

ECONOMIC AND COMPETENCE REGIONS: A DESCRIPTIVE ANALYSIS OF DANISH REGIONS

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Setting the scene:

The prosperity of the capital city and surrounding area has been used as one fundamental argument for localisation of large foreign companies (the metropolis effect). But recent research on regional systems of innovation has increasingly emphasised the local knowledge base focusing less on the structure of the system, like strong educational institutions, better transportation systems and access to political actors. Today, the structural factors are less important in part because of ICT, but also because policy initiatives have become embedded in the local political system, whereas the focus on the local knowledge base includes access to highly specialised personnel like engineers (Dalum *et al.*, 1999). The basic argument runs from knowledge to innovation, hence in knowledge-intensive industries or regions the innovative performance is expected to be higher and thus the region becomes more attractive for localisation. The attractiveness of regions for inviting new firms is, in this context, to potentially draw on the knowledge assets of the new firm. These effects have been summarised in the debate on knowledge spillovers see e.g. Audretsch and Feldman (1996) and Jaffe, Trajtenberg and Henderson (1993).

The issues to be explored in this paper cover whether the metropolis effect is in fact prevalent in Denmark by investigating different regions in terms of their economic and competence contents. If in fact the economic region diverges from the competence region does this give any indication of a change in localisation decisions in favour of more peripheral regions. The purpose of this

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paper is *not* to investigate location decisions, but to investigate whether the metropole is in fact a competence region. If it is not then the arguments based on knowledge tap in and knowledge spillovers may change location decisions of coming firms. The paper is therefore explorative and speculative leaving less room for theory development. A short review of the overall ideas is provided in the following section. A short description of the Danish context is then followed by a short review on other studies of Danish regions. These two elements are used to define the context and acts as basis for comparison. The two empirical sections describe first whether the metropole is in fact the economic region and then turns to explore the knowledge base of each region. The paper proceeds by speculating about the implications of the analyses for the overall purpose.

The metropolis effect and competence regions

The metropolis effect in a regional setting explains why the propensity of new firms to locate around the capital is higher. The explanation covers among others access to the political level, strong financial institutions and well-developed infrastructure.

A second stream of literature argues that the decisive factors in localisation decisions relates to the knowledge intensity within the region with regards to the particular industry. Thus, nearness to the political structure and access to financial institutions are downplayed for the importance of access to highly qualified employees, knowledgeable firms, local networks and high degrees of innovativeness. The dual nature of knowledge production is stressed in the discussion of the regions. On the one hand, the firm localises in areas of complementary knowledge assets within the same industry, but benefits can accrue to a region from the activities of firms in that region (Voyer 1998: 81) as well. The success factors of a knowledge-based region for attracting new firms has been narrowed down to eight (Isaksen, 1998 and Voyer, 1998): specialisation within one or more industries; the role of local networks; availability of R&D and educational institutions; access to a qualified work force; access to competent financial institutions; cooperation between firms and other institutions; contacts to knowledgeable milieus elsewhere and a high degree of innovativeness (differences are seen between Isaksen and Voyer, these eight are based on Isaksen (op. cit. page 15-21). However, these issues are to some extent stylised as the potential for a region to catch up with the metropole must depend on other factors such as productivity, growth in new firms and not least the sectoral distribution of such activities. In the following analyses we have tried to mix a bundle of regular financial and economic indicators with more knowledge-oriented ones. Obviously, such lists have the characteristics of being incomplete but also very comprehensive. However, for such an explorative endeavour the end justifies the mean.

Finally, the choice of the region as the appropriate unit of analysis is not without problems. First, the literature deals with a diverse set of units ranging from countries, regions, clusters, milieus and innovation systems. Each of these cover a wide range of literature stressing the advantages and disadvantages of itself or the others. It is not the intention of this paper to cover and review this literature adding to the diversity of contributions. Instead

we argue for the adoption of the region as the unit of analysis to allow for policy related speculations. For the present purpose the appropriate unit of analysis is therefore the region.

Danish Regions: A short description

To present the reader with the empirical context, this section highlights three traditional descriptive measures; population figures, unemployment and GDP pr. capita (see table 1). In terms of *population* figures the Capital region is smaller than Funen & Jutland where the former accounts for about one third of the population and the latter 55.4% of the population. The means¹ of the two regions are however not significantly different at 5% level of significance. The same goes for the third region, Others, which accounts for about 11% of the population but if the level of significance is set at 10% the two other regions are significantly larger than the counties of the Other region.

In terms of *unemployment*, the level is decreasing in the period with no significant differences between the three regions. Table 1 highlights the first important finding namely the relative larger size of the Funen & Jutland region compared to the Capital, but the smaller share of GDP earned by the former region (50,3% GDP as compared to 55,4% of the population). Significant differences between the main areas are reported between Funen & Jutland and the Other area at the level of GDP and at GDP/capita and between the Capital and the Other region measured by GDP alone.

For the other combinations of regions no significant differences can be reported. Viewed on structural changes (from 1993 to 1996 – marked in grey in table 1) in terms of unemployment Funen & Jutland is improving with lower than average and decreasing unemployment shares. In the Capital region unemployment is decreasing but compared to the country average unemployment is worsening. Conversely, the GDP/capita measure is increasing in the Capital region and compared to the average improving whereas the opposite trend is seen for Funen & Jutland. Generally, the Other region is performing worse than the two other main areas.

Studies on Danish Regions: previous findings

A study on differences in the European Regions (Barré *et al.*, 1998: chapter 1 and 2) grouped the 15 Danish regions according to productivity and technological and scientific densities. In a similar study based also on both technological and economic activities Verspagen (1999) investigated the four largest countries of Europe and also identified four clusters of regions 'regional clubs' that are somewhat similar to those of Barré *et al.* (1998) lending some support to their findings.

¹ A test of similarity of means has been run for each comparison of the differences between regions. The test level is 5% and the hypothesis tested is similarity of means. The results are not presented in tables but simply mentioned in the text.

