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A Satellite Account for Research and Development, 1990-2003

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Preface

Large attention is focussed on research and development

Large international as well as national attention is focussed on research and development (R&D). The EU has set out an objective, implying that expenditure on research and development must account for at least 3 pct. of the gross domestic product (GDP) in 2010. In 2001, R&D expenditure constituted, at EU level, approximately 2 pct. of GDP. The Danish government has endorsed this objective of research and development accounting for 3 pct. The efforts to be made on R&D are generally considered to be a good instrument to create well-paid employment and economic growth.

Satellite account for research and development in the context of the national accounts

In the national accounts – with the present calculation principles – R&D is regarded as expenditure on an equal footing with other current expenditure, e.g. purchases of raw materials, entertainment costs and marketing. The task of the present project was to compile a satellite account for research and development in the context of the national accounts, in which expenditure on research and development is regarded as *gross fixed capital formation* in the new category *research and development.* The new R&D investments give rise to new capital stocks, measuring the value of total R&D results in society. The mentioned adjustments of the national accounts have an impact on, e.g. GDP and other important aggregates in the national accounts. The publication shows, to which extent, these aggregates are affected by the changed classification of R&D.

New principle for treating R&D in the national accounts

In the context of the national accounts, a process has been initiated, which is to result in a revised manual on national accounts in 2008. One of the most far-reaching proposals for change concerns the treatment of research and development, where it is considered to regard expenditure on research and development as capital formation. This publication gives a foretaste of how this revision – if adopted – will affect the national accounts.

Corporate group project

The present theme publication presents the results from those parts of the corporate group project concerning *research and development - motive power for growth and innovation,* which was prepared by Statistics Denmark. The corporate group project was conducted by Statistics Denmark in collaboration with the Ministry of Economic and Business Affairs.

Calculations and publication

Work on the satellite account for research and development in the context of the national accounts was conducted by Christian Gysting, Head of Section and Claus Bisgaard Jensen and Margit Jørgensen, student assistants. Poul Erik Olesen, Head of Section, has translated the original Danish text into English.

Statistics Denmark, August 2006

Jan Plovsing / Ole Berner

Contents

Explanation of symbols

0 0,0	Less than 0.5 of the unit applied
.	Category not applicable
. .	Data too uncertain
. . .	Data not available
-	Nil

Summary

What is a satellite account for research and development in the context of the national accounts?

In the present theme publication, a satellite account for research and development (R&D) for Denmark in the context of the national accounts is described. This implies that a national account is compiled in which expenditure on research and development is regarded as *gross fixed capital formation*. In the existing national accounts, expenditure on research and development is instead treated as current expenditure, i.e. intermediate consumption or government consumption depending on the sector. As a result of the new R&D investments, R&D capital must also include the capital stock. Subsequently, capital stock (stocks and consumption of fixed capital) has been estimated for R&D investments. The reclassification of R&D has a general impact on the level of GDP. There was an increase in GDP of 2.2 pct. in 2002.

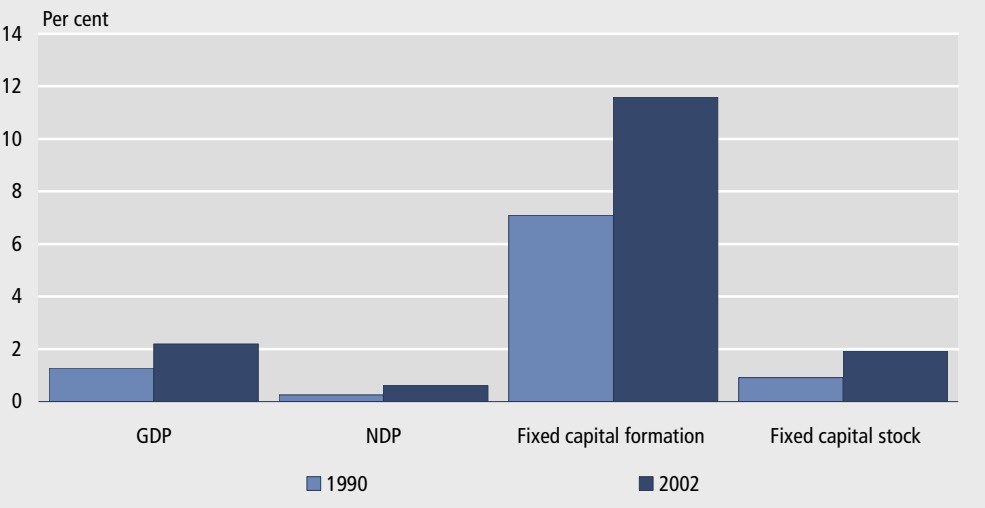
Primary data

Frequently, expenditure on research and development is not directly observable in the national accounts. Against this background, it was necessary to include alternative data sources for the size of R&D related expenditure. In this context, figures from the *Danish Centre for Studies in Research and Research Policy (CFA)* are primarily used. R&D expenditure is estimated by CFA in accordance with the international definitions outlined in the *Frascati manual.* Special data supplies, which contain figures back to 1981, are used for the calculations in the present context. Furthermore, internal source data from Statistics Denmark are also used, of which employment statistics broken down by employment category and industry are the most important.

Method

The general procedure applied in reclassifying research and development expenditure is the construction of a bridge table between R&D estimated according to the definition in the Frascati manual and R&D estimated according to the principles in the national accounts. The selection of method complies with the international consensus to create satellite accounts for research and development in the context of the national accounts. However, compared to other similar studies, there may be differences in the estimation principles for calculating each individual element in the bridge table.

Figure 1. **Upward adjustments as a consequence of the reclassification of R&D**



Note: The figure shows – expressed as a percentage - the impact of the reclassification of research and development expenditure on selected items in the national accounts (current prices) for 1990 and 2002. Fixed capital estimated as net stock.

Impact resulting from the reclassifications

The principal aim is, as already mentioned, to compile a satellite account for research and development in the context of the national accounts. One of the most interesting results in connection with compiling a satellite account is how the main aggregates in the national accounts are affected by the reclassification of R&D, from current expenditure to capital formation. Figure 1 shows the impact on *gross domestic product (GDP)*, *net domestic product (NDP)*, *gross fixed capital formation* and *fixed capital stock*.

It appears from the figure that especially capital formation is positively affected, while the stock of fixed capital and GDP are, to a smaller extent, affected. However, the impact on NDP is relatively small. It can also be seen that the impact on all components is greater in 2002, compared to 1990.

Difference in the impact on investments and stocks

The greatest contribution of the reclassification to stocks and investments, respectively in 2002, is seen for investments (gross fixed capital formation), which account for about 11.5 pct., compared to 2 pct. for stocks, see figure 1. This difference is attributed to the average service lives, as capital stocks are dominated by dwellings and non-residential buildings with a long service life seen in relation to R&D investments.

Sharp increase in R&D investments

There is a sharp increase in R&D during the period 1990 to 2002. R&D investments estimated at constant prices constituted DKK 16.1 bn. in 1990 and DKK 30.3 bn. in 2002. This corresponds to an increase of 88.6 pct. or an average increase of 5.4 pct. annually. The greatest contribution to this growth is made by the *manufacturing industry,* as 2/3 of the increase can be attributed to increases in the manufacturing industry's R&D investments. *Public and personal services* are the second major contributor to this growth, with approximately 1/4.

Small R&D industries account for the greatest increase in growht rates

The greatest increases in R&D investments at constant 2000 prices, estimated as the average annual growth rate, are attributed to *transport, post and telecommunications* (13.4 pct.) and *electricity, gas and water supply* (11.2 pct.). However, R&D investments made in these industries constitute an insignificant part of total R&D investments. The average annual growth rate was 7.3 pct. for the *manufacturing industry*, whereas it was 5.1 pct. for *public and personal services.* The growth rate in *finance and business activities* (1.2 pct.) was far below the average.

Table 1. Investments in research and development

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	Average annual growth
	Current prices, mill. DKK.													pct.
Total	11 747	12 660	13 274	14 158	15 244	16 664	17 697	20 494	21 705	23 693	26 597	30 015	31 351	8.5
1 Agriculture, fishing and quarrying	14	17	23	28	27	32	33	25	36	15	71	96	91	17.1
2 Manufacturing	5 003	5 233	5 655	5 762	6 384	6 760	7 733	9 106	10 638	11 223	13 860	16 602	16 674	10.6
3 Electricity, gas and water supply	22	34	50	67	69	66	61	42	70	27	63	111	118	15.0
4 Construction	48	57	86	107	109	111	84	55	101	42	107	189	190	12.2
5 Wholesale and retail trade; hotels, restaurants.	334	475	461	429	478	533	769	983	978	1 236	1 060	921	1 007	9.6
6 Transport, storage and communication	17	24	33	40	42	46	45	59	72	102	109	116	103	16.3
7 Financial intermediation, business activities	3 191	2 831	3 873	3 065	4 306	3 185	4 337	4 305	4 655	4 638	4 448	4 506	4 913	3.7
8 Public and personal services	3 118	3 990	3 093	4 660	3 830	5 930	4 635	5 919	5 154	6 410	6 880	7 475	8 256	8.5
	Constant 2000-prices, mill. DKK													
Total	16 083	16 652	16 764	17 943	18 370	19 608	20 119	22 093	22 967	24 338	26 597	29 761	30 329	5.4
1 Agriculture, fishing and quarrying	38	49	70	88	86	97	67	47	78	28	71	98	97	8.1
2 Manufacturing	6 974	6 948	7 169	7 351	7 656	7 861	8 751	9 721	11 193	11 577	13 860	16 595	16 234	7.3
3 Electricity, gas and water supply	31	44	64	85	86	79	66	45	73	27	63	105	110	11.2
4 Construction	65	74	109	139	139	137	96	62	108	43	107	184	181	8.9
5 Wholesale and retail trade; hotels, restaurants.	457	598	560	523	564	608	838	1 054	1 036	1 285	1 060	912	988	6.6
6 Transport, storage and communication	22	30	41	48	50	54	47	59	74	100	109	113	100	13.4
7 Financial intermediation, business activities	4 200	3 544	4 737	3 693	5 060	3 629	4 873	4 515	4 851	4 706	4 448	4 494	4 829	1.2
8 Public and personal services	4 296	5 365	4 015	6 017	4 730	7 143	5 380	6 589	5 553	6 572	6 880	7 260	7 790	5.1

Note: Input-deflation is applied in calculating research and development investments at constant prices. This implies for industries with large and fluctuating net operating surpluses – which is the case for mining and quarrying - that price trends vary to some extent. A description of the method for deflation is given in section 2.12.

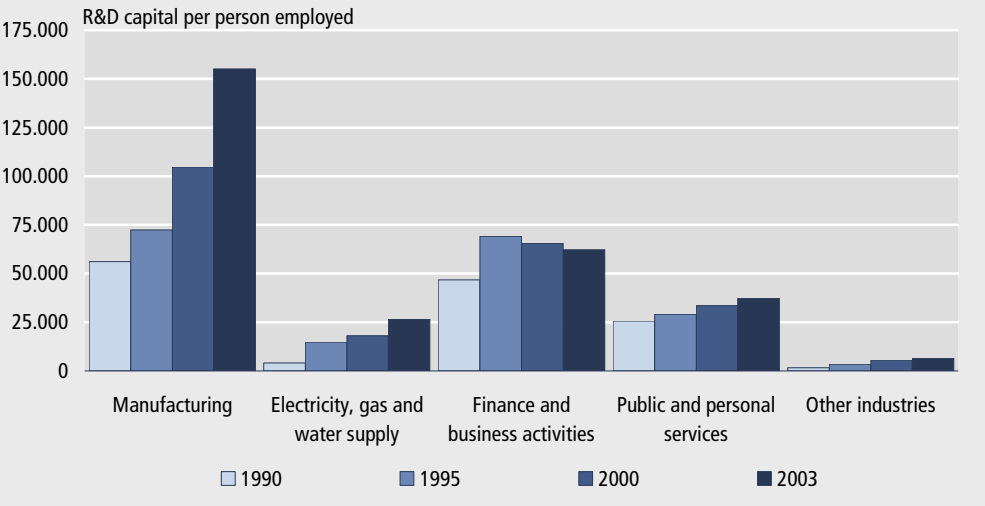
R&D capital

The statistics on R&D capital (estimated as net stock) take cumulative R&D investments into consideration after deductions of technical and economic obsolescence (and revaluations, if the statistics are compiled at current prices). Consequently, net stock of R&D is a suitable measurement for the value of R&D capital, which is available to the industries. It appears from figure 1 that the level of total capital stock is increased in 2002 by about 2 pct. due to the reclassification of R&D, compared to about 1 pct. in 1990. This is an indication of a substantial increase in the stock of R&D capital.

Almost a trebling of the manufacturing industry´s R&D capital per person employed

Since the beginning of the 1990's, research and development activities increased considerably in the manufacturing industry. The scope of R&D capital almost trebled during the period from 1990 to 2003, when this is measured as per person employed and price trends are taken into consideration. It also applies that the manufacturing industry is the industry group, which accounts, by far, for the greatest scope of R&D capital per person employed. R&D, estimated at constant 2000 prices, accounted for DKK 56,000 per person employed in 1990 and DKK 155,000 in 2003, which corresponds to an average annual increase of 8.1 pct. Consequently, increasing R&D capital and decreasing employment have contributed to this development.

Figure 2. **R&D capital at constant 2000 prices per person employed**

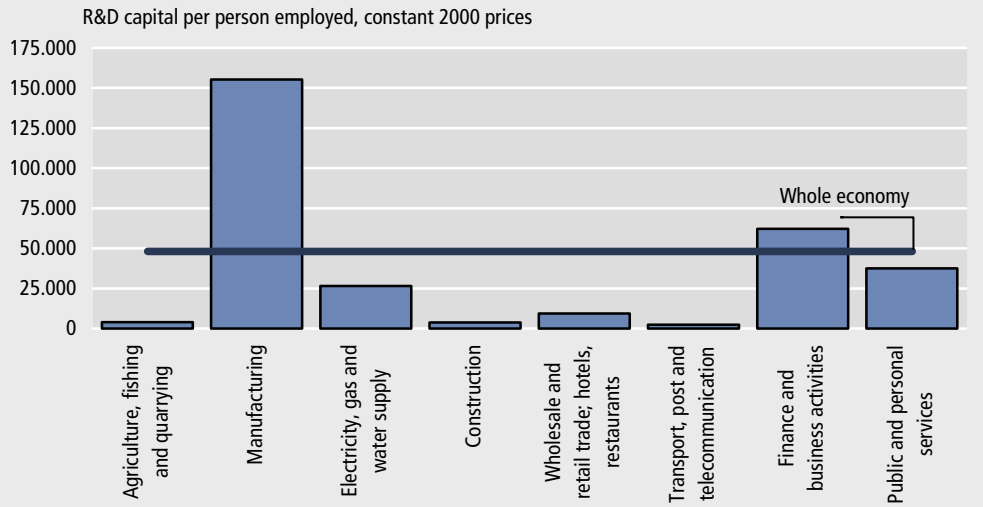


Note: In calculating capital per person employed, R&D capital is defined as net stock at constant 2000 prices at the beginning of the year, whereas employment is the sum of the number of employees and self-employed. Other industries cover the industries agriculture, fishing and quarrying, construction, wholesale and retail trade; hotels, restaurants, as well as transport, post and telecommunications.

More modest increases in other industries

For the total economy, there was an annual average increase of 5.1 pct. in R&D capital per person employed, which is slightly lower than the increase in the manufacturing industry. Trends in the two other large R&D industries *finance and business activities* as well as *public and personal services* are slightly more moderate. There was, as a matter of fact, a small decline in *finance and business activities* after 1997. It applies to all industry groups that the level in 2003 is considerably above the starting point in 1990.

Figure 3. **R&D capital per person employed by industry. 2003**



Note: In the calculation of capital per person employed, capital is defined as net stock at constant 2000 prices at the beginning of the year, whereas employment is the sum of the number of employees and self-employed.

Detailed classification of industries

For the total economy in 2003, R&D capital per person employed was about DKK 48,000, when R&D capital stock was estimated at constant 2000 prices. Only the *manufacturing industry* and *finance and business activities* range above the average, whereas other industries range below the average, see figure 3. Several industries range far below the average for the total economy.

Increasing importance of R&D for the manufacturing industry

The importance of research and development is increasing for the manufacturing industry seen in relation to other types of production equipment (machinery, non-residential buildings, etc.). In 2003, R&D capital accounted for 17.3 pct. of the total quantity of production equipment, compared to 9.3 pct. in 1990, estimated at current prices. The reason for the increase can be attributed to the considerably higher investments in research and development than investments in traditional production equipment by the manufacturing industry. It is especially the chemical industry (including the pharmaceutical industry) and the electronics industry, which account for a substantial R&D capital.

Explanation of terms

R&D investments are the value of R&D results, which is acquired by a unit from a third party or which is created by the unit itself by own production over the period of time in question. The method for valuation of R&D investments depends on whether they are acquired through purchases or own production. If they are acquired via purchases from a third party, they are valued on the basis of the purchase price, whereas in the case of own production, they are valued on the basis of costs, which can be related to research and development activities, i.e. current costs on employees, materials, production equipment and any taxes on production, net. In this publication, the concepts investments, capital formation and gross fixed capital formation are applied synonymously.

R&D capital (estimated as net stock) is the value of patents, intellectual rights, formulas as well as trade secrets and – descriptions, etc. – i.e. the preconditions of producing something that is the result of research and development. In this publication, the concepts capital, fixed capital, capital stock and production equipment are applied synonymously.

A **satellite account** is in the context of the national accounts indicative of analyses within the framework of the national accounts, where: 1) One or several main classifications or definitions are changed, or 2) There is an introduction of supplementary variables or alternative sub-groupings of existing variables in the national accounts are made. An example of the first-mentioned point is the reclassification of research and development, while satellite accounts for tourism or the environment are examples of the last-mentioned point.

1. The Most Important Trends

1.1 Results

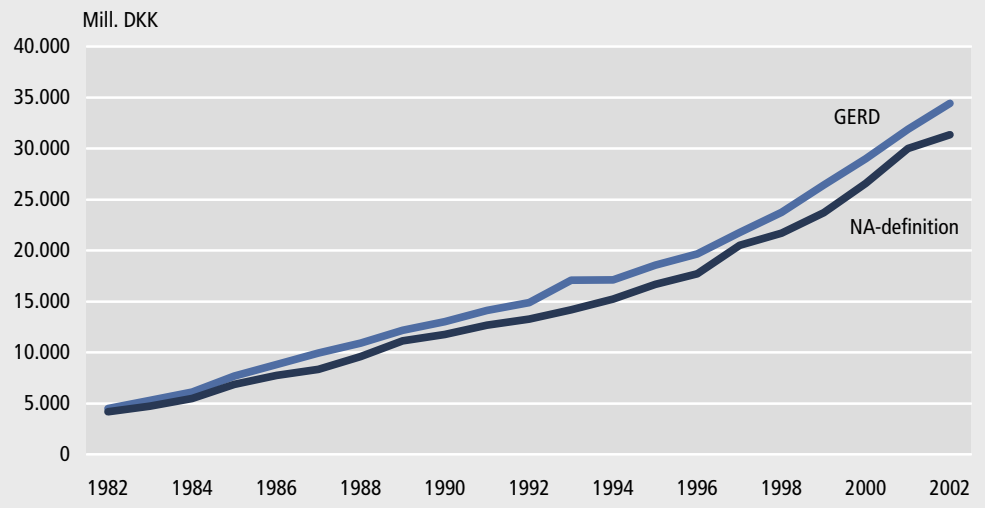
The most important trends in a R&D satellite account[1] in the context of the national accounts are outlined below.

1.2 R&D investments

Current prices

Figure 1.1 shows trends in R&D investments according to the definition (GERD) in the Frascati manual and the definitions in the national accounts (NA definition), respectively. It appears that trends are more or less parallel, whereas R&D investments in the context of the national accounts are consistently slightly lower. The lower level of these R&D investments is mainly due to adjustments of software overlaps in the NA investments. As mentioned in sections 3.5 and 3.7, there is a considerably element of software in R&D investments estimated according to the GERD definition. The corrections with regard to software are equal to DKK 5.3 bn. in 2002.

Figure 1.1 **Investments in R&D, GERD and NA definition, current prices**



Source: Danish Centre for Studies in Research and Research Policy and OECD.

The level of R&D investments (NA definition) is approximately DKK 5 bn. in 1982, increasing to about DKK 31 bn. in 2002. The period has seen an annual increase of about 9.6 on average, as part of this growth can, however, be attributed to price increases, implying that real growth is somewhat lower.

