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## The Geography of Talent: Employment Growth, Spatial Dynamics and the impact of the Public Sector in Denmark

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# The Geography of Human Capital: Employment Growth, Spatial Dynamics and the Impact of the Public Sector in Denmark

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**Abstract**

Knowledge economy has led to an increasing focus on labour qualifications and distribution of human capital as an important factor for urban and regional growth. This paper examines how human capital is distributed as well as how it is related to employment growth, and what impact the public sector has on this relation. The latter remains unpacked in most studies of human capital, but public service provision and welfare state policies have a strong impact on the distribution of human capital. Studying the case of Denmark, we examine (I) the geography and impact of human capital in the Danish knowledge economy, (II) the impact of the public sector on urban and regional growth and (III) finally discuss how a distinction between publicly and privately employed human capital can contribute to a more differentiated understanding of urban and regional job growth.

**Keywords:** Human capital, employment growth, welfare state, regional growth

# **The Geography of Human Capital: Employment Growth, Spatial Dynamics and the Impact of the Public Sector in Denmark**

## **1. Introduction**

The paper analyses the geography of human capital and the impact of the public sector. For more than two decades, talent and human capital have increasingly been seen as major sources for economic growth in the knowledge economy (Lucas, 1988; Romer, 1990; Glaeser, 2005; Florida, 2002a; Storper and Scott, 2009; Asheim et al, 2011a). In much of the contemporary literature in urban and regional studies, talent, e.g. the ability of people or groups of people to produce, use and distribute knowledge, solving problems as well as generating new ideas and human capital, e.g. the competence and knowledge of people to perform as labour usually measured as formal education, typically above bachelor level, often remain a generic input (e.g. Florida, 2002b; Glaeser and Berry, 2005). This is contrasted by several recent studies that all have pointed to the importance of understanding the diversity of talents and human capital in the economy in terms of growth, employment, education, knowledge, industry and geography (Backsted et al 2008; Scott, 2010a; 2010b; Asheim and Hansen, 2009; Hansen et al, 2011). In this paper, we provide another dimension to this debate and examine the diversity of human capital by dividing between publicly and privately employed human capital to understand the spatial dynamics of human capital and urban and regional employment growth. First, we

examine what kinds of geographies of human capital that exist in Denmark to get a better understanding of the spatial dynamics of human capital. Secondly, we examine the relationship between growth of human capital and total employment growth among Danish municipalities, and thirdly, we examine whether there is a bias of human capital towards the largest cities and urban landscapes as often claimed in the literature.

Further, the direct impact of the Danish welfare state is examined in terms of publicly employed human capital to come to a better understanding of how human capital and job growth are related. The public sector in Denmark accounts for 30.6 % of the total national employment and 43.1 % of the Danish stock of human capital in 2006. Thus, the welfare state plays a major role in the Danish economy in terms of distributing jobs and job growth and especially job opportunities for human capital across space. In this sense, the public sector is an interesting lens through which to discuss regional development; because the location dynamics of jobs in the welfare state are politically resolved.

Thus, this paper answers the following three research questions:

- (I) What is the geography and impact of human capital in the Danish knowledge economy?
- (II) Does the public sector contribute to less unequal regional growth?

- (III) Can distinguishing between publicly and privately employed human capital contribute to a more differentiated understanding of the regional job growth?

To answer these questions, we have structured the paper as follows. Section 2 will theorise on the role of human capital in regard to regional development and introduces the Danish welfare state to frame the context within which this study is analysed. Section 3 presents the method and variables. Next, in section 4, follows an analysis of the geography of human capital with focus on the distinct differences in the distribution of human capital employed in the public and in the private sector. Section 5 analyses the relationship between employment growth and the location of human capital in the public and private sector; and, finally, section 6 discusses and concludes on the findings.

## **2. Human Capital, Regional Development and the Welfare State**

In urban and regional studies, the importance of human capital and talent as a key resource for regional competitiveness and firm location has received much attention recently (Asheim et al 2011a; Asheim et al 2011b; Glaeser, 2003; Florida, 2002), including focus on the labour supply side, e.g. Florida's (2002) technology, talent and tolerance model or Asheim and Hansen's (2009) notion of a need to distinguish between different knowledge bases. A central reason for this focus is that knowledgeable people are not evenly distributed in space (Storper & Scott 2009). Studies of the geography of human capital, talents and the creative class in Denmark, Europe and the US support this

observation. Talents and human capital concentrate by large in metropolitan regions (Florida 2002a; Boschma & Fritsch 2009; Hansen & Winther 2010), which emphasises the process of urbanisation and the importance of city regions and metropolitans areas as key places of economic growth (Scott, 2008a; 2008b).

While it is widely accepted that a high concentration of human capital increases competitiveness of regions and regional growth, the unanimity among academics is less distinct in regard to whether or not attracting human capital to a region is a feasible way to growth (Wojan et al 2007; Hansen and Niedomysl, 2009; Faggian and McCann, 2009; Eriksson and Lindgren, 2009). In this debate, two positions are central. The first position sees labour as a highly mobile resource that can be propelled to places that offer the right composition of amenities and is a position that stresses the path-dependent nature of economic development. The first position is primarily driven by North American scholars within regional science who argue that a high concentration of human capital increases regional competitiveness and that human capital can be increased through political action such as creating attractive cities (Glaeser et al 1992; Glaeser 1999; Cheng and Rosenthal, 2008). A key precondition in this approach to regional growth is that labour and especially human capital is hyper mobile and willing to move from one city to another if their preferences are not fulfilled. This assumption is central in many studies and underpinned by North American based studies (Florida, 2002a; Clark et al, 2002). Studies from North America suggest that amenities of various kinds can be used to attract and retain high

skilled labour and thereby be used as a mean to change the local composition of skills and thus kick-start and boost regional growth (Florida, 2002a; Glaeser et al, 2001). However, such patterns of hyper migration are far less evident in Europe, and therefore the precondition for an amenity driven approach to regional development is problematic (Hansen & Winther, 2011a). Most studies carried out in Europe are sceptical towards amenities as a driver for economic growth but stresses job opportunities and income change as the most important motives for migration (e.g. Houston et al, 2008; Hansen and Niedomysl, 2009; Arntz, 2010; Andersen et al 2010; Niedomysl and Hansen, 2010). This different outcome of studies on location and migration patterns among human capital between European and North America is significant and important to have in mind when discussing growth dynamics.