Table 1: Main description

	Population (in 1000) (% of total)		Unemployment (deviation from av.)		GDP/capita (regions share of GDP)	
	1993	1996	1993	1996	1993	1996
Funen & Jutland	2867.3 (55.4)	2906.4 (55.4)	12.2 (-0.2)	8.0 (-0.9)	149.8 (50.3)	164.2 (49.6)
Funen	465.2 (9.0)	470.5 (9.0)	14.1 (1.7)	8.9 (0.0)	137.3 (7.5)	151.5 (7.4)
Southern Jutl.	251.3 (4.9)	252.9 (4.8)	11.4 (-1.1)	7.1 (-1.7)	148.4 (4.4)	164.4 (4.3)
Ribe	220.7 (4.3)	223.1 (4.3)	11.0 (-1.5)	7.0 (-1.9)	162.9 (4.2)	173.3 (4.0)
Vejle	334.3 (6.5)	339.8 (6.5)	11.8 (-0.6)	7.5 (-1.3)	153.0 (6.0)	168.3 (5.9)
Ringkøbing	269.0 (5.2)	271.7 (5.2)	9.8 (-2.6)	6.3 (-2.6)	162.1 (5.1)	180.0 (5.1)
Aarhus	609.9 (11.8)	625.2 (11.9)	13.0 (0.6)	9.3 (0.4)	148.3 (10.6)	161.4 (10.5)
Viborg	229.9 (4.4)	232.3 (4.4)	10.6 (-1.8)	7.2 (-1.6)	150.9 (4.1)	165.5 (4.0)
Northern Jutl.	487.0 (9.4)	490.8 (9.4)	15.6 (3.2)	10.7 (1.8)	148.6 (8.5)	163.1 (8.3)
Capital	1724.7 (33.3)	1752.1 (33.4)	11.8 (-0.7)	9.1 (0.2)	195.5 (39.5)	219.9 (40.0)
Copenh.- Frederiksb.	553.3 (10.7)	565.5 (10.8)	14.6 (2.2)	11.7 (2.9)	277.6 (18.0)	300.9 (17.7)
Copenhagen county	603.9 (11.7)	607.3 (11.6)	10.3 (-2.1)	7.9 (-1.0)	194.2 (13.7)	226.1 (14.3)
Frederiksborg	346.1 (6.7)	353.7 (6.7)	9.4 (-3.0)	6.9 (-2.0)	123.1 (5.0)	142.2 (5.2)
Roskilde	221.4 (4.3)	225.5 (4.3)	9.9 (-2.6)	7.2 (-1.6)	106.9 (2.8)	122.2 (2.9)
Other	588.6 (11.4)	592.5 (11.3)	13.6 (1.2)	10.5 (1.6)	129.6 (8.9)	143.5 (8.8)
Western Zealand	286.3 (5.5)	289.9 (5.5)	13.0 (0.5)	9.3 (0.4)	143.5 (4.8)	159.6 (4.8)
Storstrøm	257.1 (5.0)	257.5 (4.9)	14.0 (1.6)	10.6 (1.8)	114.1 (3.4)	127.9 (3.4)
Bornholm	45.2 (0.9)	45.2 (0.9)	13.9 (1.5)	11.7 (2.8)	125.7 (0.7)	129.3 (0.6)
Denmark	5180.6	5251.0	12.4	8.9	165.0	183.3

Source: Statistics Denmark

The population growth rates for Denmark equals 1.34 covering country differences from – 0.08% on Bornholm to 2.45% in Aarhus. The population sizes are not significantly different from each other calculated on the main areas: Funen & Jutland; the Capital and Others. GDP pr. Capita is calculated in 1990 prices. The growth rates in GDP alone range from 2.7% (Bornholm) to 15.3% (Frederiksborg) and growth in GDP/capita range from 2.8% (Bornholm) to 14.1% in Copenhagen county.

Four regions were shown to have high productivity and very high technological and scientific densities; four regions show productivity, technological and scientific densities just above the EU average and three regions just below the EU average. Finally, three regions have no scientific activities and the last region is characterised by productivity just below the EU average but both the technological and scientific densities are very low. The first group of 4 regions accounts for 39% of the population, the second accounts for 45,8% and the final types represents 15.2% of the population. The further results of the above study highlight the relative weak position of the Danish regions relative to the European average: only in chemicals and pharmaceuticals are the Copenhagen and Frederiksberg communities within the top 20 in Europe (measured on patents the communities rank 12 and on publication rank 14). A compound measure of scientific and technological densities place the above communities on rank 40 with 0.7% of the EU activities and position Copenhagen county on rank 58 with 0.5%. Thus, on the European map of science and technology activities Denmark plays a negligible role. But if an intra-country view is taken the results indicate that the Copenhagen and Frederiksberg communities are superior to the other regions of Denmark. A first indication of the metropolis effect has therefore been provided by previous literature. Potential catch-up regions are represented by group A and B with higher than average S&T activities.

Indicators and methodology

The data include patent applications by Danish firms submitted to EPO (covering 1978-96), economic data covering 1993 and 1996 (in one case only 1997) like turnover, export, and R&D combined with educational and employment data. The data are presented as comprehensively as possible, but in some cases the data are not complete either in terms of the time series or in terms of the regional coverage.

Based on the discussion of the terms economic and competence region from the previous section the indicators are chosen. The local knowledge base is in particular thought of as the technological and scientific knowledge, which are proxied by patents (divided into two periods 1978-89 and 1990-96) and educational data (science share defined as the number of persons educated within technical or science related disciplines). Furthermore, the role of universities and research institutes is important in two respects, first as sources of *significant innovation-generating knowledge* [Acs, 1998 #350: 112], and second as educators of future employees of the firms in the region (for empirical tests see [Almeida, 1999 #351]). To address these issues, the paper presents indicators of the density of scientific and technical personnel. The role of international environments and internationalisation in general are addressed by the export shares of the regions. That is high shares of internationalisation reflects access to international customers and thus potential to draw on these relationships for future location decisions. Innovative capacity is proxied by R&D expenditures by the firms in the regions as well as their technological performance by technological specialisation and patent shares.

Denmark is represented by 15 counties that are collapsed into three main geographical areas: the Capital, Funen & Jutland and Others (the latter includes three less developed counties). The focus will in particular be on the first two as the Capital region is expected to be the Metropole and the Funen & Jutland area to be the potential catch up or competence region. The results are always presented for all three areas.

