CONCENTRATION OF TALENT AND REGIONAL GROWTH: EMPRICAL EVIDENCE FROM SPANISH AUTONOMUS COMMUNITIES

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Abstract

The talents are considered to be one of the most important means to generate regional growth. However talented people are not spread equally across nations or places; instead tend to concentrate within particular locations. Economists for a long time have stressed that there exists a link between the agglomeration of talent and regional growth. Besides, there are strong tentative empirical evidences that the agglomeration of human capital contributes to regional development and growth. From such a perspective, the central question that we discus and will try to answer is "how do concentration of talent and related sectors affect regional growth?" Shortly the focus of this research is an empirical evaluation of the effects of talent on regional differentiation by means of detailed analysis for 17 Autonomous Communities of Spain between 1996 and 2004. We hypothesise that regions specialising in strategic sectors that are creative and having rapid productivity growth would experience faster growth and concentration of talent will have positive and significant impact on regional economic performance. Regional economic performance is measured by four separate indicators; volume of regional employment, value added in industrial and service oriented production and finally Gross Domestic Product (GDP) of Autonomous Communities. Talent matrix contains two separate indicators; human capital as an educational attainment, talent- employment in selected occupations that are assumed to be strategic for regional growth providing economic specialization- as an occupational attainment. Overall we find empirical evidence that talent base of Spanish Regions are an important factor behind the regional economic activity dispersion.

Keywords: talent, regional growth, panel data, Spain

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I. INTRODUCTION

Nowadays, the role of talent –high skilled workers- as represents an emerging paradigm, being at the centre of a scientific debate in economic development and has been the subject of growing interest among not only economists, economic geographers, 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 the economic specialization. Karlsson and Johansson (2008) claim that knowledge infrastructure, human capital, talent, creativity, knowledge generation, knowledge protection, knowledge accumulation, knowledge appropriation, knowledge flows etc., as well as the creative use of knowledge are basic drivers of the specialization of regions and hence of regional development. The purpose of this research is to discuss the role of talent on regional growth.

Florida asserts high skilled human capital, called talents, is the key to success in this new era of economic growth. Their idea and creativity are the most important element in the economic success of firm or of regions (Florida, 2002a). In this new approach, today knowledge based economy growth and local development is found associated with "clustering of talented people and human capital" as pointed out also by Lucas (1998). Also other authors highlighted how local development is highly related with high skilled human capital (Glaeser et.al., 1992; Henderson et. al., 1995; Capone, 2006).

Since we know that talent is associated with economic development, and we also know that talent is spread unevenly, it is important to understand the factors that account for this varied geography (Mallender and Florida, 2007). Economists for a long time have stressed that there exists a link between the agglomeration of talent and regional growth. Besides, there are strong tentative empirical evidences that the agglomeration of human capital, which is used as a component of talent in the scope of this study, contributes to regional development and growth. In this context place of human capital enters the real of Fujita (1988) and Krugman (1991) type of new economic geography (NEG) models as well as the new growth theories associated with Romerian framework (1990) that formally highlights the connection between knowledge, human capital accumulation and economic growth. From such a perspective, the central question that we discus and will try to answer is "how do concentration of talent and related sectors affect regional economic performance?"

Shortly the focus of this research is an empirical evaluation of the effects of talent on regional differentiation by means of detailed analysis for 17 Autonomous Communities of Spain between 1996 and 2004. We hypothesise that regions specialising in strategic sectors that are creative and having rapid productivity growth would experience faster growth and concentration of talent will have positive and significant impact on regional economic performance. Originating from this central question, static, non-spatial panel data models are constructed and evaluated. In the following section, impact of talent concentration on regional development and growth discussions from the literature are briefly reviewed. In section III, methodology of the research is described, concentration of economic activity and spatial distribution of talent by Spanish Autonomous Communities are analysed. In section IV, constructed models on talent and regional development are discussed and findings are presented. The last section evaluates and discusses.

As will be broadened in section III, differentiation of regional economic performance is measured by four separate indicators; volume of regional employment, value added in industrial and service oriented production and finally Gross Domestic Product (GDP) of Autonomous Communities. Talent matrix contains two separate indicators; human

capital and employment in selected occupations such as high-tech, knowledge intensive services, real estate, architecture and engineering, R&D, advertising and market research, professional, scientific & technical activities, financial and insurance activities and Creative activities (see appendix) that are assumed to be strategic for regional growth providing economic specialization. Education indicator is measured as the percentage of employment with bachelor's degree and above. Occupational indicator is measured as the percentage of employment in the selected sectors. Moreover a number of control variables are inserted, namely; population growth, percentage of employment in manufacture and service industries. Eventually, we find that economic performance indicators signal the significant positive impact of talent on regional economic activity. Concentration of talent based occupation in the employment plays a crucial role in understanding the regional differences. On another note the impact of well educated employment is also crucial for each economic activity.

II. CONCEPTS AND THEORY

Human capital and talent- high skilled workers- have long been connected to urban and regional growth in theory. The presence of human capital and talent, that are believed to be a key component of development and generate innovation, is essential for the economic growth. The literature on the effects of talent concentration on regional growth is notably vast. In this section we would like to offer brief summary of literature focusing on positive impact of talent concentration on regional development and growth. As we mentioned above human capital and employment in selected occupations that are assumed to be strategic for economic performance of regions providing economic specialization are the components of our talent definition.

Knowledge based and creative sectors provide economic specialization in recent decades. By all means, they are being more strategic for urban and regional economics and development. Skills and abilities of individuals to solve problems and transfer knowledge are a focal point in the knowledge economy. These skills and abilities are built up in investment processes, which involve formal and informal education as well as learning-by-doing, learning-by-using, and accumulation of experiences. Karlsson et.al., (2009) view the value of these skills and abilities of an individual as his or her human capital. The increased interest in the knowledge economy has led to the development of new models of economic growth, 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) clarified the role of human capital externalities in economic development and highlighted the clustering effect of human capital, which now embodied the knowledge factor. He recognized the role of great cities, which localize human capital and information, create knowledge spillovers, and become engines of economic growth (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 but also tentative empirical evidences that the agglomeration of human capital contributes to regional development and growth (Karlsson et.al., 2009). Skill-based technological progress is translated into productivity and wage increases of college graduates in high-tech industries. With such a scenario, cities specializing in industries having rapid productivity growth would experience faster

growth and attract more college graduates from other regions (Karlsson et.al., 2009). 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. Policy assistance at regional levels can mitigate such inequalities in the certain and distribution of human capital (Ahmed, 2009).