[1] For a more detailed description of the concepts and calculation methods, see section 2, *General Statistics on Research and Development – Data Sources and Use*, and section 3, *A Satellite Account for Research and Development*.

Table 1.1 **Investments in R&D as a percentage of GDP, different definitions**

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
	pct.												
GERD definition	1.55	1.61	1.64	1.88	1.75	1.82	1.84	1.93	2.04	2.18	2.24	2.39	2.51
National accounts definition	1.38	1.43	1.44	1.53	1.54	1.61	1.63	1.79	1.83	1.92	2.02	2.20	2.23

Note: Investments according to the national accounts definition are given as a percentage of GDP, after reclassification of R&D expenditure, while R&D investments (expenditure) are given according to the GERD definition as a percentage of GDP, without any reclassification of R&D expenditure.

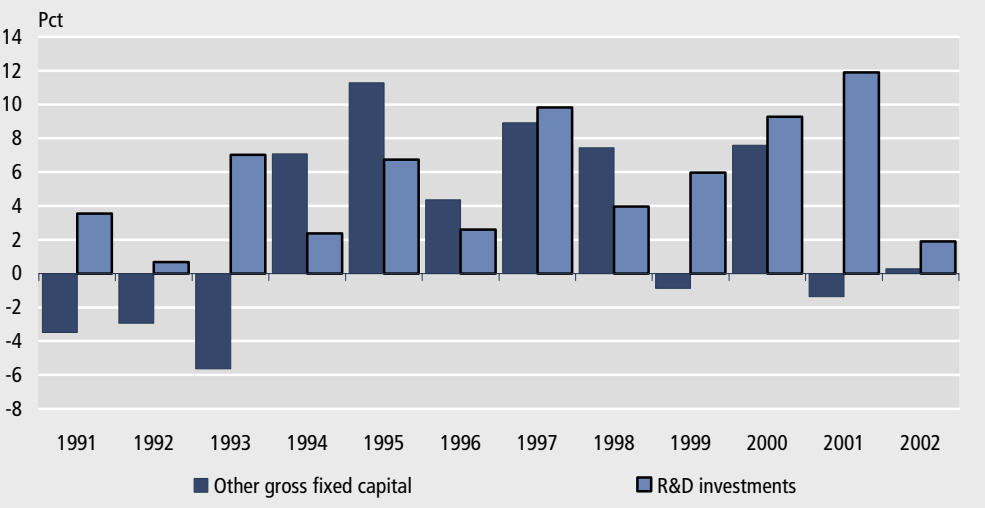
Increasing R&D investments

Table 1.1 shows investments in R&D as a percentage of GDP to provide an overview of trends in real terms. It appears that there is a substantial increase in R&D according to both definitions. R&D (GERD definition) accounts for 1.55 pct. in 1990 and 2.51 pct. in 2002, i.e. an increase of almost 1 percentage point.

Constant 2000 prices

During the period 1990-2002, R&D investments (according to national account principles) increased by an average of 5.4 pct. per year, while other gross fixed capital formation rose by 2.6 pct. on average. For comparison, GDP (estimated exclusive of R&D expenditure as capital formation) at constant 2000 prices increased by 2.0 pct. on average during this period. Figure 1.2 shows the annual real growth in R&D investments and other gross fixed capital formation.

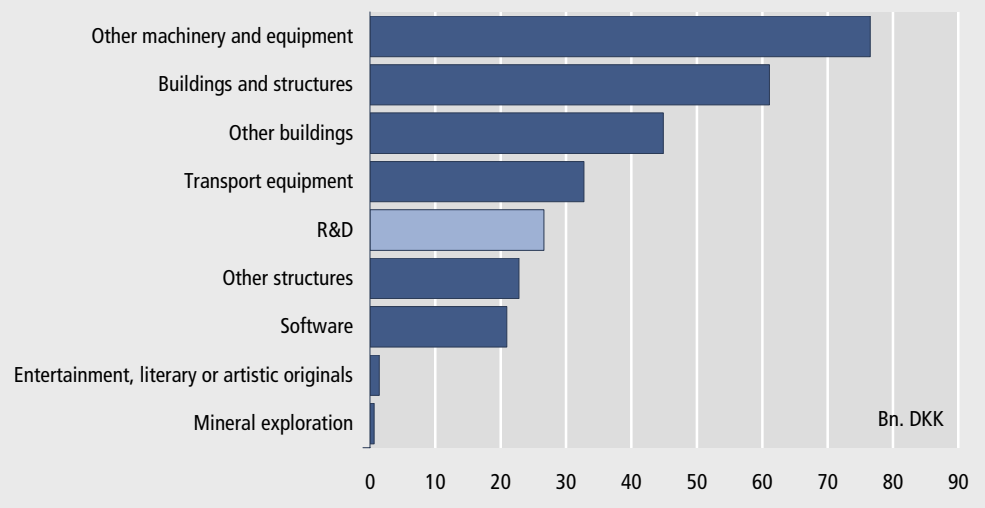
Figure 1.2 **Gross fixed capital formation by type, annual real growth, constant 2000 prices**



Note: The R&D gross fixed capital formation is estimated in accordance with the national accounts definitions.

The reason for the difference in average annual growth rates for R&D investments and other gross fixed capital formation in the context of the national accounts is mainly attributed to large differences in real growth at the beginning and at the end of the period.

Figure 1.3 **Gross fixed capital formation, selected types of assets, current prices. 2000**



Note: The figure excludes investments in livestocks, which together with other investments, represent a very modest amount.

Composition of gross fixed capital formation

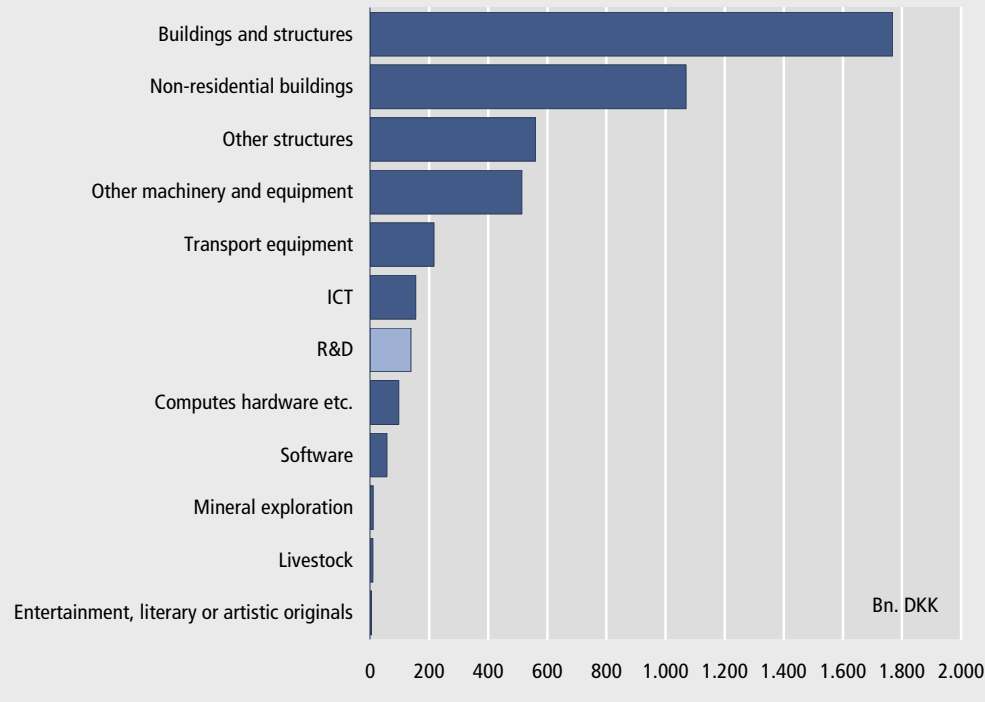
If we look at the composition of investments by type of investment in the year 2000 (see figure 1.3), R&D investments account for the 5th largest type of investment. In 2000, R&D investment exceeds, e.g. investments in software and structures. R&D investments account for about 9 pct. of total gross fixed capital formation (including R&D investments), see table 3.6 in section 3.15.

1.3 R&D capital stock

Level of R&D capital

The value of R&D capital – estimated by net stock at current prices – amounted to DKK 139 bn. at the beginning of 2003, while the total value of society's capital stock was DKK 4.190 bn. Figure 1.4 shows the classification of capital by type.

Figure 1.4 **Net stock by type of assets, current prices, 2003**



Note: Net stock for ICT (information and communcation technology) is the sum of net stock for software and computer-hardware, etc. Computer-hardware, etc. is a memo item under machinery and equipment.

Composition

R&D capital accounted for 3.2 pct. of total capital at the beginning of 2003. If we look at trends in the composition of capital stock, it appears from table 1.2 that dwellings and non-residential buildings are the dominant types of capital in both 1990 and 2003, although there is a considerable (relative) decrease in the stock of dwellings during the period. One of the capital types accounting for the highest increase in relative importance is research and development, only exceeded by structures (major investments in the Great Belt Bridge and Oresund Bridge). However, the share of research and development of total capital stock is comparatively small. This is partly attributed to the relatively short service life for R&D in relation to buildings and plants.

Table 1.2 **Composition of capital stock (net stock) current prices**

	1990	2003	Change
	pct.		Pct. point
Total	**100.00**	**100.00**	**0.00**
Of this ICT	3.10	3.57	0.47
Other machinery and equipment	12.53	11.80	-0.73
Transport equipment	4.22	4.98	0.75
Buildings and structures	44.98	40.66	-4.32
Non-residential building	25.23	24.58	-0.65
Other structures	10.15	12.88	2.73
Livestock	0.24	0.21	-0.03
Computer software	0.59	1.32	0.73
Entertainment, literary or artistic originals	0.09	0.12	0.03
Mineral exploration	0.24	0.25	0.01
Research and development	1.72	3.19	1.48

Note: Capital stock for ICT (information and communcation technology) is the sum of capital stock for software and computer-hardware, etc. Computer-hardware, etc. is a memo item under machinery and equipment.

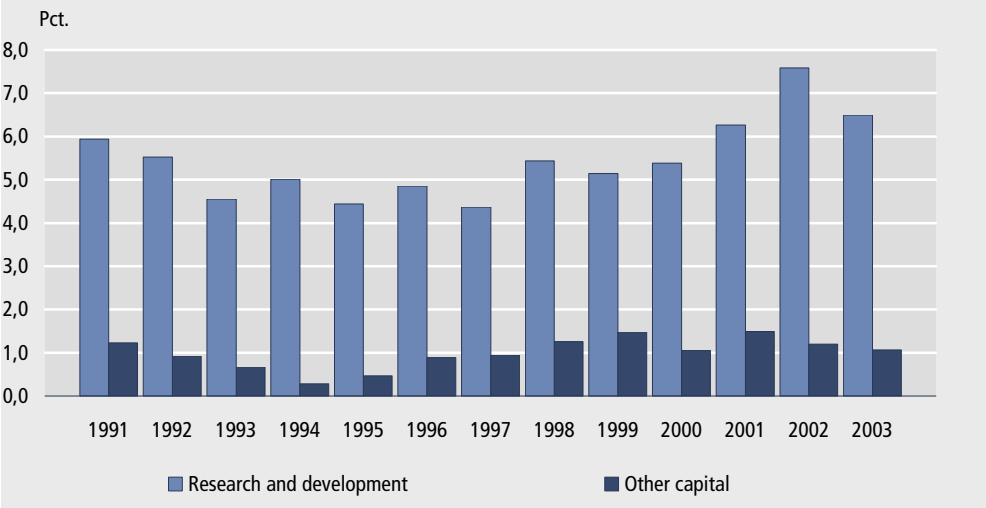
ICT

There is only a slight increase in the share of ICT capital stock, although considerable real growth is seen. The substantial price falls in ICT products have resulted in still cheaper prices for ICT products, while at the same time an improved capital stock is achieved. The price falls have given rise to negative revaluations of the ICT stock, implying that the share of ICT stock has not increased as much, although considerable real growth is seen.

Real growth in R&D capital

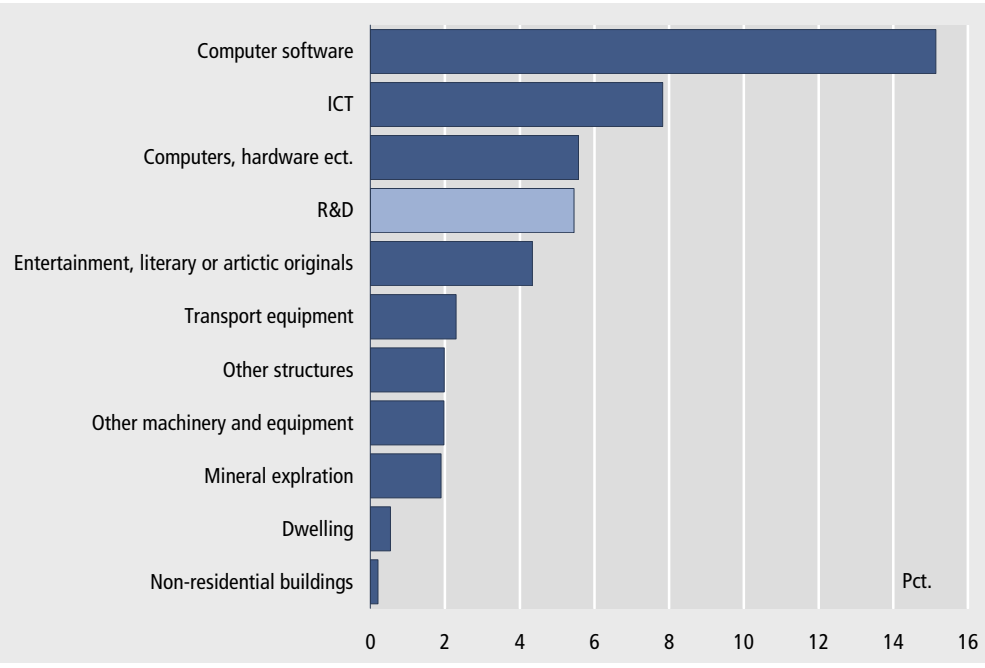
Considerable annual real growth in the stock of R&D capital is seen from 1990 until 2003 – estimated as net stock at constant 2000 prices. The growth rate for R&D capital stock ranged between 4.4 pct. and 7.6 pct. during the period. There has been a considerably higher increase in real growth for R&D capital stock than real growth in other capital stock – where real growth ranged between 0.3 pct. and 1.5 pct. Figure 1.5 shows year-on-year real growth rates for R&D capital and other capital, respectively.

Figure 1.5 **Annual real growth in net stock, constant 2000 prices**



Real growth in R&D capital stock was considerable over the period 1990-2003, showing an average of 5.5 pct. per year, see figure 1.6. Only growth in ICT capital (software and computer-hardware, etc.) was higher, while average annual growth rates for original artistic works remained more or less at the same level as that of R&D capital. The high growth rate in ICT capital must especially be seen in relation to the fast-moving technological development, where there are major improvements over time in the quality of products, such as computers and software, without corresponding price increases.

Figure 1.6 **Average growth rate in capital stock. 1990-2003**



Note: Capital stock for ICT (information and communcation technology) is the sum of capital stock for software and computer-hardware, etc. Computer-hardware, etc. is a memo item under machinery and equipment. The figure excludes average annual growth rates for livestocks.

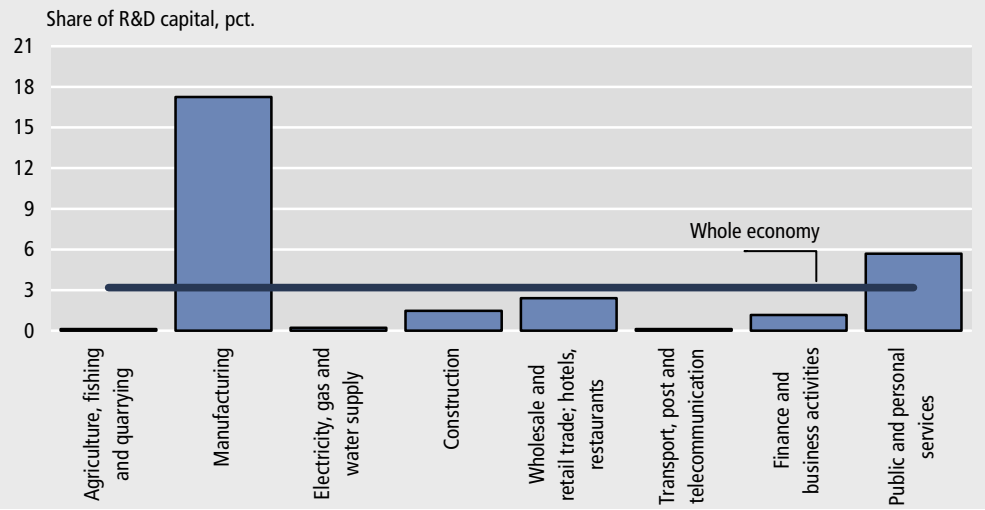
It is worth noting that the economic operators, to a higher and higher extent, increase their value of intellectual rights – original artistic works and research and development – as well as high-technology products, such as computers and software. And this happens at the relative expense of traditional non-financial assets, such as buildings general machinery and equipment as well as transport equipment.

1.4 Figures broken down by industry

Intensity of R&D capital

If the importance of R&D capital is estimated for each industry on the basis of the share of R&D capital of the total capital (intensity of R&D capital), it appears that there are great differences among industries, see figure 1.7. The manufacturing industry accounts for the highest R&D intensity, which is far above average for the total economy, whereas *public and persons services* are the only other major group of industries, where the share is also above average. The vast amount of basic research, which is, to a large extent, performed by universities, is classified to public and personal services. *Public and persons services* range below average, when estimations are conducted per person employed (see figure 3 in the summary), and range above average when estimations are conducted on the basis of the intensity of R&D capital. The reason for this must be considered in relation to the K/L ratio (capital per person employed) of the industry, as *public and personal services* cover a group of industries with a very high overall employment intensity.

Figure 1.7 **Intensity of R&D capital, main industry grouping. 2003**

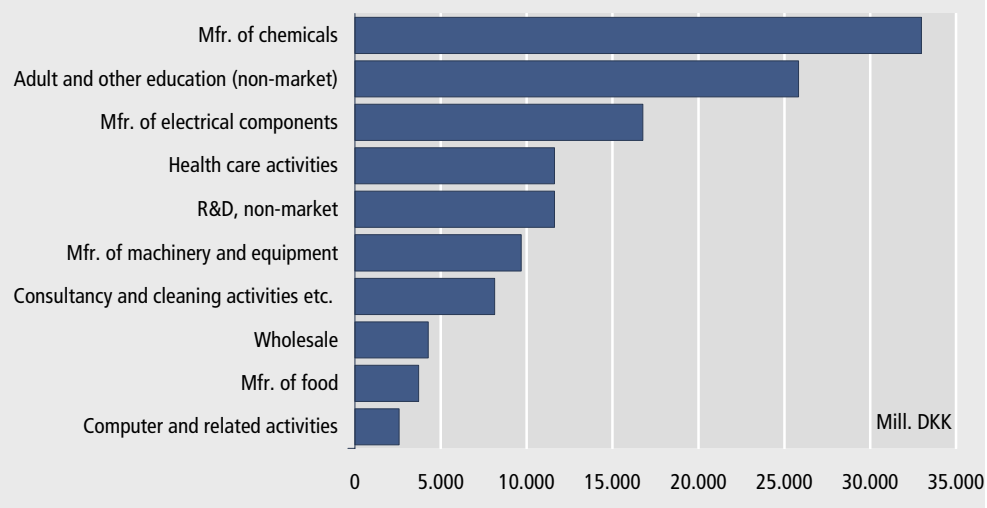


Note: The intensity of R&D capital of the industries is indicative of the share of R&D capital of the industries in question of the total amount of capital. The intensities of R&D capital are estimated on the basis of values at current prices.

Level of R&D stocks

Figure 1.8 shows 10 industries, which have the highest R&D capital at the beginning of 2003, where capital is estimated as net stock at current prices. It appears that *manufacture of chemicals* (including manufacture of drugs and medicines) accounts for the highest F&D capital, followed by *education, non-market* (including universities) and *electronics industry*.

