



# COUNTRY SPECIALISATION REPORT

**Country: Denmark**

**Date: June 2006**

**ERAWATCH Network asbl:** Project team: NIFU STEP, University of Sussex (SPRU), Joanneum Research, Logotech, FhG-ISI

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## COUNTRY SPECIALISATION REPORT - DENMARK

### MAIN FINDINGS

Denmark, like most Nordic countries presents a very consistent specialisation profile, in terms of research, economic and technological specialisation. Thus it appears specialised in a large number of services sectors, such as community services, business activities, IT services and telecommunications etc. Similarly, it is also specialised in a large number of research intensive manufacturing sectors such as instruments, machinery, plastics and pharmaceuticals.

More importantly, there is a strong correlation (Table 2) between economic specialisation, BERD and technological specialisation which stands for both periods under examination (1993-95 & 2001-2003). Employment for both periods is correlated with BERD for both periods and with value added, as are the exports. In addition, employment in the period 1993-95 is strongly correlated with patents during the 2001-2003 period. Finally, the interdependence between the various specialisations is stronger in the manufacturing sector. This can be partially explained by the lack of data for exports and patents in services.

R&D intensity in Denmark grew by 52% over the 1993-2003 period. Thus GERD during 2003 amounted to 2.6% of GDP (Figure 1). This remarkable growth can be attributed mainly to the increase of BERD, from 1% of GDP during 1993 to 1.8% of GDP in 2003, a growth of 83%. HERD also grew significantly over the same period by 53.8%, while GOVERD was reduced to 0.2% of GDP. This increased spending by enterprises (Table1), BERD during 2003 accounted for 69.7% of GERD, resulted in a shift in the shares of funding sources for R&D. The government share as a funder of R&D was reduced from 38.1% to 26.5% during 2003, while firms provided the lion's share with 61.3% in the same year.

Significant changes during the same period occurred also in GBAORD priorities. Thus Denmark in a decade became underspecialised in socioeconomic objectives such as energy, exploitation of earth and the environment and became specialised in humal health and civil research. Denmark also increased its specialisation in social structures and relationships and maintained its specialisation in general university funds and agriculture production and technology.

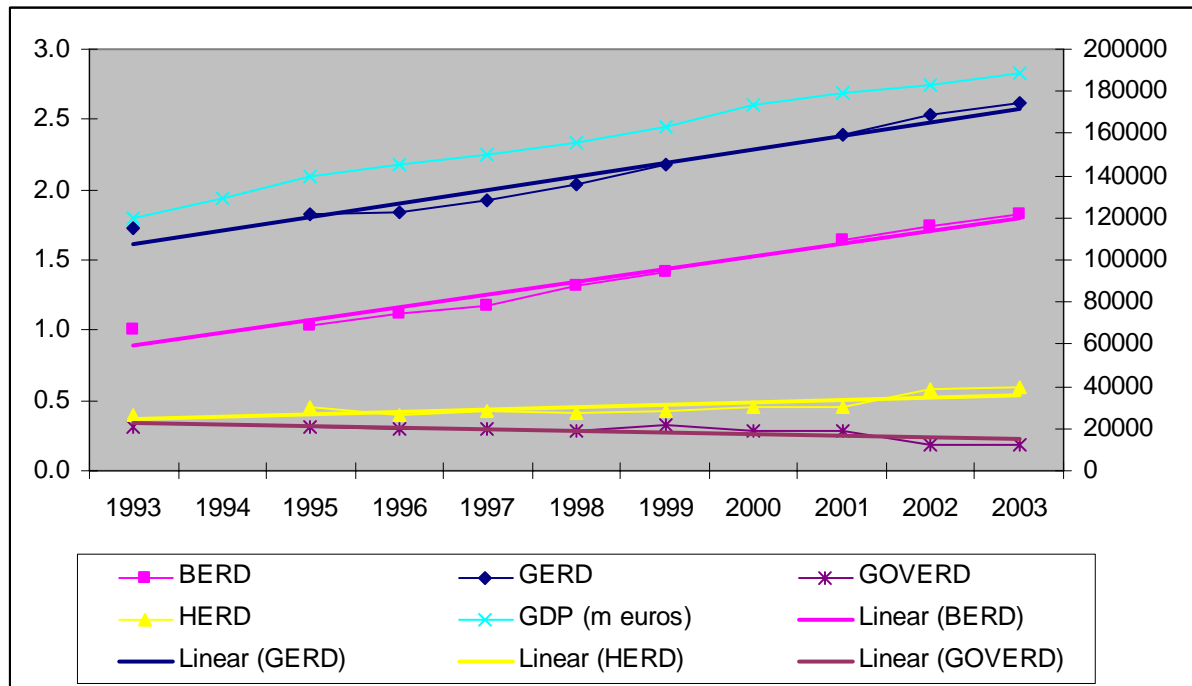
Important changes occurred also in research conducted in Universities, where natural sciences and engineering shares were reduced in favour mainly of medical sciences and secondarily of social sciences (Figure 4). The steep increase in the share of medical sciences (from 15.4% of HERD during 1993 to 27.1% in 2003) is in concordance with Denmark's specialisation profile in GBAORD. The opposite direction in focus can be observed in GOVERD where for the same period, the share of the fields of engineering and agricultural sciences increased significantly, while the share of medical sciences was almost halved. The above changes indicate a restructuring of the public research system and a segregation of the roles of PRO's and HEI's.

In terms of scientific specialisation (Figures 9, 10 & 11) Denmark exhibits a pattern of specialisation similar to the picture presented by HEI's and PRO's, particularly in scientific fields related to medical sciences, such as pharmacology, clinical medicine, immunology and microbiology. In terms of technological specialisation (Figure 12), Denmark is specialised in a small number of sectors such as pharmaceuticals, chemicals, instruments and food products, without significant fluctuations during the 1993-2003 period.

In terms of business expenditure on R&D, Denmark exhibits a clear specialisation in the services sector (Figure 6), such as other business activities, IT services and telecommunications and financial intermediation and in a very small number of manufacturing industries including the pharmaceuticals, food industry, machinery and instruments. At the same time, the public funding of BERD (Figure 8) is directed mainly to these sectors, with the business activities receiving over three quarters of the total public funding of BERD in 1998.

**MAIN R&D FIGURES – TOTAL R&D EXPENDITURE**

Figure 1. R&D expenditure by performing sector as per cent of GDP (left axis). GDP in million Euros (right axis). Denmark. 1993-2003.



Source : OECD, Main Science and Technology Indicators, November 2005

Table 1. R&D expenditure by sector of performance and source of funds .Denmark. 1993 and 2003. Million Euros. Current prices.

	GOVERD		BERD		HERD		Non profit		Total	
	1993	2003	1993	2003	1993	2003	1993	2003	1993	2003
Business	12.2	5.1	1012.7	2990.9	8.9	30.4	0.1	0.5	1034.0	3026.9
Government	295.4	284.6	69.8	77.8	428.1	940.3	1.3	6.2	794.6	1308.8
Higher Education										
Non profit	37.1	16.5	23.7	1.0	24.3	90.2	18.7	23.5	103.8	131.2
From Abroad	23.2	30.1	98.6	373.6	28.4	63.3	1.2	2.7	151.4	469.6
Total	368.0	336.3	1204.8	3443.2	489.6	1124.1	21.3	32.9	2083.8	4936.6

Pre-EMU euro and EURO

Source: OECD OFFBERD 2005

Figure 2. GERD by type of research. Denmark

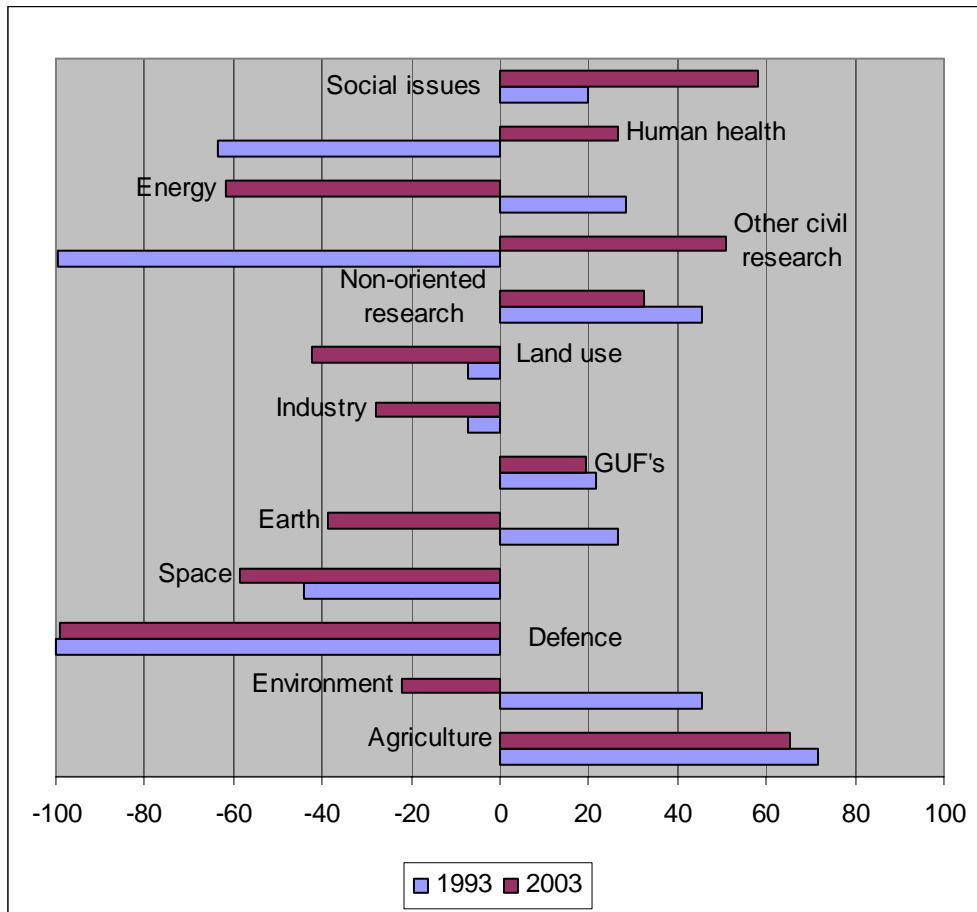
No data available

Source: OECD OFFBERD 2005

**PUBLIC R&D STATISTICS**

**GBAORD by socioeconomic objective**

Figure 3. Government Budget Appropriations or Outlays for R&D (GBAORD) by socio-economic objective. Specialisation profile. Denmark. 1993 and 2003.