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). As in mentioned Qian (2008), Ullman (1958) noticed the importance of human capital in regional development half a century ago. Human capital has been proven 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. Rauch (1991) finds a positive relationship between the human capital stock and property costs or the average wage in cities Qian (2008). Glaeser (1998, 1999, 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, they found that cities that begin with more educated populations exhibit higher rates of population growth as time goes on (Florida, 2002). Simon and Nardinelli (1996) examined the connection between human capital and city growth in the US and 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 growth. 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), (Qian, 2008). On the other hand, human capital is a strong and consistent predictor of job growth, average wage, average wage change, and the net immigration of college graduates. For years, human capital had been established by economists as a robust predictor of per capita income levels (Hoyman and Faricy, 2008). Hoyman and Faricy (2008) indicate that human capital is also correlated with job growth and the influx of young, educated workers. 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 around others with high levels of human capital. Other empirical studies have found that human capital is strongly associated with urban and regional growth. Rauch (1993) found that both wages and housing rents were higher in cities with higher average education levels.

As in Florida (2002) mentioned, Jacobs (1961, 1969) called attention to the central role played by people in the generation and organization of economic activity in cities. The diversity of economic actors and their high level of interaction promote the creation and development of new products and new technology Florida (2002). The replacement of raw materials or natural harbours with human capital and creativity as the crucial wellspring of economic growth means that in order to be successful in the emerging creative age of the knowledge economy, regions must develop, attract and retain talented and creative people who generate innovations, develop technology intensive industries and power economic growth (Clifton and Cooke, 2007). The definition of creative industries refers to 'industries which have their origin in individual creativity, skill

and talent and which have a potential for wealth and job creation through the generation and exploitation of intellectual property' (DCMS 2001, p. 5), (Lazzeretti et. al. 2008). Karlsson et.al. (2009) observe that the critical input in the knowledge economy – the human capital – is strongly concentrated in geographical space, much more so than most other types of economic resources and activities. With other words, they conclude that human capital exhibits strong tendencies to agglomerate in certain locations (Karlsson et.al. 2009; Berry and Glaeser 2005) argued 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 recent years, the literature on urban and regional economics reveals a substantial increase in the interest of how agglomeration in general and knowledge spillovers in particular affect the regional growth process at the firm level, the sector level and the overall level. Karlsson et.al. (2009) observe that human capital measured in terms of people with higher education levels tend to agglomerate to a substantially higher degree than the population at large.

In brief, most of the researchers agree with talent, measures human capital based on educational attainment or occupational attainment, is strongly associated with economic development, and also agree with talent is spread unevenly. This research would like to contribute to this literature by investigating one of the South European cases, Spain. It attempts to identify regional differentiation associated with the concentration of talent in Spanish Autonomous Communities.

III. RESEARCH AND METHODS

In accordance to the literature review summarized in Section II and scope of the study, this section is organized in three parts: concentration of economic activity for explaining the regional economic performance to account for regional differences; spatial concentration of talent for explaining talent distribution on a space and contribution to economic development; data, variables and methods are preferred for empirical analysis.

CONCENTRATION OF ECONOMIC ACTIVITY IN SPAIN

Discussion of regional differences can be carried out from various channels. From the perspective of the ongoing study, we find it vital to concentrate on the regional economic performance to account for the regional differences. In this framework, based on the broad structure of the Spanish Autonomous Communities as well as their development levels; number of employment, industrial value added and service sector value added and regional GDP are regarded as indicators of economic activity levels of the regions. These assessed indicators are compared in their levels and their growths.

As mentioned, four specific indicators are evaluated to asses the dynamism of the economic activity of the autonomous regions of Spain. Following the central literature regarding urban growth model, we believe although unit of observation for the study is autonomous regions, assessing the distribution of employment will yield important insight about the labour market dynamism of Spain. Moreover, keeping in mind the relatively high share of industry and services in Spanish economy, the industrial value added and the service sector value added will also be investigated. In line with the expectations of

the development economics, the transfer of production from industrial activities toward more service sector oriented activities can also be captured for Spain (even for a relatively short time period). This will also give a growth and development orientation to the study.[1]

Table 1: Employment Concentration of Autonomous Communities of Spain (*)

	1996	1997	1998	1999	2000	2001	2002	2003	2004	Avrg.
Andalucía	1.458	1.461	1.494	1.506	1.496	1.559	1.550	1.614	1.631	1.530
Aragón	0.663	0.656	0.651	0.634	0.661	0.656	0.682	0.675	0.692	0.663
Asturias	0.428	0.429	0.400	0.385	0.398	0.399	0.396	0.399	0.400	0.404
Balears	0.182	0.188	0.190	0.179	0.174	0.187	0.184	0.171	0.177	0.181
Canarias	0.268	0.254	0.260	0.268	0.241	0.256	0.269	0.272	0.263	0.261
Cantabria	0.225	0.206	0.210	0.204	0.209	0.216	0.228	0.230	0.226	0.217
Castilla y León	0.961	0.925	0.936	0.923	0.912	0.888	0.922	0.939	0.957	0.929
Castilla - La Mancha	0.682	0.681	0.693	0.721	0.665	0.726	0.755	0.732	0.743	0.711
Cataluña	4.366	4.358	4.333	4.408	4.353	4.291	4.136	4.137	4.057	4.271
Comunitat Valenciana	2.250	2.287	2.304	2.297	2.314	2.246	2.277	2.229	2.197	2.267
Extremadura	0.162	0.166	0.172	0.172	0.169	0.184	0.187	0.183	0.197	0.177
Galicia	0.959	0.987	1.039	0.984	1.018	1.023	1.061	1.057	1.050	1.020
Madrid	1.994	1.948	1.901	1.844	1.920	1.788	1.746	1.724	1.721	1.843
Murcia	0.428	0.462	0.432	0.452	0.463	0.466	0.474	0.490	0.503	0.463
Navarra	0.410	0.406	0.419	0.423	0.430	0.449	0.449	0.460	0.477	0.436
País Vasco	1.375	1.391	1.380	1.402	1.384	1.471	1.488	1.491	1.502	1.432
Rioja (La)	0.190	0.195	0.186	0.196	0.193	0.194	0.197	0.196	0.206	0.195