The second dominating position on human capital and regional growth in the knowledge economy is developed within the framework of the Californian school in economic geography (Storper & Walker, 1989; Scott, 1988; Storper, 1995). Advocates of this theoretical approach argue that the technological development and territory are closely interrelated and therefore economic dynamics are deeply dependent upon the dominating industrial structures. Storper and Walker (1989) argued long ago that industries produce regions rather than regions produce industries. In a similar way, Storper and Scott (2009) address the relation between labour skills and regional development, arguing that the relationship between concentrations of human capital and

regional development has to be understood in a wider economic and evolutionary context. The dominating institutions, industrial structures and labour qualifications have to be taken into consideration if we are to understand the dynamics of regional growth. In this paper, we aim to come closer to an understanding of the dynamics of regional development from a human capital based perspective. Looking into the role of human capital in Denmark, following Storper and Scott (2009) we argue that including institutions, regional hierarchies but also the role of the welfare state is essential to the understanding of growth dynamics and the geography of human capital. In this paper, we hence distinguish between publicly and privately employed human capital to unfold the uneven economic geography of Denmark. We focus on the welfare state and its use of human capital. Human capital is not just human capital. As mentioned above, human capital and talent were treated generically in many studies of urban and regional growth over the years (Florida, 2002a; 2002b; Glaeser & Berry, 2005). Recently, several have pointed to the importance of diversity of talents and human capital in the economy. Backsted et al (2008) distinguished between various forms of human capital and showed the importance of scientists and engineers for urban growth. Scott (2008a) and Scott (2010b) illustrated the impact of cognitive human capital in the US metropolitan areas. In their analysis of Swedish regions, Asheim & Hansen (2009) revealed how different knowledge bases have their specific geography, and Hansen et al, (2011) indicated a strong variation in the use of human capital among manufacturing industries depending on the level of technology and their location in space. Herslund (2011) indicated that rural

human capital in terms of highly skilled entrepreneurs follows different trajectories compared to those located in the city. Thus, urban and regional growth depends on the division of human capital by knowledge base, sector and industry, technology level, urban size, position in the regional hierarchy and education (arts, science and engineering, etc.).

However, when discussing the role of human capital for fostering urban and regional growth, the role of publicly versus privately employed human capital is, to our knowledge, never touched upon. Especially, in countries where the (welfare) states are providers of basic goods such as schools, day care, eldercare, universities, research institutes, museums, health care and public administration, the role and potential of the state as an important distributor of human capital is interesting. In a regional perspective, the welfare state therefore becomes a diffuser of employment on non-market terms and thus becomes non-market contributor to regional development.

Thus, in this paper we distinguish between publicly and privately employed human capital to add a new perspective to the debate on human capital and regional development, as the location of publicly employed human capital is driven by different processes and rationalities than thus dominating the privately employed human capital. The location of the health care sector, educational and social institutions and public administration is the core service provision of the public sector and the locations of these services are

politically resolved and hence follow different rationalities including those connected to demography and population.

### **Regional Growth and the Impact of the Welfare State**

To understand urbanisation as well as urban and regional growth, focus on the interaction between socio-economic processes, spatial and historical variation as well as economic and institutional development is needed (Massey, 1984; Amin, 1994; Martin, 2000; Scott 2008; Storper, 1997). In this paper, we study how public consumption and service provision employ human capital and hence contribute to form the urban and regional growth patterns using the Danish welfare state as an example. At all levels (local, regional and national), the state persists to have a strong influence governing and regulating the economy (Lipietz, 1986; Boyer, 1990; Jessop 2002; Brenner, 2004). Using a regulation school perspective, Peck (1996) convincingly showed how various welfare and workfare states have a strong impact on local and regional labour markets as well as segmentation beyond labour demand and supply relations. Further, he includes the shift from Fordist to post-Fordism and from Keynesian welfare state to Schumpeterian workfare state to show how the state and state strategies impact on local labour market changes. Additionally, various forms of Schumpeterian workfare states (Jessop, 2002; Peck, 1996), neoliberal, neocorporatist and neostatist, all produce different spaces of regulation and governance and state consumption and, hence, different national paths of economic development. Recently, varieties of capitalism were used to mark the differences between various

national states' way of organising the economy. According to Hall and Soskice (2001), national states can be categorised based on how liberal or coordinated their markets are. The more government interact in regard to labour market relations, the more coordinated the economy is<sup>1</sup>. Therefore, Sweden and Germany are often highlighted as two examples of coordinated market economy. In the other end of the spectrum, United Kingdom and United States are often highlighted as representatives of the liberal market economy, because the state plays only a marginal role in regard to labour market issues. Between the two poles, we find Denmark. On the one hand, the Danish welfare state qualifies Denmark to be categorised as a coordinated economy, but on the other hand, Denmark is characterised by liberal legislation with a high degree of flexibility on the labour market (Hansen & Jensen-Butler, 1996). Thus, the modern capitalist welfare state in Denmark has a strong impact on the economic geography in terms of regulation, redistribution of income and service provision (Esping-Andersen, 1990; Jensen-Butler, 1992). The regulation ranges from securing property rights, macroeconomic stability using fiscal and monetary policies to production and reproduction of labour including education and training as well as general service provision such as infrastructure, health care and a range of social institutions. Further, the welfare state has a direct impact on urban and regional development through public consumption and job creation.

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<sup>1</sup> For a critique on the variety of capitalism perspective, see Gertler 2010 and Brenner et al 2010.