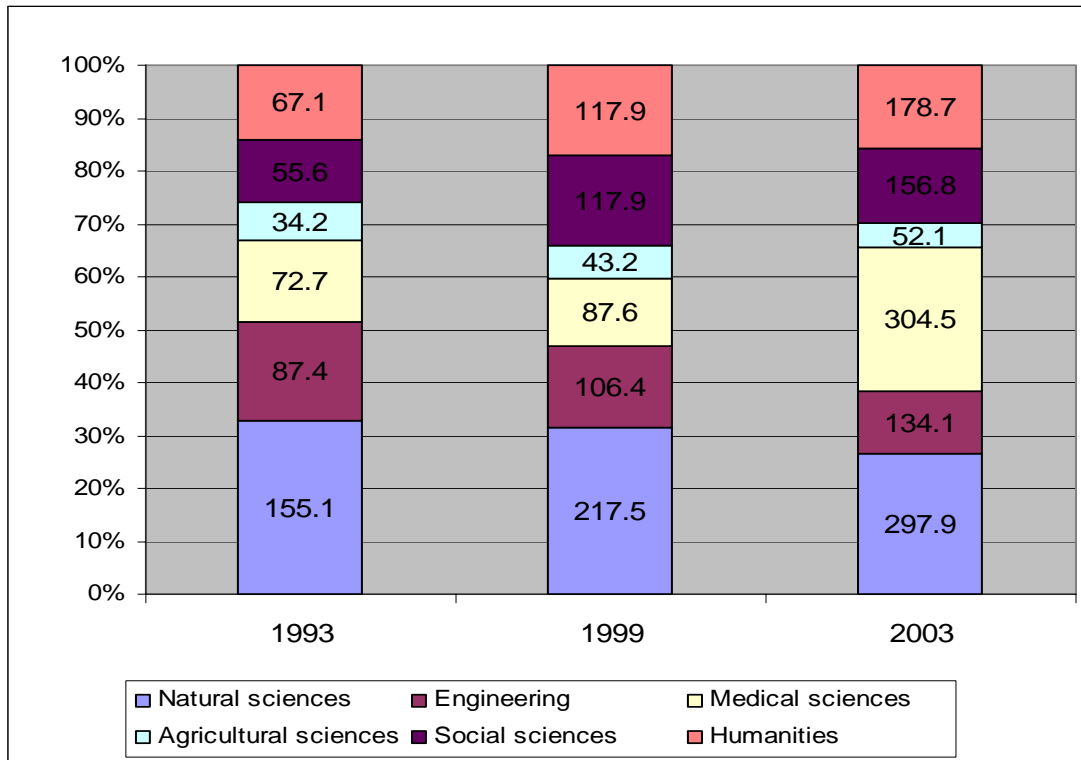


Notes: Specialisation index with EU15 as reference. Max specialisation: + 100. Min. specialisation: -100.  
 Source: OECD Basic Science and Technology Statistics 2005, own calculations.



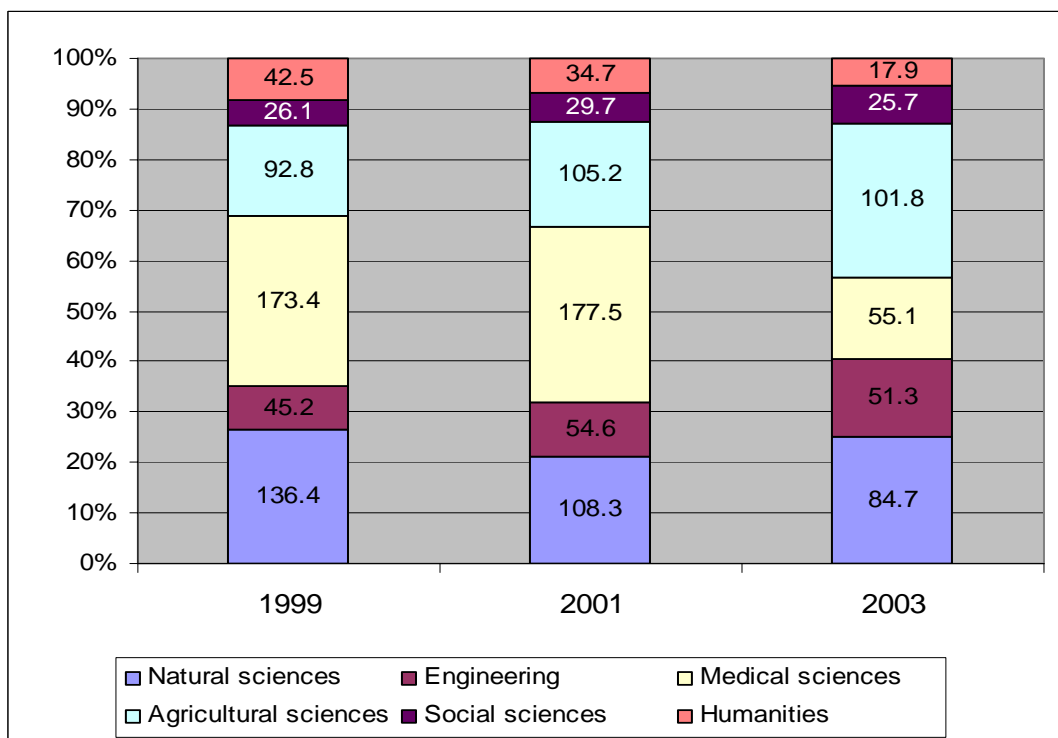
**HERD by field of science**

Figure 4. Expenditure on R&D in the Higher Education Sector (HERD) by field of science. Denmark. 1993, 1999 and 2003. Per cent of total HERD and in million Euros.



Source: OECD Basic Science and Technology Statistics 2005.

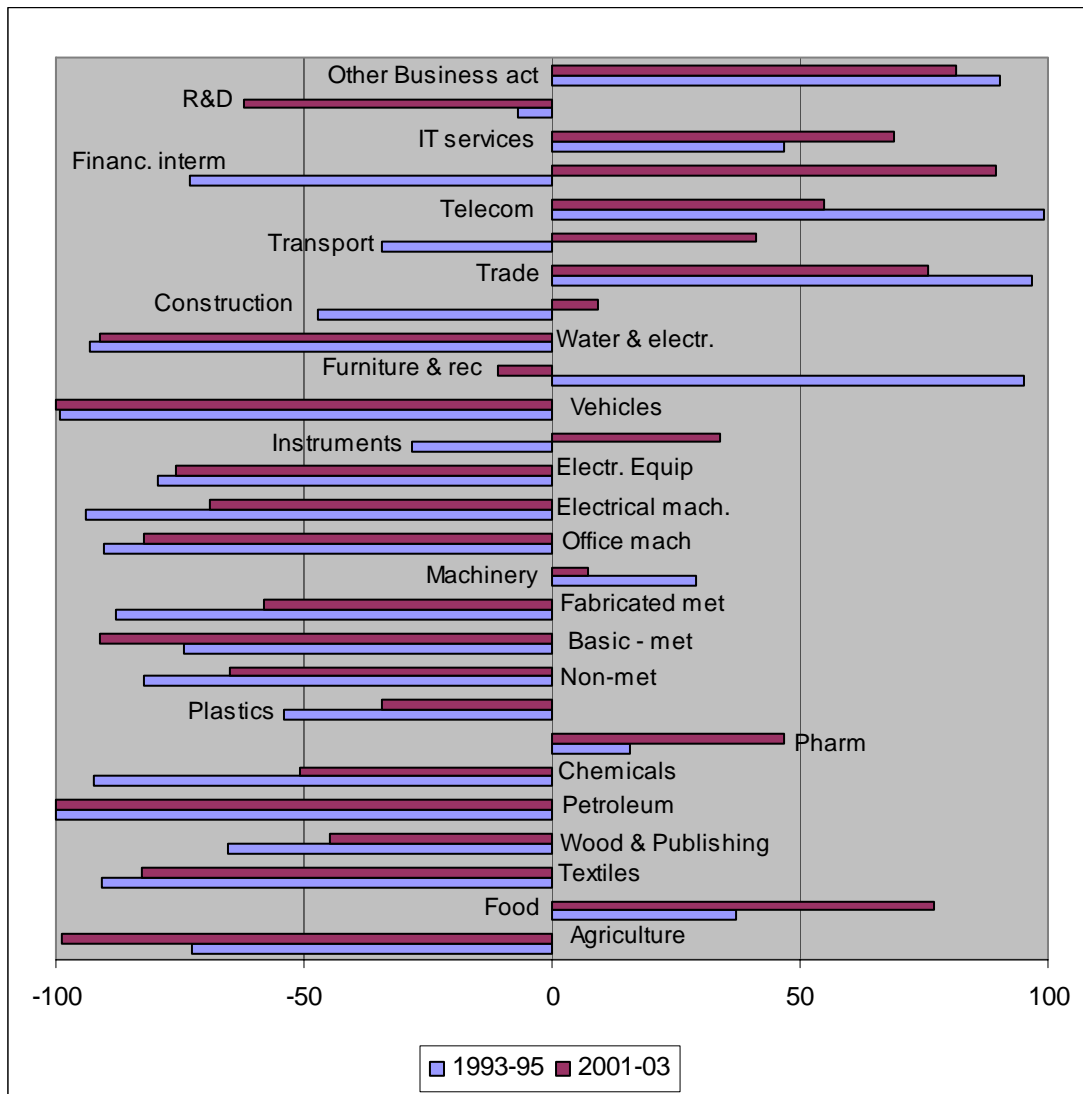
Figure 5. Expenditure on R&D in the Government sector (GOVERD) by field of science. Specialisation profile. Denmark. 1999, 2001 and 2003.