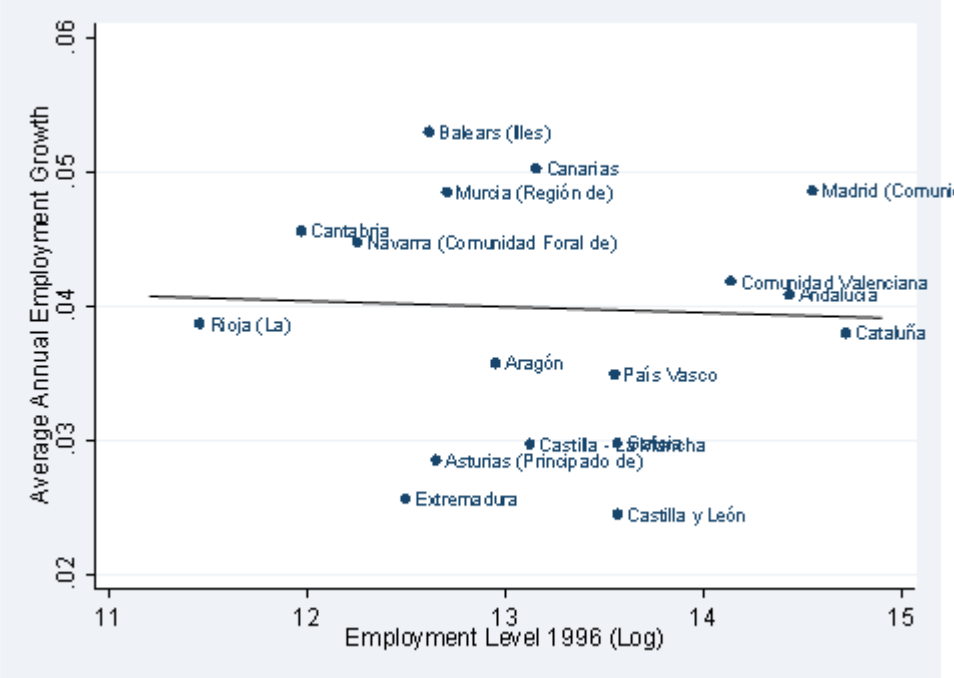
Source: INE, authors´ own calculation
(*)Spain Average Employment = 1.00

Investigation of table 1 is informative in the sense that, it contains information regarding both the concentration and also performance of employment among in the regions of Spain. It is worth mentioning that regions of Cataluña, Valencia, Madrid, País Vasco and Andalucía outperform the Spain averages in employment levels. Here it is also noteworthy that remaining regions distribution regarding the employment levels is not uniform, while there are a number of regions close to the Spain averages (Galicia, Castilla y Leon and Aragon), some are still far away from the averages of the economic activity-dynamism (Rioja, Balears, Extremadura). These findings become more interesting when the employment growth figures and the above findings are compared. To see how regions perform between each other (in terms of employment growth) annual average employment growth rates are computed and related with the initial employment stocks of the regions in 1996. By doing so, one can argue about the convergence of the employment stock among the regions of Spain. In case a clear negative relationship is detected, then regions with lower employment stock in 1996 would be outperforming the others, in favour of convergence of distribution of employment. However Figure 1 gives the absence of a clear relationship between the position of the region in 1996 and its growth performance. However it is worth mentioning that employment rich regions like Madrid, Cataluña and Valencia are

[1] Note that path of regional GDP for Spanish Autonomous Communities will be evaluated here. However as a complementary analysis additional remarks will be done in section IV while discussing empirical findings regarding the dynamics behind regional differentiation of income among Spanish Autonomous Communities.

realizing above average annual employment growths, which is against the convergence phenomenon.

Figure 1: Employment Performance of Autonomous Communities



Source: INE, authors´ own calculation

After having a general understanding about the employment structure at the regional level, next a similar understanding is carried out for the industrial development in Spain. Instead of observing the overall regional value added covering the whole economic activities, we prefer to concentrate on two specific economic activities For the overall industry and also for services, relative positions of Autonomous Communities in Spain are summarized in Tables 2 and 3. Actually one can argue that usage of industry value added will already capture the overall dynamics of the production side, hence it is a common expectation that most of the time, other economic activities, such as service and trade sectors, will follow the common pattern realized in the industry as a whole. However due to the distinct structure of Spain and also as to see whether there is a time based shift from industrial production to service sector based regional development, we aim to investigate the dynamics of the process separately for industry and service sector value added. Findings reported in Table 2 and 3 are comparable and will clarify our just mentioned concerns. First of all regarding the overall performances both set of findings give much or less the similar results about the regions that are outperforming the Spain averages. However what is striking is related with the dominance of a number of Autonomous Communities while moving from industry to services. It is apparent that Madrid and Andalucía move forward in terms of the relative positions, whereas Cataluña and País Vasco are found to be lagging in terms of their relative positions among the outperformers of Spain. While these findings are only for illustrative and comparison purposes, we believe they yield valuable information about the structure of production in Spain. It is expected that after having a deeper insight about the distribution of talent based occupations (or employment) in Spain; a more analytical understanding will complement the study.

Table 2: Industrial VA Concentration of Autonomous Communities of Spain (*)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Avrg.
Andalucía	1.779	1.743	1.720	1.715	1.732	1.735	1.773	1.828	1.854	1.874	1.775
Aragón	0.606	0.617	0.618	0.610	0.591	0.595	0.585	0.596	0.596	0.593	0.601
Asturias	0.506	0.500	0.494	0.494	0.472	0.468	0.460	0.450	0.445	0.441	0.473
Balears	0.223	0.225	0.223	0.219	0.220	0.217	0.224	0.227	0.222	0.219	0.222
Canarias	0.373	0.372	0.378	0.391	0.406	0.403	0.420	0.436	0.438	0.440	0.406
Cantabria	0.222	0.217	0.219	0.222	0.223	0.221	0.225	0.228	0.229	0.233	0.224
Castilla y León	1.069	1.055	1.058	1.055	1.045	1.061	1.046	1.053	1.067	1.070	1.058
Castilla - La Mancha	0.602	0.597	0.606	0.604	0.616	0.608	0.608	0.614	0.602	0.605	0.606
Cataluña	3.928	3.976	3.972	3.966	3.911	3.869	3.849	3.778	3.751	3.733	3.873
Comunitat Valenciana	1.756	1.727	1.750	1.778	1.789	1.812	1.817	1.813	1.808	1.798	1.785
Extremadura	0.246	0.239	0.231	0.224	0.228	0.240	0.239	0.247	0.243	0.240	0.238
Galicia	0.976	0.972	0.986	0.978	0.993	0.999	0.986	0.995	0.987	0.984	0.986
Madrid	2.428	2.467	2.435	2.422	2.417	2.392	2.383	2.329	2.353	2.349	2.398
Murcia	0.374	0.373	0.376	0.372	0.382	0.395	0.399	0.404	0.404	0.408	0.389
Navarra	0.391	0.394	0.400	0.399	0.401	0.401	0.402	0.408	0.404	0.413	0.401
País Vasco	1.363	1.370	1.380	1.396	1.417	1.425	1.430	1.437	1.436	1.440	1.409
Rioja (La)	0.155	0.155	0.155	0.156	0.157	0.158	0.157	0.155	0.158	0.160	0.157

Source: INE, authors´ own calculation
(*) Spain Average Industry VA= 1.00

Table 3: Services VA Concentration of Autonomous Communities of Spain (*)