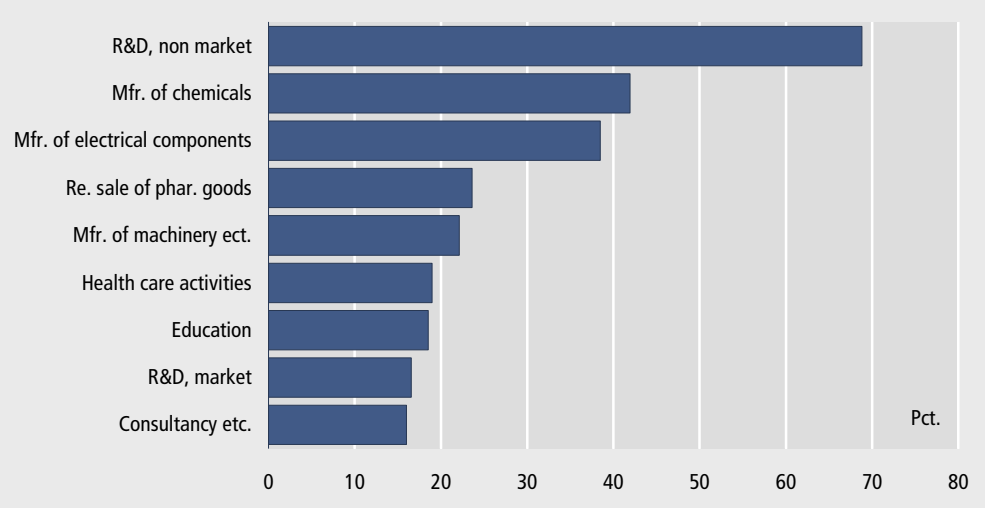
Figure 1.8 **The scope of R&D capital, detailed industry classification, current prices. 2003**



Detailed classification of industries - R&D intensity

There are great differences in the percentage represented by R&D capital of total capital among industries. The intensity of R&D capital varies from 0 pct. to almost 70 pct. of an industry's capital stock for the industries classified to the 57-grouping in the national accounts. R&D capital accounts for about 70 pct. of total capital in the industry *research and development, non-market*. This is followed by *manufacture of chemicals* and *electronics industry,* where R&D capital accounts for about 40 pct. Figure 1.9 shows the 9 most R&D intensive industries.

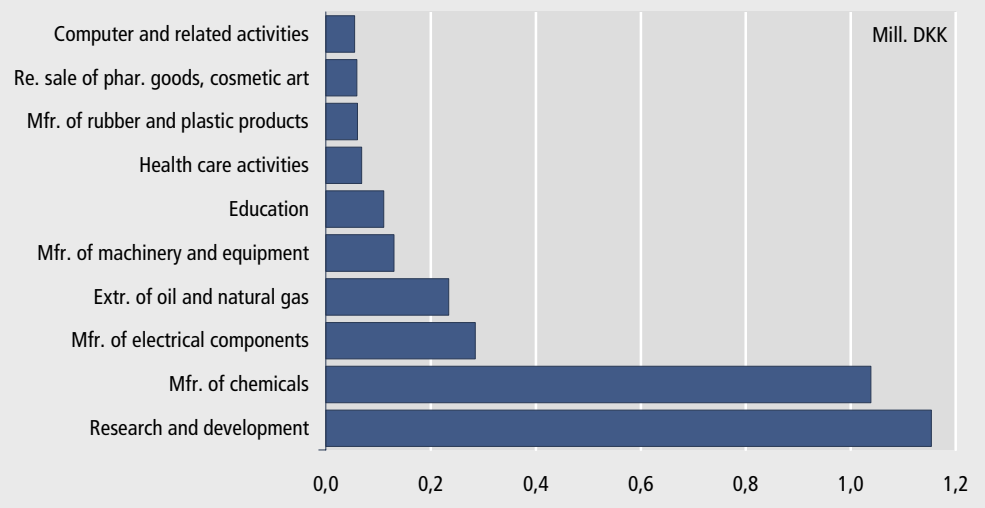
Figure 1.9 **Intensity of R&D capital, detailed industry grouping. 2003**



Note: The intensity of R&D capital of the industries is indicative of the share of R&D capital of the industries in question of the total amount of capital. The intensities of R&D capital are estimated on the basis of values at current prices.

Figure 1.10 shows the 11 industries, which have the highest R&D capital per person employed in 2002. The industry *research and development* accounts for the highest capital per person employed, with about DKK 1.1 mill. per person employed. The industry *manufature of chemicals* accounts for approximately DKK 1.0 mill. per person employed and the industry thus accounts for the second-largest R&D capital per person employed. These 2 industries rank far above the other industries.

Figure 1.10 **R&D capital per person employed, detailed industry classification. 2002**

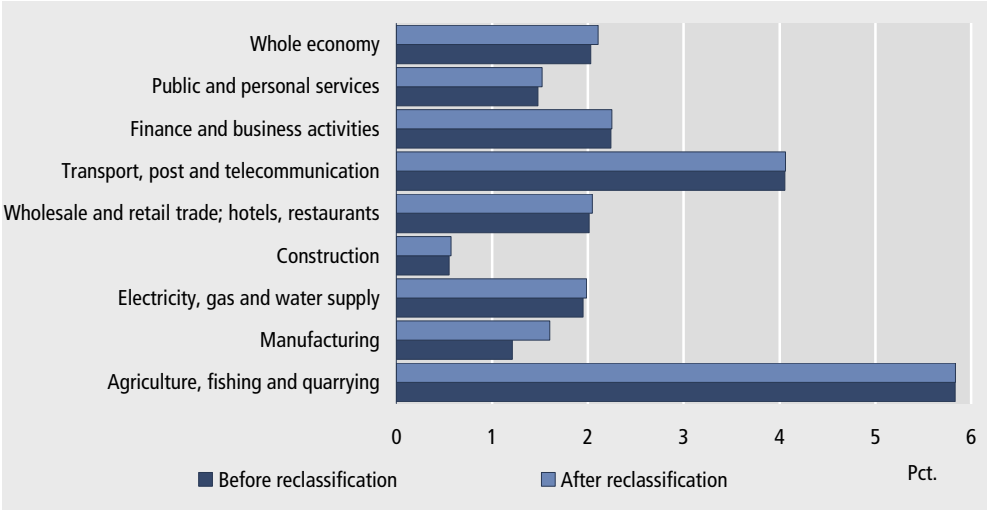


Note: R&D capital per person employed is estimated as net stock at current prices, at the beginning of the year, divided by the number of persons employed.

1.5 Revisions of gross value added broken down by industry

Reclassification of R&D expenditure has given rise to changes in real growth rates for gross value added. This is illustrated in figure 1.11, which shows the average annual growth rate for gross value added, covering the period 1990-2002 for the total economy and broken down by industry according to the 9-grouping in the national accounts. The revisions are comparatively substantial for the manufacturing industry, while there is hardly any impact on the other industries.

Figure 1.11 **Average annual real growth in Value Added, 1990-2002**



If we look at the *manufacturing industry* the growth rate is adjusted by 0.39 percentage points as the result of the reclassification. Within the manufacturing industry, it is primarily *manufacture of chemicals* and *electronics industry*, where growth rates are revised upwards.

2. General Statistics on Research and Development – Data Sources and Uses

2.1 Data sources for changes in expenditure on research and development

Definition of R&D

Under the auspieces of the OECD, agreement has been reached concerning a definition of research and development, and national expenditure on R&D is estimated in accordance with this definition in a wide number of countries – which is outlined in the Frascati manual *(Frascati Manual – Proposed standard practice for surveys on research and experimental development)*. The Frascati manual is thus the international manual on estimating R&D expenditure. In Denmark, it is the Danish Centre for Studies in Research and Research Policy, CFA, which is responsible for the collection of data on R&D in accordance with the international definitions. Danish figures for R&D are reported by CFA to OECD/Eurostat, and these can be applied in international studies measuring R&D activities.

Scope of statistics from the Danish Centre for Studies in Research and Research Policy

CFA prepares two publications on the actual scope of R&D in Denmark; one for the public sector (Research and experimental work in the public sector – research statistics 2002) and one for the private sector[2] (Research and experimental work in the business sector – research statistics 2003). The two publications provide together an overview of R&D expenditure in all sectors of the Danish economy. There is a comprehensive amount of figures, as information on R&D expenditure is also collected in addition to the collection of information on staff, financing, industry classification (NACE) and regional location.

Private business enterprises

For the private sector, the statistics are based on questionnaires sent to relevant business enterprises, as small and medium-sized enterprises only participate via sample surveys. The response rate was 63.3 pct. for the 2001 statistics. Figures are raised for business enterprises, which have not provided any reply or enterprises, which have not been selected.

Public sector

The statistics on R&D for the public sector (which also include non-profit institutions serving households) are also based on a questionnaire-based survey. However, unlike the private business sector, the survey conducted is a large-scale survey.

2.2 Frascati manual

GERD – Gross domestic Expenditure on Research and Development

The main aggregate for R&D expenditure in the Frascati manual is *Gross Domestic Expenditure on Research and Development* (GERD), constituting a statistical compilation of all expenditure paid on R&D performed domestically. The statistics on GERD are compiled by summing up the costs – compensation of employees, other current expenditure and investments in buildings and equipment - related to research and development activities. Due to the circumstance that GERD is estimated on the basis of costs, a market valuation of research and development[3] is not achieved, which is the preferred criterion of valuation in the national accounts statistics[4] (see section 3.5).

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[2] A classification of sectors is applied by the Danish Centre for Studies in Research and Research Policy, where the public sector consists of the general government sector and non-profit institutions serving households, while the private sector comprises the other sectors of the economy. In the present publication, the public sector only covers the general government sector, while non-profit institutions serving households are transferred to the *private sector.* The national accounts statistics distinguish only between the general government sector and the remaining sectors of the economy. For the last-mentioned group, *private sector* and *corporate sector* are synonymous.

[3] However, a subset of the R&D produced is sold to other units, and this subset will therefore have a market price.

[4] In accordance with the terminology of the national accounts, a distinction is made between valuation of output on the basis of market prices and valuation of output on the basis of a summation of costs, where input values are frequently valued on the basis of market prices. The first-mentioned is considered valuation of output on the basis of market prices, while the last-mentioned is considered as valuation on the basis of costs. There are no market values for output

GERD does not contain R&D conducted abroad paid by Danish operators for domestic uses, i.e. imported R&D. Furthermore, the statistics on GERD do not take exports of R&D into account, so that R&D results, which are resold, are not deducted. However, GERD includes R&D produced domestically and financed from abroad. R&D estimated in accordance with the GERD-definition cannot be regarded as a reliable indicator of the quantity of R&D available for the domestic economy, if there is a great difference in imports and exports of R&D. GERD cannot be regarded as a reliable indicator of domestic investments in R&D, but on the basis of the existing definitions, GERD can be regarded as a reliable indicator of domestic production of R&D services.

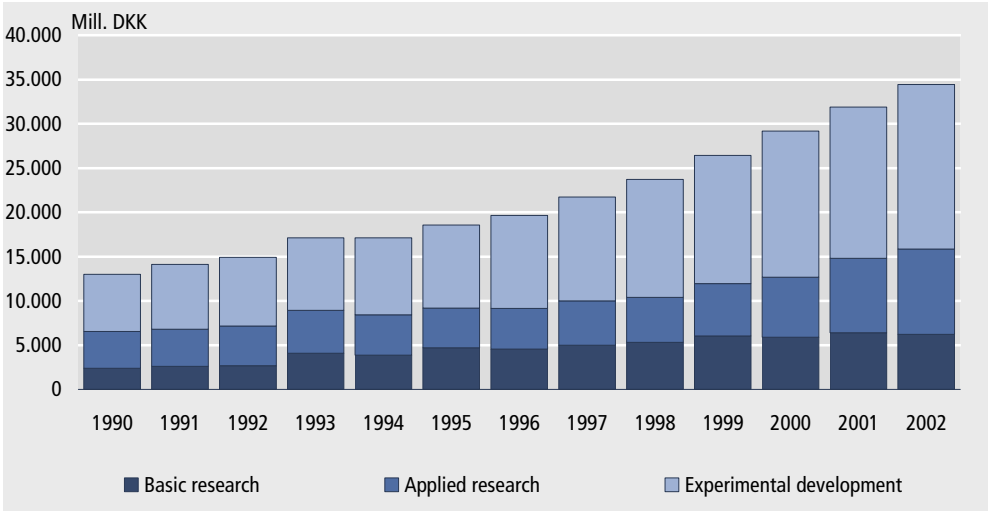
Types of research and development

In the Frascati manual, the statistics on R&D expenditure distinguish between 3 types of research and development:

- **Basic research** is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view.
- **Applied research** is also original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific practical aim or objective.
- **Experimental development** is systematic work, drawing on knowledge gained from research and practical experience that is directed to producing new materials, products and devices; to installing new processes, systems and services; or to improving substantially those already produced or installed.

R&D conducted by public research institutions, e.g. universities, is typically dominated by basic research, whereas R&D conducted by private business enterprises is typically dominated by experimental development. Figure 2.1 shows the composition of R&D in Denmark broken down by 3 types of research and development. In 2002 experimental development accounted for 54.0 pct. of total R&D expenditure, compared to 49.9 pct. in 1990, i.e an increase of 4.1 percentage points. The share of expenditure on basic research remained largely unchanged during this period, expenditure accounted for 18.2 pct. in 1990, compared to 18.0 pct. in 2002. However, there was a considerable fall in the share of applied research during the period, from 31.9 pct. in 1990 to 27.9 pct. in 2002. Total expenditure on research and development constituted almost DKK 35 bn. in 2002, compared to approximately DKK 13 bn. in 1990.

Figure 2.1 **R&D expenditure (GERD) broken down by type of research, current prices**

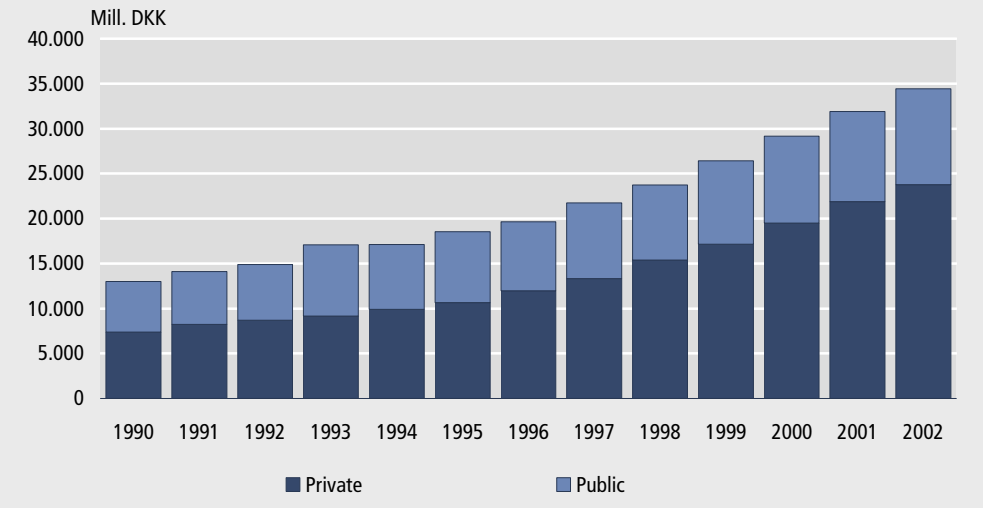


Source: Danish Centre for Studies in Research and Research Policy, OECD and own calculations.

for the general government sector, and valuation on the basis of costs is thus applied. Due to the circumstance that the general government sector represents a substantial part of the Danish economy, a substantial part of output for the Danish economy is thus cost driven. Valuation of research and development on the basis of costs is not a unique example.

Expenditure broken down by producing sector is an alternative compilation to R&D expenditure broken down by type of research. This breakdown is shown in figure 2.2. It is especially the private sector's share of the production of R&D services that has increased. In 1990 the share of R&D services accounted for 56.9 pct. and 69.0 pct. in 2002, which is an increase of 13.1 percentage points. In analogy with this the public sector's share of the production of R&D services has shown a corresponding fall.

Figure 2.2 **R&D expenditure (GERD) broken down by producing sector, current prices**



Note: The Danish Centre for Studies in Research and Research Policy defines the public sector as the general government and private non-profit institutions

Source: Danish Centre for Studies in Research and Research Policy, OECD and own calculations.

2.3 Innovation and research and development

Innovation can be regarded as output of (succesful) research and development, although other factors may also constitute input to innovation, e.g. *learning by doing*. The OECD has prepared a manual – Oslo manual – defining innovation as *new or technically improved products or processes.* However, the manual recognizes that other factors can be regarded as innovation. The method used for compiling the value of innovation is similar to R&D – the costs involved.

In accordance with the definitions of R&D and innovation, respectively in the *Oslo manual* and the *Frascati manual,* R&D is a subset of innovation. The Danish Centre for Studies in Research and Research Policy has estimated that expenditure on innovations of the business sector amounted to DKK 42.3 bn. in 2002, while the corresponding (private) research and development expenditure was estimated at DKK 23.8 bn.

2.4 Practical use of R&D statistics

Because of significant contributions of R&D to economic growth, the EU has laid down a number of objectives for the development in R&D expenditure. These objectives are based on R&D compiled in accordance with the definitions in the Frascati manual, see section 1.2.

Alternatively, the R&D statistics can be applied in compiling R&D capital stock and a growth account within the frameworks of the national accounts. However, a new definition of R&D expenditure and a reclassification of certain aagregates in the national accounts are then necessary. This is outlined in *section 3. – A satellite account for research and development.*

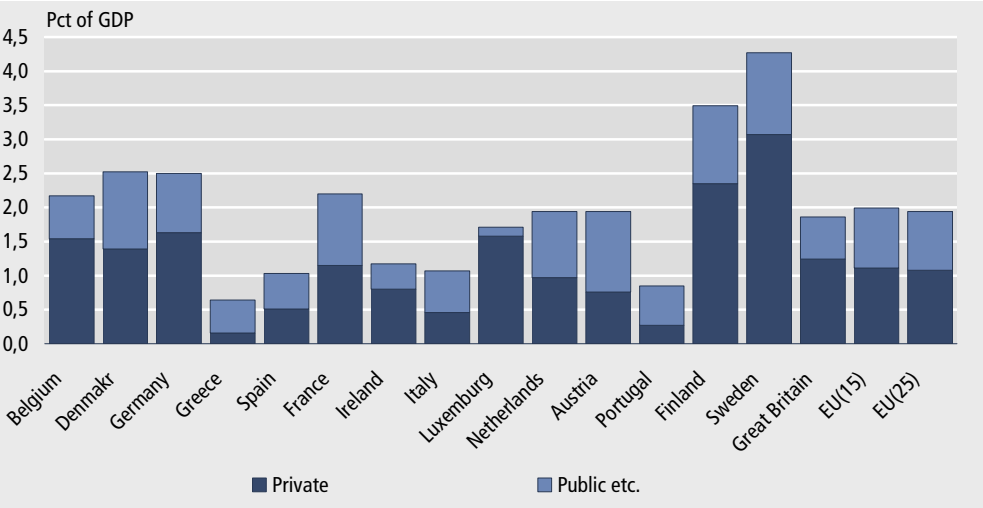
2.5 Objective for the level of R&D expenditure

Lisbon strategy

On 23-24 March 2000, the European Council held an extraordinary meeting in Lisbon, where a number of strategic objectives was adopted, to ensure that EU's Member States up until 2010 become the *most competitive and dynamic knowledge-based economy* in the world. This is to be achieved by strengthening employment and by implementing economic reforms. Simultaneously, social coherence is to be ensured within the frameworks of a knowledge-based economy. It was also recognized at the meeting that research and develop play an essential part in economic growth, employment and social coherence.

As part of the Lisbon strategy a *European Research Area* (ERA) is to be created. Furthermore, R&D activities are specifically to be strengthened by improving the environment for private research investments. R&D partnerships and new high-technology business enterprises must be supported by means of fiscal policy, risk capital and financial support from the European Investment Bank (EIB).

Figure 2.3 **R&D expenditure (GERD) as pct. of GDP, by financing sector, 2001**



Note: R&D expenditure is in accordance with the GERD definition and for 2001 or the most recently available year. The figure distinguishes between whether R&D expenditure is financed by the public sector, etc. or by the private sector. Alternatively, a distinction could be made between producing sector, see figure 2.2.

Source: Eurepean Commission (2004).

Barcelona objective

The Lisbon Strategy and its implementation were discussed at the European Council Meeting 15-16 March 2002 in Barcelona. It was decided that if the EU were to catch up with its most important "competitors", there must be a sharp increase in the general activities conducted with respect to research, development and innovation. The following objective was laid down[5]:

> *"…total expenditure on R&D and innovation in the EU must be increased, with a view to approaching 3 pct. of GDP not later than in 2010. 2/3 of these new investments should come from the private sector."*

A general notice by the EU "*Investing in research: An action plan for Europe*" from March 2003 gives an outline of how this objective of R&E expenditure accounting for 3 pct. of GDP, which was decided at the Barcelona meeting, is to be achieved by the Member States. The recommendations can be summed up by three action areas:

[5] In practice, this objective is considered on the basis of the size of R&D expenditure, according to the GERD definition, in relation to GDP. Figures for the scope of innovation are thus excluded from the objective.