Source: OECD Basic Science and Technology Statistics 2005

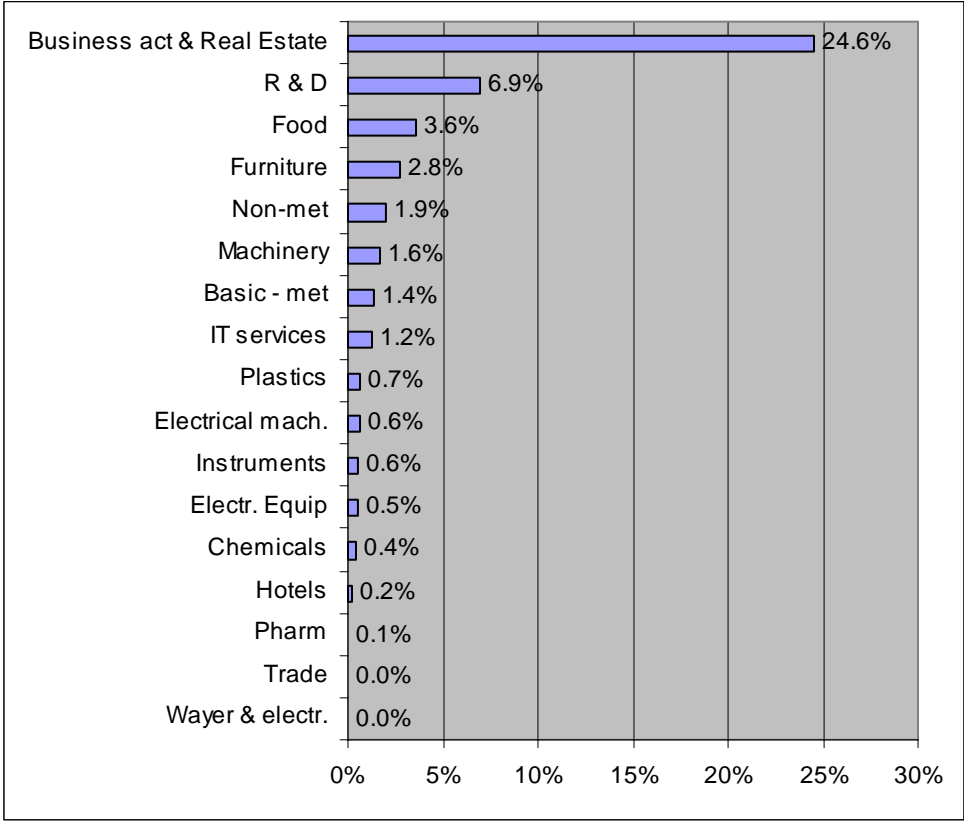
**BUSINESS ENTERPRISE INTRAMURAL EXPENDITURE ON R&D (BERD)**

Figure 6. Business enterprise intramural expenditure on R&D by industrial sector. 31 sectors. Specialisation profile. Denmark. Averages 1993-1995 and 2001-2003.



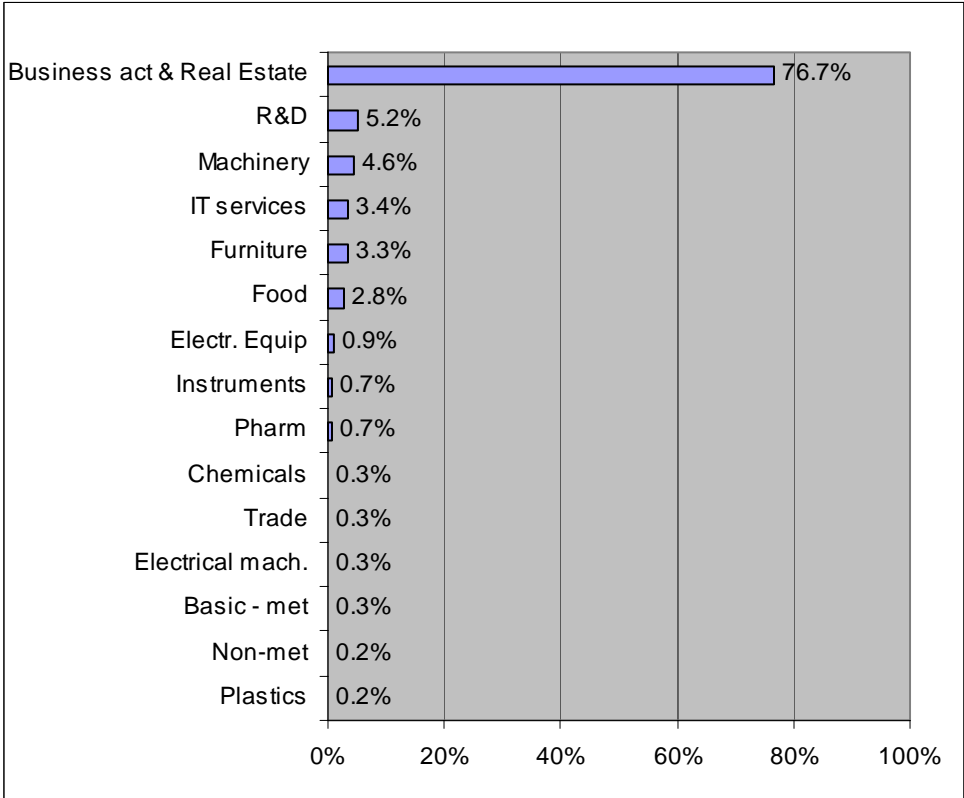
Notes: Specialisation index with EU15 as reference. Max specialisation: + 100. Min. specialisation: -100.  
 Source: OECD Basic Science and Technology Statistics 20052005, ANBERD 2005, own calculations

Figure 7. Shares of Business enterprise intramural expenditure on R&D (BERD) in the sectors funded by government. 1998 last available year in OECD statistics.



Source:OECD Basic Science and Technology Statistics 2005, own calculations

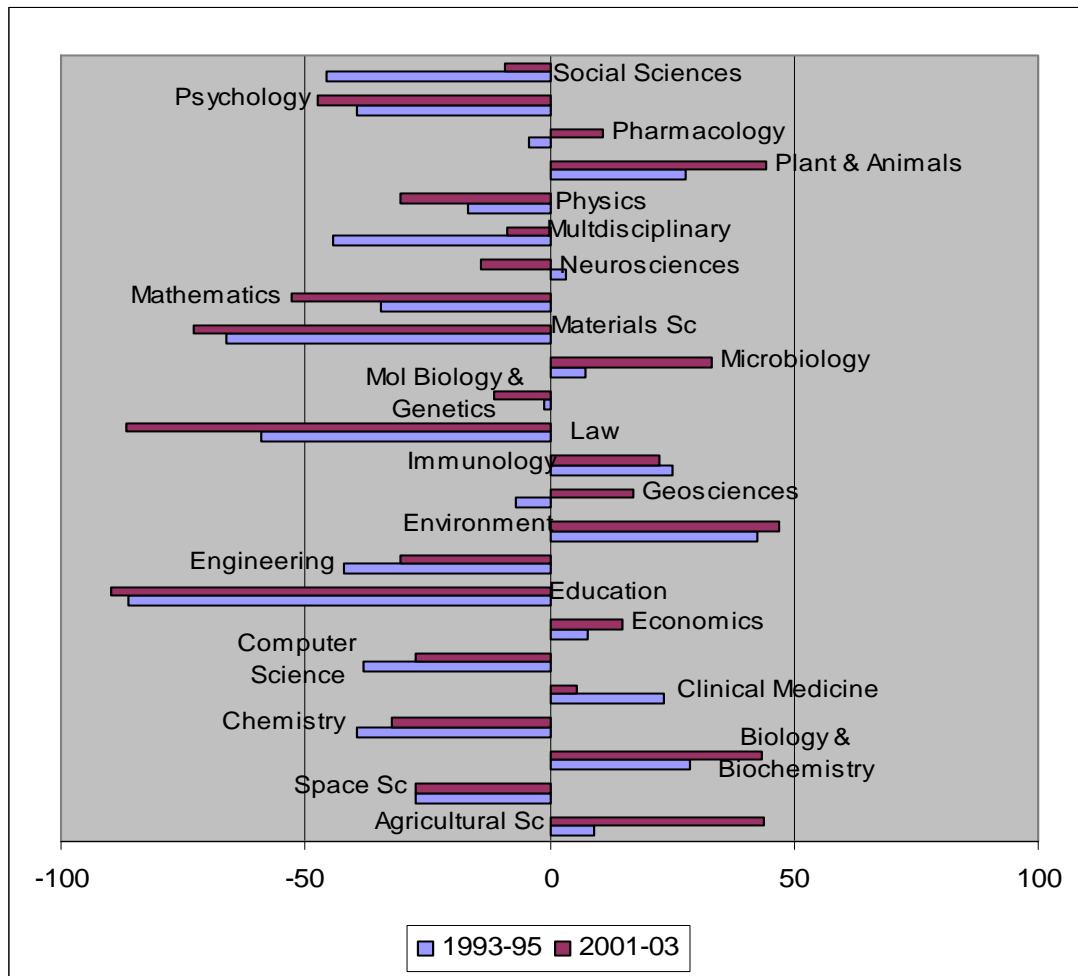
Figure 8. Shares of total government funding of Business enterprise intramural expenditure on R&D (BERD) by industrial sectors. 1998 last available year in OECD statistics.