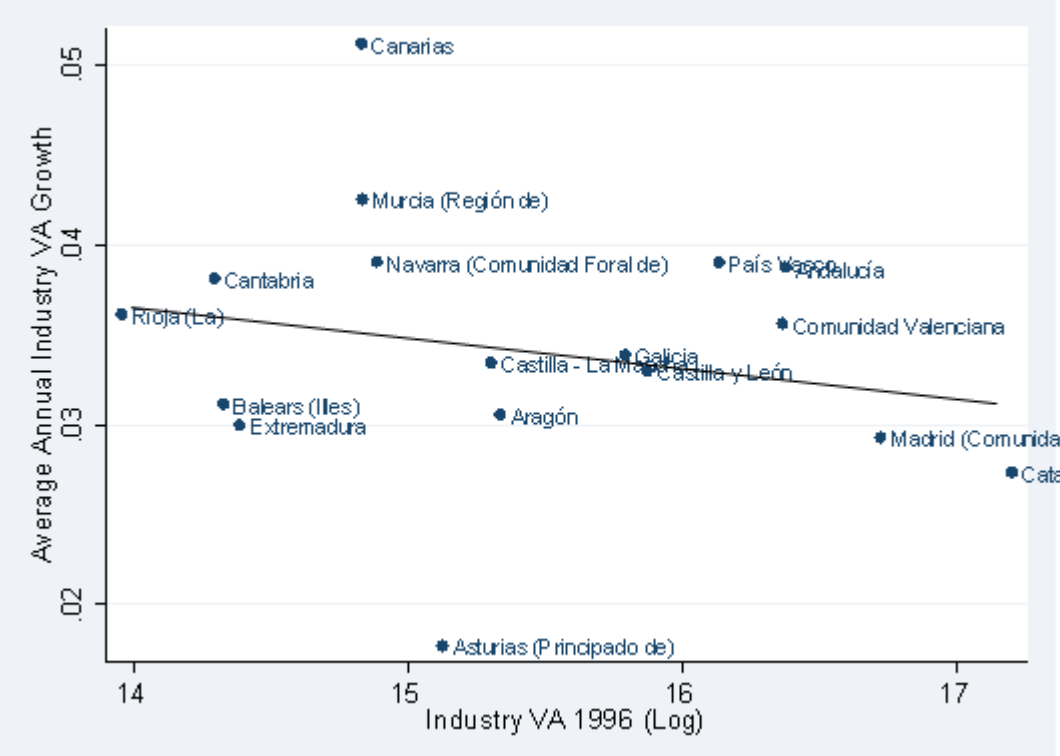
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Avrg.
Andalucía	2.518	2.530	2.545	2.529	2.539	2.572	2.554	2.562	2.564	2.579	2.549
Aragón	0.548	0.544	0.541	0.527	0.526	0.526	0.521	0.522	0.522	0.523	0.530
Asturias	0.401	0.399	0.394	0.393	0.378	0.377	0.374	0.375	0.373	0.370	0.383
Balears	0.510	0.516	0.529	0.520	0.523	0.514	0.504	0.494	0.488	0.483	0.508
Canarias	0.829	0.833	0.832	0.840	0.858	0.846	0.840	0.836	0.840	0.840	0.839
Cantabria	0.218	0.217	0.216	0.217	0.218	0.221	0.221	0.221	0.219	0.218	0.219
Castilla y León	1.003	0.982	0.966	0.946	0.949	0.935	0.943	0.936	0.930	0.927	0.952
Castilla - La Mancha	0.557	0.563	0.564	0.575	0.567	0.562	0.573	0.577	0.575	0.570	0.568
Cataluña	3.206	3.216	3.158	3.094	3.104	3.077	3.071	3.079	3.085	3.079	3.117
Comunitat Valenciana	1.657	1.667	1.676	1.689	1.686	1.706	1.707	1.715	1.706	1.701	1.691
Extremadura	0.307	0.312	0.308	0.310	0.315	0.314	0.313	0.313	0.315	0.317	0.312
Galicia	0.944	0.930	0.927	0.916	0.908	0.897	0.892	0.888	0.894	0.899	0.909
Madrid	3.423	3.430	3.459	3.545	3.544	3.563	3.602	3.610	3.608	3.612	3.540
Murcia	0.397	0.397	0.409	0.416	0.413	0.416	0.415	0.418	0.426	0.426	0.413
Navarra	0.256	0.256	0.257	0.255	0.250	0.255	0.255	0.254	0.258	0.256	0.255
País Vasco	1.042	1.025	1.032	1.043	1.040	1.036	1.031	1.017	1.017	1.019	1.030
Rioja (Las)	0.116	0.113	0.113	0.110	0.109	0.111	0.111	0.111	0.110	0.110	0.112

Source: INE, authors´ own calculation
(*) Spain Average Services VA= 1.00

As a complementary view to the industry and service sector dispersion, the relative positions of the regions in 1996 are compared with their growth realizations. Figure 2 gives the results regarding this relationship, remarking that regions with relatively better position in Spain are realizing lower industrial production growth rates which is in favour

of the convergence discussion. Such a preliminary finding can give a hint about the convergence of industrial production's dispersion in Spain. However keeping in mind the short time dimension, results should be taken just for illustrative purposes.

Figure 2: Industrial Production Performances of Autonomous Communities



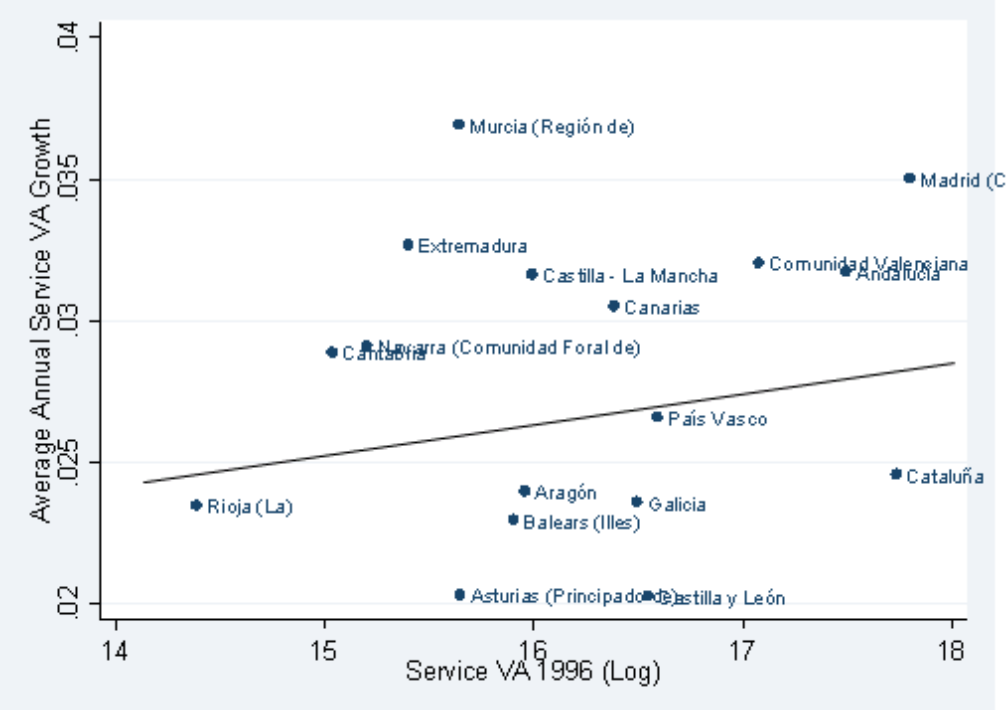
Source: INE, authors´ own calculation

However, when the same illustration is investigated for the service sector developments, results underline the positive association. Regions like, Madrid, Andalucía and Valencia are realizing high growth rate in their service sector value added, which actually stands as a finding against the convergence phenomenon. Note that our concerns mentioned above regarding the evaluation of convergence persists here too.