- The effectiveness of the existing financial public support to R&D and innovation must be improved.
- A redistribution of funds towards R&D and innovation must be effected.
- The framework conditions for private R&D investments must be improved.

These initiatives must be coordinated, both at national level and Community level. In order to achieve the objective, the EU Commission has estimated that public R&D investments must increase by 6 pct. annually and private R&D investments must increase by 9 pct. until the year 2010.

National objectives

The objective that R&D expenditure must account for 3 pct. of GDP is aimed at the EU as a whole. It has been possible for each EU Member State to lay down its own national objectives – which may differ from EU´s total objectives – depending on their national starting point, which is the case for a number of EU Member States. A national deviation from EU's overall goal will, especially, be of relevance to countries, which are either above the goal of 3 pct. or far below. For example, in Sweden, where R&D expenditure accounts for more than 4 pct. of GDP, an objective has been laid down, which aims at maintaining the level of R&D in relation to GDP in 2010. If the national objectives for R&D in 2010 are achieved by the EU Member States, R&D expenditure as a percentage of GDP must be expected to reach about 2.5 pct. of GDP[6] and not the 3 pct., which constitutes the overall objective. Consequently, EU's Member States must, taken as a whole, exceed their national objectives to fulfil EU`s overall objective.

Danish objective

The Danish government has adopted EU`s objective for the scope of R&D expenditure in 2010, i.e. total expenditure on R&D must account (at least) for 3 pct. of GDP, where public R&D expenditure must account (at least) for 1 pct. of GDP. In 2001, R&D expenditure in Denmark reached 2.5 pct. of GDP.

Figure 2.3 shows R&D expenditure as a percentage of GDP broken down by publicly and privately paid expenditure in each EU Member State. For Japan and USA, total R&D expenditure as a percentage of GDP accounts for 3.1 pct. and 2.8 pct., respectively, compared to EU's 2.5 pct. of GDP. It can also be seen that EU Member States as a whole are about 1 percentage point from meeting the overall objective that R&D expenditure must account for 3 pct. of GDP. It also appears that two countries – Sweden and Finland – are above the goal for the EU as a whole.

[6] On the assumption of an average real growth for all EU Member States of 2 pct. until 2010.

[12] Or for R&D expenditure.

3. A Satellite Account for Research and Development

3.1 Research and development in the current national accounts

The current international manual on national accounts – *System of National Accounts 1993* (SNA93) – sets out the guidelines for compiling national accounts by the countries to promote international comparability. The manual was prepared on the basis of international cooperation between UN, OECD, IMF, EU and the World Bank, as well as the member countries of these organisations. The manual was published in 1993 and sets out the guidelines for treating R&D expenditure in the national accounts.

The manual recognizes (§ 6.163) that the character of R&D expenditure is theoretically an investment due to the circumstance that R&D expenditure generates, as a main rule, a return for the owners over a number of years, when expenditure has been paid for. Simultaneously, ownership of the R&D results will be valuable and can be sold at a positive value to third party. Taking these circumstances into consideration, such expenditure is, in practice, regarded as capital formation. However, the manual on national accounts also underlines that there are considerable practical problems involved in compiling R&D capital formation, and as a consequence of this, it has been decided, as an established custom, to treat R&D expenditure as current expenditure instead of as capital formation. As a result of this, the general national accounts published do not include statistics on investments in R&D[12], and it is therefore necessary to rely on alternative sources in order to get an idea of the scope of R&D expenditure.

3.2 Revision of the manual on national accounts

A revised edition of the international manual on national accounts, SNA93 rev.1, is to be available in 2008, and work on preparing the revision is already in progress. One of the subjects presently considered is how to treat R&D, and significant efforts had been made in order to remove the problems, which previously implied that R&D could not be regarded as capital formation.

The considerations concerning the way in which R&D is to be treated in the national accounts were made, e.g. by the *Canberra II Group on measurement of non-financial assets*, where a vast amount of analytical work was undertaken with respect to estimating R&D investments in accordance with the general national accounts standards. The future treatment of R&D in the context of the national accounts will probably be conducted in accordance with these guidelines. In the section below, national accounts are also compiled on the basis of these analyses, where R&D expenditure is reclassified to capital formation.

3.3 Is all R&D expenditure to be capitalised?

Research and development, which become freely available, do not fulfil the requirement of being regarded as capital formation[13], as these ”assets” are not in actual fact subject to enforced ownership rights by institutional units – the results can be utilised by everybody. Internationally, it seems to have been agreed that only non-freely available research and development results are to to recognized as an asset.

[13] Assets are defined In SNA93 (§ 10.2) as: ”The assets recorded in the balance sheets of the System are economic assets. These are defined as entities: (a) Over which ownership rights are enforced by institutional units, individually or collectively; and (b) From which economic benefits may be derived by their owners by holding them, or using them, over a period of time.”

However, this is only to be implemented, if research and development can, in practice, be divided into freely available and non-freely available, and consequently, it may all be regarded as capital formation. This is a change of the international attitude compared to previously, when there were clear indications that all R&D was to be capitalised, even though the elements, which were made freely available, could be identified. There is thus a change of attitude with respect to delimiting the "asset boundary" of what is to be treated as assets.

In the present publication, all expenditure on research and development is recorded as capital formation, which gives rise to an overstatement of the estimated level for investments in research and development in relation to the "true" level in accordance with the principles for estimating the national accounts. The greatest scope of freely available research and development must be expected to be found in the public sector. It will be natural in connection with the continued work in this field to examine how research and development costs are to be divided into what is freely available and what is non-freely available.

3.4 Satellite account for R&D in Denmark

A Danish satellite account for research and development in the context of the national accounts is compiled in the section below. The satellite account covers the period 1990-2003. However, the period covered by the underlying time series is longer, and R&D investments and capital stock have been estimated back to 1966. This is necessary in order to create a R&D capital stock by means of PIM - *Perpetual Inventory Method*.

Method The general procedure applied in recognizing R&D as an asset is the compilation of a bridge table between R&D expenditure estimated according to the definition of the Frascati manual and R&D production and R&D investments estimated in accordance with the national accounts principles. The selection of the method complies with the international consensus concerning the construction of satellite accounts for research and development in the context of national accounts, see e.g. *de Haan and van Rooijen-Horsten (2004)* and *Mandler and Peleg (2004)*. In relation to these studies, there are deviations in the estimation principles for calculating each individual element in the bridge table. There may, e.g. be differences in the methods applied for conducting adjustments of software investments included in GERD. When output and investments for R&D estimated in accordance with the national accounts principles are known, the present national accounts are adjusted so that R&D are treated as capital formation.

3.5 R&D investments estimated on the basis of costs

The primary data for compiling a satellite account for research and development are insufficient in the current national accounts. Against this background, it is essential to include alternative data sources. Expenditure data for research and development supplied by the *Danish Centre for Studies in Research and Research Policy (CFA)* covering the period 1981-2002[14], have been applied. Another important source for conducting the estimates is Statistics Denmark's employment statistics showing earnings and number of employees broken down by employment category (DISCO code numbers) and industry.

GERD R&D expenditure estimated in accordance with the GERD definition *(Gross Domestic Expenditure on Research and Development)* is the main aggregate in the R&D statistics compiled by CFA (see section 1.2). This aggregate can be regarded as an indicator for

[14] Detailed statistics showing R&D expenditure are only compiled for each second year before 1997.

domestic output of R&D. R&D in accordance with this definition is estimated as the sum of wage and salary costs, current expenditure and investments in buildings and equipment related to the research and development activity defined in accordance with the Frascati manual.

Observed market prices (purchase prices) are the optimum method for valuing investments for each R&D service. There is, in practice, no great trade in R&D services, and in the light of this, it is necessary to estimate R&D investments on the basis of costs. When output is to be determined on the basis of costs for a market producer the following componets are added; compensation of employees (wage and salary costs), intermediate consumption (current expenditure), consumption of fixed capital (depreciations), other production taxes less other production subsidies (subsidies, net) and net operating surplus. In the case of a public non-market producer, the same calculation of costs is applied, except for the fact that it is customary to exclude net operating surplus.

To estimate investments in accordance with the definitions in the national accounts, it has, generally speaking, been necessary to conduct the following adjustments in R&D expenditure, estimated in accordance with the GERD definition:

- Investments in buildings and equipment are replaced by an estimate for consumption of fixed capital.
- An estimate for net operating surplus is added.
- Overlapping investments in software have been excluded.
- An estimate for subsidies is added.
- Purchases and sales of R&D among industries, sectors and abroad are adjusted.

Table 3.1 shows the transition between R&D expenditure according to the definition (GERD) in the Frascati manual, to respectively *output of R&D services (column 7)* and *R&D investments (column 9)* according to the national accounts principles (NA definition) as established by the international manual on national accounts (SNA93).

Table 3.1 Bridge table between R&D in accordance with the GERD definition and NA definition

Year	GERD	Gross fixed capital formation included in GERD	Consumption of fixed capital	Software	Subsidies, net	Return to capital	R&D output	Output for the account of a third party (imports / exports)	R&D gross fixed capital formation
	1	2	3	4	5	6	7	8	9
	Current prices, DKK mill.								
2002	34 432	3 501	3 563	5 306	-172	2 225	31 242	109	31 351
2001	31 883	3 492	3 235	4 093	-195	2 036	29 374	641	30 015
2000	29 008	3 640	2 958	3 614	-194	2 002	26 521	77	26 597
1999	26 420	3 346	2 779	3 196	-218	1 741	24 181	-488	23 693
1998	23 731	2 399	2 605	3 463	-222	1 662	21 915	-210	21 705
1997	21 749	1 891	2 461	2 966	-264	1 713	20 802	-308	20 494
1996	19 656	1 737	2 232	2 552	-301	1 247	18 545	-849	17 697
1995	18 545	1 737	2 099	1 937	-264	1 348	18 054	-1 389	16 664
1994	17 120	2 048	1 896	1 671	-287	1 330	16 340	-1 096	15 244
1993	17 099	3 167	1 735	1 454	-245	992	14 960	-802	14 158
1992	14 896	2 129	1 555	1 339	-252	1 157	13 889	-615	13 274
1991	14 100	1 930	1 472	1 264	-190	899	13 087	-427	12 660
1990	12 996	1 623	1 315	1 201	-192	745	12 040	-293	11 747

Note: Column 7 = 1-2+3-4+5+6, while column 9 = 7+8.

3.6 Consumption of fixed capital replaces capital formation

The Frascati manual's defintion of R&D expenditure is given by a summation of the following components wage and salary costs, current expenditure and investments in buildings and equipment. This does not correspond with the customary practice in the national accounts for estimating output on the basis of costs. In the national accounts, consumption of fixed capital is applied, instead of capital formation. The reason why consumption of fixed capital is applied in the national accounts, instead of capital formation is that consumption of fixed capital – depreciation of the capital goods – constitutes the *annual* costs[15] involved in maintaining the capital goods. Simultaneously, the costs have been distributed over the entire service life of capital stock, but if investments are applied, then the costs involved in possessing capital stock are regarded as initial over the service life of capital stock. If there are great fluctuations from year to year in the acquisitions of capital stock, there will also be great fluctuations in the compilation of costs by applying investments, while consumption of fixed capital will provide a more even cycle of costs over time.

In the present publication, fixed capital is estimated as a mark-up on the sum of wage and salary costs and intermediate consumption at the level of industries. The mark-up rate is obtained from the general national accounts at industry level, where the consumption of fixed capital's share of compensation of employees and intermediate consumption can be simply estimated. This calculation method implicitly assumes that it is just as capital intensive to produce R&D services as other output.

3.7 Overlaps with software

There is an element of research and development expenditure targeted at software development included in the compilation of GERD. The Frascati manual, e.g states explicitly (§ 151) that innovation of software for homebanking is to be included in R&D expenditure, which is already included in investments in software in the national accounts, and must therefore be excluded to avoid duplicate imputation. CFA has asked (2002) what is the purpose of the business enterprises' R&D expenditure. CFA has established that approximately 14 pct. of R&D expenditure is related to output of software. However, there is no classification by industry.

On the basis of detailed information on employment categories at industry level from the employment statistics broken down by employment categories, it is possible to create two employment categories (wage and salary costs), software programmers and researchers, where the share of software programmers accounts for approximately 14 pct. of the size of the two groups. The ratio between these two groups is applied in adjusting software at industry level.

3.8 Other production taxes less subsidies (subsidies, net)

The *other production taxes less subsidies (subsidies, net)* paid or received by a business enterprise increase or reduce a business enterprise's production costs. Given that subsidies are dominant, the sales price demanded by the business enterprise for its products will be reduced, concurrently with the value of *subsidies, net*[16]. The greater

[15] There is also indirect expenditure in the form of alternative costs involved in the amounts of money tied to the captial stock. See section 3.9 on return on fixed capital.

[16] A business enterprise receiving a subsidy can, in principle, decide to make adjustments in the surplus (return on fixed capital), instead of adapting the sales price. If this is the case, it will, however, not have an impact on the requirement of making a supplement concerning subsidies. Instead, the estimation of return on fixed capital must take this adjustment of the return on fixed capital into account. The calculation of the return on fixed capital is described in section 3.9.

the subsidy, the lower the sales price. When the production value is estimated on the basis of costs, then the production value must be reduced by the value of the *subsidies, net*. Figures for *subsidies, net* are known from the national accounts, as the relevant production subsidies for R&D can be directly identified.

3.9 Return on fixed capital

When compiling the value of output on the basis of costs, it is necessary to add a supplement to the costs for the return – after deduction of consumption of fixed capital – which owners of the capital stock is to be paid in order to tie up money in the capital stock[17], instead of an alternative placement. This return to owners is estimated as a mark-up on wage and salary costs and current expenditure on the basis of the general ratio between net operating surplus and compensation of employees as well as intermediate consumption at industry level. This calculation implies that it is assumed that R&D output is just as capital-intensive as other output in the industry, and that the net return from the R&D asset does not differ from the return from other assets.

3.10 Production of R&D services for the account of a third party

R&D services for the account of a third party are, to some extent, produced among operators. This implies that the output in an industry is not identical to the investment in R&D. It is thus necessary to compile these flows to estimate the actual investments at industry and sector level. The information from CFA on purchases and financing is used for determining the general level for production of R&D for the account of a third party. At a more detailed industry level, information on R&D broken down by product group is used. These products are transferred to characteristic industries (the industry which typically produces the product in question). For example, it assumed that R&D for *raw material from agriculture, forestry and fishery* produced by the *knowledge service industries* have been sold to industries in agriculture, forestry and fishery[18].

If the figure in the item production of R&D services for the account of a third party is considered for the total economy – which is equal to the difference between R&D production and R&D investments – then the value corresponds to net exports, see table 3.1.

3.11 Classification of industries

Classification of industries

An additional industrial classification of R&D investments is conducted in the satellite account for R&D in the context of the national accounts, compared to the classify-cation known from CFA. CFA publishes figures distributed to approximately 30 industries, whereas investments in the satellite account of the national accounts are distributed to the 57-grouping in the national accounts, however, not all 57 industries have R&D investments. Statistics Denmark's employment statistics showing compensation of employees and number of employees broken down by employment category (DISCO code numbers) and industry are the source for this additional split-up. The split-up has been conducted by including information on employment of persons engaged in research-like occupational categories (broadly speaking) broken down by industry. Furthermore, a number of assumptions with respect to the production of

[17] The return on fixed capital is often assumed to be consistent with the national accounts aggregate net operating surplus. This is also the case in this publication.

[18] For reasons of confidentiality, the Danish Centre for Studies in Research and Research Policy, CFA has not made the complete product distribution for 50-products available, implying that a less detailed production classification is used.

R&D services for the account of a third party have been made, see section 3.10. This means that investing industries are not necessarily similar to producing industries.

Uncertainty

There is, of course, some degree of uncertainty related to the classification of industries, implying that the classification of industries must be interpreted with caution. Firstly, Statistics Denmark has had no access to the underlying data reported in the questionnaires to establish which business enteprises report data, and we have therefore not been able to check whether CFA's classification of industries[19] is correct in accordance with the definitions in the national accounts. It has not been possible to study the reports underlying the NACE group *(51.6) wholesale trade of machinery, equipment and accessories;* this is a place where it is not assumed a priori that there are great amounts of expenditure on R&D, which is the case for the figures from CFA, showing DKK 500 mill. in 2002. Secondly, the method of using information on employment categories implies that relatively great amounts of R&D expenditure are transferred to the national accounts group *(52300) retail sale of pharmaceutical goods, cosmetic articles, etc.* as there are many persons employed in this industry, who fall within the employment categories, which are defined as being of R&D relevance.

3.12 Constant prices

The calculation of R&D output at constant prices is conducted by input deflation of each input component – compensation of employees, intermediate consumption, consumption of fixed capital, subsidies and net operating surplus. Input deflation is not an optimum solution, as it is preferable to use real price or quantity indices for output. Unfortunately, such indices are not available, which could have provided a satisfactory result. The same price indices have been used for both own account production of R&D and R&D produced for the account of a third party.

[19] The Danish Centre for Studies in Research and Research Policy has distributed all R&D activities to the industry in which the business enterprise in question has its main activity. From 2002, studies into which industries the R&D results are of relevance have also been conducted.

Table 3.2. R&D investments according to the definitions in the national accounts

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
	R&D investment, DKK mill.									
R&D investments, current prices	14 158	15 244	16 664	17 697	20 494	21 705	23 693	26 597	30 015	31 351
R&D investments, 2000 prices	17 943	18 370	19 608	20 119	22 093	22 967	24 338	26 597	29 761	30 329
	price trends, 2000=100									
GDP deflator	86.4	88.3	89.5	91.6	94.0	95.4	96.9	100.0	102.5	104.1
R&D investments, deflator	78.9	83.0	85.0	88.0	92.8	94.5	97.4	100.0	100.9	103.4

The following deflators for the input components are applied in estimating R&D output at constant prices:

- **Compensation of employees**: Weighting of 2 indices of earnings: 1) Trends in the compensation of employees per man-year for persons engaged in research and development activities, according to the R&D statistics from CFA (broken down by persons employed in the public and private sector and 2) Statistics Denmark's general indices of earnings for the manufacturing industry and the private sector, respectively.
- **Intermediate consumption**: Implicit price indices from the national accounts for intermediate consumption at the level of industries.
- **Consumption of fixed capital**: Implicit price indices from the national accounts for consumption of fixed capital at the level of industries.
- **Subsidies**: The base year's percentage rate[20] for subsidies.
- **Net operating surplus**: The base year's percentage rate for net operating surplus.

Applying the base year's percentage rate for net operating surplus in calculations at constant prices for industries with relatively large and varying net surpluses, may give rise to fluctuations in the estimated price trends. This especially applies to the industry *extraction of oil and natural gas.*

Table 3.2 shows trends in R&D investments at current prices and at constant 2000 prices, respectively, as well as the associated implicit price indices. It appears from the table that price trends up until the year 2000 are more substantial for R&D investments than for price trends generally estimated by means of the GDP deflator.

3.13 Capital stock

When the R&D investments are known, it is a comparatively easy task to estimate R&D capital stock and consumption of fixed capital, as only assumptions for service lives and survival functions are missing. The following service lives – dependent on the type of research – have been applied for capital stock, as almost all industries[21] have been provided with the same service life:

- Basic research: 13 years
- Applied research: 11 years
- Experimental development: 9 years

[20] When an input component is deflated by means of the base year's percentages, the value of the input component as a percentage of the basic price from the base year for all years, is maintained, where the input component is estimated at constant prices. For example, if the value during the base year of an input component is 13 pct. of the basic price, the value of the input component at constant prices will be 13 pct. of the basic price at constant prices for all years.

[21] There may be a few deviations at industry level, if there is an estimate for the service life of R&D investments in the industry.

Australian survey

The assumptions concerning service lives are inspired by a study from the Australian Bureau of Statistics, which has examined for how long patents are maintained. In Australia, the patentee must, 5 years after the issue of patent, pay an amount each year in order to maintain the patent. The period of time for which the patent is maintained indicates how long time the economic value of research and developments results has lasted, i.e. the economic service life of the R&D results. The studies have shown that the average time for maintaining a patent is 9 years.

Service life depends on the type of research

It is assumed in the calculations of capital stocks that experimental development is typically protected by patents, and against this background the average service life of this type of research is fixed at 9 years. It is also assumed that the service life of basic research and applied research is slightly higher, as the possibilities of utilization for these types of research are somewhat broader than is the case for experimental development.