3 measures are applied for evaluation of the regions. The first measure is the internal share (either patent, turnover or other variable), which is defined as:

$$IS_R = \frac{P}{\sum_R P}; \text{ where } P = \text{number of e.g. patents and } R = \text{the region.}$$

The internal share therefore measures the internal distribution of activities. For instance measured on the sectoral distribution of firms, a high share of firms in low tech industries would lead us to assume less innovative potential. Thus, within each region the sum IS must equal 100.

The external share is defined in a similar fashion but now the denominator is defined by the total of the country (here Denmark):

$$ES_R = \frac{P}{\sum_{DK} P}; \text{ where } P = \text{number of e.g. patents and } DK = \text{Denmark.}$$

The external share measures the external structure of activities. If we want to know how the Danish population is distributed across the regions we calculate the external share (ES). Thus for Denmark the sum of ES must equal 100.

Finally, the level of specialisation expresses the relative strength of a region on a particular variable. The revealed technological advantage (RTA) is defined as:

$$RTA = \frac{\frac{P_{iR}}{\sum_R P_R}}{\frac{\sum_{R,t} P_{tR}}{\sum_{R,t} P}}; \text{ where } R \text{ equals the region and } t \text{ the number of e.g. patents.}$$

This measure yields values in the interval $[0 : \infty]$ with a neutral value of 1. That is the distribution of RTA is highly right-skewed. If on the other hand we transform the RTA we get RPA:

$$RPA = 100 \ln(RTA) \Rightarrow$$

$$RPA_{hyp} = 100 * \frac{(RTA^2 - 1)}{(RTA^2 + 1)}$$

This index yields values in the range from –100 to 100 with a neutral value of 0.

These three measures are used below in a variety of settings and the interpretation of them follows from the above description.

Differences and similarities: descriptive measures²

To distinguish between the economic and the knowledge based regions³ we first take a general descriptive view on the counties of Denmark. Table 2 to 5 present the economic descriptives related to the firm level. Table 6 highlights the structure of the human resources combined with firm size and average pay and tables 7 and 8 illustrate the main technological indicators.

In table 2 it is clearly seen that turnover pr. company is much higher in the Capital region compared to the other regions. Remarkably is also the fact that although Northern Jutland celebrates its IT and communications cluster Dalum (1995 and 1999) the turnover pr. company in the Funen & Jutland region is just barely half the share in the Capital region within IT⁴.

Table 2: Business related indicators: Turnover/company

	Funen & Jutland		Capital		Others		Denmark	
	1993	1996	1993	1996	1993	1996	1993	1996
Div.	3061	3897	6434	7273	1903	2304	3560	4375
IT	4788	7281	8227	9425	2018	2899	6301	8063
Medico	9835	10818	33415	44732	8494	10061	21981	27899
Metal- prod	4552	5881	4317	5150	3142	3609	4320	5409
Trade	6498	8455	12768	15473	3571	4992	8502	10715
Operational service	1141	1296	1486	1741	928	992	1249	1429
Knowledge services	1367	1522	2053	2633	710	734	1693	2079
Total	3529	4468	6839	7960	2074	2602	4284	5267

Source: Statistics Denmark

Div. summarises the following industries: food, clothing, furniture, tourism, construction, IT and communication, transport, energy and environment, and medico and health. This aggregation is applied in the following tables as well.

² Where the data are available they are singled out on each county, but in some instances we have preferred to illustrate the sectoral results, and they have only been available for the economic areas.

³ In the following we will almost solely focus on the two main geographical areas of Funen & Jutland and the Capital as the Other group is performing very poorly on all indicators. Thus, the chance of an area to catch up is perceived to be higher in the Funen & Jutland area than in the Other region.

⁴ The IT and communication as well as medico and health industries are separated out from the summarised 'diverse' group to allow for an investigation of the influence of the local clusters. These local clusters are appraised as carriers of growth especially the IT cluster in Northern Jutland (part of the Funen & Jutland region) as well as the medico cluster around the Capital region. For theoretical arguments on high tech and growth driving clusters see e.g. Paci and Usai (2000); Almeida and Kogut (1999); and Lawson and Lorenz (1999).

Table 3: Business related indicators: Export shares

	Funen & Jutland		Capital		Others		Denmark	
	1993	1996	1993	1996	1993	1996	1993	1996
Div.	27	28	38	39	20	19	31	31
IT	17	18	18	19	17	25	18	19
Medico	15	13	46	53	23	24	40	46
Metal- prod	36	31	41	38	30	27	37	33
Trade	15	14	15	14	5	8	14	14
Operational service	5	5	5	3	8	1	5	4
Knowledge services	9	9	21	21	5	4	16	17
Total	22	22	24	24	15	14	23	23

Source: Statistics Denmark

Div. summarises the following industries: food, clothing, furniture, tourism, construction, IT and communication, transport, energy and environment, and medico and health. This aggregation is applied in the following tables as well.

This can of course be attributed to larger firm sizes in the Capital region, however the pattern of larger than average turnovers pr. company is also reflected in the other industries besides the metal and production technology industry. For the medico industry the turnover pr. company is almost twice the achievements of the two other regions. Thus, for the Copenhagen cluster a correspondence is obtained to the expectations of the cluster.

Table 3 highlights the degree of internationalisation of the single industries. In general, a rather dispersed picture is seen with the medico and health industries being the most internationalised with shares of 40% increasing to 46% in 1996. The firms in the Capital region are, generally seen, more internationalised with only IT and operational services below the national average. In Funen & Jutland and the Other regions the picture is quite the opposite with only trade and operational service above average in the former region and IT and operational service above average in the latter region. However, the overall level of internationalisation is approximately equal for the Funen & Jutland region and the Capital region between 20 and 25% with no signs of increasing internationalisation for Denmark in general.