Overall we believe these findings can shed light on the methods to observe the developments in the economic performance of regions. In the context of regional differences, level of regional economic activity or growth path of the economic activity can be both investigated. Here we believe analysis of the ongoing sub section yields evidence on the dissimilar patterns realized in the growth performances and the economic activity levels of regions of Spain. While these developments can be linked with convergence phenomenon we believe such an approach will be out of the scope of the ongoing discussion. Hence we prefer to divert the investigation of the central question by focusing on the economic activity levels of Autonomous Communities in Spain. Our concern is that, different development levels realized for different economic activity indicators among the regions of Spain may prevent the investigation of the direct links between talent base and economic performances. Some already developed regions, realizing below average growth rates will probably be composed of a sound talent base. From this perspective we believe level of economic activity is more applicable to relate with the talent bases of the regions. By doing so, instead of relating

the economic activity growth of the regions, findings will depict the differentiation of the level of economic activity within Spain

Figure 3: Services Sector Performance of Autonomous Communities



Source: INE, authors´ own calculation

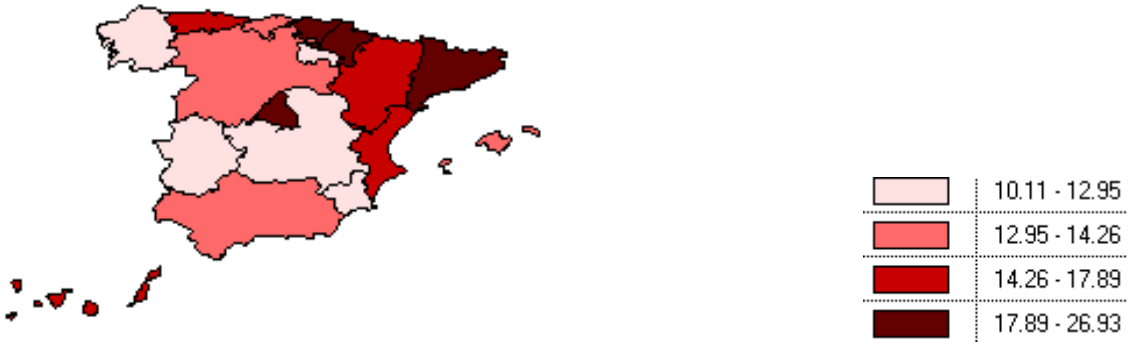
SPATIAL CONCENTRATION OF TALENT IN SPAIN

Distribution of employment and value added volume of industrial and service sector based production give a general insight about concentration of economic activity in among the regions of Spain. After drawing the borders of the study and also mentioning the dispersion of economic activity in Spain, it is complementary to carry the investigation towards the spatial distribution of talent in Spain. In line with the central idea of the study, it is noteworthy to discuss the regional structure of talent by decomposing the indicator between talent based occupations and human capital level of employment.

Figure 4 summarizes the talent base picture of Spain for 2004. Regions of Cataluña, Valencia, País Vasco, Navarra, Aragon, Asturias and Madrid have the highest share of talent based occupations in their own employment stocks. Moreover again same regions, but excluding Asturias but including Andalucía and Galicia this time has the highest share of educated employment in their employment stocks. Here note that low performance of Asturias in terms of economic activity is noteworthy, although it already has a sound talent based occupation density. To have a better insight density of the four different economic activity indicators are illustrated in figure 5 and provided in appendix. A comparison of figure 4 and 5 will clarify our concerns regarding the possible positive association between talent base and the regional economic activity differentiation in Spain, thus can represent a solid background for the constructed model in the next sub section.

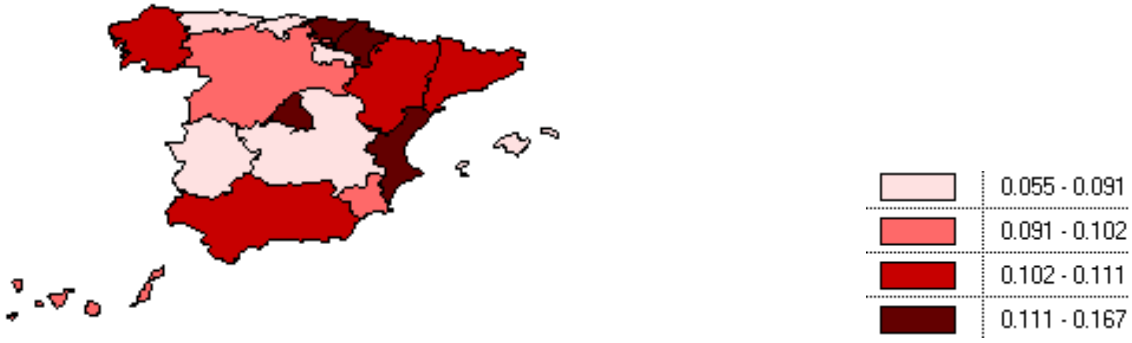
Figure 4: Spatial Distribution of Talent in Spain (2004)

Occupational attainment



Employment in Talent Based Occupations (% of employment)
Source: SABI database

Educational attainment



Employment with bachelor's degree and above (% of employment)
Source: IVIE database