Source: OECD Basic Science and Technology Statistics 2005, own calculations

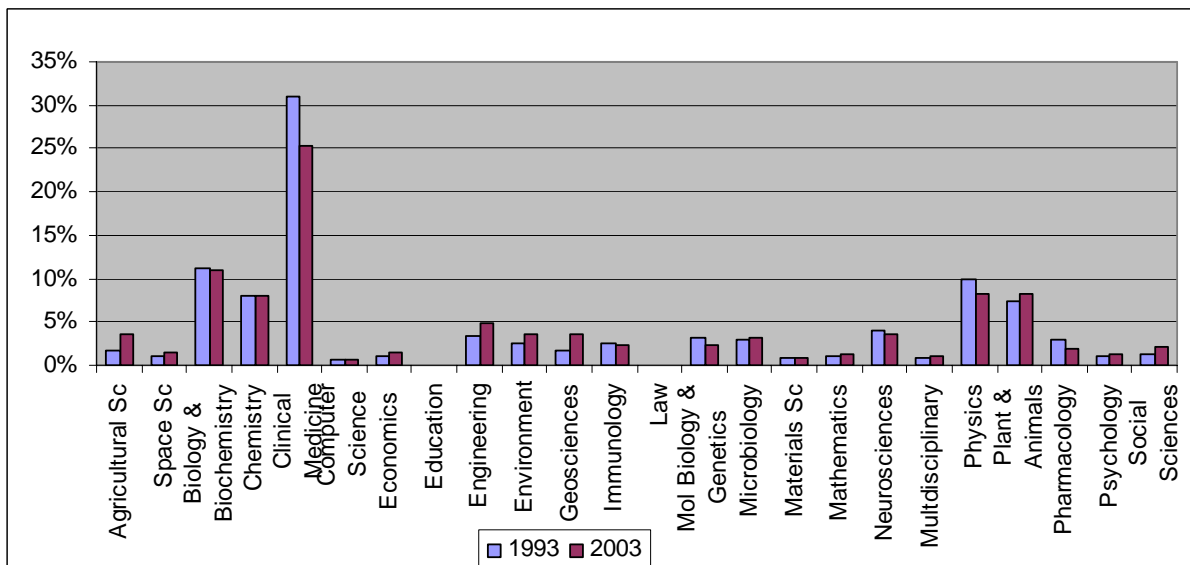
**BIBLIOMETRICS**

Figure 9. Number of publications by scientific field. 25 Scientific fields. Specialisation profile. Denmark. Averages 1993-1995 and 2001-2003.



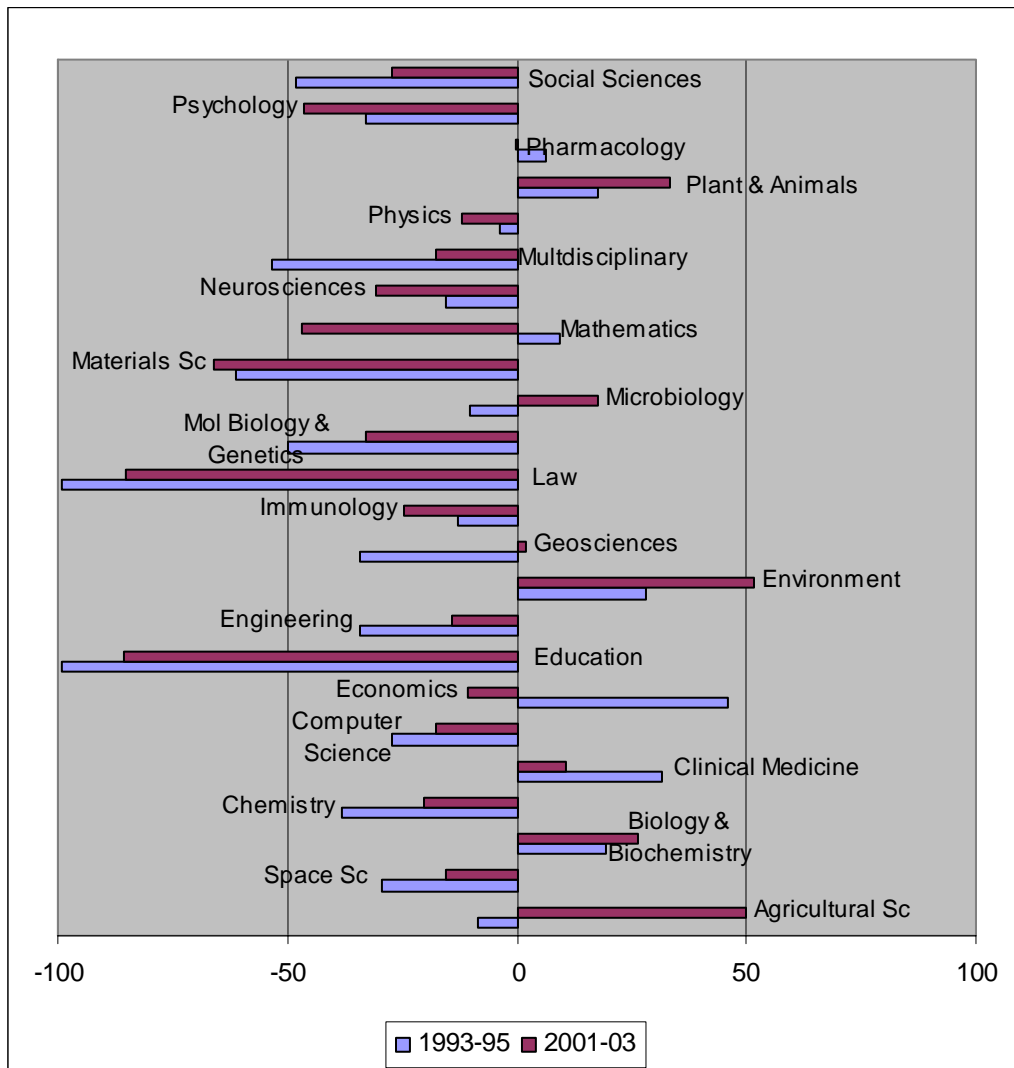
Notes: Specialisation index with EU15 as reference. Max specialisation: + 100. Min. specialisation: -100. Source: Thomson ISI, NSIODE 2005, own calculations.

Figure 10. Shares of total publications by scientific field. 25 Scientific fields. Denmark. 1993 and 2003.



Source: Thomson ISI, NSIODE 2005.

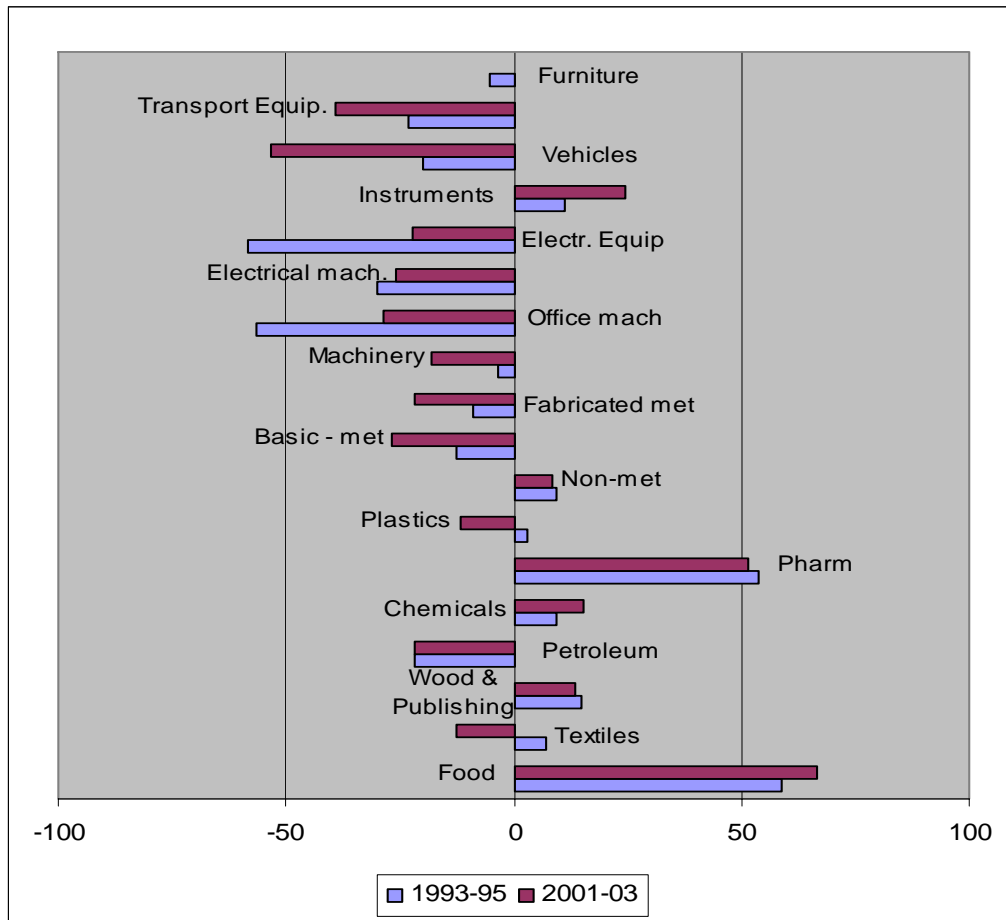
Figure 11. Number of citations by scientific field. 25 scientific fields. Specialisation profile. Denmark. Averages 1993-1995 and 2001-2003. Five years citation window. (i.e. citations to papers published in the period 1989-1991 and in the period 1997-1999).