Table 4a: Distribution of firms (in %) across regions (1993)

	Funen & Jutland			Capital			Others			Denmark
	Intern	Extern	RPA	Intern	Extern	RPA	Intern	Extern	RPA	Intern
Div.	68	67	11	42	19	-35	69	14	13	61
IT	6	42	-34	14	50	52	5	8	-43	8
Medico	0	41	-37	1	52	55	0	7	-45	1
Metal- prod	2	60	0	2	28	1	2	12	-2	2
Trade	19	54	-11	28	37	26	17	10	-21	21
Op. S	5	50	-18	8	38	30	6	12	-2	6
Know	7	38	-42	21	54	58	7	7	-46	11
Total	100	60		100	28		100	12		100

Source: Statistics Denmark

Table 4b: Distribution of firms (in %) across regions (1996)

	Funen & Jutland			Capital			Others			Denmark
	Intern	Extern	RPA	Intern	Extern	RPA	Intern	Extern	RPA	Intern
Div.	66	66	11	42	21	-34	68	13	13	59
IT	6	41	-35	15	52	51	5	7	-44	8
Medico	0	42	-33	1	51	50	0	7	-44	1
Metal- prod	2	61	3	1	28	-6	1	12	1	1
Trade	19	53	-11	27	37	23	18	10	-18	21
Op. service	6	51	-15	9	38	25	7	12	-2	7
Know. serv.	7	38	-42	21	55	56	7	7	-47	11
Total	100	59		100	29		100	12		100

Source: Statistics Denmark

Table 4 (a and b) presents the distribution of firms across regions, where internal represents the internal distribution of firms *within* the region, thus the number of firms within each industry is divided by the total number of firms in the region. The internal share illustrates the internal distribution of industries. If the region is having an above average share of firms within industries (those are marked in grey) that are expected to be more knowledge intensive or innovative then the potential for future performance is expected to be higher. External refers to the total number of firms within an industry divided by the total number of firms in Denmark within the industry. Finally, the RPA represents the two first divided by each other and transformed (see the methodological section above) to reveal the level of specialisation (these are marked in grey).

In general, 59% of the Danish firms are located within the Funen & Jutland region in 1993 compared to 29% in the Capital region and 12% in the Others. Thus, compared to the population figures relatively more firms are located in the Funen & Jutland region. In 1996, the shares of firms within the regions are fairly unchanged, thus the growth of firms is equally distributed across the regions.

Measured on the *Internal share of firms* both Funen & Jutland and Others have relatively more firms in the 'diverse' industry group than the Capital region. The industries within the diverse group are mostly low tech skill intensive industries besides the IT and communication and Medico and health which are separated out in the tables. In IT and communication the Capital region has an internal share of 15%, indicating that almost one fifth of the firms in the region are IT and communication. In comparison the shares of the other regions are respectively 6 and 5%. From 1993 to 1996 the share for the Capital region and Funen & Jutland increase by 2% thus indicating an internal structural change. A similar increase is seen for the medico industry in the Capital region.

A final observation regards the service industries (operational services and knowledge based services), which are relatively more important within the Capital region (with total 30% of the firms) compared to only 13% in Funen & Jutland and 14% in Others. The focus on these industries relate to the innovative capacity of the regions as the service industries are generally considered to be less innovative than the manufacturing industries.

Table 5a: Distribution of turnover across regions (1993)

	Funen & Jutland			Capital			Others			Denmark
	Intern	Extern	RPA	Intern	Extern	RPA	Intern	Extern	RPA	Intern
Div.	59	58	15	39	35	-24	63	7	22	50
IT	8	32	-41	17	65	36	5	2	-70	12
Medico	1	18	-76	5	79	51	1	3	-61	3
Metal- prod	2	63	24	1	28	-43	2	9	37	2
Trade	35	41	-18	52	55	20	30	4	-34	42
Op. service	2	46	-8	2	46	2	3	9	39	2
Know. serv.	3	31	-44	6	66	37	2	3	-56	4
Total	100	49		100	45		100	6		100

Source: Statistics Denmark

Table 5b: Distribution of turnover across regions (1996)

	Funen & Jutland			Capital			Others			Denmark
	Intern	Extern	RPA	Intern	Extern	RPA	Intern	Extern	RPA	Intern
Div.	58	59	16	38	34	-25	60	7	19	49
IT	9	37	-29	17	60	30	6	3	-66	13
Medico	1	16	-81	6	81	54	1	3	-66	3
Metal- prod	2	66	27	1	26	-48	2	8	30	2
Trade	36	42	-18	52	54	19	34	5	-24	43
Op. service	2	46	-9	2	46	4	3	8	31	2
Know. serv.	2	28	-53	7	70	43	2	3	-69	4
Total	100	50		100	44		100	6		100

Source: Statistics Denmark

Table 5 illustrates in the same fashion as table 4 the distribution of activities in this table the distribution of turnover across regions to illustrate where the economic potential comes from in the business sector.

The first observation concerns the relative earnings of the firms in the regions measured as the external share of turnover compared to the external share of firms in the region (from table 4). 50% of turnover in Denmark is earned in Funen & Jutland but 59% of the firms were located in that particular region. Similarly, 12% of the firms are located in the Other region but only 6% of turnover is earned within the region. Thus, as a productivity measure the Capital regions is superior to the other regions by earning 44% of turnover achieved by only 29% of the firms.

Funen & Jutland is specialised in diverse as well as metal and production technology industries, whereas the Capital region is specialised in IT, medico, trade and knowledge based services. These results in combination illustrate the clear advantages of the metropole. None of the results leads us to conclude that the Funen and Jutland region are in approach to close the gap to the Capital region. The latter is characterised by higher than expected shares of firms, GDP/capita, share of turnover by the business firms. Only one single indication could speak in favour of the Funen & Jutland region, namely the fact that services are much more important and takes up more employment in the Capital region. In the following 3 tables we take a closer look at some knowledge-oriented categories to start investigating the knowledge base of the Danish regions.

The first observation based on table 6 is that average pay pr. employee is significantly higher in the Capital region compared to the other regions. This result can be linked to the educational level in Denmark in general which has increased considerably during the last 15 years, however a lag between the Capital region and Funen & Jutland appears to be persistent De_Jysk_Fynske_Kommuner (2000: 47). Higher wage levels will evidently have a negative impact on the opportunities of the firms for further investments in e.g. R&D. On the other hand, higher technical and engineering skills may improve the innovative potential of the firm and thus be more important than the wage levels alone.