The Danish welfare state is a large universal welfare state with provision of free health care, free medical help, free education, subsidised day care, various social benefits (including unemployment benefits) and pensions independent of employment history and supplementary pension schemes. The greater part of the Danish welfare state is mainly financed by taxes based on a progressive income tax system administrated by the state (nationally and locally). The welfare state is based on national solidarity and social redistribution of income resources between high income earners to low income earners, e.g. transfers in form of unemployment benefits and pensions. Hence, income redistribution between social classes is a vital part of the Danish welfare state (Ploug et al, 2004). This redistribution has marked regional effects including a strong redistribution of jobs and income (Hansen & Jensen-Butler, 1996; Nørskov, 1991).

A major outcome of the Danish welfare state was a marked upgrade of the labour force in terms of formal education in the past decades. This transformation happened along with the transformation of the industrial structure towards a knowledge economy. The upgrade sustains the increasing focus on learning and the growing complexity of production, use and distribution of knowledge in contemporary capitalism. Also, it manifests the national focus on formal education and vocational training provided by the local, regional and national governments, which has been a keystone in welfare state policy and philosophy since its start in the late 19<sup>th</sup> and early 20<sup>th</sup> century (Ploug et al, 2004). Consequently, to understand the dynamics that shape the geography of human

capital in Denmark, one has to pay attention to the public sector and its use and thus its distribution of human capital.

The role of the welfare state in Denmark, as in many other European countries, is important for understanding economic dynamics as well as geographical patterns of job growth – the specific impact depends on the particular form of welfare state. The welfare state in Denmark accounts for more than 30 % of the national employment and the public expenditures amount to more than 50 % of GDP in 2006 (Danmarks Statistik, 2006). The Danish welfare state has a marked impact both on the national economy and on the local and regional economies through three layers of government – state, region and municipalities (Hansen and Jensen-Butler, 1996). The spatial distribution of welfare state jobs does not necessarily follow the logic of capitalist markets: it is politically resolved. In terms of service provision, the welfare state is made up of three large and central sectors, health care sector including hospitals; social institutions including day care; and the educational sector from primary school to universities. The three sectors are important in terms of jobs, and moreover the health care sector, the higher educational sector and the public administration have very strong concentrations of human capital. Thus, to understand the geography of human capital in Denmark, the spatial dynamics and employment growth, the role of the welfare state needs to be considered.

### **3. Method**

The empirical material of this study is based on register based data from Statistics Denmark. Data contain detailed information on all individuals in Denmark aggregated at the municipality level. In the period analysed, Denmark consisted of 270 municipalities. Data contain information on level of education and which industries people are working within. In this study, we look at changes in the share of human capital from 1993-2006. The two years chosen represent a growth period in the Danish economy starting with a shift in government in 1993 that resulted in substantial government initiatives to stimulate economic growth in both the public and private sector and ending just before the economic crisis started in 2007. Thus, this analysis covers economic changes in a 13 years' period of more or less coherent economic growth, although the millennium crisis led to some restructuring of industries.

In the analysis we use correlations and an OLS with cluster-robust standard errors (STATA) to control for spatial dependence at regional level to demonstrate the relationship between the public and private sector in regard to generating employment growth. We add the cluster-robust standard errors to compensate for spatial autocorrelation. The robust standard errors are generated by clustering the 270 municipalities into 23 labour market regions based on commuting patterns (see Larsen, 2006). Models with mixed effects and multilevel effects were also applied to test for variation within and between the labour market regions. The LR test, however, suggested that the OLS model was the best to predict the causalities this paper analyses.

To analyse the relationship between job growth and the public and the private sectors' use of human capital, we have composed one dependent and two independent variables. Moreover, we include a number of control variables to control for spatial effects in regard to various urbanised areas.

*Employment growth* is our dependent variable. We wish to be able to say something about the general employment development in Denmark during 1993-2006. The variable indicates the percentage changes in employment on municipality level from 1993-2006. *Growth in public human capital* is one of two independent variables. This variable indicates the change in percentage in employed human capital (ISCED 97, category 5A and 6) in the public sector on municipality level from 1993-2006. Publicly employed people are people employed within the following NACE sectors: 75: Public administration and defence; compulsory social security; 80: Education; and, 85: Health and social work. In this study, human capital is defined as people with a bachelor degree, or above and only employed people are included. The second independent variable is *Growth in private human capital*. This variable is calculated in the same way as the growth in public human capital variable, but here we only include people employed in the private sectors.

In the OLS model we include a number of control variables. All variables are dummy variables and are included to control for spatial effects. The first control variable *City*

*Region* indicates whether a municipality is included in one of the four largest cities in Denmark; Copenhagen city region, Aarhus, Aalborg or Odense. Consequently, the variable is controlling for urbanisation effects. The second control variable is *University region* and is constructed to indicate whether municipalities gain any effect from hosting a university. The third control variable is named *Outer city* and refers to the transition zone between the Copenhagen city area and the rural areas. This zone is defined by Winther and Hansen (2006), and according to their research, the outer city has a unique position in terms of growth in the semi urban landscape of Copenhagen. The fourth and last control variable indicates municipalities that are parts of a larger semi-urban area in the eastern part of Jutland; *Østjyske Bybånd*. The *Østjyske Bybånd* is characterised as a diffused urban area that stretches from Randers in the north through Aarhus, Herning and Horsens to Vejle, Kolding, Fredericia and Haderslev in the south (for definition of the *Østjyske Bybånd*, see Nissen and Wither, 2008).

#### **4. The Geography of Human Capital in Denmark: Spatial Dynamics and the Role of the Public Sector**

During the last 15-20 years, the Danish economy experienced an economic resurgence in terms of employment growth, although the millennium crises and the current economic crisis caused some fluctuation (Andersen & Winther, 2010). The resurgence of the

economy is based on a long term transformation away from an agricultural and industrial based economy towards an economy based on knowledge and services. Agriculture and manufacturing are no longer engines of employment growth, and likewise the more traditional services such as transport, bank and insurance have stagnated. The most significant employment growth was in business services, including knowledge services, creative industries, the cultural economy, and the public sector especially health care and education (Hansen & Winther, 2010; Smidt-Jensen et al, 2009; Winther, 2007).