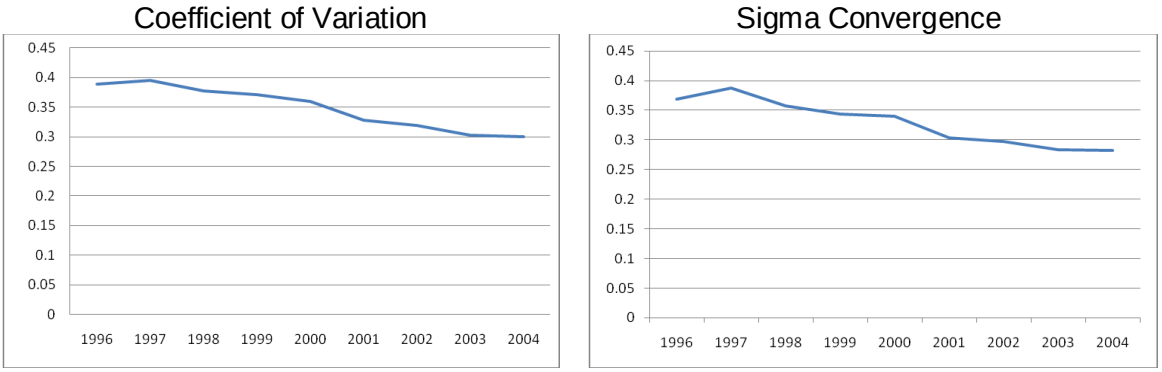
While the illustration regarding the talent map of Spain as well as the density of economic activity in Spain gives a general insight in a static manner, having a broader view to the dispersion of talent among the Autonomous Communities of Spain can be informative. In line with this objective two different dispersion measures are considered. From equations 1 and 2 coefficient of variation and the sigma convergence can be derived, where "y" represents the talent indicator observed, "μ" and "σ" represent the mean and the standard deviation of the talent indicator investigated.[2]

[1] $CV_t = \frac{\mu_t}{\sigma_t}$

[2] $\sigma_t^2 = \frac{1}{N}\sum_{1}^{N}[\ln(y_{i,t}) - \mu_t]^2$

Keeping in mind the short time dimension, results illustrated in Figure 6 and 7 can be used to assess the historical path of the dispersions of talent among the Autonomous regions of Spain. Regarding the employment share of talent based occupation, both dispersion measures remark an improvement. However same comment cannot be directly done for the share of employment with university degree. First of all the short period of investigation depicts a cyclical pattern. Moreover although coefficient of variation seems to decrease in the sample period, it is in the mood of increasing during the last two years. Moreover sigma convergence measure indicates an increase during the sample period. Hence while share of talent base occupations in Spain are realizing a more equal distribution, a similar comment cannot be done for the share of educated employment in the employment base.

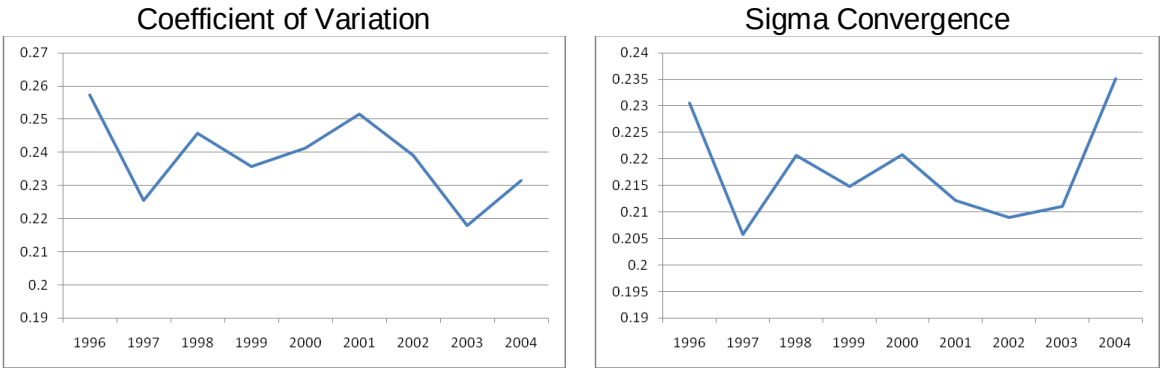
Figure 6: Regional Dispersion of Talent Based Occupations



Sources: SABI, authors' own calculations

[2] For a more detailed discussion about different measures of convergence and dispersion, see Barro, Sala-i Martin (1992) and Baumol et al. (1994).

Figure 7: Regional Dispersion of Employment with University Degree



Sources: IVIE, authors' own calculations

DATA, VARIABLES AND METHODS

Combining different forms of economic activity and talent is the central theme of the study. Using the Spanish data at the Autonomous Communities level for the period of 1996-2004 a number of different panel data models are preferred. Data is collected from three separate sources of Spain; INE, SABI, IVIE (see appendix). Due to data availabilities Ceuta and Melilla are not included in the panel data analysis, keeping the number of cross sections at 17.

Equation 3 is a static non-spatial panel data model, where y represents three different economic activity indicators, employment level, industrial value added, and services value added respectively. X represents the relevant talent indicator and Q is the control variables of the model for robustness check. As debated by Baltagi (2005) the one way error model is represented in equation 3, where v_i is the individual specific error and $u_{i,t}$ is an IID remaining error. Here the central discussion is related with 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 as the fixed effect transformation, is the right procedure. However if one assumes that the individual specific effect is random and it will not be correlated with the other exogenous variables, then usage of efficient GLS estimator will be more accurate. While random effect (RE) estimator is efficient it can suffer from the consistency. Hence it will be informative to check the consistency of the estimator by using a typical Hausman (1978) test. Note that this test is not a test to compare the two models; rather it is implemented to decide between two estimators of the same model.

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

IV. EMPIRICAL FINDINGS

Four different economic activity indicators are analyzed in tables 6, 7, 8 and 9 for employment, industry value added and services value added and regional GDP respectively. All results are reported in appendix.

Five different models are run respectively for each economic performance indicator. Share of employment in talent based occupations and the share of employment with university degree are considered as the indicators capturing the impact of regional talent base on regional economic activity. Moreover a number of control variables are included to assess the robustness of the results regarding the indicators of talent. Following the concerns of Krugman (1991), demand potential is injected into the models by using population growth level. Note that from the perspective of urban growth models, population growth can also be regarded as an indicator explaining the rise of urban areas. However in the context of autonomous regions we find it more informative to regard population growth as a broad measure of demand. Finally following the remarks of Marlet and van Woerkens (2007) structure of employment is also investigated. Share of employment in manufacturing and services are also injected separately into the models. While a number of different social and economical indicators can also be preferred, we limit the number of variables to avoid specification biases that can occur due to relatively low number of observations.

Overall results reported for fixed effect within estimators and the random effect GLS estimator mostly remark similar findings. Note that Hausman (1978) test results indicate the consistency of the efficient random effect estimator (GLS-estimator) in all models but model IV in table 6, model III in table 7 and model IV in table 9. However note that results are robust based on the selected estimation method.