Uncertainty

The selection of service life has a direct impact on the level of net stocks. The longer a capital asset is expected to live, the greater the net stock. Consequently, the assumption concerning service lives is of great importance to the level of capital stocks, and the statistical uncertainty, which is naturally inherent in the selection of service lives, is reflected in a corresponding uncertainty for the level of stocks.

Winfrey S3 survival function has been selected as survival function. It is the same function, which is applied for most of the traditional capital stock.

Table 3.3 shows the result from the calculations of the capital stock for R&D calculations covering the total economy.

From 1992 to 2003 the net stock – estimated at constant 2000 prices – rose from DKK 130 bn. to DKK 230 bn., corresponding to a total increase of 77 pct. or 5.3 pct. on average per year. The increase in the net stock is the result of increasing R&D investments. Estimated at constant 2000 prices, R&D investments increased from DKK 16.7 bn. in 1992 to DKK 30.3 bn. in 2003, corresponding to a total percentage increase of 81 pct. or 5.5 pct. annually.

Table 3.3. R&D capital stock

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
	current prices, DKK mill.											
Gross stock	100 274	107 108	115 592	126 006	136 399	149 109	162 635	175 205	189 751	204 267	234 830	269 846
Net stock	57 276	61 080	65 793	71 388	77 054	83 904	91 640	98 823	107 249	116 022	135 133	155 901
Investments	13 274	14 158	15 244	16 664	17 697	20 494	21 705	23 693	26 597	30 015	31 351	…
Consumption of fixed capital	10 558	11 097	12 275	13 198	14 300	15 798	16 894	18 270	19 789	21 233	23 823	…
	constant 2000 prices, DKK mill.											
Gross stcok	129 854	136 034	143 081	150 086	157 792	165 315	174 091	182 914	192 318	203 192	216 549	229 727
Net stock	74 152	77 526	81 411	85 005	89 130	93 007	98 061	103 112	108 656	115 465	124 263	132 330
Investments	16 764	17 943	18 353	19 608	20 109	22 093	22 967	24 338	26 597	29 761	30 329	…
Consumption of fixed capital	13 388	14 058	14 755	15 478	16 226	17 040	17 912	18 793	19 789	20 997	22 263	…

Note: Stock are estimated at the beginning of the year.

3.14 Adjusted national accounts

When capital formation, capital stock, and the associated consumption of fixed capital for R&D are known, it is possible to compile national accounts, where R&D is treated as capital formation. The results from these calculations are shown in the present section. Such statistics are naturally subject to some degree of uncertainty, as the primary data are insufficient, especially with respect to the production of R&D services for the account of a third party.

Assumptions

In addition to knowledge of capital formation and consumption of fixed capital concerning R&D, it is necessary to make a number of additional assumptions to compile a R&D satellite account in the context of the national accounts. These assumptions are:

- All amounts of expenditure for research and development must be regarded as capital formation – also expenditure on R&D, which is made freely available.
- Research and development (in addition to the part, which is made up by software) are not already partially transferred to capital formation in the current national accounts[22].
- The compilation of R&D expenditure (GERD) from CFA provides complete coverage of R&D expenditure paid in Denmark.
- R&D services produced for the account of a third party are included in R&D expenditure (GERD) estimated by CFA.
- The results from paid R&D expenditure can immediately be used, i.e. there is no difference between when the expenditure was paid and when the results are used.

Corrections to the national accounts

The following corrections to the national accounts have been made to reclassify R&D expenditure:

- *Production and capital formation* for the corporate sector are increased due to the recognition of *own account production* of R&D.
- The *production of R&D services for the account of a third party* (purchases of R&D services by the corporate sector) is reclassified from *intermediate consumption* to *capital formation.*
- The *value of output* and government consumption expenditure for the general government sector is supplemented as the result of new *consumption of fixed capital* with respect to the R&D capital for the general government sector.
- *Production of R&D services for the account of a third party* (purchases of R&D services by the general government sector) is reclassified from *government consumption expenditure* to *capital formation.*
- *Own-accout production of R&D* carried out by the general government sector is reclassified from *government consumption expenditure* to *capital formation*.

[22] A number of business enterprises may consider to capitalise their expenditure on R&D in their accounts, and if this is the case, capital formation in the context of the national accounts can de facto include R&D – i.e. classified as another type of capital formation – as the accounts data of the business enterprises form the basis of the compilation of capital formation in the national accounts.

Table 3.4. Impact on reclassification of R&D in the national accounts, current prices. 2002

	ENS95-kode		Before reclassification	After reclassification	Effect of reclassification
			current prices, DKK mill.		
		Account 0: Goods and services			
1	P.1	Output	2 325 440	2 350 171	24 731
2	D.21-D.31	Taxes less subsidies on products	197 102	197 102	
3	P.7	Imports of goods and services	568 189	568 189	
4		**Resources (1+2+3)**	3 090 731	3 115 462	24 731
5	P.2	Intermediate consumption	1 149 805	1 144 518	- 5 287
6	P.3	Final consumption expenditure	1 012 468	1 011 134	- 1 334
7	P.3	from this Government consumption expenditure	360 212	358 878	- 1 334
8	P.3	from this private consumption expenditure	652 256	652 256	
9	P.51+P.53	Government consumption expenditure	270 845	302 196	31 351
12	P.52	Changes in inventories	9 297	9 297	
14	P.6	Exports of goods and services	648 317	648 317	
15		**Uses (5+6+9+12+14)**	3 090 732	3 115 463	24 731
		Account 1 : Production			
1	P.1	Output	2 325 440	2 350 171	24 731
2	P.2	Intermediate consumption	1 149 805	1 144 518	- 5 287
3	B.1g	Gross value added (1-2)	1 175 635	1 205 652	30 017
4	D.21-D.31	Taxes less subsidies on products	197 102	197 102	
5	B.1*g	Gross domestic product (3+4)	1 372 737	1 402 754	30 017
6	K.1	Consumption of fixed capital	222 999	246 039	23 040
8	B.1*n	Net domestic product (5-6)	1 149 738	1 156 715	6 977
		Account 2.1.1 : Generation of income			
1	B.1*g	Gross domestic product	1 372 737	1 402 754	30 017
2	D.21-D.31	Taxes less subsidies on products	197 102	197 102	
3	B.1g	Gross value added (1-2)	1 175 635	1 205 652	30 017
4	D.29-D.39	Other taxes less subsidies on production	658	658	
5		Gross domestic product at factor cost (3-4)	1 174 977	1 204 994	30 017
6	D.1	Compensation of employees (payable by res. prod.)	743 625	743 625	
7	B.2g+B.3g	Gross operating surplus and mixed incl. (5-6)	431 352	461 369	30 017
8	K.1	Consumption of fixed capital	222 999	246 039	23 040
9		Net operating surplus (7-8)	208 353	215 330	6 977
		Account 2.1.2, 2.2 and 2.4			
1	B2g+B.3g	Gross operation surplus and mixed income	431 352	461 369	30 017
2	D.1	Compensation of employees (received by res. employees)	742 956	742 956	
3	D2.+D4	Taxes on production and imports	204 271	204 271	
4	D.3	Property income, net from ROW	- 22 059	- 22 059	
5	B.5*g	Gross national income (1+2+3+4)	1 356 520	1 386 537	30 017
6	D.5	Current taxes on income, wealth etc. from ROW	1 233	1 233	
7	D.6+D.7	Social contributions and benefits	- 31 029	- 31 029	
8	B.6	Gross national disposable income (5+6+7)	1 326 724	1 356 741	30 017
9	P.3	Final consumption expenditure	1 012 468	1 011 134	- 1 334
10	B.8g	Gross savings (8-9)	314 256	345 607	31 351
		Account 3.1: Capital			
1	P.51+P.53	Gross fixed capital formation	270 845	292 282	21 437
		Account 4.1: Primo status account			
1	AN.11	Fixed capital	4 111 365	4 190 134	78 769
		Account 4.2: Change in status account			
1		Fixed capital	99 377	108 439	9 062
		Account 4.3: Ultimo status account			
1	AN.11	Fixed capital	4 210 742	4 298 573	87 831

Table 3.4 shows extracts from the structure of the national accounts at current prices for 2002 before the reclassification of R&D expenditure, after the reclassification and the total impact on the reclassification. It is thus possible to get an overall overview of the impacts on the reclassification.

Decomposition of GDP

An overall upward adjustment of GDP by approximately DKK 30 bn. from DKK 1.373 bn. to DKK 1.404 is conducted in 2002 as the result of the reclassification of R&D, see table 3.4. The reason for the increase in the level of GDP is explained by 3 factors:

(1) Purchased R&D is reclassified from *intermediate consumption* to *capital formation*, (2) The *value of output* for own-accout production of research and development for private producers is supplemented and (3) *The public production value* is increased as the result of new R&D consumption of fixed capital for the general government sector. The scope of of these 3 factors appears from table 3.5.

Table 3.5 **Decomposition of the correction to GDP, current prices DKK mill. (1990 and 2002)**

	1990	2002
	DKK mill.	
1 **GDP before reclassification**	**840 648**	**1 372 737**
Private sector		
2 Purchased R&D services (from intermediate consumption to capital formation)	477	5 287
3 Own accounts production of R&D services (supplement to output)	6 286	16 151
General government sector		
4 New depreciations concerning R&D (supplement to output)	3 944	8 580
5 **GDP after reclassification (1+2+3+4)**	**851 355**	**1 402 754**

Table 3.6 below shows the results from the capitalisation of research and development in the national accounts for gross domestic product (GDP), net domestic product (NDP), capital formation and capital stock for the whole period 1990 to 2002. It appears that the new R&D investments have especially an impact on the level of GDP, capital formation and capital stocks, at current prices.

Table 3.6. Results from the adjustment to the national accounts figures (I)

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
		current prices, DKK bn.												
GDP	before adjustm.	841	874	907	912	977	1 020	1 069	1 126	1 164	1 213	1 294	1 336	1 373
GDP	after adjustment	851	886	919	925	991	1 034	1 086	1 145	1 185	1 236	1 320	1 365	1 403
GDP	**adjustm., pct.**	**1.27**	**1.33**	**1.39**	**1.41**	**1.43**	**1.45**	**1.55**	**1.70**	**1.83**	**1.88**	**2.00**	**2.17**	**2.19**
NDP	before adjustm.	714	739	767	767	825	862	902	949	979	1 018	1 090	1 122	1 150
NDP	after adjustment	715	741	769	769	827	863	905	952	984	1 023	1 096	1 130	1 157
GDP	**adjustm., pct.**	**0.26**	**0.26**	**0.26**	**0.23**	**0.21**	**0.18**	**0.26**	**0.36**	**0.45**	**0.45**	**0.56**	**0.69**	**0.61**
Cap. formation	before adjustm.	166	165	162	156	170	189	200	222	240	242	263	266	271
Cap. formation	after adjustment	177	177	175	170	185	206	218	243	262	266	289	296	302
Cap. formation	**adjustm. pct.**	**7.09**	**7.68**	**8.20**	**9.09**	**8.99**	**8.82**	**8.83**	**9.22**	**9.05**	**9.78**	**10.12**	**11.29**	**11.58**
Fixed aasets	before adjustm.	2 714	2 858	2 961	3 049	3 128	3 192	3 289	3 405	3 522	3 657	3 781	3 987	4 111
Fixed assets	after adjustment	2 738	2 886	2 992	3 083	3 164	3 232	3 332	3 451	3 574	3 714	3 844	4 057	4 190
Fixed assets	**adjustm., pct.**	**0.91**	**0.98**	**1.05**	**1.11**	**1.17**	**1.25**	**1.29**	**1.37**	**1.47**	**1.56**	**1.67**	**1.76**	**1.92**
		percentage annual real growth												
GDP	before adjustm.,		1.29	1.46	-0.76	4.85	2.93	2.47	2.67	1.76	2.76	3.28	0.70	0.58
GDP	after adjustment		1.33	1.49	-0.71	4.83	2.93	2.57	2.77	1.89	2.79	3.41	0.91	0.60
GDP	**difference**		**0.04**	**0.04**	**0.05**	**-0.03**	**0.00**	**0.10**	**0.10**	**0.12**	**0.03**	**0.13**	**0.21**	**0.01**
Cap. formation	before adjustm.		-3.48	-2.94	-5.65	7.09	11.27	4.36	8.91	7.45	-0.88	7.60	-1.36	0.27
Cap. formation	after adjustm.		-2.94	-2.64	-4.56	6.64	10.85	4.20	8.99	7.14	-0.30	7.75	-0.14	0.44
Cap. formation	**difference**		**0.54**	**0.30**	**1.08**	**-0.45**	**-0.42**	**-0.16**	**0.08**	**-0.31**	**0.58**	**0.15**	**1.22**	**0.17**

The corrections made to the net domestic product (NDP) are considerably smaller, compared to GDP, which is due the circumstance that an opposite adjustment is conducted as a consequence of increasing consumption of fixed capital.

There is a clear tendency over time that the corrections are greater and greater, and this applies irrespectively to GDP, NDP, gross fixed capital formation and fixed assets. This must naturally be considered in relation to the relatively increasing expenditure paid with respect to R&D. The corrections made to capital formation are greater than

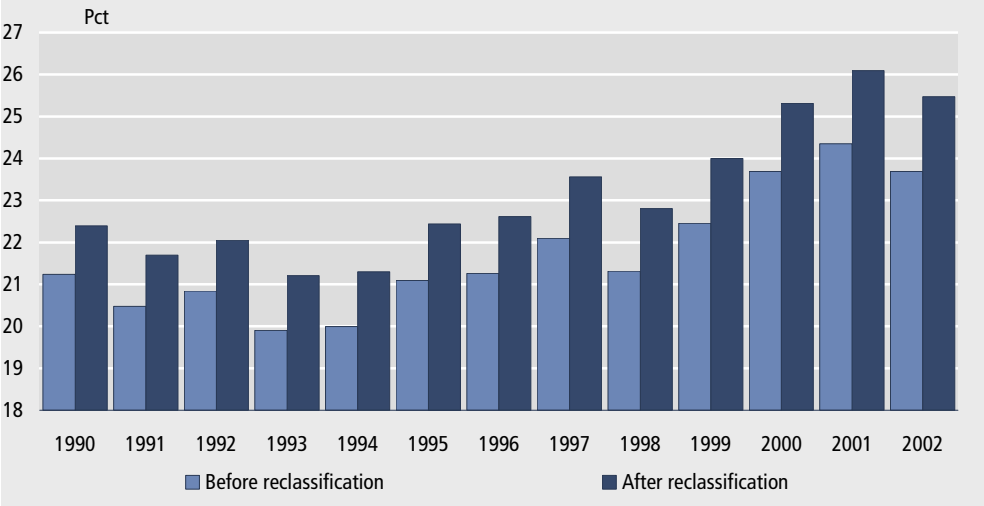
the corrections made to stocks of fixed assets, which must be considered in relation to the composition of the stocks, where buildings and structures – with a comparatively long service life – make up the greater part of the stocks.

Table 3.7. Results from the adjustment to the national accounts figures (II)

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
		current prices, DKK bn.												
Gross operating surplus	before adjustment	271	287	308	305	341	352	362	378	366	380	430	426	431
Gross operating surplus	after adjustment	282	298	320	318	355	367	379	397	387	402	456	455	461
Gross operating surplus	**difference, pct.**	**3.95**	**4.06**	**4.09**	**4.22**	**4.09**	**4.19**	**4.59**	**5.07**	**5.81**	**6.02**	**6.01**	**6.80**	**6.96**
Gross savings	before adjustment	171	171	181	175	188	208	220	241	241	264	292	314	314
Gross savings	after adjustment	183	184	194	189	204	225	237	262	262	288	319	344	346
Gross savings	**difference, pct.**	**6.87**	**7.41**	**7.33**	**8.11**	**8.10**	**8.00**	**8.06**	**8.50**	**9.02**	**8.98**	**9.10**	**9.57**	**9.98**

Real growth of GDP is – seen over a long period of time – adjusted slightly upwards by the reclassification of R&D expenditure. Please note that the increase in real growth of GDP must not be interpreted as the R&D capital stock's contribution to real growth. It is necessary to calculate and construct a growth account in order to find these impacts. The impact on real growth in capital formation shows a slightly more fluctuating tendency.

Figure 3.2 **Saving ratio, total economy, pct.**



Note: The saving ratio is estimated as gross savings divided by gross national disposable income.

If the impact on incomes (table 3.7) after reclassification of R&D expenditure is onsidered, it appears that corporate earnings – estimated on the basis of gross operating surplus – are adjusted upwards. The reclassication has no impact on compensation of employees. The upward adjustment of gross operating surplus is mainly due to the fact that output is adjusted upwards, and to a smaller extent, that intermediate consumption is adjusted downwards.

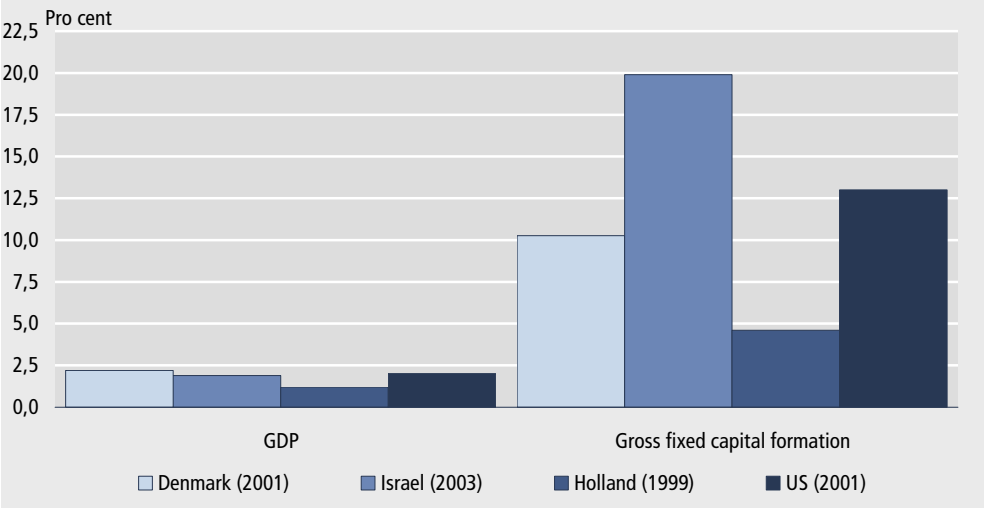
There is also an upward adjustment of total gross savings, see table 3.7. There is a very substantial and increasing upward adjustment over time – an indication of the increasing importance of research and development activities. Lack of capitalisation of intangible assets (also other than R&D) results in an incorrect valuation of real savings. There is an understatement of gross savings for national economies with major "investments" in non-capitalised intangible assets. Against this background, there are problems involved in conducting comparisons of gross savings among countries with different degrees of expenditure on non-capitalised intangible assets.

Figure 3.2 shows trends over time in the saving ratio before and after the reclassification of research and development costs. As a result of the increasing upward adjustment of gross savings, the upward adjustment of the saving ratio will also be greater over time. The saving ratio is indicative of the percentage of the income created domestically, which can be used for capital formation without the need of any foreign co-finaning.

3.15 International comparison

Denmark is not the only country where the impact on classification of research and development in the national accounts has been investigated. Figure 3.3 shows a comparison of the impact on reclassification of R&D in Denmark, with corresponding estimates from Israel, Netherlands and USA. It appears from the figure that there are, especially, differences in the impact on reclassification of investments. There are methodological differences in the statistics due to the circumstance that full international consensus has not been achieved, with respect to the principles for capitalising research and development. To this is added that there may be some degree of uncertainty related to the compilation of statistics on R&D costs. This implies that a firm interpretation should not be put on the differences shown among the selected countries.

Figure 3.3 **International comparison of the impact on reclassification of R&D**



Note: The figures indicate (as a percentage) the size of the adjustments of GDP and gross fixed capital formation (at current prices) as a consequence of the reclassification of R&D. Gross fixed capital formation for the USA also contains changes in inventories. There are some methodological differences in the satellite accounts for research and development in the context of the national accounts. For example, freely available research and development may be included in research and development in R&D investments (Denmark, Israel and USA), or it may be assumed that R&D results can be directly applied (Denmark).
Source: Fraumeni and Okubo (2002), de Haan and van Rooijen-Horsten (2004), and Peleg, Brenner and Zalewsky (2005), other supplied information as well as own estimates.

3.16 Conclusion – Research and development are of importance

Important competitive parameter

Research and development are an important competitive parameter for business enterprises and consequently for each individual country. This is broadly recognized and is reflected in, e.g. the Danish government's and EU's general objective that R&D expenditure must account for at least 3 pct. of GDP in 2010. The importance of R&D can be explained by the contribution of R&D to creating well-paid employment and economic growth.