Notes: Specialisation index with EU15 as reference. Max specialisation: + 100. Min. specialisation: -100.  
 Source: Thomson ISI, NSIODE 2005, own calculations.

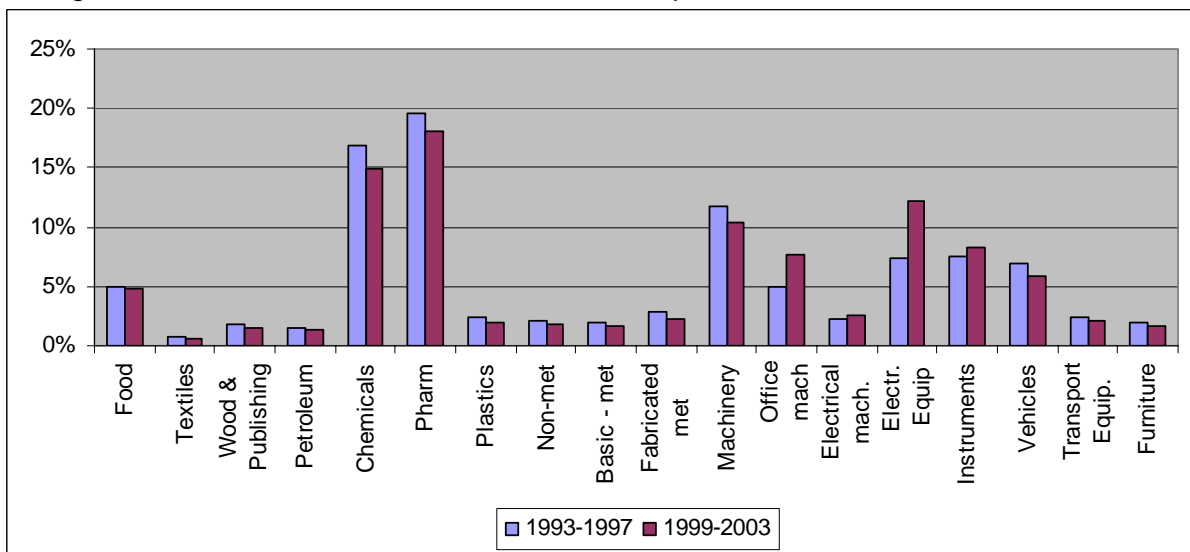
**PATENTS**

Figure 12. Number of patents by industrial sector. 18 sectors in manufacturing. Specialisation profile. Denmark. Averages 1993-1995 and 2001-2003. Based on correspondence matrix ISI-SPRU-OST.



Notes: Specialisation index with EU15 as reference. Max specialisation: + 100. Min. specialisation: -100. Source: European Patent Office 2005, own calculations.

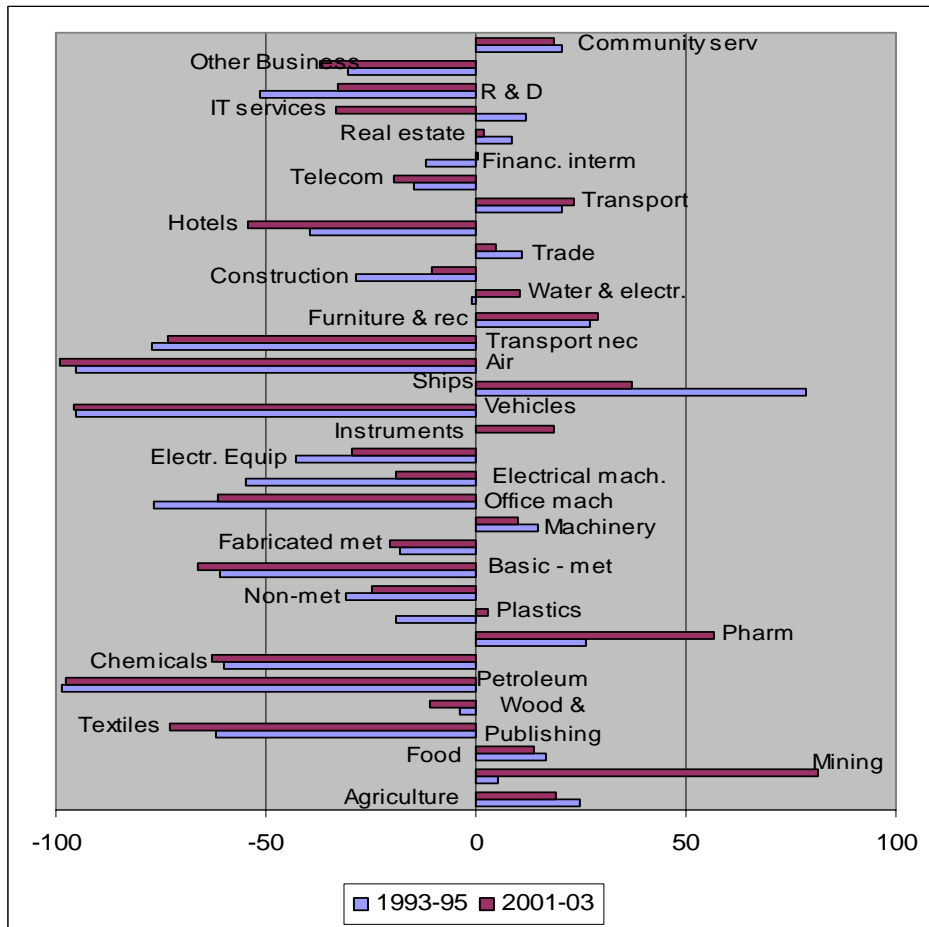
Figure 13. Shares of total patents by industrial sector. 18 sectors in manufacturing. Denmark. Averages 1993-1997 and 1999-2003. Based on correspondence matrix ISI-SPRU-OST.



Notes: Specialisation index with EU15 as reference. Max specialisation: + 100. Min. specialisation: -100. Source: European Patent Office 2005, own calculations.

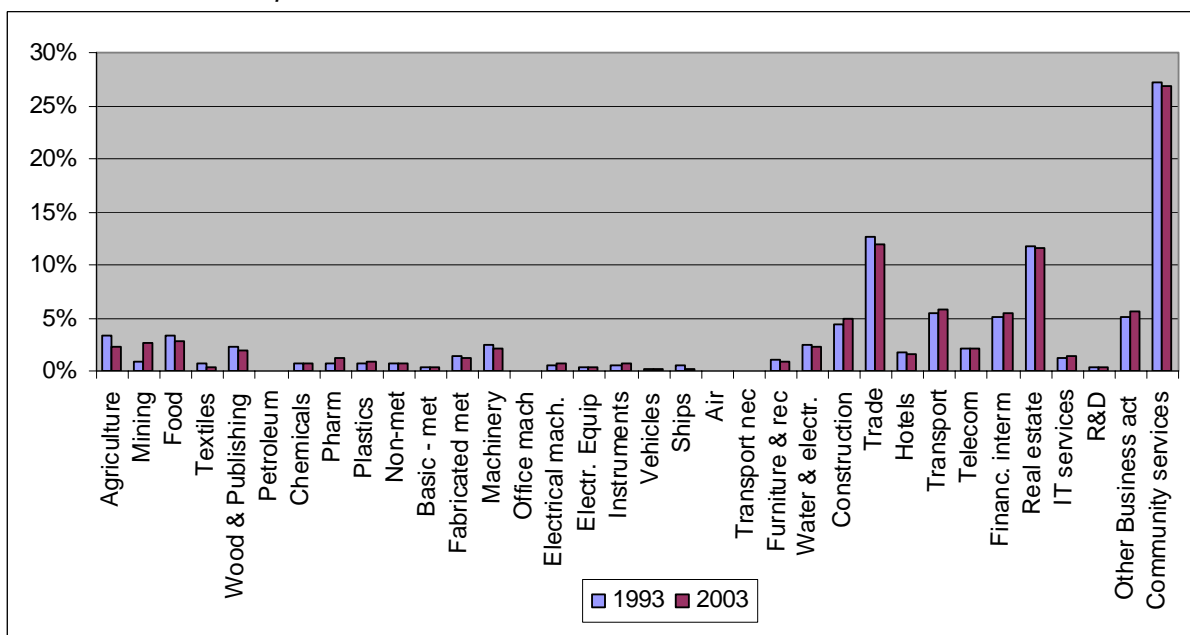
**ECONOMIC SPECIALISATION**

Figure 14. Value added by industrial sector. 34 sectors. Specialisation profile. Denmark. Averages 1993-1995 and 2001-2003. Million Euros. Current prices.



Notes: Specialisation index with EU15 as reference. Max specialisation: + 100. Min. specialisation: -100.  
Source: OECD, STAN 2005, own calculations.