>>> Table 6, 7, 8 and 9 Insert Here <<<

In general results reported for economic performance indicators signal the significant positive impact of talent on regional economic activity in line with the theoretical expectations. Concentration of talent based occupation in the employment plays a crucial role in understanding the regional differences of four different forms of economic activity. On another note the impact of well educated employment is also crucial for each economic activity. However when the share of services in the employment are included, this effect is observed to be negligible for the differences among employment levels and the industrial value added. 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 regional GDP pin points that educated employment has a significant impact even when the share of the service sector employment is included. Note that in all of the models, free from the economic activity indicator, share of manufacturing employment and regional demand measured by the annual population growth, are both found to be significantly affecting the regional differentiation of economic performance. From this perspective we believe reported models in tables 6, 7, 8 and 9 validates that talent is an important determinant for understanding the regional differences among the Autonomous Communities of Spain.

V. DISCUSSION

Place of talent and related social and economical properties of localities are investigated by distinct theoretical point of views. While different channels are defined at the end a common expectation is postulated that talent is unevenly distributed among regions and this unequal distribution somehow cause differences between the economic performance levels and growths of localities. From these general arguments this study concentrates on 17 Autonomous Communities of Spain and validates that talent is unevenly dispersed among the regions of Spain and this has severe impacts on the differences between the economic activity levels, measured by employment volume, industry and service value added and finally regional GDP.

We believe results are important from a number of different perspectives. First of all, spatial dispersion of talent base and the selected economic activity indicators are geographically following identical patterns. Second of all the dispersion of the talent based employment is found to be realizing a path of improvement in favour of a more equal distribution. However a one to one improvement in the distribution of employment with university degree cannot be detected. Finally panel data results allows us to see the overall connection between the talent bases and the economic performance of regions, providing clear evidence that talent is a vital element of the regional differences. From this point of view, it will not be naive to propose that policy implications directly on the promotion of talent based occupations (and/or jobs) as well as increasing the education attainment of regions will have direct and indirect consequences on regional development.

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APPENDIX

Table 4: Description of the independent and dependent variables

Variable	*Measure*	*Source*
Independent		
Talent components		
Talent based occupations	percentage of talent based employment who works at the selected sectors, in total employment by autonomous communities of Spain from 1996 to 2004 (the data is not available for Ceuta and Melilla)	'Sistema Anual de Balances Ibéricos' (**SABI**) **database***
Human capital	percentage of employment with bachelor's degree and above in total employment by autonomous communities of Spain from 1996 to 2004	Instituto Valenciano de Investigaciones Económicas **(IVIE)**
Explanatory/ Controls		
Manufacture	percentage of manufacture employment in total employment by autonomous communities of Spain from 1996 to 2004	Instituto Nacional de Estadística**(INE)**
Service	percentage of service sector employment in total employment by autonomous communities of Spain from 1996 to 2004	Instituto Nacional de Estadística**(INE)**
Population growth	population growth per year by autonomous communities of Spain from 1996 to 2004	Instituto Nacional de Estadística**(INE)**
Dependent		
Number of Employment	number of employment by autonomous communities of Spain from 1996 to 2004	Instituto Nacional de Estadística**(INE)**
GDP	income (GDP) per year by autonomous communities of Spain from 1996 to 2004	Instituto Nacional de Estadística**(INE)**
Industrial VA	industry value added per year by autonomous communities of Spain from 1996 to 2004	Instituto Nacional de Estadística**(INE)**
Service VA	service sector value added per year by autonomous communities of Spain from 1996 to 2004	Instituto Nacional de Estadística**(INE)**

* data classified at 4 digit level for selected occupations, represent talent indicator, are only available from the SABI database in Spain between 1996-2004. According to this data availability, all other variables are collected from 1996 to 2004; panel data models are constructed on 9 years period only.

Table 5: Selected occupations-talent based- on the purpose of the research

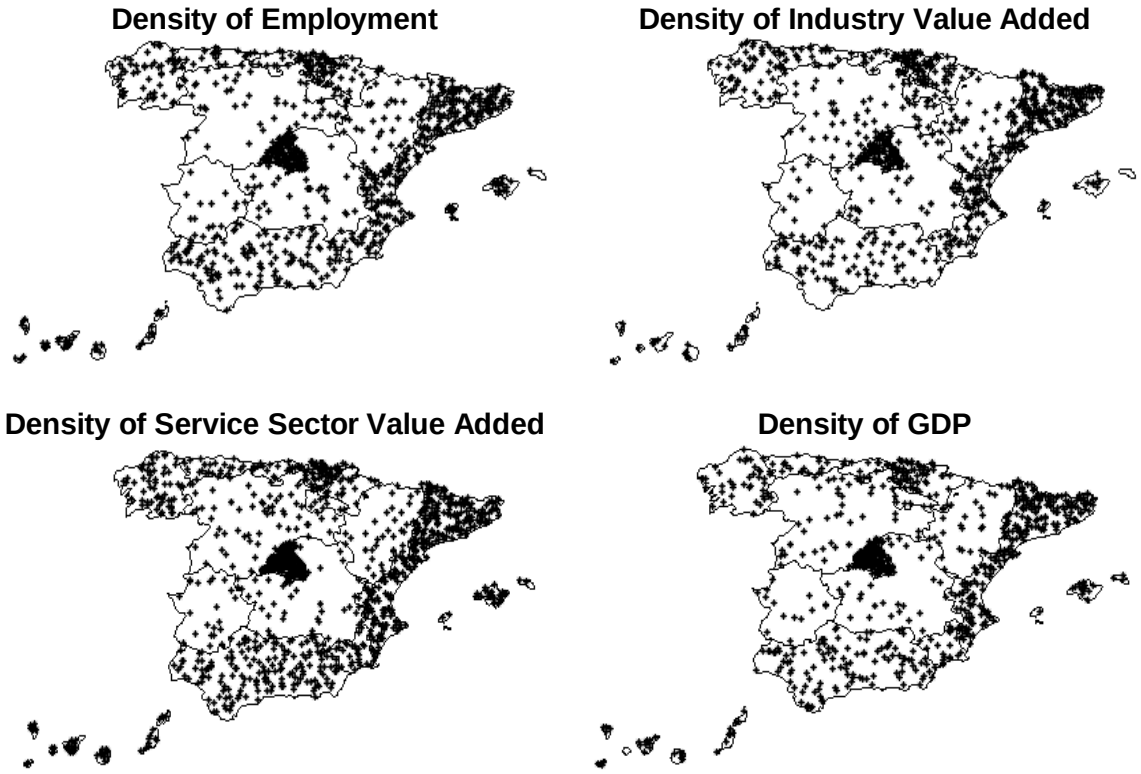
Sectors	Codes-CNAE*
high-tech	
Manufacture of basic pharmaceutical products	2441, 2442, 2330
Manufacture of computers and peripheral equipment	3001, 3002, 3230
Manufacture of electronic components	2466, 3110, 3120, 3130, 3210, 3230
Manufacture of communication equipment	1740, 2442, 2924, 3162, 3220, 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 5: Density of Economic Activity in Spain (2004)



Source: INE

Table 6: Dynamics of Differentiation of Employment among Autonomous Regions of Spain