Different compilation methods

This theme publication shows the size of R&D according to 2 different definitions: the definition in the Frascati manual (GERD - Gross domestic Expenditure on Research and Development) and the principles applied in the national accounts. The present section outlines the most important conclusions drawn with regard to development and share of R&D. Finally, the consequences of the convention concerning the treatment of R&D, with respect to a number of central aggregates in the national accounts are discussed.

Statistics on R&D activities according to the definitions in the Frascati manual

R&D is compiled according to the Frascati manual's definitions

Trends in the share of R&D estimated in accordance with the Frascati manual's definitions can be summed up as follows:

- R&D expenditure at current prices increases over time, from DKK 13.0 bn. in 1990 to DKK 34.4 bn. in 2002.
- R&D-expenditure as a percentage of GDP increases over time, from 1.6 pct. in 1990 to 2.5 pct. in 2002.

Public expenditure on health and welfare is considerably higher

Total Danish R&D expenditure of DKK 34.4 bn. in 2002 may seem substantial, but by way of comparison, public expenditure is, e.g. considerably higher for, respectively health services (DKK 75.9 bn. in 2002) and social security and welfare (DKK 319.7 bn. in 2002).

Still some way to go

As already mentioned, the Danish government's objective implies that R&D expenditure must account for 3 pct. of GDP in 2010, and Denmark is in the process of reaching this target, although there is still some way to go before the 3 pct. is achieved. For the EU(25), R&D expenditure constitutes 1.9 pct. in 2001.

National accounts statistics on the size of research and development

A satellite account for research and development in the context of the national accounts

Looking at trends in R&D investments within the frameworks of the national accounts (i.e. where the statistics on R&D investments have consistently been compiled in relation to the national accounts). Consequently, trends from 1990 to 2003 for the total economy can be summarized in the following way:

- There is an average annual real growth in R&D investments of 5.3 pct., from 1990 to 2002.
- R&D investments account for an increasingly higher share of GDP, from 1.4 pct. in 1990 to 2.2 pct. in 2002.
- The share of R&D investments of total investment increases, from 6.6 pct. in 1990 to 10.4 pct. in 2002.
- There is during the period from the beginning of 1990 to the beginning of 2003 an average annual real growth in R&D capital of 5.5 pct.
- R&D capital per person employed increased by 5.1 pct. on average from the beginning 1990 to the beginning of 2003.

Results at industry level

The main results at industry level can be summarized as follows:

- R&D capital per person employed in the manufacturing industry increased by an annual average of 8.1 pct., from the beginning of 1990 to the beginning of 2003.
- For the manufacturing industry, R&D capital accounts for 17.3 pct. of the total capital stock (2003).
- For the chemical industry and electronics industry, R&D capital accounts for an even higher share, 41.9 pct. and 38.5 pct. of the total stock of capital (2003), respectively.
- At the beginning of 2003, the *manufacturing industry* is the industry group accounting for the highest R&D capital (DKK 67.6 bn.), followed by *public and personal services* (DKK 39.7 bn) and *finance and business activities* (DKK 24.8 bn.).

The above results show that there is a sharp rise in the share of R&D during the period 1990 to 2003, and R&D is playing an increasingly more important part. This applies especially to the chemical industry and electronics industry, where R&D investments are the dominant type of investment.

Reclassification of research and development in the national accounts

Impact on reclassification

Today, expenditure on research and development is not treated as capital formation in the national accounts, but as current expenditure. If this convention is changed for the treatment of R&D, a number of central aggregates in the national accounts are, at the same time, changed:

- GDP at current prices (2002) are adjusted by +2.2 pct.
- Gross fixed capital formation at current prices (2002) is adjusted by +11.6 pct.
- The total quantity of production equipment (beginning of 2003) is adjusted by +1.9 pct. estimated at current prices.
- The total saving in society – estimated as the saving ratio[23] – is adjusted from 23.7 pct. to 25.5 pct. in 2002.
- The value of investments in the manufacturing industry is adjusted by DKK 16.7 bn. to DKK 51.8 bn. in 2002.
- The value of the capital stock in the manufacturing industry is adjusted by DKK 67.6 bn. to a total of DKK 392.2 bn. by the end of 2002.

The share of R&D is considerable …

It is of importance to the compilation of GDP how research and development are treated in the national accounts. An adjustment of GDP by 2.2 pct. must be regarded as considerable.

… especially for the manufacturing industry

The impact of a reclassification of R&D from current expenditure to capital formation is especially considerable in the manufacturing industry. Consequently, investments (2002) and the capital stock (end of 2002) are adjusted by 47.5 pct. and 20.8 pct., respectively. The composition and share of the capital structure in the industry is markedly changed.

R&D investments in satellite accounts or as part of the national accounts

In some types of analyses, it is expedient to know the share of R&D investments and R&D capital, if the structure or the causes of economic growth for the economy or the industries, including especially the manufacturing industry, are to be analysed. The share of R&D can be quantified by compiling satellite accounts, or by a general decision to change the classification of R&D in the national accounts.

[23] The saving ratio is estimated as gross savings divided by gross national disposable income.

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5. Tables

Tables Page

Table 1. R&D investments by kind of activity, current prices

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
		current prices, DKK mill.												
	R&D investments, total	**11 747**	**12 660**	**13 274**	**14 158**	**15 244**	**16 664**	**17 697**	**20 494**	**21 705**	**23 693**	**26 597**	**30 015**	**31 351**
1	**Agriculture, fishing and quarrying**	**13**	**16**	**23**	**27**	**26**	**32**	**32**	**25**	**36**	**16**	**70**	**96**	**91**
109	Agriculture, horticulture and forestry	3	4	3	6	6	7	5	4	6	2	4	7	5
500	Fishing.	0	0	0	0	0	0	0	0	1	0	0	0	0
1009	Mining and quarrying	10	12	20	21	20	25	27	21	29	14	66	89	86
2	**Manufacturing**	**5 005**	**5 232**	**5 656**	**5 762**	**6 384**	**6 759**	**7 733**	**9 105**	**10 638**	**11 222**	**13 860**	**15 491**	**16 673**
1509	Mfr. of food, beverages and tobacco	312	291	316	334	367	398	405	427	500	406	776	1 111	997
1709	Mfr. of textiles, wearing apparel, leather	23	29	26	21	14	8	16	24	30	23	15	15	47
2009	Mfr. of wood products, printing and publ	40	40	48	53	56	59	60	71	79	80	91	101	102
2309	Mfr. of chemicals, plastic products etc.	1 507	1 565	1 794	1 873	2 212	2 485	3 071	3 885	4 873	5 393	6 741	8 216	7 996
2600	Mfr. of other non-metallic mineral products.	122	128	87	44	47	47	66	86	94	103	114	128	57
2709	Mfr. of basic metals and fabr. metal prod.	2 935	3 108	3 301	3 348	3 594	3 665	4 010	4 499	4 939	5 090	5 985	6 882	7 326
3600	Mfr. of furniture; manufacturing n.e.c	66	71	84	89	94	97	105	113	123	127	138	149	148
3	**Electricity, gas and water supply**	**22**	**34**	**50**	**67**	**69**	**66**	**61**	**42**	**70**	**27**	**63**	**111**	**118**
4	**Construction**	**48**	**57**	**86**	**107**	**109**	**111**	**84**	**55**	**101**	**42**	**107**	**189**	**190**
5	**Wholesale and retail trade**	**334**	**475**	**461**	**430**	**478**	**534**	**769**	**983**	**978**	**1 236**	**1 060**	**921**	**1 007**
5000	Sale and repair of motor vehicles etc	0	0	0	0	0	0	0	0	0	0	0	0	0
5100	Ws. and commis. trade, exc. of m. vehicles	283	405	390	355	402	441	651	836	834	1 075	910	802	871
5200	Re. trade and repair work exc. of m. vehicles	51	70	71	75	76	93	118	147	144	161	150	119	136
5500	Hotels and restaurants	0	0	0	0	0	0	0	0	0	0	0	0	0
6	**Transport, storage and communication**	**17**	**23**	**33**	**40**	**43**	**46**	**45**	**59**	**71**	**102**	**109**	**116**	**103**
6009	Transport.	9	12	19	24	26	30	11	8	19	10	34	60	57
6400	Post and telecommunications	8	11	14	16	17	16	34	51	52	92	75	56	46
7	**Financial and, business activities**	**3 191**	**2 831**	**3 873**	**3 065**	**4 306**	**3 185**	**4 337**	**4 305**	**4 655**	**4 638**	**4 448**	**4 506**	**4 913**
6509	Financial intermediation and insurance etc.	37	46	59	74	83	72	105	160	140	225	253	315	1 023
7009	Real estate and renting activities	0	0	0	0	0	0	0	0	0	0	0	0	0
7209	Business activities etc.	3 154	2 785	3 814	2 991	4 223	3 113	4 232	4 145	4 515	4 413	4 195	4 192	3 890
8	**Public and personal services**	**3 118**	**3 991**	**3 093**	**4 659**	**3 829**	**5 930**	**4 635**	**5 920**	**5 153**	**6 409**	**6 879**	**7 475**	**8 255**
7500	Public administration etc.	125	82	191	120	194	116	156	118	203	168	131	152	105
8000	Education	1 934	2 447	1 737	2 786	2 169	3 572	2 755	3 819	3 147	4 189	4 560	5 046	5 609
8519	Health care activities	927	1 312	1 013	1 594	1 291	2 050	1 493	1 795	1 584	1 771	1 934	2 040	2 326
8539	Social work activities.	0	0	0	0	0	0	0	0	0	0	0	0	0
9009	Other community, social and personal act.	132	150	152	159	175	192	231	188	219	281	254	237	215

Table 2. R&D investments by kind of activity, constant prices

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
		2000-prices, DKK mill.												
	R&D investments, total	**16 083**	**16 652**	**16 764**	**17 943**	**18 370**	**19 608**	**20 119**	**22 093**	**22 967**	**24 338**	**26 597**	**29 761**	**30 329**
1	**Agriculture, fishing and quarrying**	**38**	**49**	**69**	**87**	**86**	**97**	**66**	**47**	**79**	**28**	**70**	**98**	**97**
109	Agriculture, horticulture and forestry	4	5	4	8	8	9	6	4	7	2	4	7	6
500	Fishing.	0	0	0	0	0	0	0	0	1	0	0	0	0
1009	Mining and quarrying	34	44	65	79	78	88	60	43	71	26	66	91	91
2	**Manufacturing**	**6 974**	**6 948**	**7 168**	**7 350**	**7 655**	**7 862**	**8 752**	**9 722**	**11 192**	**11 577**	**13 860**	**15 527**	**16 234**
1509	Mfr. of food, beverages and tobacco	405	363	384	408	431	447	444	447	528	421	776	1 068	945
1709	Mfr. of textiles, wearing apparel, leather	31	37	31	25	17	10	18	26	32	24	15	15	48
2009	Mfr. of wood products, printing and publ	54	52	60	66	67	68	67	76	82	83	91	101	100
2309	Mfr. of chemicals, plastic products etc.	2 173	2 163	2 360	2 542	2 808	3 003	3 599	4 200	5 153	5 528	6 741	8 370	7 854
2600	Mfr. of other non-metallic mineral products.	170	176	114	57	57	57	74	91	99	104	114	125	54
2709	Mfr. of basic metals and fabr. metal prod.	4 056	4 071	4 120	4 146	4 168	4 169	4 436	4 764	5 169	5 289	5 985	6 774	7 096
3600	Mfr. of furniture; manufacturing n.e.c	85	86	99	106	107	108	114	118	129	128	138	142	137
3	**Electricity, gas and water supply**	**31**	**44**	**64**	**85**	**86**	**79**	**66**	**45**	**73**	**27**	**63**	**105**	**110**
4	**Construction**	**65**	**74**	**109**	**139**	**139**	**137**	**96**	**62**	**108**	**43**	**107**	**184**	**181**
5	**Wholesale and retail trade**	**457**	**598**	**560**	**523**	**564**	**609**	**838**	**1 054**	**1 036**	**1 285**	**1 060**	**912**	**988**
5000	Sale and repair of motor vehicles etc	0	0	0	0	0	0	0	0	0	0	0	0	0
5100	Ws. and commis. trade, exc. of m. vehicles	382	503	468	434	475	506	705	889	885	1 117	910	791	850
5200	Re. trade and repair work exc. of m. vehicles	75	95	92	89	89	103	133	165	151	168	150	121	138
5500	Hotels and restaurants	0	0	0	0	0	0	0	0	0	0	0	0	0
6	**Transport, storage and communication**	**22**	**30**	**41**	**49**	**50**	**55**	**47**	**59**	**74**	**100**	**109**	**113**	**100**
6009	Transport.	12	16	25	31	32	37	14	10	23	11	34	59	56
6400	Post and telecommunications	10	14	16	18	18	18	33	49	51	89	75	54	44
7	**Financial and, business activities**	**4 200**	**3 544**	**4 737**	**3 693**	**5 059**	**3 629**	**4 873**	**4 515**	**4 851**	**4 706**	**4 448**	**4 494**	**4 829**
6509	Financial intermediation and insurance etc.	51	63	82	93	97	86	123	178	144	228	253	302	957
7009	Real estate and renting activities	0	0	0	0	0	0	0	0	0	0	0	0	0
7209	Business activities etc.	4 149	3 481	4 655	3 600	4 962	3 543	4 750	4 337	4 707	4 478	4 195	4 192	3 872
8	**Public and personal services**	**4 297**	**5 365**	**4 015**	**6 018**	**4 730**	**7 143**	**5 380**	**6 589**	**5 553**	**6 572**	**6 879**	**7 261**	**7 790**
7500	Public administration etc.	174	110	251	149	235	139	179	127	215	174	131	149	100
8000	Education	2 688	3 310	2 290	3 663	2 731	4 379	3 235	4 287	3 415	4 286	4 560	4 898	5 305
8519	Health care activities	1 262	1 756	1 288	2 010	1 555	2 404	1 708	1 970	1 690	1 827	1 934	1 983	2 177
8539	Social work activities.	0	0	0	0	0	0	0	0	0	0	0	0	0
9009	Other community, social and personal act.	173	189	186	196	209	221	258	205	233	285	254	231	208

Table 3. R&D gross stock by kind of activity, current prices

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
		current prices, DKK mill.													
	R&D gross stock, total	**84 123**	**91 837**	**100 274**	**107 108**	**115 592**	**126 009**	**136 406**	**149 114**	**162 643**	**175 225**	**189 786**	**204 312**	**221 480**	**241 298**
1	**Agriculture, fishing and quarrying**	**47**	**58**	**68**	**86**	**102**	**127**	**196**	**266**	**274**	**304**	**454**	**591**	**615**	**638**
109	Agriculture, horticulture and forestry	18	19	18	20	26	32	38	43	45	49	48	47	48	45
500	Fishing.	0	0	0	0	0	0	0	0	0	1	1	1	1	1
1009	Mining and quarrying	29	39	50	66	76	95	158	223	229	254	405	543	566	592
2	**Manufacturing**	**35 225**	**38 607**	**42 229**	**44 930**	**48 203**	**52 572**	**56 261**	**61 506**	**67 230**	**73 069**	**79 924**	**88 307**	**99 256**	**111 424**
1509	Mfr. of food, beverages and tobacco	2 512	2 689	2 817	2 905	3 023	3 231	3 428	3 627	3 754	3 898	4 036	4 564	5 382	6 073
1709	Mfr. of textiles, wearing apparel, leather	158	169	182	187	192	194	188	197	210	222	226	214	205	228
2009	Mfr. of wood products, printing and publ	336	348	377	390	419	457	486	522	567	607	641	684	723	785
2309	Mfr. of chemicals, plastic products etc	10 759	11 986	13 287	14 274	15 545	17 712	19 834	22 926	26 603	30 695	35 242	40 063	46 668	53 964
2600	Mfr. of other non-metallic mineral products.	1 013	1 046	1 098	1 108	1 074	1 042	1 010	998	982	948	933	922	954	932
2709	Mfr. of basic metals and fabr. metal prod.	19 915	21 803	23 855	25 428	27 268	29 196	30 526	32 382	34 208	35 735	37 819	40 762	44 128	48 169
3600	Mfr. of furniture; manufacturing n.e.c.	532	566	613	638	682	740	789	854	906	964	1 027	1 098	1 196	1 273
3	**Electricity, gas and water supply**	**83**	**103**	**137**	**183**	**239**	**306**	**387**	**449**	**487**	**538**	**541**	**576**	**643**	**708**
4	**Construction**	**196**	**240**	**283**	**351**	**441**	**546**	**661**	**740**	**781**	**873**	**871**	**909**	**1 021**	**1 130**
5	**Wholesale and retail trade**	**1 383**	**1 753**	**2 247**	**2 625**	**2 953**	**3 349**	**3 795**	**4 423**	**5 157**	**5 869**	**6 878**	**7 631**	**8 102**	**8 682**
5000	Sale and repair of motor vehicles etc	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5100	Ws. and commis. trade, exc. of m. vehicles	1 160	1 481	1 900	2 204	2 459	2 788	3 172	3 726	4 334	4 928	5 822	6 490	6 932	7 457
5200	Re. trade and repair work exc. of m. vehicles	223	272	347	421	494	561	623	697	823	941	1 056	1 141	1 170	1 225
5500	Hotels and restaurants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	**Transport, storage and communication**	**71**	**83**	**103**	**130**	**174**	**209**	**255**	**295**	**341**	**398**	**484**	**569**	**661**	**739**
6009	Transport	27	35	47	64	88	114	143	154	160	173	179	200	246	283
6400	Post and telecommunications	44	48	56	66	86	95	112	141	181	225	305	369	415	456
7	**Financial and, business activities**	**18 832**	**20 862**	**22 396**	**24 639**	**26 283**	**29 326**	**31 036**	**34 490**	**37 362**	**39 911**	**42 310**	**43 617**	**44 774**	**46 670**
6509	Financial intermediation and insurance etc.	113	136	171	229	312	387	454	556	738	873	1 063	1 273	1 553	2 541
7009	Real estate and renting activities	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7209	Business activities etc.	18 719	20 726	22 225	24 410	25 971	28 939	30 582	33 934	36 624	39 038	41 247	42 344	43 221	44 129
8	**Public and personal services**	**28 286**	**30 131**	**32 811**	**34 164**	**37 197**	**39 574**	**43 815**	**46 945**	**51 011**	**54 263**	**58 324**	**62 112**	**66 408**	**71 307**
7500	Public administration etc.	160	292	390	596	742	938	1 071	1 256	1 385	1 554	1 684	1 754	1 818	1 816
8000	Education.	18 572	19 666	21 193	21 680	23 369	24 579	27 096	28 906	31 510	33 577	36 326	38 899	41 933	45 468
8519	Health care activities.	8 728	9 241	10 189	10 741	11 829	12 664	14 098	15 038	16 235	17 105	18 110	19 124	20 231	21 529
8539	Social work activities.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9009	Other community, social and personal act.	826	932	1 039	1 147	1 257	1 393	1 550	1 745	1 881	2 027	2 204	2 335	2 426	2 494