Table 6: HRM descriptives

	Av. pay/ employee		Technical and natural sciences to total education (%)		
	1993	1996	1997#		
			Short technical	Medium technical	Long eng. and technical
Denmark	0,19	0,22	40,56	15,23	27,98
Cbh. & Frederiksberg	0,26	0,27	31,74	15,41	28,75
Copenhagen	0,23	0,25	34,64	18,87	33,36
Frederiksborg	0,19	0,22	34,87	19,69	34,41
Roskilde	0,18	0,20	42,46	18,30	29,24
Capital	0,23	0,25	38,90	15,95	29,19
Western Zealand	0,18	0,20	44,05	11,20	23,04
Storstrom	0,16	0,18	40,61	10,19	20,38
Bornholm	0,16	0,18	35,11	7,52	18,18
Others	0,17	0,19	42,06	10,52	21,62
Funen	0,18	0,20	41,80	14,25	20,53
Southern Jutland	0,17	0,20	47,85	15,68	21,30
Ribe	0,18	0,20	48,36	13,32	20,68
Vejle	0,18	0,20	43,75	19,05	22,62
Ringkobing	0,17	0,19	40,39	12,67	20,98
Aarhus	0,18	0,21	45,26	15,18	25,87
Viborg	0,16	0,19	44,19	11,33	29,44
Northern Jutland	0,18	0,20	43,95	10,53	20,03
Funen & Jylland	0,18	0,20	44,55	14,24	24,09

Source: Statistics Denmark

Grey areas indicate shares above country average.

*: The average pay pr. employee ranges from 0.17 (3 counties) to 0.26 (Frb. and Copenhagen). The basis is the number of employees in the area to the total pay (in million Danish kroner).

α: Calculated as average number of full-time employees pr. company.

#: Calculated as percentage of total educated people within the group in 1997.

Access to engineers and technicians has been an important argument for the potential of a region to stay ahead or closing the gap in a technological sense,

i.e. with relative more engineers a region may better be able to develop new technologies and thus create competitive advantages. The second column of table 6 illustrates the relative shares of technical and natural sciences (singled out for short term education, medium term education and long term education at the university level) for the year 1997. In Denmark, 40.6% of the people finalising a short-term education take a technical degree. The similar numbers for medium and long-term are 15.2% and 28%. The argument for dividing the level of education is that in terms of innovative potential we expect the potential to increase with the educational level. Not stating that a person with a short term technical degree cant be innovative only that the likelihood increases with the length of education. Obviously, this argument is founded on the notion of absorptive capacity by Cohen and Levinthal [, 1990 #176]. With increasing education the potential for absorbing, integrating and utilising knowledge from others both close to the person and from external sources grows. However, as the measure is calculated here (a share of the number of people in total taking a short term degree that was technical), the higher shares in each category indicate a contribution to the innovative potential.

From table 6 it can be seen that the Other and Funen & Jutland regions are primarily above average on the short technical degrees whereas the Capital region is above average on the medium and long term technical degrees. Thus, in the Capital region relatively more people that are getting an education are trained in engineering and technical sciences at a higher educational level. Hence, from an HRM perspective the two lagging regions possess some innovative potential based on the educational levels of the inhabitants.

So far the Capital region has been doing better on the economic indicators pinpointing the region as the main economic region, which is by no means surprising. In the following two tables we turn to the technological indicators to continue to focus on the knowledge bases of the regions.

Table 7 presents the patenting behaviour of the single counties and table 8 presents the strength of this behaviour in terms of specialisation figures. Measured on patenting behaviour the Capital area is most active accounting for around 60% of the patent applications in Denmark based on app. 65% of the total R&D expenses. Also if patents pr. capita are calculated the Capital region is much more productive compared to the other two regions that both lie around 0.2 patents pr. 1000 inhabitants although it is increasing from the first to the second period. A sharp increase is also seen in the Capital region from 0.6 to 0.95 patents pr. 1000 inhabitants⁵. These figures indicate that more knowledge intensive firms are located in the Capital region, but the question then arises whether the pharmaceutical companies are alone driving the technological development of the region or if there are other sources of competitive advantage.

⁵ The high number of patents pr. inhabitant especially in Frederiksborg should be coupled with Novo Nordisk the Danish pharmaceutical company and other firms in the pharmaceutical industry, which is an industry with a very high propensity to patent.

Table 7: Technological descriptives

	Patent share (%)		Patent/ capita (1000)		R&D expenses	
	1979-89	1990-96	1979-89	1990-96	1985-89	1991-95
Funen & Jutland	33.0	29.8	0,20	0,26	31.2	33.2
Funen	6.9	5.0	0,26	0,27	n.a	n.a
Northern Jutland	4.7	3.5	0,17	0,18	n.a	n.a
Ribe	2.0	1.9	0,16	0,22	n.a	n.a
Ringkobing	2.9	2.4	0,19	0,23	n.a	n.a
Southern Jutland	1.5	3.1	0,10	0,31	n.a	n.a
Vejle	6.0	4.7	0,32	0,36	n.a	n.a
Viborg	1.5	1.4	0,11	0,16	n.a	n.a
Aarhus	7.4	7.7	0,22	0,32	n.a	n.a
Capital	59.7	65.5	0,60	0,95	66.9	65.1
Frb.-Copenhagen	3.1	4.6	0,09	0,21	n.a	n.a
Frederiksborg	21.0	21.9	1,10	1,59	n.a	n.a
Copenhagen	27.8	32.6	0,79	1,36	n.a	n.a
Roskilde	7.8	6.4	0,65	0,73	n.a	n.a
Others	7.2	4.7	0,22	0,20	1.8	1.8
Storstrom	3.0	1.8	0,20	0,17	n.a	n.a
Bornholm	0.5	0.1	0,23	0,25	n.a	n.a
Western Zealand	3.7	2.9	0,19	0,04	n.a	n.a
Denmark	100	100	0,34	0,48	100	100

In table 8 the distribution of technological activities is traced based on five main technological areas. An analysis of the level of specialisation reveals that Funen and Jutland is the region with the strongest increase in specialisation over time with increasing levels in electrical engineering, process engineering and mechanical engineering. An unchanged or decreasing trend is seen in all five technological areas in the Capital region although the level of specialisation is positive in both instruments and chemicals and pharmaceuticals as expected above.