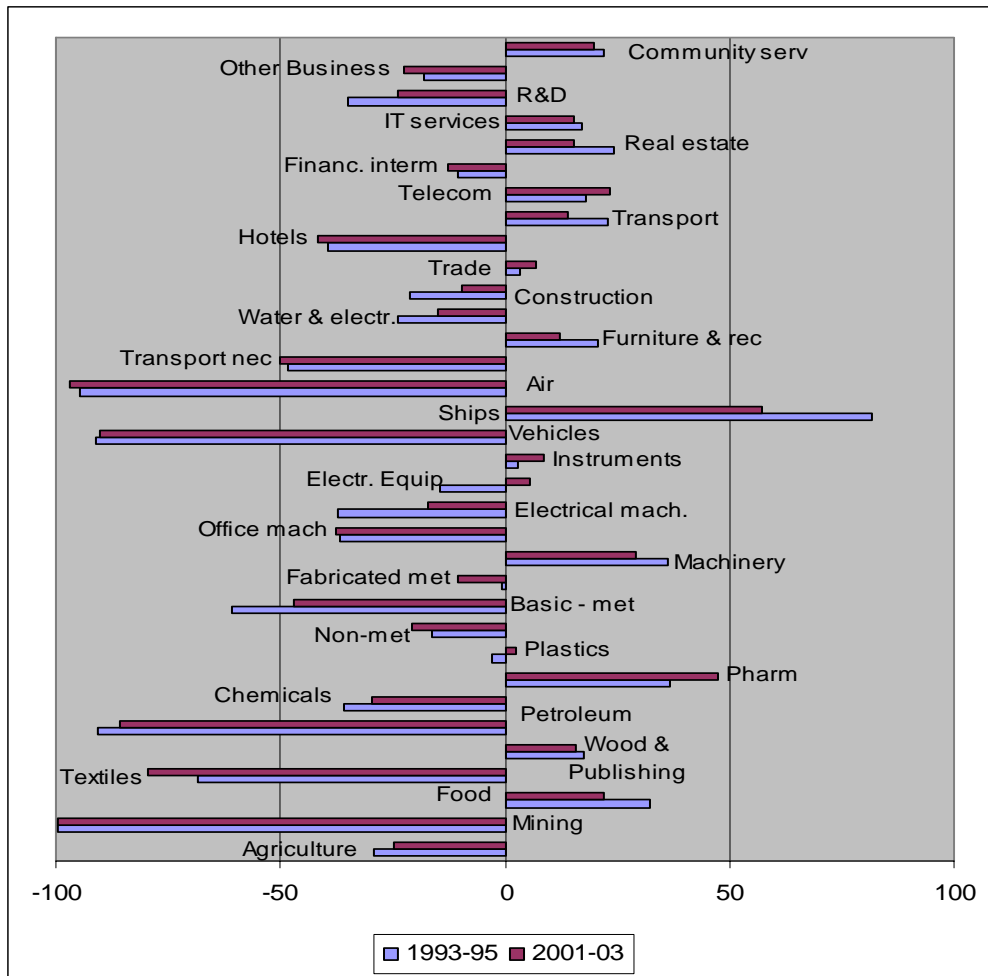
Figure 15. Shares of total value added by industrial sector. 34 sectors. Denmark. 1993 and 2003. Million Euros. Current prices.



Source: OECD, STAN, 2005.

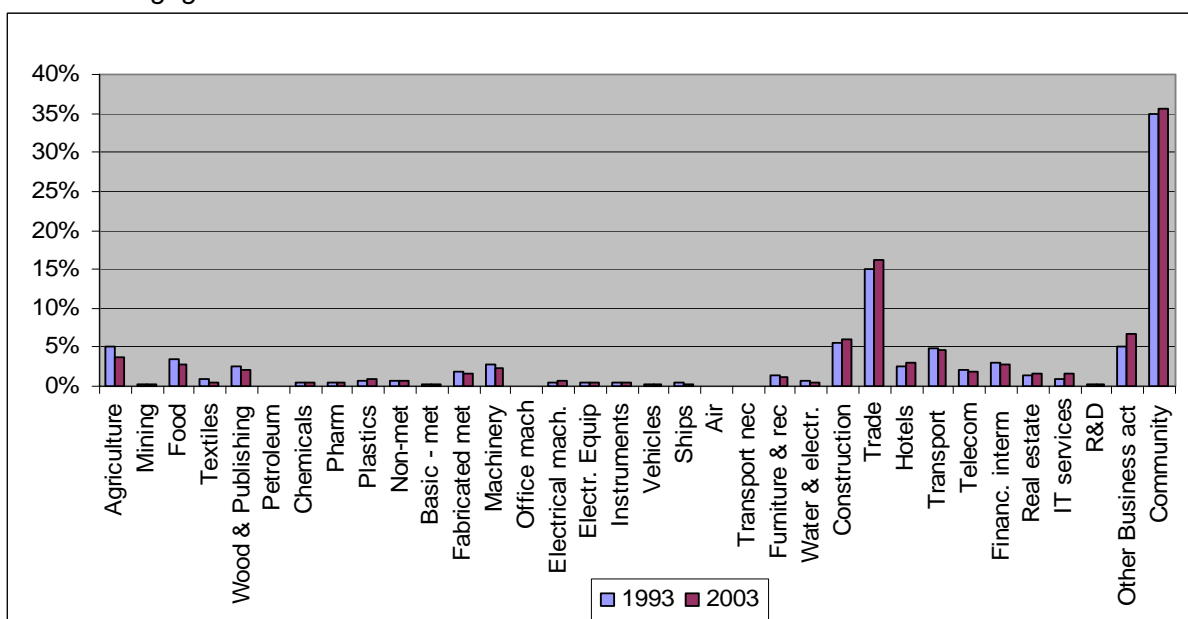


Figure 16. Employment by industrial sector. Specialisation profile. Denmark. 34 sectors. Averages 1993-1995 and 2001-2003. Numbers engaged – hundreds.



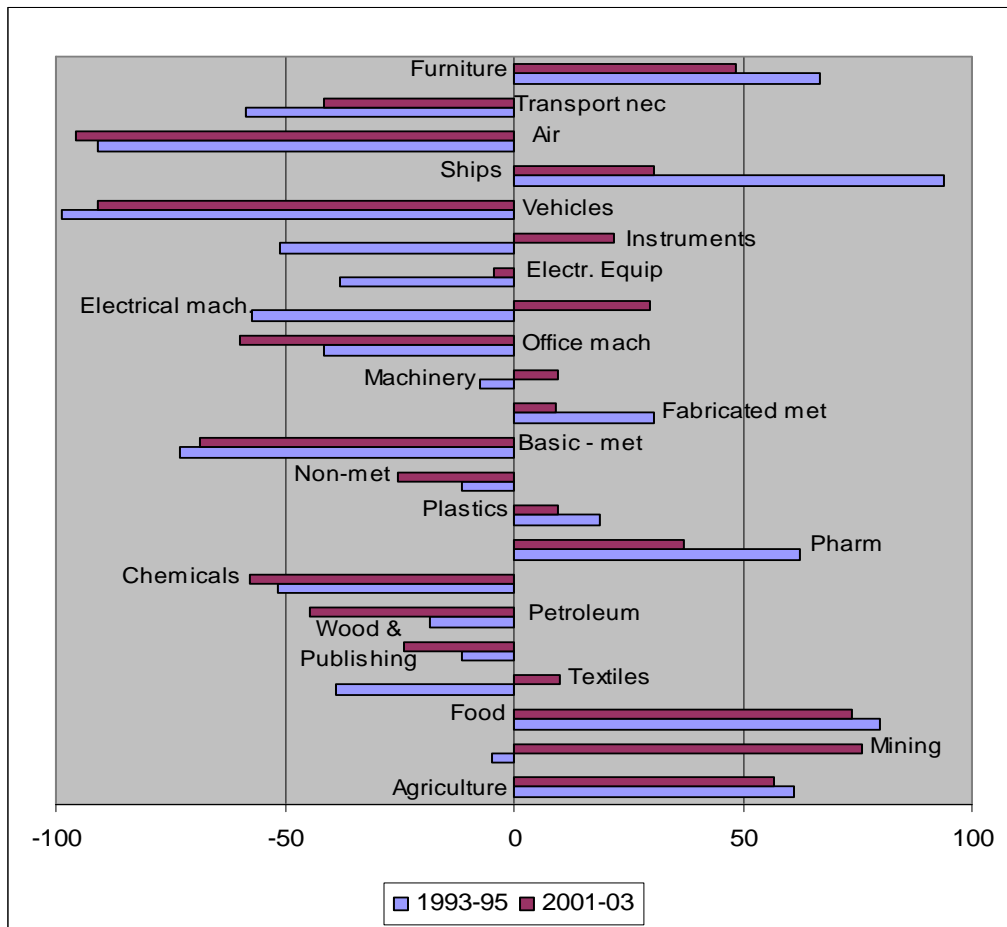
Notes: Specialisation index with EU15 as reference. Max specialisation: + 100. Min. specialisation: -100. Source: OECD, STAN, 2005, own calculations.

Figure 17. Shares of total employment by industrial sector. 34 sectors. Denmark. 1993 and 2003. Numbers engaged – hundreds.