The resurgence of the Danish economy is also a resurgence of large city regions. The two most densely populated areas in Denmark, Copenhagen and Aarhus, have witnessed employment and population growth rates that exceed most other parts of the country. Winther (2001; 2007) and Hansen & Winther (2007) discuss this transformation in terms of changing industrial structures, and Hansen & Winther (2010) explore the uneven geography of employed human capital in the greater Copenhagen region. Though these studies are limited to the Copenhagen area and thus an urban context, they provide a solid picture of the dynamics of the Danish regional economy. Manufacturing in traditional terms is substituted by knowledge intensive productions and services, and to a large extent the remaining manufacturing industries become more and more dependent upon product and process innovation even in the low tech sector (Hansen & Winther, 2011b). As stated earlier, this process is not only general in Denmark but can also be witnessed in most developed countries. What makes Denmark of particular interest in this

matter is that Denmark hosts a relative large share of human capital, that the average wage level in Denmark is high compared to many other European and North American countries (Berlingske Tidende, 2011) and last and central for this article that Denmark has a large public sector that locates due to political decision making and not due to principals of capitalist market. This produces different dynamics of location and thus allows us to examine the impact of human capital for regional development in general; more specific, it also allows us to look for different impacts of human capital employed in the public sector vis-à-vis human capital employed in the private sector.

**Table 1:** Shares and growth of the highest educational level in Denmark 1993 and 2006

	1993 (%)	2006 (%)	Growth 1993-2006 (%)
Compulsory school	36.0	25.6	-24
Lower secondary	44.3	46.5	12
Higher secondary	14.8	19.2	39
Bachelor level	0.5	1.6	233
Academic degree	4.3	6.7	68
PhD	0.1	0.4	299
<b>Total</b>	100	100	7

Table 1 reveals the upgrade of the formal qualifications of the employees in Denmark in the period between 1993 and 2006. The share of employees with only compulsory level of education was reduced markedly from 36 % to 25 %. The remaining categories all increased their shares in the same period. The lower secondary increased only slightly while the growth in higher secondary and especially literate associated education increased their shares considerably. This development is reflected in the growth rates, where especially highly skilled with a university degree grew with a high rate throughout

the period. This reveals a general upgrading of formal skills in Denmark but with the important notion that the group of lower secondary educations remains almost the same while especially university related skills increased in this period.

**Table 2:** Employment, sectors and human capital

<b>Denmark</b>	<b>Share % 1993</b>	<b>Share % 2006</b>	<b>Growth 1993-2006 %</b>
<i>Employment</i>	-	-	5.71
<i>Public employment</i>	29.47	30.69	10.08
<i>Private employment</i>	70.53	69.31	3.89
<i>Human capital</i>	4.78	8.57	89.42
<i>Public human capital share of total employment</i>	2.36	3.7	65.3
<i>Private human capital share of total employment</i>	2.42	4.88	112.98
<i>Public human capital share of total human capital</i>	49.4	43.12	-
<i>Private human capital share of total human capital</i>	50.6	56.88	-

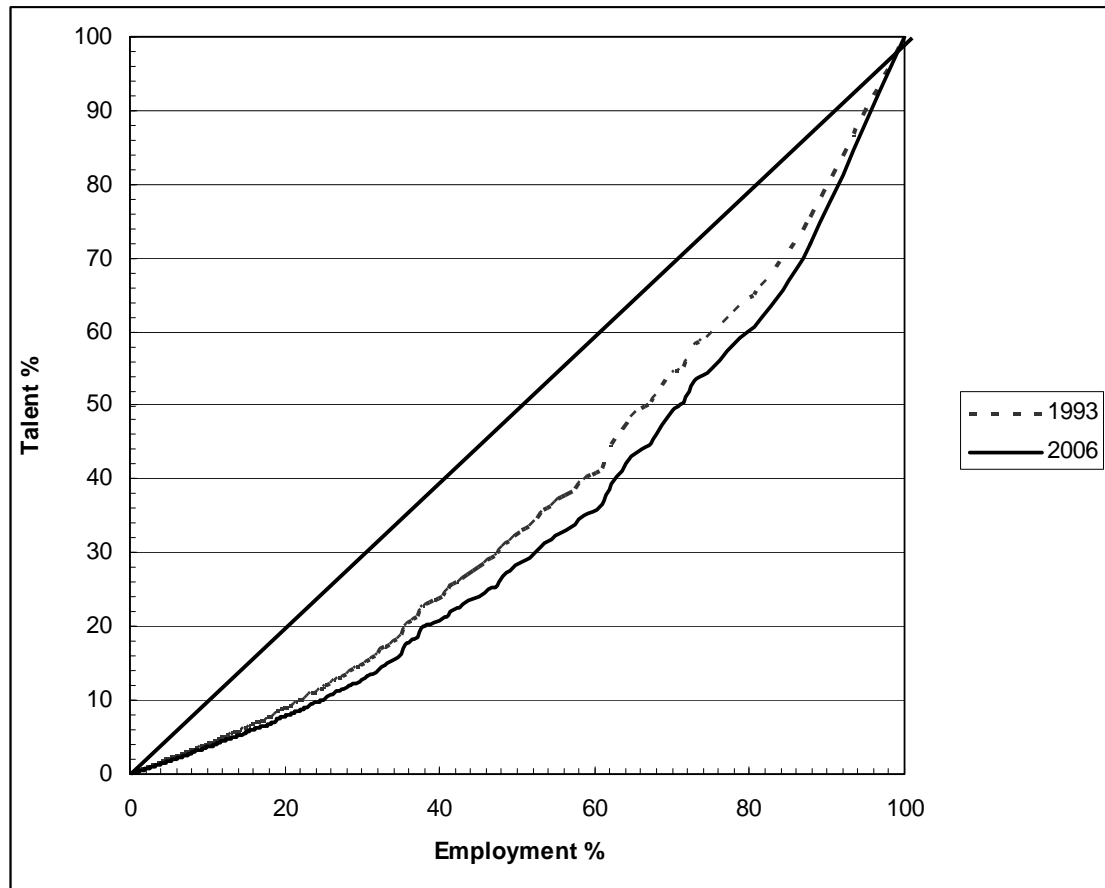
Table 2 displays an overall employment growth close to 6 % in Denmark from 1993 to 2006. The growth was strengthening especially after the millennium crisis (Nissen & Winther, 2008). Table 2 also reveals that the employment growth in the public sector was markedly higher than in the private sector. This is due to the expansion of the three large public service provision sectors, health care, social care and education. Public administration, however, actually lost employment. Growth in private sector remained more moderate with a total growth rate of close to 4 %. The geography of the employment growth was very uneven and contrasted the growth patterns of the 1970s and 1980s. The employment growth was highly concentrated to the two large urbanised

regions while often more moderate in smaller towns and cities and declining in the periphery (Nissen & Winther, 2008).