Table 4. R&D gross stock by kind of activity, constant 2000-prices

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
		2000-prices, DKK mill.													
	R&D gross stock, total	**117 798**	**123 606**	**129 854**	**136 034**	**143 081**	**150 107**	**157 813**	**165 346**	**174 122**	**182 946**	**192 355**	**203 236**	**216 549**	**229 727**
1	**Agriculture, fishing and quarrying**	**119**	**151**	**190**	**251**	**327**	**395**	**473**	**521**	**543**	**586**	**574**	**595**	**633**	**660**
109	Agriculture, horticulture and forestry	18	19	21	24	31	37	42	45	45	49	48	47	48	45
500	Fishing.	0	0	0	0	0	0	0	0	0	1	1	1	1	1
1009	Mining and quarrying	101	132	169	227	296	358	431	476	498	536	525	547	584	614
2	**Manufacturing**	**50 097**	**52 476**	**54 755**	**57 139**	**59 546**	**62 033**	**64 445**	**67 462**	**71 175**	**76 077**	**81 135**	**88 232**	**97 863**	**106 881**
1509	Mfr. of food, beverages and tobacco	3 318	3 415	3 468	3 533	3 615	3 710	3 803	3 879	3 946	4 082	4 104	4 478	5 141	5 677
1709	Mfr. of textiles, wearing apparel, leather	215	212	223	228	231	228	216	214	220	227	226	214	205	228
2009	Mfr. of wood products, printing and publ	461	467	473	482	506	523	543	563	589	618	648	684	723	761
2309	Mfr. of chemicals, plastic products etc.	15 890	16 913	17 902	19 075	20 395	21 938	23 602	25 778	28 440	31 926	35 652	40 426	46 674	52 231
2600	Mfr. of other non-metallic mineral products.	1 431	1 451	1 474	1 443	1 353	1 262	1 170	1 092	1 034	979	938	916	922	870
2709	Mfr. of basic metals and fabr. metal prod.	28 081	29 307	30 487	31 623	32 656	33 549	34 252	35 038	36 006	37 258	38 540	40 441	43 075	45 952
3600	Mfr. of furniture; manufacturing n.e.c.	701	711	728	755	790	823	859	898	940	987	1 027	1 073	1 123	1 162
3	**Electricity, gas and water supply**	**115**	**137**	**171**	**225**	**299**	**373**	**438**	**486**	**511**	**553**	**546**	**563**	**611**	**657**
4	**Construction**	**271**	**314**	**363**	**453**	**567**	**679**	**782**	**839**	**855**	**906**	**877**	**899**	**987**	**1 063**
5	**Wholesale and retail trade**	**1 949**	**2 299**	**2 776**	**3 189**	**3 535**	**3 882**	**4 233**	**4 776**	**5 493**	**6 154**	**7 006**	**7 598**	**7 987**	**8 400**
5000	Sale and repair of motor vehicles etc	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5100	Ws. and commis. trade, exc. of m. vehicles	1 615	1 913	2 318	2 668	2 954	3 245	3 536	3 994	4 604	5 173	5 931	6 449	6 803	7 175
5200	Re. trade and repair work exc. of m. vehicles.	334	386	458	521	581	637	697	782	889	981	1 075	1 149	1 184	1 225
5500	Hotels and restaurants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	**Transport, storage and communication**	**88**	**101**	**124**	**153**	**194**	**233**	**277**	**310**	**352**	**408**	**483**	**565**	**644**	**704**
6009	Transport	32	42	57	77	104	133	165	174	173	186	181	200	241	273
6400	Post and telecommunications	56	59	67	76	90	100	112	136	179	222	302	365	403	431
7	**Financial and, business activities**	**25 517**	**27 100**	**28 083**	**30 325**	**31 564**	**34 183**	**35 341**	**37 634**	**39 395**	**41 243**	**42 670**	**43 560**	**44 237**	**45 051**
6509	Financial intermediation and insurance etc.	144	180	228	294	373	457	529	630	784	888	1 067	1 257	1 484	2 356
7009	Real estate and renting activities	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7209	Business activities etc.	25 373	26 920	27 855	30 031	31 191	33 726	34 812	37 004	38 611	40 355	41 603	42 303	42 753	42 695
8	**Public and personal services**	**39 642**	**41 028**	**43 392**	**44 299**	**47 049**	**48 329**	**51 824**	**53 318**	**55 798**	**57 019**	**59 064**	**61 224**	**63 587**	**66 311**
7500	Public administration etc.	227	400	510	758	903	1 128	1 250	1 398	1 481	1 628	1 715	1 735	1 750	1 698
8000	Education.	26 179	26 955	28 298	28 542	30 057	30 528	32 500	33 175	34 767	35 364	36 741	38 322	40 176	42 370
8519	Health care activities.	12 127	12 473	13 286	13 595	14 579	15 051	16 327	16 847	17 570	17 945	18 390	18 853	19 294	19 854
8539	Social work activities.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9009	Other community, social and personal act.	1 109	1 200	1 298	1 404	1 510	1 622	1 747	1 898	1 980	2 082	2 218	2 314	2 367	2 389

Table 5. R&D net stock by kind of activity, current prices

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
		current prices, DKK mill.													
	R&D net stock, total	**47 361**	**52 224**	**57 276**	**61 080**	**65 793**	**71 394**	**77 062**	**83 915**	**91 660**	**98 843**	**107 286**	**116 059**	**126 977**	**138 865**
1	**Agriculture, fishing and quarrying**	**28**	**34**	**41**	**52**	**67**	**84**	**129**	**168**	**155**	**167**	**230**	**302**	**324**	**343**
109	Agriculture, horticulture and forestry	9	10	9	9	16	20	24	26	23	26	20	20	23	20
500	Fishing.	0	0	0	0	0	0	0	0	0	1	1	1	1	0
1009	Mining and quarrying	19	24	32	43	51	64	105	142	132	140	209	281	300	323
2	**Manufacturing**	**19 894**	**21 944**	**23 937**	**25 381**	**27 064**	**29 368**	**31 288**	**34 338**	**37 915**	**41 920**	**46 370**	**52 163**	**59 968**	**67 648**
1509	Mfr. of food, beverages and tobacco	1 406	1 503	1 546	1 576	1 636	1 742	1 846	1 949	2 018	2 131	2 182	2 592	3 248	3 716
1709	Mfr. of textiles, wearing apparel, leather	72	89	99	110	108	103	96	98	103	113	118	108	100	123
2009	Mfr. of wood products, printing and publ	180	188	203	213	230	254	271	290	316	336	356	378	405	440
2309	Mfr. of chemicals, plastic products etc.	6 209	7 010	7 791	8 394	9 151	10 447	11 690	13 607	15 985	18 791	21 801	25 165	29 862	34 400
2600	Mfr. of other non-metallic mineral products	537	560	594	585	534	488	450	438	436	438	453	475	517	491
2709	Mfr. of basic metals and fabr. metal prod.	11 206	12 284	13 372	14 147	15 020	15 917	16 492	17 476	18 553	19 571	20 885	22 833	25 172	27 774
3600	Mfr. of furniture; manufacturing n.e.c.	284	310	332	356	385	417	443	480	504	540	575	612	664	704
3	**Electricity, gas and water supply**	**48**	**63**	**90**	**122**	**169**	**217**	**261**	**286**	**285**	**306**	**284**	**294**	**343**	**397**
4	**Construction**	**120**	**151**	**182**	**233**	**298**	**363**	**432**	**455**	**443**	**482**	**442**	**454**	**549**	**638**
5	**Wholesale and retail trade**	**873**	**1 111**	**1 440**	**1 657**	**1 810**	**2 016**	**2 252**	**2 651**	**3 162**	**3 590**	**4 257**	**4 634**	**4 752**	**4 949**
5000	Sale and repair of motor vehicles etc	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5100	Ws. and commis. trade, exc. of m. vehicles	735	940	1 221	1 393	1 508	1 681	1 884	2 237	2 657	3 027	3 625	3 961	4 091	4 275
5200	Re. trade and repair work exc. of m. vehicles	138	171	219	264	302	335	368	414	505	563	632	673	661	674
5500	Hotels and restaurants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	**Transport, storage and communication**	**37**	**50**	**66**	**85**	**118**	**143**	**166**	**188**	**210**	**240**	**302**	**353**	**404**	**449**
6009	Transport	17	25	34	44	63	82	97	97	88	89	86	102	138	174
6400	Post and telecommunications	20	25	32	41	55	61	69	91	122	151	216	251	266	275
7	**Financial and, business activities**	**9 986**	**11 640**	**12 719**	**14 442**	**15 312**	**17 292**	**17 827**	**19 714**	**21 034**	**22 247**	**23 268**	**23 593**	**23 894**	**24 764**
6509	Financial intermediation and insurance etc.	64	84	114	161	220	264	296	359	476	555	679	815	1 005	1 837
7009	Real estate and renting activities	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7209	Business activities etc.	9 922	11 556	12 605	14 281	15 092	17 028	17 531	19 355	20 558	21 692	22 589	22 778	22 889	22 927
8	**Public and personal services**	**16 375**	**17 231**	**18 801**	**19 108**	**20 955**	**21 911**	**24 707**	**26 115**	**28 456**	**29 891**	**32 133**	**34 266**	**36 743**	**39 677**
7500	Public administration etc.	142	252	308	467	546	665	708	786	814	897	938	929	940	905
8000	Education.	10 740	11 193	12 040	11 933	12 932	13 310	14 987	15 802	17 451	18 424	20 095	21 701	23 605	25 826
8519	Health care activities.	5 013	5 233	5 831	6 024	6 734	7 116	8 099	8 502	9 123	9 432	9 857	10 332	10 873	11 613
8539	Social work activities.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9009	Other community, social and personal act.	480	553	622	684	743	820	913	1 025	1 068	1 138	1 243	1 304	1 325	1 333

Table 6. R&D net stock by kind of activity, constant 2000-prices

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
		2000-prices, DKK mill.													
	R&D net stock, total	**66 328**	**70 267**	**74 152**	**77 526**	**81 411**	**85 025**	**89 149**	**93 039**	**98 095**	**103 141**	**108 693**	**115 501**	**124 263**	**132 330**
1	**Agriculture, fishing and quarrying**	**75**	**95**	**125**	**166**	**224**	**266**	**316**	**326**	**312**	**330**	**294**	**303**	**334**	**356**
109	Agriculture, horticulture and forestry	9	10	11	11	19	23	27	26	23	26	20	20	23	20
500	Fishing.	0	0	0	0	0	0	0	0	0	1	1	1	1	0
1009	Mining and quarrying	66	85	114	155	205	243	289	300	289	303	273	282	310	336
2	**Manufacturing**	**28 308**	**29 831**	**31 067**	**32 298**	**33 466**	**34 692**	**35 866**	**37 681**	**40 139**	**43 637**	**47 052**	**52 155**	**59 169**	**64 917**
1509	Mfr. of food, beverages and tobacco	1 857	1 907	1 905	1 919	1 954	2 000	2 048	2 085	2 118	2 227	2 216	2 544	3 104	3 475
1709	Mfr. of textiles, wearing apparel, leather	98	108	122	130	128	122	110	105	109	115	118	108	100	123
2009	Mfr. of wood products, printing and publ	242	247	250	260	276	292	302	311	327	343	358	378	405	428
2309	Mfr. of chemicals, plastic products etc	9 175	9 893	10 504	11 220	12 006	12 934	13 905	15 302	17 085	19 543	22 053	25 390	29 865	33 295
2600	Mfr. of other non-metallic mineral products	756	776	800	760	672	591	519	475	456	451	455	472	502	460
2709	Mfr. of basic metals and fabr. metal prod.	15 806	16 514	17 093	17 593	17 988	18 289	18 500	18 899	19 520	20 406	21 277	22 663	24 569	26 493
3600	Mfr. of furniture; manufacturing n.e.c.	374	386	393	416	442	464	482	504	524	552	575	600	624	643
3	**Electricity, gas and water supply**	**69**	**85**	**113**	**153**	**211**	**262**	**296**	**308**	**299**	**314**	**285**	**287**	**326**	**371**
4	**Construction**	**164**	**197**	**232**	**298**	**382**	**453**	**510**	**516**	**487**	**497**	**443**	**450**	**532**	**602**
5	**Wholesale and retail trade**	**1 231**	**1 455**	**1 780**	**2 013**	**2 169**	**2 336**	**2 505**	**2 861**	**3 362**	**3 763**	**4 335**	**4 613**	**4 683**	**4 786**
5000	Sale and repair of motor vehicles etc	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5100	Ws. and commis. trade, exc. of m. vehicles	1 023	1 213	1 488	1 687	1 816	1 957	2 096	2 398	2 821	3 176	3 692	3 935	4 016	4 112
5200	Re. trade and repair work exc. of m. vehicles.	208	242	292	326	353	379	409	463	541	587	643	678	667	674
5500	Hotels and restaurants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	**Transport, storage and communication**	**47**	**59**	**76**	**99**	**134**	**157**	**180**	**196**	**216**	**243**	**299**	**351**	**395**	**428**
6009	Transport	20	29	40	54	76	93	111	107	96	94	86	102	136	169
6400	Post and telecommunications	27	30	36	45	58	64	69	89	120	149	213	249	259	259
7	**Financial and, business activities**	**13 488**	**15 089**	**15 904**	**17 737**	**18 335**	**20 117**	**20 272**	**21 497**	**22 156**	**22 958**	**23 453**	**23 561**	**23 642**	**23 966**
6509	Financial intermediation and insurance etc.	78	113	154	209	263	313	346	407	508	561	681	802	956	1 699
7009	Real estate and renting activities	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7209	Business activities etc.	13 410	14 976	15 750	17 528	18 072	19 804	19 926	21 090	21 648	22 397	22 772	22 759	22 686	22 267
8	**Public and personal services**	**22 946**	**23 456**	**24 855**	**24 762**	**26 490**	**26 742**	**29 204**	**29 654**	**31 124**	**31 399**	**32 532**	**33 781**	**35 182**	**36 904**
7500	Public administration etc.	198	340	406	595	666	802	826	878	870	938	954	921	906	848
8000	Education.	15 139	15 342	16 075	15 711	16 631	16 532	17 973	18 138	19 253	19 400	20 321	21 378	22 613	24 068
8519	Health care activities.	6 967	7 066	7 601	7 621	8 296	8 451	9 378	9 527	9 873	9 894	10 009	10 187	10 368	10 708
8539	Social work activities.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9009	Other community, social and personal act.	642	708	773	835	897	957	1 027	1 111	1 128	1 167	1 248	1 295	1 295	1 280

Table 7. R&D consumption of fixed capital, current prices

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
		current prices, DKK mill.												
	R&D consumption of fixed capital, total	**8 850**	**9 683**	**10 558**	**11 097**	**12 259**	**13 198**	**14 273**	**15 793**	**16 897**	**18 261**	**19 789**	**21 231**	**23 040**
1	**Agriculture, fishing and quarrying**	**6**	**7**	**10**	**8**	**14**	**14**	**27**	**32**	**27**	**37**	**61**	**65**	**69**
109	Agriculture, horticulture and forestry	2	2	2	1	3	2	6	5	3	7	4	3	6
500	Fishing.	0	0	0	0	0	0	0	0	0	0	0	0	1
1009	Mining and quarrying	5	5	7	8	11	12	21	27	24	29	57	62	62
2	**Manufacturing**	**3 922**	**4 314**	**4 696**	**4 867**	**5 397**	**5 768**	**6 163**	**6 821**	**7 322**	**7 907**	**8 757**	**9 615**	**10 787**
1509	Mfr. of food, beverages and tobacco	273	293	304	306	329	354	370	397	397	417	448	528	606
1709	Mfr. of textiles, wearing apparel, leather	16	19	19	22	20	18	20	19	25	21	25	23	24
2009	Mfr. of wood products, printing and publ	37	38	40	41	43	50	51	56	63	67	71	73	80
2309	Mfr. of chemicals, plastic products etc.	1 010	1 123	1 250	1 293	1 481	1 682	1 879	2 236	2 549	2 947	3 404	3 824	4 502
2600	Mfr. of other non-metallic mineral products.	108	111	117	112	114	108	105	105	99	98	97	98	102
2709	Mfr. of basic metals and fabr. metal prod.	2 422	2 665	2 901	3 027	3 335	3 475	3 651	3 914	4 093	4 252	4 599	4 945	5 346
3600	Mfr. of furniture; manufacturing n.e.c	56	65	65	67	75	81	85	94	96	105	113	124	128
3	**Electricity, gas and water supply**	**11**	**12**	**19**	**21**	**28**	**37**	**49**	**51**	**55**	**56**	**61**	**69**	**70**
4	**Construction**	**24**	**30**	**34**	**42**	**53**	**65**	**78**	**81**	**91**	**95**	**100**	**104**	**116**
5	**Wholesale and retail trade**	**169**	**217**	**268**	**300**	**335**	**384**	**443**	**516**	**600**	**684**	**781**	**849**	**901**
5000	Sale and repair of motor vehicles etc	0	0	0	0	0	0	0	0	0	0	0	0	0
5100	Ws. and commis. trade, exc. of m. vehicles.	143	183	225	249	282	319	373	439	499	579	666	720	772
5200	Re. trade and repair work exc. of m. vehicles	26	33	43	51	54	65	70	77	101	105	115	128	129
5500	Hotels and restaurants	0	0	0	0	0	0	0	0	0	0	0	0	0
6	**Transport, storage and communication**	**7**	**10**	**14**	**10**	**22**	**27**	**27**	**36**	**42**	**44**	**57**	**71**	**70**
6009	Transport	2	4	7	6	11	15	15	17	20	17	18	26	24
6400	Post and telecommunications	5	6	7	4	11	12	13	19	22	27	39	45	46
7	**Financial and, business activities**	**1 967**	**2 145**	**2 360**	**2 530**	**2 794**	**3 018**	**3 244**	**3 651**	**3 861**	**4 138**	**4 340**	**4 426**	**4 594**
6509	Financial intermediation and insurance etc.	12	16	20	30	39	44	54	69	88	106	131	152	226
7009	Real estate and renting activities	0	0	0	0	0	0	0	0	0	0	0	0	0
7209	Business activities etc.	1 954	2 129	2 340	2 500	2 755	2 973	3 191	3 582	3 773	4 032	4 209	4 274	4 368
8	**Public and personal services**	**2 745**	**2 948**	**3 158**	**3 317**	**3 616**	**3 884**	**4 242**	**4 605**	**4 899**	**5 301**	**5 632**	**6 033**	**6 432**
7500	Public administration etc.	22	33	46	63	81	96	110	125	139	152	164	168	167
8000	Education	1 787	1 905	2 012	2 086	2 249	2 398	2 614	2 825	3 012	3 288	3 504	3 774	4 071
8519	Health care activities	855	913	999	1 058	1 162	1 259	1 362	1 479	1 564	1 660	1 756	1 854	1 964
8539	Social work activities.	0	0	0	0	0	0	0	0	0	0	0	0	0
9009	Other community, social and personal act.	81	97	101	109	124	131	157	176	184	200	208	236	231

Table 8. R&D consumption of fixed capital, constant 2000-prices

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
		2000-prices, DKK mill.												
	R&D consumption of fixed capital, total	**12 137**	**12 763**	**13 388**	**14 058**	**14 756**	**15 479**	**16 222**	**17 038**	**17 917**	**18 784**	**19 789**	**20 995**	**22 263**
1	**Agriculture, fishing and quarrying**	**16**	**18**	**28**	**30**	**43**	**44**	**56**	**59**	**59**	**64**	**61**	**66**	**73**
109	Agriculture, horticulture and forestry	2	3	4	1	4	3	7	6	3	8	4	3	7
500	Fishing.	0	0	0	0	0	0	0	0	0	0	0	0	1
1009	Mining and quarrying.	14	15	24	29	39	41	49	53	56	56	57	63	65
2	**Manufacturing**	**5 450**	**5 712**	**5 939**	**6 183**	**6 435**	**6 686**	**6 936**	**7 267**	**7 696**	**8 165**	**8 757**	**9 580**	**10 489**
1509	Mfr. of food, beverages and tobacco	354	365	370	373	386	398	406	415	420	432	448	508	575
1709	Mfr. of textiles, wearing apparel, leather	21	24	23	27	24	21	23	21	26	21	25	23	24
2009	Mfr. of wood products, printing and publ.	50	50	50	51	52	58	58	60	66	69	71	73	78
2309	Mfr. of chemicals, plastic products etc.	1 455	1 551	1 644	1 756	1 881	2 033	2 202	2 417	2 696	3 018	3 404	3 895	4 423
2600	Mfr. of other non-metallic mineral products.	151	152	154	146	139	129	118	111	104	100	97	96	96
2709	Mfr. of basic metals and fabr. metal prod.	3 346	3 491	3 622	3 750	3 868	3 957	4 037	4 145	4 284	4 419	4 599	4 867	5 175
3600	Mfr. of furniture; manufacturing n.e.c	73	79	76	80	85	90	92	98	100	106	113	118	118
3	**Electricity, gas and water supply**	**15**	**16**	**24**	**27**	**35**	**44**	**54**	**54**	**58**	**57**	**61**	**66**	**66**
4	**Construction**	**32**	**39**	**43**	**55**	**67**	**80**	**89**	**91**	**97**	**96**	**100**	**101**	**111**
5	**Wholesale and retail trade**	**232**	**273**	**326**	**366**	**396**	**439**	**483**	**554**	**636**	**711**	**781**	**841**	**884**
5000	Sale and repair of motor vehicles etc	0	0	0	0	0	0	0	0	0	0	0	0	0
5100	Ws. and commis. trade, exc. of m. vehicles	193	228	270	305	333	366	404	467	530	601	666	710	754
5200	Re. trade and repair work exc. of m. vehicles	39	45	56	61	63	73	79	87	106	110	115	131	130
5500	Hotels and restaurants	0	0	0	0	0	0	0	0	0	0	0	0	0
6	**Transport, storage and communication**	**9**	**13**	**17**	**13**	**26**	**31**	**30**	**38**	**45**	**45**	**57**	**69**	**67**
6009	Transport	3	5	9	8	14	18	18	20	23	19	18	25	23
6400	Post and telecommunications	6	8	8	5	12	13	12	18	22	26	39	44	44
7	**Financial and, business activities**	**2 599**	**2 727**	**2 903**	**3 096**	**3 278**	**3 474**	**3 647**	**3 857**	**4 049**	**4 209**	**4 340**	**4 412**	**4 503**
6509	Financial intermediation and insurance etc.	17	22	27	38	46	53	62	77	90	107	131	147	213
7009	Real estate and renting activities	0	0	0	0	0	0	0	0	0	0	0	0	0
7209	Business activities etc.	2 582	2 705	2 876	3 058	3 232	3 421	3 585	3 780	3 959	4 102	4 209	4 265	4 290
8	**Public and personal services**	**3 784**	**3 965**	**4 108**	**4 288**	**4 476**	**4 681**	**4 927**	**5 118**	**5 277**	**5 437**	**5 632**	**5 860**	**6 070**
7500	Public administration etc.	31	44	61	78	98	114	126	135	147	158	164	164	158
8000	Education	2 484	2 577	2 653	2 742	2 831	2 939	3 069	3 171	3 268	3 364	3 504	3 663	3 850
8519	Health care activities	1 163	1 222	1 269	1 334	1 400	1 477	1 558	1 624	1 669	1 712	1 756	1 802	1 838
8539	Social work activities.	0	0	0	0	0	0	0	0	0	0	0	0	0
9009	Other community, social and personal act.	106	122	125	134	147	151	174	188	193	203	208	231	224