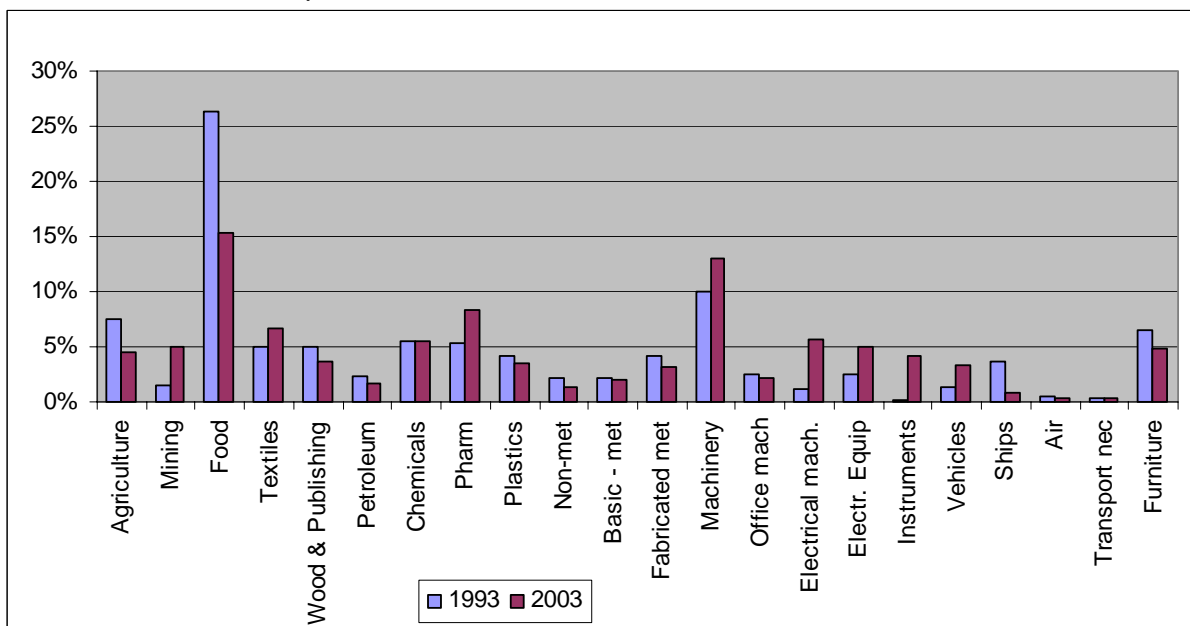
Source: OECD, STAN, 2005.

Figure 18. Exports by industrial sector. Specialisation profile. Denmark. 34 sectors. Averages 1993-1995 and 2001-2003. Thousand USD. Current prices.



Notes: Specialisation index with EU15 as reference. Max specialisation: + 100. Min. specialisation: -100. Source: UNIDO, INDSTAT4 2005, ISIC Rev3 and COMTRADE 2005, own calculations.

Figure 19. Shares of total exports by industrial sector. 34 sectors. Denmark. 1993 and 2003. Thousand USD. Current prices.



Source: UNIDO, INDSTAT4 2005, ISIC Rev3 and COMTRADE 2005, own calculations.

**CORRELATION ANALYSIS**

Table 2. Correlation analysis. Specialisation indexes BERD, Value added, Employment, Exports and patents. Denmark. Averages 1993-1995 and 2001-2003.

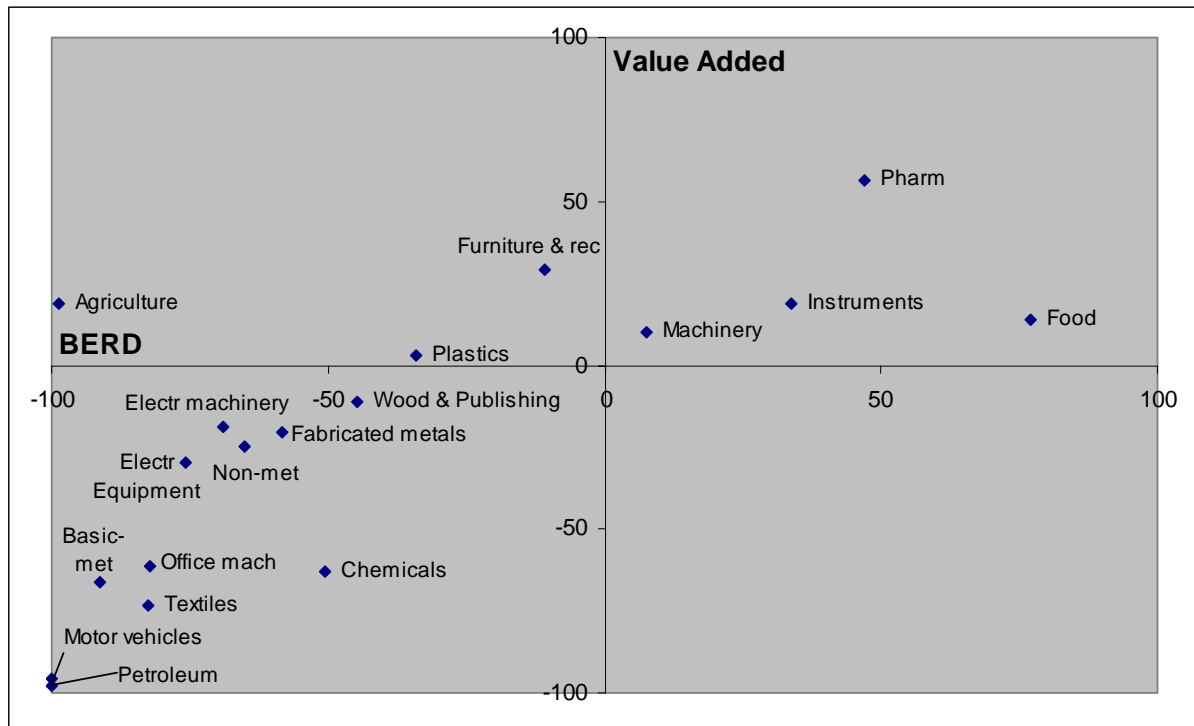
Correlations

	DK_BERD 9395	DK_BERD 0103	DK_PAT 9395	DK_PAT 0103	DK_VA 9395	DK_VA 0103	DK_EMP 9395	DK_EMP 0103	DK_EXP 9395	DK_EXP 0103
DK_BERD9395 Pearson Correlation Sig. (2-tailed)	1									
DK_BERD0103 Pearson Correlation Sig. (2-tailed)	.748** .000	1								
DK_PAT9395 Pearson Correlation Sig. (2-tailed)	.497* .042	.745** .001	1							
DK_PAT0103 Pearson Correlation Sig. (2-tailed)	.546* .023	.840** .000	.846** .000	1						
DK_VA9395 Pearson Correlation Sig. (2-tailed)	.566** .002	.604** .001	.617** .008	.682** .003	1					
DK_VA0103 Pearson Correlation Sig. (2-tailed)	.427* .026	.514** .006	.533* .028	.654** .004	.884** .000	1				
DK_EMP9395 Pearson Correlation Sig. (2-tailed)	.622** .001	.694** .000	.509* .037	.659** .004	.814** .000	.603** .000	1			
DK_EMP0103 Pearson Correlation Sig. (2-tailed)	.584** .001	.647** .000	.434 .082	.633** .006	.772** .000	.607** .000	.976** .000	1		
DK_EXP9395 Pearson Correlation Sig. (2-tailed)	.648** .004	.537* .021	.583* .014	.650** .005	.847** .000	.727** .000	.717** .000	.655** .001	1	
DK_EXP0103 Pearson Correlation Sig. (2-tailed)	.617** .006	.607** .008	.494* .044	.607** .010	.794** .000	.868** .000	.496* .019	.486* .022	.758** .000	1

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

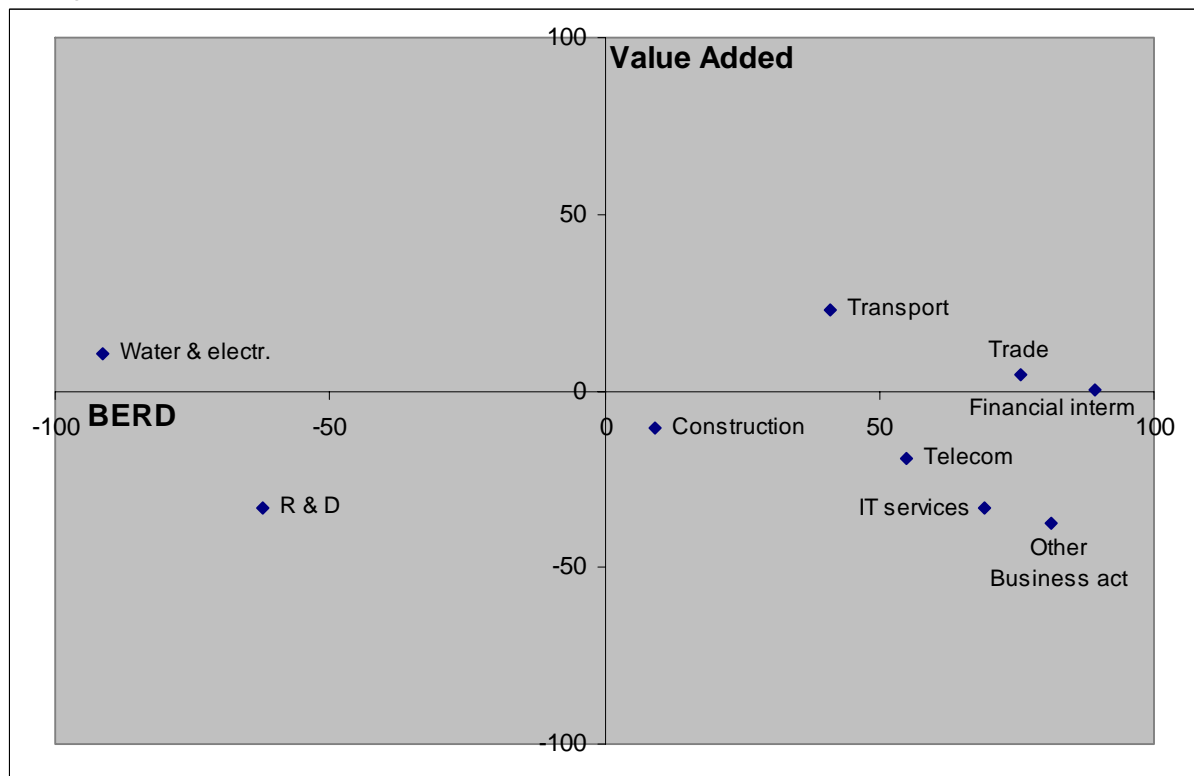
\* Correlation is significant at the 0.05 level (2-tailed).