The growth of human capital is very different from the growth in total employment – see Table 2. First of all, the number of highly skilled employed almost doubled in the period with a national growth of close to 90 %. The result is that the share of total employment grew from close to 5 % to 8.5 %. In contrast to total employment, private human capital had a stronger growth than public human capital. The private human capital in Denmark more than doubled their number in the period 1993-2006 with a growth of almost 113 % while public human capital had a growth of still impressive 65 %. Thus, the growth of the 1990s and the first half decade of the new millennium resulted in a large expansion of human capital in both the public but especially the private sector. In spite of the powerful growth of private human capital, human capital remained overrepresented in the public sectors. In 2006, the public sector had 30.69 % of the total employment but 43.12% of the total human capital. Hence, the public sector employs 40 % more human capital than expected from its share of total employment. Consequently, an examination of the geography of human capital in Denmark must take public human capital into account, but first we need to establish an overview of the spatial distribution of human capital.

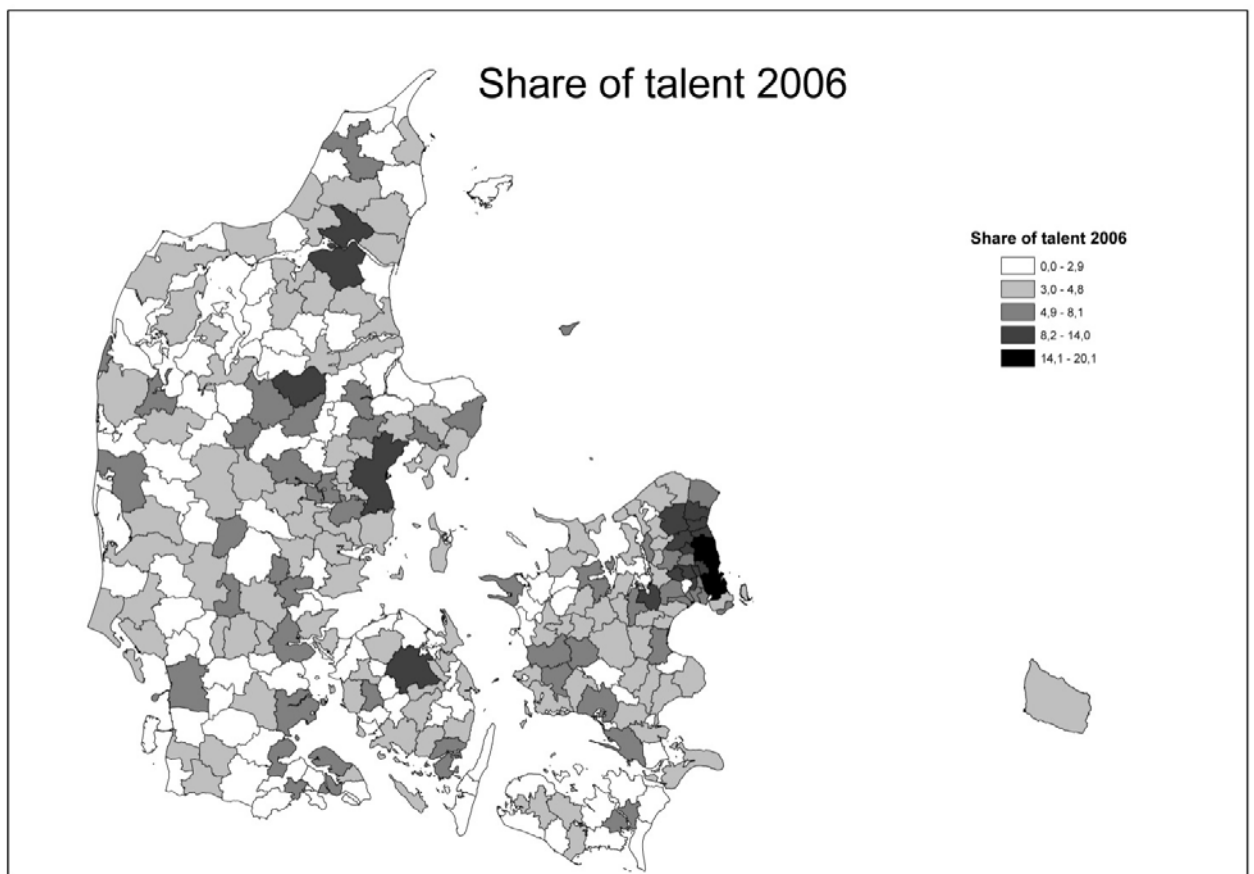
Figure 1 is a Lorenz diagram visualising the uneven distribution of human capital among Danish municipalities. The diagram consists of two curves indicating the years 1993 and

2006. In case of an equal distribution, the two curves would have followed the straight 45 degree curve. The plotted curves illustrate, however, that there is a spatial uneven distribution of human capital in Denmark at the level of municipalities. In 2006, municipalities that accounted for 80 % of total employment only accounted for less than 60 % of the human capital, the remaining 20 %, hence, accounted for 40 % of human capital. The latter includes the municipality of Copenhagen which accounts for 12 % of the national employment, but more than 20 % of national human capital. Moreover, the uneven spatial distribution of human capital grew from 1993 to 2006. This is indicated by the smaller area below the 2006 curve compared to the 1993 curve. Thus, there was an increased spatial concentration of human capital: municipalities with high concentrations of human capital increased their share of human capital while municipalities with low shares of human capital experienced declining shares.