	Model I		Model II		Model III		Model IV		Model V	
	FE	**RE**	**FE**	**RE**	**FE**	**RE**	**FE**	**RE**	**FE**	**RE**
Talent Based Occupations (%emp.)	0.071* (0.01)	0.071* (0.01)	0.033* (0.01)	0.034* (0.01)	0.029* (0.005)	0.030* (0.005)	0.032* (0.004)	0.032* (0.004)	0.016* (0.002)	0.016* (0.002)
Employment with University Degree (% emp.)	-	-	5.607* (0.619)	5.586* (0.616)	4.223* (0.603)	4.220* (0.600)	3.212* (0.568)	3.304* (0.575)	0.095 (0.325)	0.104 (0.330)
Population Growth	-	-	-	-	2.396* (0.647)	2.365* (0.644)	2.20* (0.579)	2.196* (0.588)	0.814** (0.384)	0.810** (0.361)
Employment in Manufacturing (% of emp.)	-	-	-	-	-	-	6.734* (1.22)	6.184* (1.212)	-	-
Employment in Services (% of emp.)	-	-	-	-	-	-	-	-	3.237* (0.165)	3.231* (0.169)
# of observations	153	153	153	153	136	136	136	136	136	136
F-Wald Test	147.63	4763.93	168.60	343.25	109.32	334.56	110.40	428.22	532.31	6886.95
(p-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Hausman Test	0.06		0.81		0.93		9.28		0.09	
(p-value)	(0.81)		(0.67)		(0.82)		(0.06)		(0.99)	

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

Table 7: Dynamics of Differentiation of Industrial Value Added among Autonomous Regions of Spain

	Model I		Model II		Model III		Model IV		Model V	
	FE	**RE**	**FE**	**RE**	**FE**	**RE**	**FE**	**RE**	**FE**	**RE**
Talent Based Occupations (%emp.)	0.071*	0.072*	0.034*	0.035*	0.033*	0.034*	0.036*	0.037*	0.023*	0.023*
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)
Employment with University Degree (% emp.)	-	-	5.501*	5.465*	3.835*	3.834*	2.527*	2.576*	0.600	0.637
			(0.594)	(0.594)	(0.576)	(0.578)	(0.480)	(0.482)	(0.463)	(0.476)
Population Growth	-	-	-	-	2.085*	2.028*	1.832*	1.813*	0.845**	0.826**
					(0.618)	(0.621)	(0.488)	(0.492)	(0.408)	(0.378)
Employment in Manufacturing (% of emp.)	-	-	-	-	-	-	8.713*	8.457*	-	-
							(1.030)	(1.021)		
Employment in Services (% of emp.)	-	-	-	-	-	-	-	-	2.538*	2.512*
									(0.231)	(0.249)
# of observations	153	153	153	153	136	136	136	136	136	136
F-Wald Test	167.41	7576.32	184.96	374.45	114.03	344.57	155.43	614.58	143.37	10761.84
(p-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Hausman Test	1.71		3.27		11.65		0.71		0.57	
(p-value)	(0.19)		(0.19)		(0.00)		(0.95)		(0.97)	

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

Table 8: Dynamics of Differentiation of Service Sector Value Added among Autonomous Regions of Spain

	Model I		Model II		Model III		Model IV		Model V	
	FE	**RE**	**FE**	**RE**	**FE**	**RE**	**FE**	**RE**	**FE**	**RE**
Talent Based Occupations (%emp.)	0.054* (0.004)	0.055* (0.004)	0.022* (0.004)	0.023* (0.005)	0.020* (0.004)	0.021* (0.004)	0.022* (0.004)	0.023* (0.004)	0.011* (0.002)	0.012* (0.002)
Employment with University Degree (% emp.)	-	-	4.819* (0.460)	4.801* (0.461)	3.514* (0.445)	3.509* (0.445)	2.625* (0.465)	2.67* (0.480)	0.680** (0.286)	0.685** (0.286)
Population Growth	-	-	-	-	2.163* (0.477)	2.144* (0.477)	1.992* (0.503)	1.986* (0.548)	1.077* (0.260)	1.073* (0.260)
Employment in Manufacturing (% of emp.)	-	-	-	-	-	-	5.917* (0.968)	5.631* (1.048)	-	-
Employment in Services (% of emp.)	-	-	-	-	-	-	-	-	2.222* (0.128)	2.219* (0.128)
# of observations	153	153	153	153	136	136	136	136	136	136
F-Wald Test	129.46	6524.87	193.34	389.14	127.40	384.82	229.62	10252.98	416.60	1670.78
(p-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Hausman Test	0.13		3.37		2.75		-1.09 (a)		1.78	
(p-value)	(0.72)		(0.19)		(0.43)				(0.78)	

*, **, *** represents significance at 1%, 5% and 10% respectively

Standard errors for coefficient estimates are in ( )

(a) Hausman test stat for Model IV is found to be negative hence fails to satisfy the asymptotic assumption of the test, thus cannot be evaluated.

Table 9: Dynamics of Differentiation of GDP among Autonomous Regions of Spain

	Model I		Model II		Model III		Model IV		Model V	
	FE	**RE**	**FE**	**RE**	**FE**	**RE**	**FE**	**RE**	**FE**	**RE**
Talent Based	0.132*	0.131*	0.065*	0.065*	0.062*	0.063*	0.066*	0.064*	0.041*	0.042*
Occupations (%emp.)	(0.010)	(0.009)	(0.009)	(0.009)	(0.009)	(0.008)	(0.010)	(0.010)	(0.004)	(0.005)
Employment with	-	-	10.104*	10.114*	8.065*	8.085*	6.314*	6.720*	1.575**	1.631**
University Degree (% emp.)			(0.982)	(0.969)	(1.009)	(0.995)	(1.048)	(1.013)	(0.633)	(0.629)
Population	-	-	-	-	3.633*	3.598*	3.295**	3.361**	1.146**	1.134**
Growth					(1.083)	(1.069)	(1.374)	(1.419)	(0.575)	(0.572)
Employment in	-	-	-	-	-	-	11.667*	9.410*	-	-
Manufacturing (% of emp.)							(2.247)	(2.182)		
Employment in	-	-	-	-	-	-	-	-	5.091*	5.062*
Services (% of emp.)									(0.283)	(0.282)
# of observations	153	153	153	153	136	136	136	136	136	136
F-Wald Test	175.44	7791.18	231.59	476.47	141.76	441.06	234.66	10670.35	480.92	1942.52
(p-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Hausman Test	0.17		0.02		0.10		28.19		1.10	
(p-value)	(0.68)		(0.99)		(0.99)		(0.00)		(0.89)	

*, **, *** represents significance at 1%, 5% and 10% respectively

Standard errors for coefficient estimates are in ( )