Figure 20. BERD versus Value added specialisation in the primary and secondary industrial sectors. Denmark. Based on average values 2001- 2003.



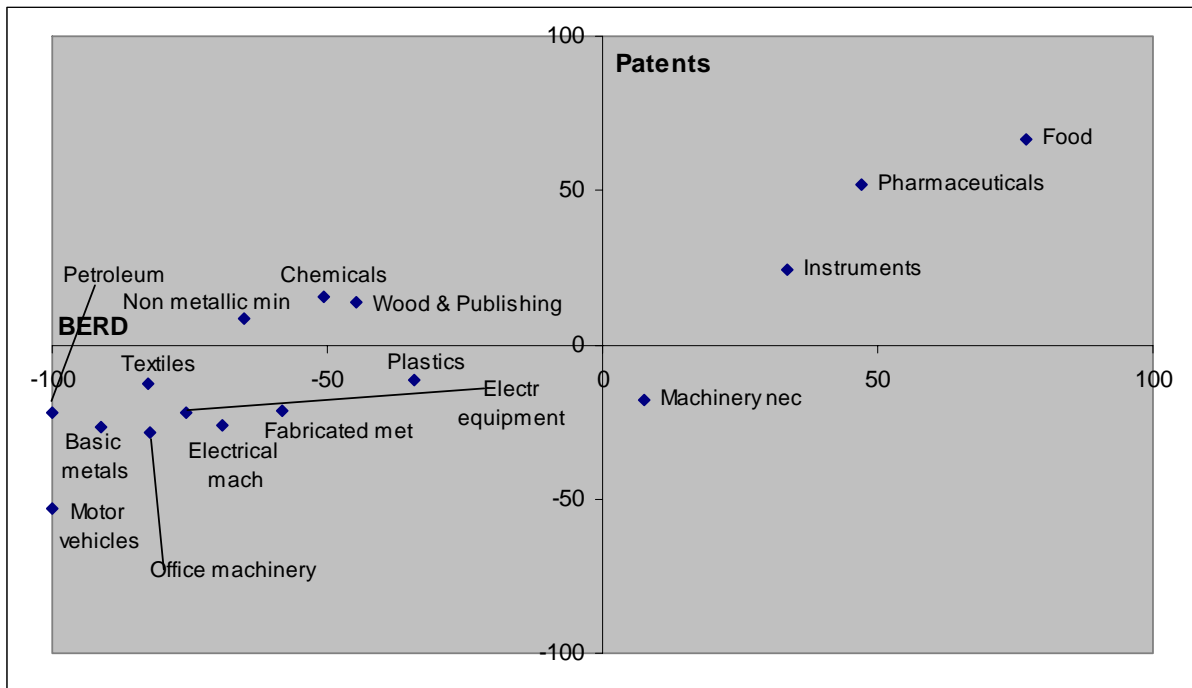
Notes: Specialisation index with EU15 as reference. Max specialisation: + 100. Min. specialisation: -100.  
Source: Own calculations

Figure 21. BERD versus Value added in services. Specialisation indexes. Denmark. Based on average values 2001- 2003.



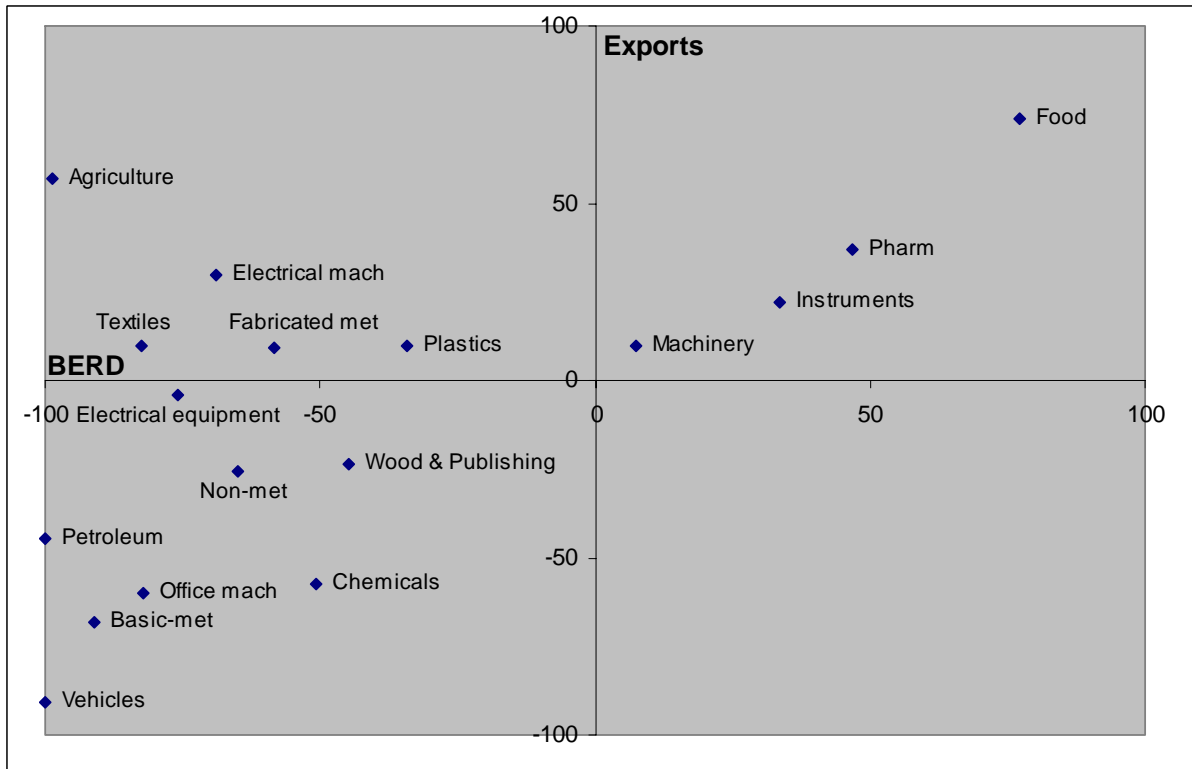
Notes: Specialisation index with EU15 as reference. Max specialisation: + 100. Min. specialisation: -100.  
Source: Own calculations

Figure 22. BERD versus patents. Specialisation indexes. Denmark. Based on average values 2001- 2003.



Notes: Specialisation index with EU15 as reference. Max specialisation: + 100. Min. specialisation: -100. Source: Own calculations

Figure 23. BERD versus exports. Specialisation indexes. Denmark. Based on average values 2001- 2003.



Notes: Specialisation index with EU15 as reference. Max specialisation: + 100. Min. specialisation: -100. Source: Own calculations

Table 3: Specialisation Profile

Areas of specialisation	Fast growing sectors >4.9%			Medium-Low growth sectors = <4.9%			Declining sectors <0		
	Increase Specialisation	Stable Specialisation	Losing Specialisation	Increase Specialisation	Stable Specialisation	Losing Specialisation	Increase Specialisation	Stable Specialisation	Losing Specialisation
Specialisation BERD	72; 65-67; 60-63; 45; 2423;		74; 50-52;	33; 15-16		64; 36-37; 29;			
Specialisation Patents			2423;	33; 24ex2423; 15-16		26; 20-22;			17-19
Specialisation Value Added	65-67; 60-63; 2423; 10-14;		75-79; 72; 50-52;	40-41; 36-37; 33; 25;		351; 29; 15- 16; 01-05			
Specialisation Employment	50-52; 2423;		75-79; 72; 60-63;	64; 33; 32; 25;		36-37; 351; 29; 20-22; 15-16			
Specialisation Exports	10-14;		2423	33; 31; 29;		36-37; 351; 28; 25; 15- 16; 01-05	17-19		

Red numbers: Decrease specialisation from specialised to non specialised

Blue numbers: Increase specialisation from non specialised to specialised

**EXPLANATORY NOTES****ISIC v3 codes and sector description**

Agriculture	01-05
Mining	10-14
Food	15-16
Textiles	17-19
Wood & Publishing	20-22
Petroleum	23
Chemicals excluding pharmaceuticals	24ex2423
Pharmaceuticals	2423
Plastics	25
Non-metal minerals	26
Basic metals	27
Fabricated metals	28
Machinery nec	29
Office machinery	30
Electrical mach.	31
Electronic equip.	32
Instruments	33
Motor vehicles	34
Ships	351
Aerospace	353
Transport nec	352+359
Furniture & recycling	36-37
Water & Electricity	40-41
Construction	45
Trade	50-52
Hotels	55
Transport	60-63
Telecoms	64
Financial intermediation	65-67
IT services	72
R & D	73
Other Business activities	74
Community services	75-99

**How to read specialisation profile figures**

Plotting specialisation indexes against each other is a method for visualising differences in specialisation patterns. The most interesting analytical dimension in this report is comparing business enterprise intramural R&D expenditure specialisation patterns with specialisation patterns in value added, employment, exports and technological specialisation (patents). The result of the plots is four distinct specialisation quadrants showing:

1. Sectors with **neither specialisation in BERD nor in the other analytical dimension** (lower left quadrant)
2. Sectors with **a specialisation in BERD and in the other analytical dimension** (upper right quadrant)
3. Sectors with a **specialisation in BERD but none in the other analytical dimension** (lower right quadrant)
4. Sectors that display a **specialisation in the other analytical dimension but not in BERD** (upper left quadrant)

If there is a good match between BERD and, say, value added specialisation patterns we expect to find all sectors either in the lower left or in the upper right quadrant. Sectors in the upper left or in the lower right of the graphs indicate anomalies, that is, specialisation in one dimension and non-specialisation in the other. If there are many sectors in these quadrants the graph indicates lack of correlation between BERD and, say, economic specialisation.

*BERD and Value Added specialisation – an example*