**Figure 1:** Concentration of human capital in Danish municipalities (1993-2006)

While Figure 1 demonstrates an increasing concentration of human capital in the municipalities that already have a high share of human capital, the Figure reveals nothing about the geography of this concentration. Therefore, to get an impression of the geographically implications of the increasing concentration of human capital, Figure 2 presents a map of Denmark displaying the shares of human capital by municipalities.

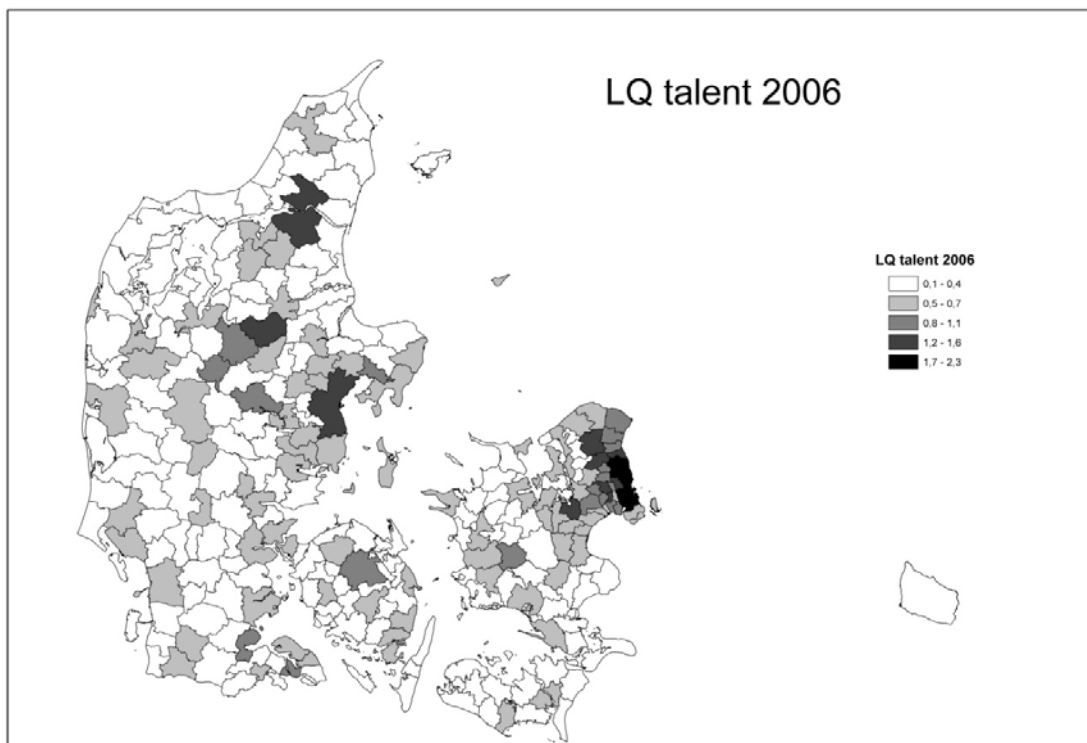


**Figure 2:** The human capital share of municipal employment 2006

The figure visualises and emphasises the uneven geography of human capital in Denmark. It reveals a marked concentration of human capital in the central and northern municipalities of Copenhagen. Outside Copenhagen, the three dominant cities (university cities), Odense, Aarhus and Aalborg also have a marked share of human capital. Most municipalities have below national average share of human capital, and in many cases

(the white municipalities), the share of human capital is very low, covering the basic service function only.

This uneven geography of human capital becomes even more evident in Figure 3 which shows the location quotient of human capital with Denmark as benchmark.



**Figure 3:** The concentration of human capital in Denmark (2006)

Most parts of the country has an under representation of human capital, in many cases less than 40 % of the national average. Only a few municipalities are in the area of the value 1, and many of the municipalities that have high concentrations of human capital

are situated in the central and northern municipalities of Copenhagen. Outside the Copenhagen city region, only three municipalities have a concentration higher than average, i.e. a LQ larger than 1, the two cities of Aarhus and Aalborg and the municipality of Tjele in which a large agricultural research centre is located. This also leaves Odense, the third largest city in Denmark, with an under representation of human capital, although the city is a university city and health care centre including hospitals.

Besides this more traditional view on the geography of human capital, data allows us to go one step deeper. We can divide between publicly and privately employed human capital. This distinction is of interest, because the Danish welfare state employs a large proportion of human capital in Denmark. Figure 4 exposes the shares of human capital employed in the public respectively private sector on municipality level in 2006. At glance, it is evident that public human capital has a different spatial distribution than private human capital. Publicly employed human capital is generally more evenly spread in Denmark, while private human capital is concentrated in the central parts of the urban regions.