These results are somewhat puzzling as a strong economic presence would be expected to result in a strong technological presence. However, the changes from the 1980'ies to the 1990'ies result in declines in all technological fields. Thus the Funen & Jutland region is moving ahead increasing the technological strength whereas the Capital region is experiencing decreases. The following section investigates these dynamic changes further based on an assumption that positive changes in technological development lead to growth and increasing living standards. If this assumption is correct the previous tables of a wealthy region with high wage and educational levels may be changed in favour of the Funen and Jutland region.

Table 8: The level and change in specialisation

	Funen & Jutland		Capital region		Others	
	1978-89	1990-96	1978-89	1990-96	1978-89	1990-96
Electrical engineering	-23.8	5.8	17.7	2.1	-76.0	-80.6
Instruments	-37.3	-41.1	19.7	12.4	-40.4	31.5
Chemicals & pharma	-62.5	-76.8	29.4	25.5	-66.1	-11.6
Process engineering	21.4	40.4	-18.4	-27.5	25.5	4.1
Mechanical engineering	30.6	48.1	-29.1	-36.4	35.2	5.7

Grey areas mark an increasing and positive level of specialisation.

Differences and similarities: A performance approach

The approach taken in this section is to investigate whether the regions can be characterised as upcoming, front runners or lagging behind in each technological area. The figures presented here represent 'Electrical engineering' and 'Mechanical engineering and Machinery'⁶. These two technological areas are chosen because the differences between the Capital region and the Funen and Jutland region are most distinct here⁷. The areas are compared over time on the degree of specialisation (RPA) within each technological field, the share of patents to all patents by the other regions (PS external) and the weight of the technological field as compared to the other technological fields *within* the region (PS internal). The external patent share is used as a performance indicator where a weight takes into account the R&D expenses. Thus, the axes cut each other at the expected share of the regions R&D expenses⁸. The internal patent share is an indication of how important the technological sub-field is to the region, where a large 'ball' indicates a very important technology. A large internal patent share indicates a potential for increasing the level of specialisation in the future. Finally, the

⁶ Three other technologies are present, namely 'Instruments' where both regions are below average specialised but with fairly high patent shares. In Knudsen (2002) this combination is characterised as the upcoming region. In 'Chemicals and Pharmaceuticals' Food chemistry is becoming more important for the Funen and Jutland region that in general is performing poorly here. The presence of among others Novo Nordisk in this technology makes the field an important area, but in fact the performance is not that high and in polymers the trend is even a decline in strength. Finally, in 'Process engineering and Special equipment' the two regions are both increasing and decreasing in strength and no real differences can be deducted.

⁷ In the reminder of the paper the 'Other' region has been left out. The region is as has been established earlier on lagging behind and in general not very industrialised. We focus on the two other areas in out comparison.

⁸ This expectation is calculated using the entropy index. Based on the existence of 3 regions one would without the weight expect each region to account for 33% of the R&D expenditures and patents, but the size and the number of companies will in fact shape the real expenditures.

level of specialisation is a sign of how strong the region is compared to the other regions.

Each figure represents 4 quadrants. The lower left quadrant is characterised by negative level of specialisation and below average patent share and is thus characterised as **lagging behind**. For a technology to be characterised as **upcoming** the level of specialisation must be negative or neutral and the patent share be positive. A very promising position is where the level of specialisation is below expectation and the level of specialisation is positive. Finally, a **strong performer** is characterised by high level of specialisation and a high external patent share (upper right quadrant).

[Insert figure 1 around here]

Figure 1 illustrates the electrical engineering technologies including electrical machinery and apparatus, audio-visual technology, telecommunications and information technology. This figure illustrates that in telecommunications Funen & Jutland is moving strongly ahead ending at the border between upcoming and strong. During the same periods the Capital region is strongly losing foothold moving from being a strong performer to lagging behind. Clearly, this indicates a loss of competitive strength of the region during the investigated period. The general picture is a move upwards for the Funen & Jutland region, whereas the Capital region is losing its competitive strength.

[Insert figure 2 around here]

Figure 2 illustrates in the same way 'Mechanical engineering and machinery' including machine tools, transport, consumer goods and equipment etc. for the two regions. The general result from electrical engineering is sustained and strengthened in this technological area with the Funen & Jutland region growing much stronger and the Capital region experiencing set-backs. Notice especially consumer goods and equipment and mechanical elements where the change from lagging behind to strong performer is very clear. In the same way the Capital region is growing stronger in thermal processes and apparatus but weakened in exactly the fields where the Funen & Jutland region is growing stronger (mechanical elements; consumer goods and equipment).

The results in this section are somewhat surprising as the Funen and Jutland region increase the level of specialisation and the technological strength in general, whereas the position of the Capital region is deteriorating. The strength of Funen and Jutland lies especially in Telecommunications, Handling and Printing, and in Agricultural and Food Processing. These results contradict the descriptive results of the previous section and points to the Funen & Jutland region as the upcoming and possibly better performing region. One implication is that the Funen & Jutland region seems to have placed itself in a superior position for better performance in the future.

Conclusions

The present paper discusses the metropolis effect from an economic and technological viewpoint based on simple descriptive analyses. The results point to the same conclusion, namely that the Capital region is the economic region, whereas the Funen and Jutland region is becoming the stronger competence region based on positive changes. The results of the performance approach pointed contrary to the results of the descriptive section. Then the question is what the implications of these diverging results are. First, the potential of the Funen & Jutland regions should apparently not be underestimated as a future knowledge-intensive and thus location attractive place. Second, there is no indication in this research or in other papers that the metropolis effect is diminished, on the contrary the metropole of Denmark seems to be very strong. But from a knowledge-oriented viewpoint this is not that relevant, instead the knowledge intensity combined with innovativeness can spark first of all new innovations, but also form the foundation for new clusters. For a policy point of view these results could be interesting. If a policy maker in the Other region studies these results it must be rather discomforting as there are no signs of industrial renewal less innovative activity. Thus structural policies encouraging new ventures seem an obvious and trivial suggestion. However the focus of the paper was more on the potential for catching up of the Funen & Jutland region. Here I wish to make one particular point, namely the discrepancy between the economic data on the IT and communication cluster compared to the technological potential in Funen & Jutland. Earlier it was mentioned that a cluster has been identified in Northern Jutland and the results from the performance approach may indicate a potential area for catch up for the region. Thus, the technological potential may soon be converted into a economic performance.