Table 9. Gross value added after reclassification by kind of activity, current prices

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
		current prices, DKK bn.												
	Gross value added, total	**736**	**769**	**800**	**808**	**860**	**896**	**935**	**983**	**1 010**	**1 055**	**1 137**	**1 175**	**1 206**
1	**Agriculture, fishing and quarrying**	**37**	**36**	**35**	**33**	**34**	**38**	**43**	**44**	**37**	**41**	**63**	**63**	**57**
109	Agriculture, horticulture and forestry	27	25	24	24	25	28	29	28	24	22	27	30	23
500	Fishing.	2	3	3	2	2	2	2	2	3	2	2	2	3
1009	Mining and quarrying	8	8	8	7	7	8	11	13	11	16	34	30	31
2	**Manufacturing**	**131**	**134**	**141**	**138**	**149**	**158**	**159**	**173**	**177**	**182**	**194**	**199**	**202**
1509	Mfr. of food, beverages and tobacco	24	25	26	26	26	27	27	29	28	28	29	31	33
1709	Mfr. of textiles, wearing apparel, leather	6	6	6	6	6	5	5	5	5	5	5	5	4
2009	Mfr. of wood products, printing and publ	17	18	19	18	20	20	21	23	24	24	25	23	23
2309	Mfr. of chemicals, plastic products etc.	19	19	20	19	22	24	25	29	31	33	36	39	38
2600	Mfr. of other non-metallic mineral products.	6	6	6	6	7	7	7	8	8	9	9	7	8
2709	Mfr. of basic metals and fabr. metal prod.	52	52	54	55	60	64	65	69	72	71	79	82	85
3600	Mfr. of furniture; manufacturing n.e.c	8	9	9	9	10	9	9	10	10	11	11	11	11
3	**Electricity, gas and water supply**	**15**	**18**	**18**	**19**	**20**	**21**	**24**	**24**	**24**	**24**	**23**	**24**	**24**
4	**Construction**	**37**	**37**	**38**	**35**	**38**	**41**	**46**	**46**	**52**	**58**	**61**	**60**	**61**
5	**Wholesale and retail trade**	**104**	**112**	**116**	**113**	**123**	**130**	**136**	**141**	**144**	**150**	**153**	**154**	**162**
5000	Sale and repair of motor vehicles etc.	10	11	12	12	14	15	16	16	16	17	16	17	17
5100	Ws. and commis. trade, exc. of m. vehicles	50	56	56	55	59	64	69	72	72	77	79	79	84
5200	Re. trade and repair work exc. of m. vehicles	32	34	36	35	37	38	37	38	40	40	41	41	44
5500	Hotels and restaurants	11	12	12	12	12	13	14	15	16	17	16	17	17
6	**Transport, storage and communication**	**55**	**57**	**60**	**61**	**65**	**67**	**72**	**77**	**76**	**81**	**91**	**94**	**95**
6009	Transport	39	41	42	43	46	48	50	55	53	56	66	68	69
6400	Post and telecommunications	16	16	18	18	19	18	22	23	23	25	24	26	26
7	**Financial and, business activities**	**159**	**168**	**175**	**183**	**197**	**199**	**203**	**215**	**222**	**230**	**253**	**269**	**278**
6509	Financial intermediation and insurance etc.	34	36	39	40	45	46	46	48	51	48	53	55	60
7009	Real estate and renting activities	76	80	84	89	94	97	99	97	100	104	114	119	122
7209	Business activities etc.	48	51	52	54	58	57	58	69	71	78	87	95	96
8	**Public and personal services**	**199**	**208**	**217**	**225**	**234**	**241**	**252**	**263**	**277**	**290**	**299**	**314**	**327**
7500	Public administration etc.	53	54	57	59	59	60	62	66	69	71	71	73	76
8000	Education	41	44	46	47	50	51	54	56	59	62	65	68	71
8519	Health care activities	34	35	36	37	38	39	41	42	45	47	49	52	54
8539	Social work activities.	39	41	43	46	48	51	54	57	61	63	67	71	74
9009	Other community, social and personal act.	32	34	35	36	38	40	41	42	44	46	48	50	52

Table 10. Gross value added after reclassification by kind of activity, constant 2000-prices

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
		2000-prices, DKK bn.												
	Gross value added, total	**898**	**907**	**919**	**921**	**958**	**989**	**1 012**	**1 038**	**1 057**	**1 090**	**1 137**	**1 148**	**1 153**
1	**Agriculture, fishing and quarrying**	**32**	**33**	**35**	**41**	**42**	**45**	**48**	**51**	**51**	**56**	**63**	**62**	**64**
109	Agriculture, horticulture and forestry	19	18	17	22	22	24	25	25	26	25	27	28	27
500	Fishing.	1	1	3	3	3	2	2	2	2	2	2	2	2
1009	Mining and quarrying	12	13	15	16	17	18	21	24	23	29	34	32	35
2	**Manufacturing**	**159**	**158**	**157**	**151**	**165**	**177**	**169**	**182**	**185**	**186**	**194**	**197**	**192**
1509	Mfr. of food, beverages and tobacco	28	28	27	28	28	30	28	30	30	31	29	31	29
1709	Mfr. of textiles, wearing apparel, leather	7	7	7	6	6	6	5	5	5	5	5	4	4
2009	Mfr. of wood products, printing and publ	24	23	22	20	20	22	21	23	23	23	25	23	22
2309	Mfr. of chemicals, plastic products etc.	17	17	19	18	20	25	25	29	32	34	37	40	36
2600	Mfr. of other non-metallic mineral products.	7	7	6	6	7	7	7	8	8	9	9	7	7
2709	Mfr. of basic metals and fabr. metal prod.	65	64	64	63	71	76	71	74	76	73	79	82	84
3600	Mfr. of furniture; manufacturing n.e.c	12	13	13	10	12	11	11	12	11	11	11	10	10
3	**Electricity, gas and water supply**	**18**	**20**	**23**	**21**	**20**	**22**	**24**	**24**	**23**	**24**	**23**	**24**	**23**
4	**Construction**	**53**	**50**	**51**	**46**	**48**	**51**	**54**	**52**	**57**	**61**	**61**	**57**	**56**
5	**Wholesale and retail trade**	**118**	**126**	**125**	**125**	**129**	**130**	**140**	**138**	**142**	**146**	**153**	**151**	**150**
5000	Sale and repair of motor vehicles etc.	16	16	16	16	18	18	18	17	17	16	16	17	17
5100	Ws. and commis. trade, exc. of m. vehicles	48	56	53	56	55	56	67	63	65	71	79	77	76
5200	Re. trade and repair work exc. of m. vehicles.	37	38	39	38	39	40	39	41	42	41	41	41	42
5500	Hotels and restaurants	17	17	17	15	17	17	16	17	17	18	16	16	16
6	**Transport, storage and communication**	**60**	**57**	**62**	**58**	**64**	**69**	**73**	**75**	**72**	**83**	**91**	**95**	**97**
6009	Transport	45	43	46	42	46	51	53	53	49	59	66	68	67
6400	Post and telecommunications	15	15	16	17	18	17	21	22	22	24	24	27	30
7	**Financial and, business activities**	**203**	**206**	**208**	**212**	**218**	**217**	**219**	**228**	**232**	**237**	**252**	**260**	**265**
6509	Financial intermediation and insurance etc.	41	43	43	41	43	41	44	48	51	51	53	53	62
7009	Real estate and renting activities	101	102	104	107	109	112	111	106	107	107	114	115	114
7209	Business activities etc.	60	61	61	63	66	63	64	74	74	80	86	93	88
8	**Public and personal services**	**255**	**256**	**259**	**267**	**273**	**278**	**284**	**288**	**295**	**297**	**299**	**301**	**306**
7500	Public administration etc.	66	65	67	68	67	69	70	72	73	73	71	70	72
8000	Education	52	54	54	56	58	58	60	60	62	63	65	65	67
8519	Health care activities	42	43	42	44	44	44	45	46	47	48	49	50	51
8539	Social work activities.	50	49	51	53	55	58	61	62	64	65	67	68	69
9009	Other community, social and personal act.	45	45	45	46	48	48	48	48	49	49	48	47	48

Table 11. Adjustment of gross value added at current prices, per cent.

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
		pct.												
	Gross value added, total	**1.48**	**1.54**	**1.60**	**1.62**	**1.65**	**1.67**	**1.81**	**1.99**	**2.15**	**2.21**	**2.33**	**2.53**	**2.55**
1	**Agriculture, fishing and quarrying**	**0.04**	**0.05**	**0.07**	**0.08**	**0.08**	**0.08**	**0.08**	**0.06**	**0.10**	**0.04**	**0.11**	**0.15**	**0.16**
109	Agriculture, horticulture and forestry	0.01	0.02	0.01	0.03	0.03	0.03	0.02	0.01	0.03	0.01	0.02	0.02	0.02
500	Fishing.	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.01	0.03	0.00	0.00	0.01	0.01
1009	Mining and quarrying	0.13	0.16	0.24	0.29	0.27	0.33	0.24	0.16	0.28	0.08	0.20	0.30	0.28
2	**Manufacturing**	**3.97**	**4.05**	**4.18**	**4.35**	**4.47**	**4.48**	**5.10**	**5.56**	**6.38**	**6.58**	**7.71**	**9.11**	**8.99**
1509	Mfr. of food, beverages and tobacco	1.34	1.20	1.22	1.29	1.42	1.47	1.53	1.50	1.85	1.46	2.71	3.68	3.09
1709	Mfr. of textiles, wearing apparel, leather	0.40	0.49	0.41	0.37	0.26	0.15	0.30	0.48	0.60	0.46	0.30	0.33	1.12
2009	Mfr. of wood products, printing and publ	0.23	0.22	0.26	0.29	0.29	0.29	0.29	0.31	0.33	0.34	0.37	0.43	0.45
2309	Mfr. of chemicals, plastic products etc.	8.81	9.22	9.71	11.11	11.31	11.71	13.97	15.23	18.97	19.27	22.65	26.57	26.40
2600	Mfr. of other non-metallic mineral products.	2.10	2.31	1.50	0.79	0.72	0.67	0.91	1.11	1.18	1.17	1.36	1.77	0.74
2709	Mfr. of basic metals and fabr. metal prod.	6.02	6.30	6.46	6.52	6.37	6.04	6.62	7.00	7.37	7.68	8.24	9.13	9.40
3600	Mfr. of furniture; manufacturing n.e.c.	0.83	0.80	0.92	1.03	1.00	1.05	1.13	1.14	1.22	1.18	1.27	1.39	1.40
3	**Electricity, gas and water supply**	**0.15**	**0.19**	**0.27**	**0.35**	**0.34**	**0.31**	**0.25**	**0.17**	**0.29**	**0.11**	**0.27**	**0.46**	**0.49**
4	**Construction**	**0.13**	**0.15**	**0.23**	**0.30**	**0.29**	**0.27**	**0.18**	**0.12**	**0.19**	**0.07**	**0.18**	**0.32**	**0.31**
5	**Wholesale and retail trade**	**0.32**	**0.42**	**0.40**	**0.38**	**0.39**	**0.41**	**0.57**	**0.70**	**0.68**	**0.83**	**0.70**	**0.60**	**0.63**
5000	Sale and repair of motor vehicles etc	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5100	Ws. and commis. trade, exc. of m. vehicles	0.57	0.73	0.70	0.66	0.68	0.70	0.95	1.18	1.16	1.43	1.16	1.02	1.05
5200	Re. trade and repair work exc. of m. vehicles.	0.16	0.21	0.19	0.21	0.20	0.24	0.32	0.38	0.36	0.41	0.37	0.29	0.31
5500	Hotels and restaurants	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	**Transport, storage and communication**	**0.03**	**0.04**	**0.05**	**0.07**	**0.07**	**0.07**	**0.06**	**0.08**	**0.09**	**0.13**	**0.12**	**0.12**	**0.11**
6009	Transport	0.02	0.03	0.05	0.06	0.06	0.06	0.02	0.02	0.04	0.02	0.05	0.09	0.08
6400	Post and telecommunications	0.05	0.07	0.08	0.09	0.09	0.09	0.16	0.23	0.22	0.37	0.31	0.22	0.18
7	**Financial and, business activities**	**1.61**	**1.73**	**1.82**	**1.74**	**1.68**	**1.68**	**1.82**	**2.04**	**2.05**	**2.16**	**1.98**	**1.85**	**1.98**
6509	Financial intermediation and insurance etc.	0.11	0.13	0.15	0.19	0.18	0.16	0.23	0.33	0.28	0.47	0.48	0.58	1.75
7009	Real estate and renting activities	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7209	Business activities etc.	5.40	5.78	6.23	6.00	5.77	6.02	6.43	6.32	6.43	6.31	5.66	5.03	4.78
8	**Public and personal services**	**1.40**	**1.44**	**1.48**	**1.50**	**1.58**	**1.64**	**1.72**	**1.79**	**1.81**	**1.88**	**1.93**	**1.97**	**2.01**
7500	Public administration etc.	0.04	0.06	0.08	0.11	0.14	0.16	0.18	0.19	0.20	0.22	0.23	0.23	0.22
8000	Education.	4.58	4.56	4.63	4.61	4.70	4.92	5.07	5.36	5.39	5.62	5.70	5.90	6.08
8519	Health care activities.	2.62	2.66	2.85	2.91	3.12	3.34	3.46	3.62	3.62	3.62	3.69	3.70	3.77
8539	Social work activities.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9009	Other community, social and personal act.	0.27	0.30	0.32	0.34	0.35	0.36	0.43	0.46	0.46	0.52	0.51	0.51	0.47

Note: The table shows the impact of the reclassification on the gross value added, measured in per cent.

Table 12. Adjustment of growth rates in GVA by kind of activity, per cent points

		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
		pct. point											
	Gross value added, total	**0.05**	**0.04**	**0.04**	**-0.02**	**-0.01**	**0.12**	**0.12**	**0.15**	**0.03**	**0.13**	**0.24**	**0.02**
1	**Agriculture, fishing and quarrying**	**0.03**	**0.06**	**0.02**	**-0.01**	**0.02**	**-0.09**	**-0.05**	**0.06**	**-0.12**	**0.08**	**0.05**	**0.01**
109	Agriculture, horticulture and forestry	0.01	0.00	0.02	0.00	0.00	-0.01	-0.01	0.01	-0.02	0.01	0.01	0.00
500	Fishing.	0.00	-0.01	0.00	0.00	0.00	0.00	-0.02	0.02	-0.03	0.00	0.01	0.00
1009	Mining and quarrying	0.04	0.12	0.07	-0.05	0.03	-0.23	-0.12	0.13	-0.29	0.15	0.09	0.00
2	**Manufacturing**	**-0.03**	**0.21**	**0.34**	**-0.25**	**-0.25**	**0.77**	**0.20**	**0.88**	**0.27**	**1.01**	**1.41**	**0.08**
1509	Mfr. of food, beverages and tobacco	-0.17	0.14	0.07	0.06	-0.04	0.07	-0.11	0.34	-0.43	1.28	0.92	-0.14
1709	Mfr. of textiles, wearing apparel, leather	0.09	-0.07	-0.03	-0.12	-0.16	0.15	0.16	0.15	-0.15	-0.18	0.03	0.80
2009	Mfr. of wood products, printing and publ	0.00	0.05	0.05	0.00	-0.02	0.01	0.01	0.03	0.01	0.01	0.07	0.02
2309	Mfr. of chemicals, plastic products etc.	-0.91	0.38	1.67	-0.32	-2.67	2.87	-0.06	2.78	0.18	2.68	3.78	0.87
2600	Mfr. of other non-metallic mineral products.	0.29	-0.93	-0.75	-0.21	-0.06	0.26	0.17	0.09	-0.01	0.12	0.37	-1.14
2709	Mfr. of basic metals and fabr. metal prod.	0.10	0.12	0.11	-0.87	-0.36	0.75	0.17	0.55	0.54	0.38	0.71	0.29
3600	Mfr. of furniture; manufacturing n.e.c	-0.07	0.11	0.25	-0.18	0.03	0.11	-0.05	0.17	0.00	0.09	0.12	-0.01
3	**Electricity, gas and water supply**	**0.05**	**0.08**	**0.13**	**0.02**	**-0.10**	**-0.08**	**-0.10**	**0.14**	**-0.23**	**0.17**	**0.20**	**0.11**
4	**Construction**	**0.02**	**0.08**	**0.09**	**-0.02**	**-0.02**	**-0.10**	**-0.06**	**0.09**	**-0.14**	**0.12**	**0.16**	**0.03**
5	**Wholesale and retail trade**	**0.09**	**-0.02**	**-0.03**	**0.02**	**0.03**	**0.17**	**0.19**	**-0.04**	**0.16**	**-0.20**	**-0.09**	**0.13**
5000	Sale and repair of motor vehicles etc.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5100	Ws. and commis. trade, exc. of m. vehicles	0.11	-0.01	-0.10	0.09	0.04	0.22	0.40	-0.07	0.24	-0.49	-0.12	0.22
5200	Re. trade and repair work exc. of m. vehicles	0.05	-0.01	0.00	-0.01	0.03	0.09	0.08	-0.05	0.05	-0.05	-0.07	0.07
5500	Hotels and restaurants	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	**Transport, storage and communication**	**0.02**	**0.01**	**0.02**	**-0.01**	**0.00**	**-0.03**	**0.01**	**0.02**	**0.00**	**0.01**	**0.01**	**-0.02**
6009	Transport	0.01	0.02	0.02	0.00	0.00	-0.05	-0.01	0.03	-0.04	0.04	0.04	0.01
6400	Post and telecommunications	0.03	0.00	0.00	-0.01	0.00	0.04	0.06	-0.02	0.09	-0.05	-0.08	-0.08
7	**Financial and, business activities**	**0.14**	**0.06**	**-0.05**	**-0.07**	**-0.01**	**0.11**	**0.10**	**-0.06**	**0.03**	**-0.14**	**-0.09**	**0.05**
6509	Financial intermediation and insurance etc.	0.02	0.05	0.04	0.00	-0.02	0.09	0.12	-0.11	0.18	0.04	0.11	1.52
7009	Real estate and renting activities	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7209	Business activities etc.	0.46	0.24	-0.30	-0.31	0.16	0.32	-0.40	-0.06	-0.29	-0.54	-0.53	-0.56
8	**Public and personal services**	**0.07**	**0.04**	**0.02**	**0.04**	**0.04**	**0.05**	**0.04**	**0.01**	**0.04**	**0.05**	**0.06**	**0.04**
7500	Public administration etc.	0.02	0.02	0.02	0.03	0.02	0.02	0.01	0.01	0.02	0.01	0.00	-0.01
8000	Education	0.06	0.12	0.01	-0.03	0.15	0.05	0.20	0.00	0.08	0.06	0.22	0.18
8519	Health care activities	0.12	0.15	0.05	0.12	0.16	0.12	0.11	0.00	0.00	0.02	0.05	0.02
8539	Social work activities.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9009	Other community, social and personal act.	0.03	0.02	0.02	0.01	0.02	0.05	0.03	0.00	0.03	0.01	0.02	-0.03

Note: The table shows the impact of the reclassification on the growth rate of gross value added, measured in per cent point.

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