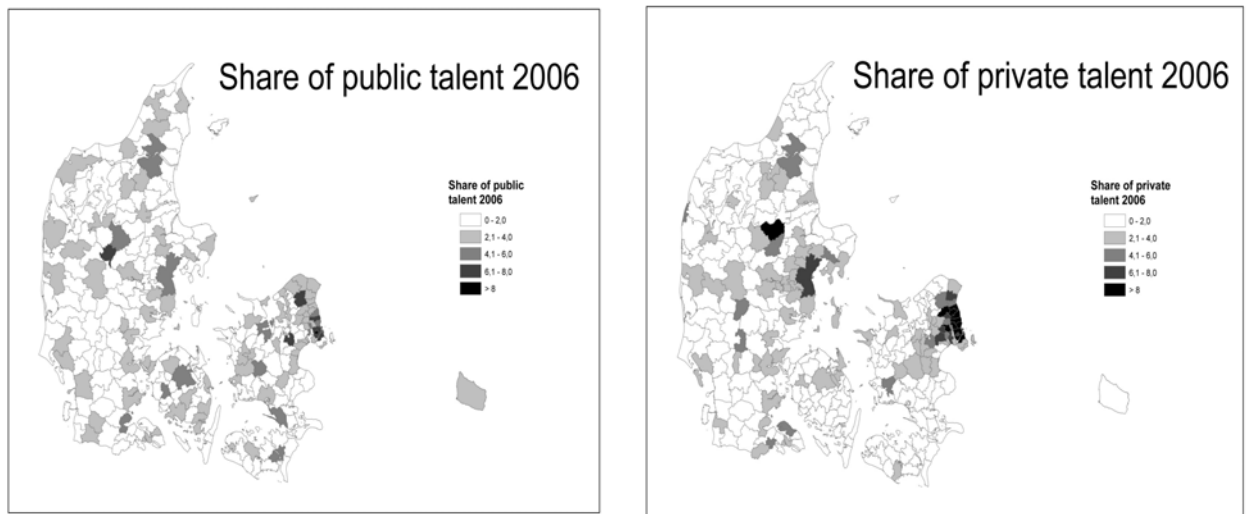


Figure 4: Patterns of human capital divided by public and private employment (2006)

This is confirmed by the basic descriptive statistics and the coefficient of variation (CV) – see Table 3. The coefficient of variation is a normalised measure of dispersion which makes it possible to compare the two sets of data. The public human capital share of municipal employment in 2006 has a CV of 71.18, while private human capital share of municipal employment has a CV of 91.13. It means that public human capital has a larger spatial deviation than private human capital, and, hence, public human capital is more evenly distributed in space.

**Table 3:** Descriptive statistics of data

	1993	2006	Public human capital 2006	Private human capital 2006
Mean	2.70	4.39	1.96	2.43
Standard deviation	1.80	3.11	1.40	2.22
Coefficient of variance	66.58	70.89	71.18	91.13

Count	270	270	270	270
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Distinguishing between human capital employed in the public and the private sector, this section provides evidence that private human capital is concentrated in urbanised areas, while the politically resolved distribution of human capital has a notably different geography.

## 5. Employment Growth and Location of Human Capital

In the introduction to this paper, we claimed that the public sector is a major consumer of human capital in Denmark. As Table 2 showed, the public sector holds 30.6 % of the total employment in Denmark but employs 43.1 % of the total human capital stock. However, growth in private human capital increased almost twice the pace of the public sector human capital in the period we are studying. In the below section, we will analyse the relationship between human capital and employment growth by analysing the linkages between growth patterns in employment and patterns of concentrations of public versus private human capital.

**Table 5:** Correlations between human capital and employment growth 1993-2006

	1	2	3	4	5	6
1 Total employment growth	1					
2 Growth in employed talent	0.608***	1				
3 Growth in public employment	0.557***	0.288***	1			
4 Growth in private employment	0.936***	0.601***	0.256***	1		
5 Growth in publicly employed human capital	0.327***	0.530***	0.435***	0.196***	1	
6 Growth in privately employed human capital	0.554***	0.885***	0.113	0.621***	0.137**	1

\*\*\* Correlation is significant at the 0.01 level (2-tailed).

\*\*Correlation is significant at the 0.05 level (2-tailed).

Table 5 provides the bivariate correlations between growth in employment and growth in human capital in the years between 1993 and 2006 based on 270 cases (the Danish municipalities). The table shows a strong relation between growth in employment and growth in human capital. This corresponds with the presumption that human capital and employment growth are closely linked in the knowledge economy, and it fits into the many studies done on this matter (Florida, 2002a; Hansen and Winther, 2010; Scott, 2008).

Noteworthy, but not surprising, the tables demonstrate stronger correlations between job growth and private sector job growth compared to public sector job growth. Job growth in the private sector is market driven and demand side adjustments can be expected to take place faster than in the public sector. The same relationship occurs when only looking at job growth in relation to growth in publicly and privately employed human capital. All in all, the correlations suggest that job growth is stronger associated with changes in the private sector compared to changes in the public sector.

Moreover, and interesting from a political aspect, the correlations suggest that the total job growth and job growth in the public sector are relatively strongly correlated

(0,557\*\*\*), but the relationship between the total job growth and job growth in the private sector is markedly stronger (0,936\*\*\*).

Going a step further in the analysis of the relationship between employment growth and human capital in Denmark, we introduce four models (see Table 6) that examine the relationship between growth in human capital and growth in total employment. All models have employment growth in the period from 1993-2002 as the dependent variable and, respectively, only *control variables* (Base Model), *growth in publicly employed human capital* (Model 1), *growth in privately employed human capital* (Model 2) and lastly *growth in publicly employed human capital* as well as *growth in privately employed human capital* (Full Model). For all models, the four control variables are included.

The result of the Base Model is an  $R^2$  value of 0.18. This indicates that urbanisation plays an important part in explaining the spatial patterns of employment growth in Denmark. Model 1 only looks in to the relation between job growth and growth in human capital in the public sector and generates an  $R^2$  value of 0.29. The coefficient shows that the city region and the outer city of Copenhagen have a marked and significant effect. Also worth mentioning is that the university dummy gives a negative coefficient, as is also evident in the Base Model. This might indicate that hosting a university is not as prosperous as being located in close proximity to a university, e.g. one of the urbanisation dummies

included in the model. Model 2, which is looking at privately employed human capital, shows the same tendencies as Model 1 and the base model, but it generates a higher  $R^2$  of 0.38. In the full model, the outcome is a stronger  $R^2$  value, rising up to 0.43. In line with Model 1 and Model 2, the coefficients that the two human capital growth variables generate are not as strong as one would expect. The two variables have almost equal effects and marginal effects; the outer city, the largest city regions and the Østjyske Bybånd demonstrate strong effects. Looking at the coefficients of the independent variables compared to the dummy variables, it is obvious that the three variables associated with different forms of urbanity hold the highest coefficients. As was also the case for the base model, the outer city generates the highest coefficient, which indicates that this transition zone outside Copenhagen plays a vital role for understanding the dynamics of human capital distribution in Denmark.