Obviously, the results are preliminary and descriptive, but even so the results appear rather strong. A further test of differences combined with alternative tests of other variables should be carried out.

The conclusion of this paper is therefore that the competence region is not the same as the metropole. The results indicate a strong potential for Funen & Jutland to catch up but in very particular technological areas. Thus regional policies should in particular pinpoint the areas of future technological strength and not go for broader development policies. This focused policy should begin with education – stimulating science related educations in these particular areas – and moving towards cluster oriented policies.

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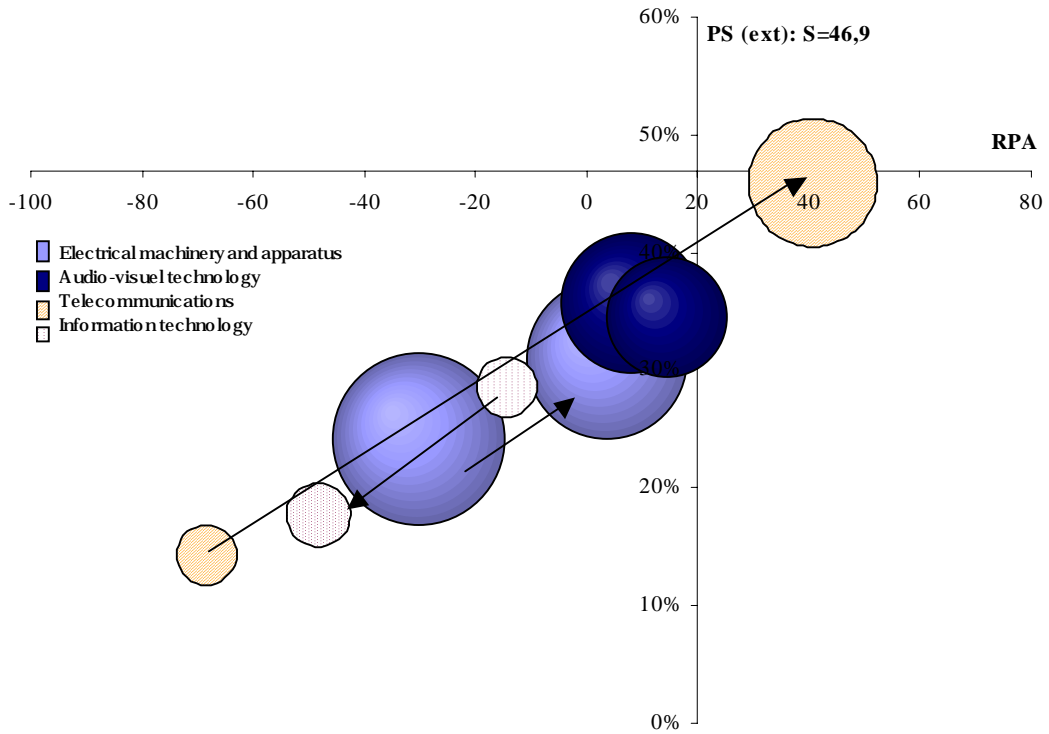
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**Technological areas of strength in 'Electrical engineering' for Funen & Jutland
(1978-89 & 1990-96)**



