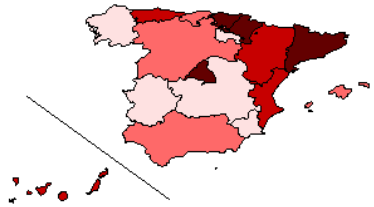
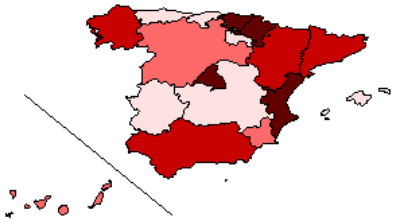


Figure 6: Relationship between Talent and Regional Differentiation in Spain (2004)

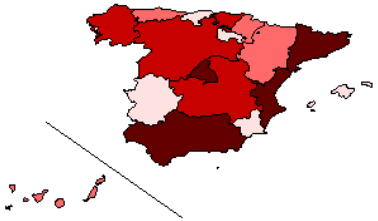
Talent Based Occupations (% of employment)



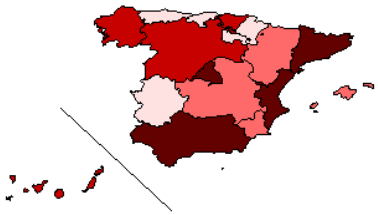
Employment with Bachelor's Degree (in working population)



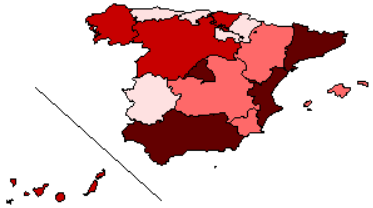
Industry Value Added (gross)



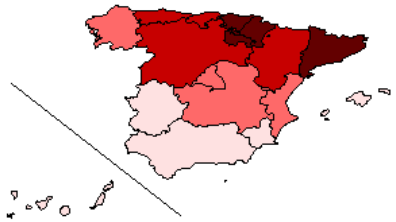
Service Value Added (gross)



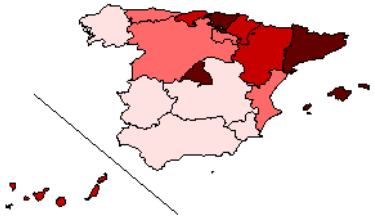
GDP (gross)



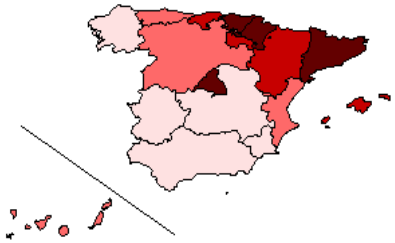
Industry Value Added (per capita)

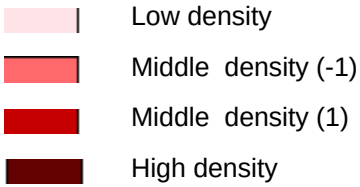


Service Value Added (per capita)



GDP (per capita)





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