**Table 6:** OLS with employment growth as dependent variable and with cluster-robust standard errors to control for spatial dependence at regional level (with std. errors in bracket)<sup>2</sup>

Employment growth	Base Model		Model 1		Model 2		Full Model	
Growth in publicly employed human capital			0.06***	(0.01)			0.05***	(0.01)
Growth in privately employed human capital					0.07***	(0.01)	0.07***	(0.01)
Controllers								
City region	10.86***	(1.22)	10.14***	(1.05)	6.34***	(1.22)	6.00***	(1.22)
University region	-2.37**	(0.99)	-2.17**	(1.01)	-1.61	(1.21)	-1.49	(1.27)
Outer city	14.24***	(1.22)	11.02***	(1.03)	10.31***	(1.16)	8.25***	(1.18)

<sup>2</sup> Robust standard errors are generated on basis of the 23 labour market regions that Denmark can be divided into according to Larsen (2006). Also regression models with mixed effects and multilevel effects were tested in order to test for variation within and between labour market regions, but an LR-test suggested that OLS models would make a better fit.

Bybånd	7.97***	(2.21)	7.56***	(1.97)	5.80***	(1.87)	5.62***	(1.71)
Intercept	-0.75	(1.22)	-4.09***	(1.37)	-5.48***	(1.46)	-8.02***	(1.60)
R-Square	0.18		0.29		0.38		0.43	

\*\*\*0.01, \*\* 0.05 level of confidents, \*0.10 level of confidents

The overall result evident from the model is that in general growth in human capital does not have a high impact on general job growth. Moreover, when distinguishing between publicly and privately employed human capital, only very marginal differences on the impact on general job growth can be found. Such results have to be explained by an urbanisation effect which is a strong driver of growth in Denmark, and notably stronger than if we study human capital isolated.

Another noteworthy outcome is the negative (although insignificant in Model 2 and the Full Model) relationship between total employment growth and the university dummy. This relationship indicates that there is no direct local effect of universities for the host municipality. One reason for such an outcome can be that surrounding municipalities to a larger extent benefit from spin-offs from universities. If this is the case, we can expect these effects to be absorbed in the three urbanisation control variables.

## 6. Discussion and Conclusions

We have presented and analysed data on the geography of publicly and privately employed human capital and how human capital contributes to employment growth in

Denmark. The general findings are that high concentrations of human capital are found in the most urbanised areas, and that the highest employment growth rates are also found in these areas. Accordingly, the claims by Florida (2002a), Glaeser (2003) and Scott (2008) that the roles of cities and city-regions are important for regional development processes in the knowledge economy are testified to some extent. While a concentration of private sector employed human capital in the most urbanised areas is significant, this concentration does only contribute marginally to the overall employment growth compared to human capital growth in the public sector. This indicates that the public sector is an important facilitator for levelling out growth differences across space.

The urban and regional hierarchies in Denmark enhance this process. Job markets with a density of job opportunities that are appealing to the group of human capital tend to be found in the most urbanised regions. Comparing the geography of human capital in 1993 with 2006 reveals that the concentration of human capital becomes more and more explicit. The less populated areas, which are often the most peripheral ones, loose shares of human capital compared to the central and urban areas.

Moreover, the analysis shows that a simple distinction in data dividing human capital into two main employment categories results in a very complex geography of human capital. The public sector being directed by political decisions and non-market dynamics and logics results in a distribution of human capital fundamentally different from human capital in

the private sector which is distributed on market terms. From the results presented here, it is obvious that privately employed human capital is increasingly concentrated in the two major city regions of Denmark: Copenhagen and Aarhus. Even though human capital is still concentrated on 'islands' across the country, it is distributed more evenly than privately employed human capital.

Lastly, the presented model shows that human capital is not the most central parameter for understanding regional development, measured as employment growth, in Denmark. Rather, the controllers indicate that urbanisation stands out as the most important process for generating growth, and, in our model, especially the outer city seems to have a strong relation to employment growth, which indicates the importance of new urban forms. Moreover, the model shows that the added contribution of private human capital is only marginal compared to the effect of the publicly employed human capital, but the private sector is central for understanding employment growth in Denmark: the human capital employed in the private sector almost doubles the explanatory value of the model.

The findings and results presented in this paper have consequences for the typical understanding of the processes of knowledge economy. In knowledge economy, human capital is assumed to be a major resource in creating competitive innovative milieus, and human capital is often viewed as a more or less homogeneous group; a generic input which Glaeser and Florida represent. However, in a welfare state like the Danish, the

public sector employs a large proportion of human capital, and their contribution to the economy is based on very different terms than the privately employed. We know from the correlations presented earlier that growth in human capital is highly correlated with growth in employment, and, moreover, that growth in employment demonstrates higher correlations with privately employed human capital than with publicly employed human capital. This indicates two important things. First, growth in employment of public human capital is disconnected from the regional economic dynamics in capitalist terms, and thus can be seen as a mean to facilitate human capital growth outside the main urban areas. Secondly, the time period 1993-2006 indicates that while public sector growth may not be as efficient as the private sector to facilitate employment growth, it may be a more efficient way to secure growth outside the most urbanised areas. Therefore, the public sector and human capital employed in the public sector may be important tools to constantly upgrade the knowledge level outside the beaten track. These conclusions point to the importance of the insights from the evolutionary institutional perspective (Scott, Storper, etc.), and, in this case, especially how institutions in form of the welfare state and urbanisation as a process have an impact on regional growth and the spatial distribution of human capital.

Put together, the data and analysis presented here demonstrate that the geography of human capital is highly complex and needs to be unfolded further. Uneven spatial patterns are being produced and reinforced by current economic dynamics. The

geography of the public sector is distributed on non-market terms which results in a different morphology compared to the private sector. The public sector represents a less uneven distribution of human capital and thus provides less urbanised areas with job opportunities for human capital too. Whether it makes sense to 'artificially' level out the uneven distribution of human capital by political discussion-making is beyond the theme of this study. We just wish to emphasise that human capital is not a homogeneous group, but consists of groups that can have very different dynamics in regard to location and impact on regional growth. Thus, we call for further research on the area questioning human capital as a uniform unit of analysis.

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