**Technological areas of strength in 'Electrical Engineering' for the Capital region
(1978-89 & 1990-96)**

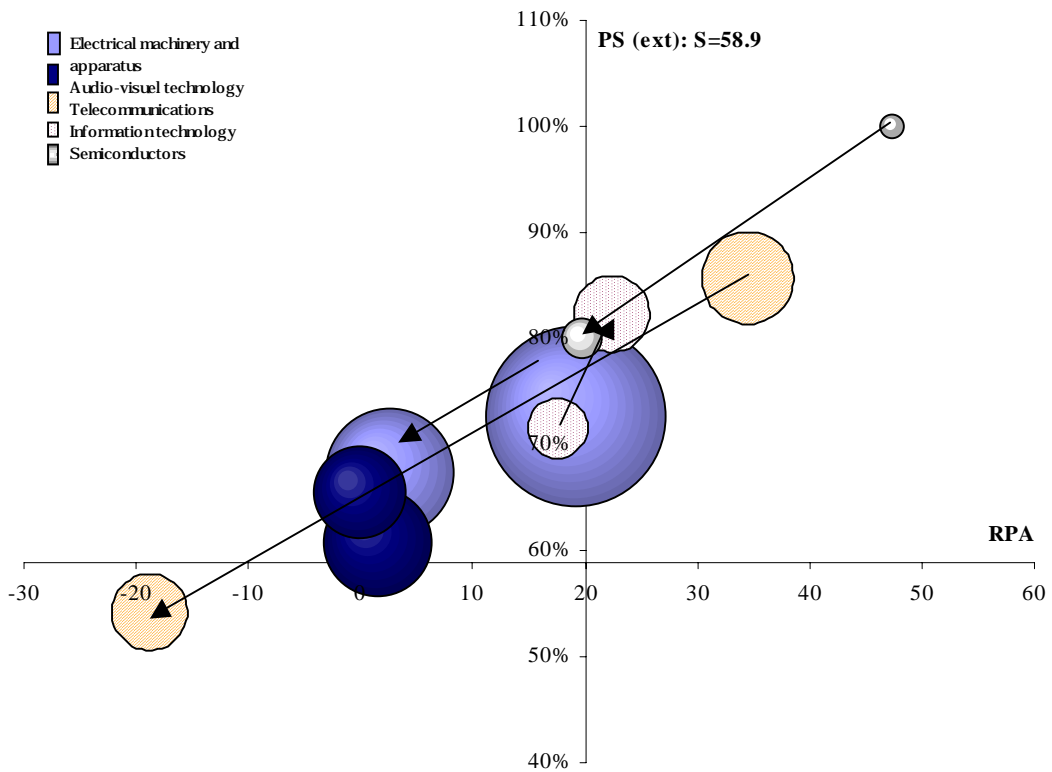
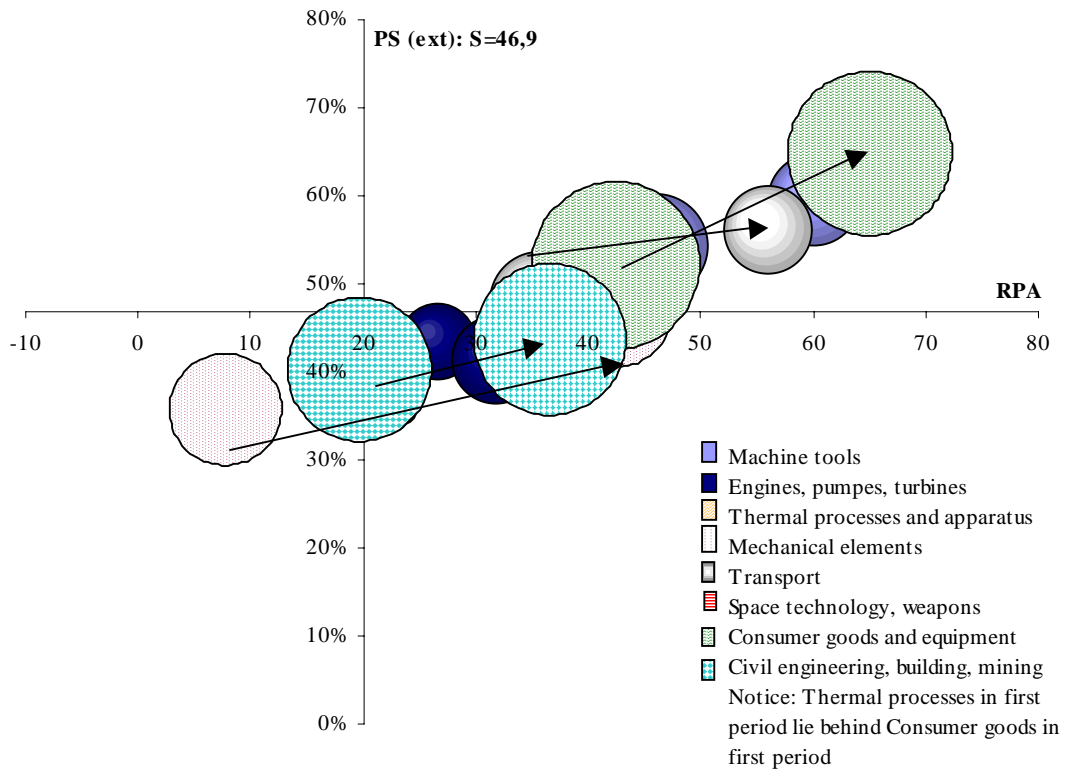


Figure 1: Comparison of Funen & Jutland with Capital region in Electrical engineering

Technological areas of strength in 'Mechanical engineering and Machinery' for Funen & Jutland (1978-89 & 1990-96)



Technological areas of strength in 'Mechanical engineering & Machinery' for the Capital region (1978-89 & 1990-96)

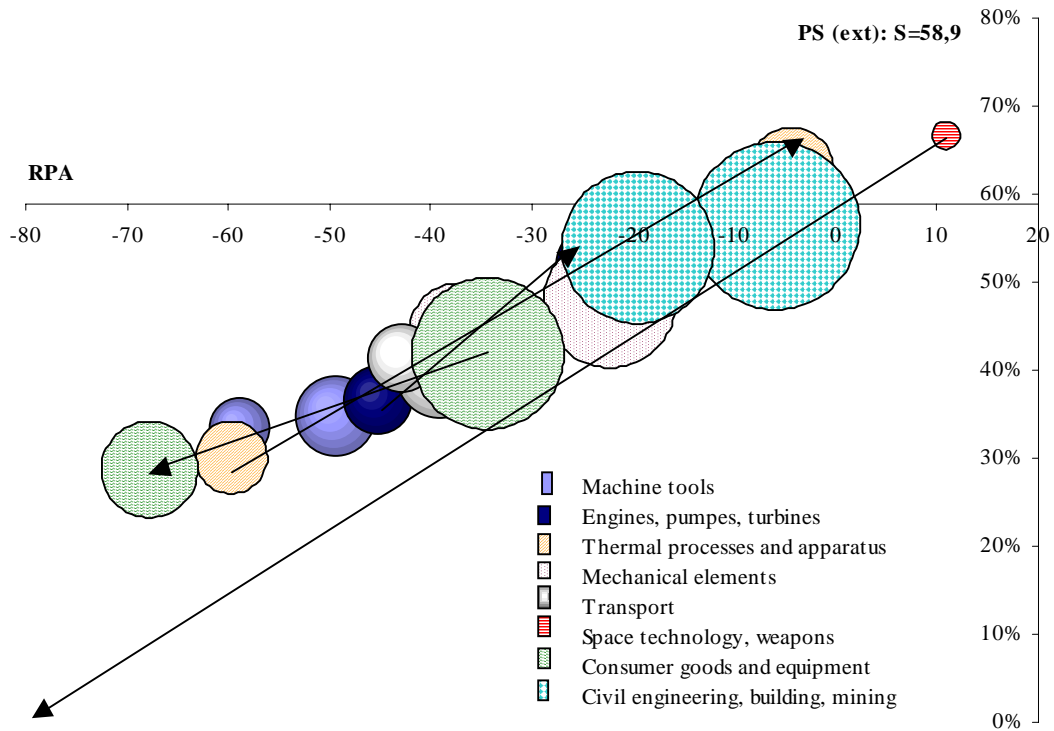


Figure 2: Comparison of Funen & Jutland with the Capital region in Mechanical Eng.