RESEARCH AND DEVELOPMENT C 2

Overview

Research and development is essential for the generation of new products and services. Although a number of companies produce innovations without formal R&D, the examination of R&D activities gives key criteria for assessing the technological capacity of a country. In particular the financial expenditure and the numbers of R&D personnel are of interest, as well as the involvement of the private sector and the state in R&D activities.

A high R&D rate has positive effects for competitiveness, growth and employment. For example, over the past decade the economy grew most where the R&D capacities expanded fastest. To this extent, Germany has no alternative in the long term to a strategy based on research, development and innovation.

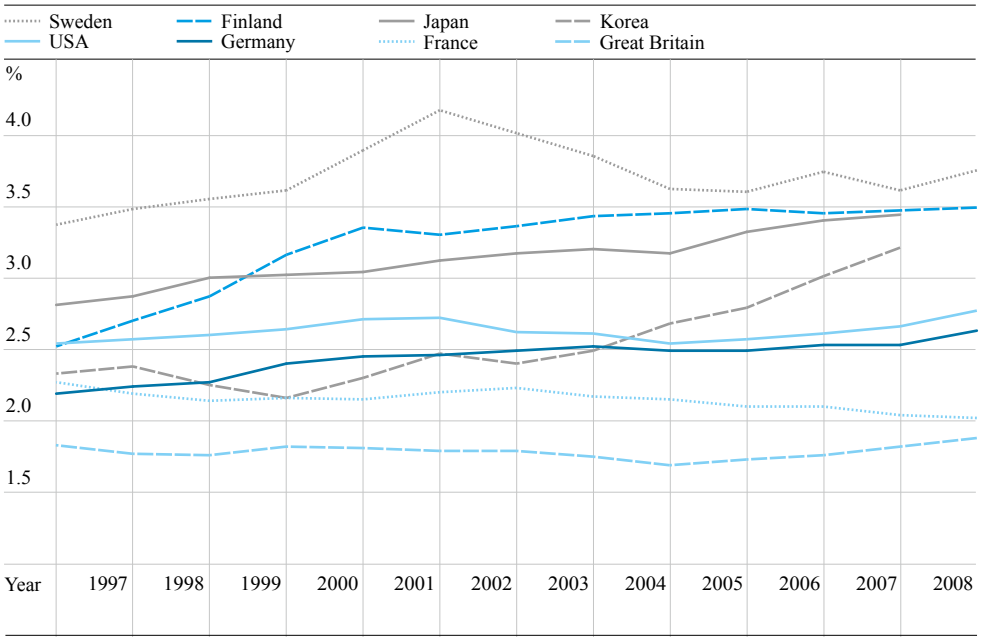
It is not possible to tell from the data which course was adopted in Germany regarding research and development during the economic and financial crisis. At the start of the crisis, the German position had been a favourable one. Currently, the plan data of German companies indicate that research and development is hardly being cut back in the crisis. However, long-term trends and international comparisons show that Germany is losing ground. Other countries, in particular in Asia, have invested much more in R&D and their economy is clearly directed towards knowledge-intensive services and cutting-edge technology. Their rapidly expanding domestic demand and well-trained workforces also make these countries attractive for direct foreign investments.

Most of the data evaluated in this section is from OECD sources (Main Science and Technology Indicators) and the R&D survey of the Stiftererband for the German science system. The data published by the OECD is gathered from 30 member countries and nine non-members, and covers central resources available for R&D, patent data, and details of foreign trade in technology-intensive industries. The Stifterverband regularly surveys some 30 000 companies in Germany regarding their R&D expenditure, their R&D personnel, sources of finance for R&D, the R&D locations, and their products.

Investigated indicators:

- Development of R&D intensity (R&D expenditure as a percentage of gross domestic product)
- R&D intensity in selected OECD countries
- Investment by the government in R&D
- Internal R&D expenditure of universities and non-university research institutions
- Public and private sector funding for R&D

C 2 – 1 R&D INTENSITY IN SELECTED OECD COUNTRIES



Data estimated in part.
Source: OECD (2009a). Calculations and estimates by NIW.

R&D intensity: Expenditure on research and development as a proportion of GDP.

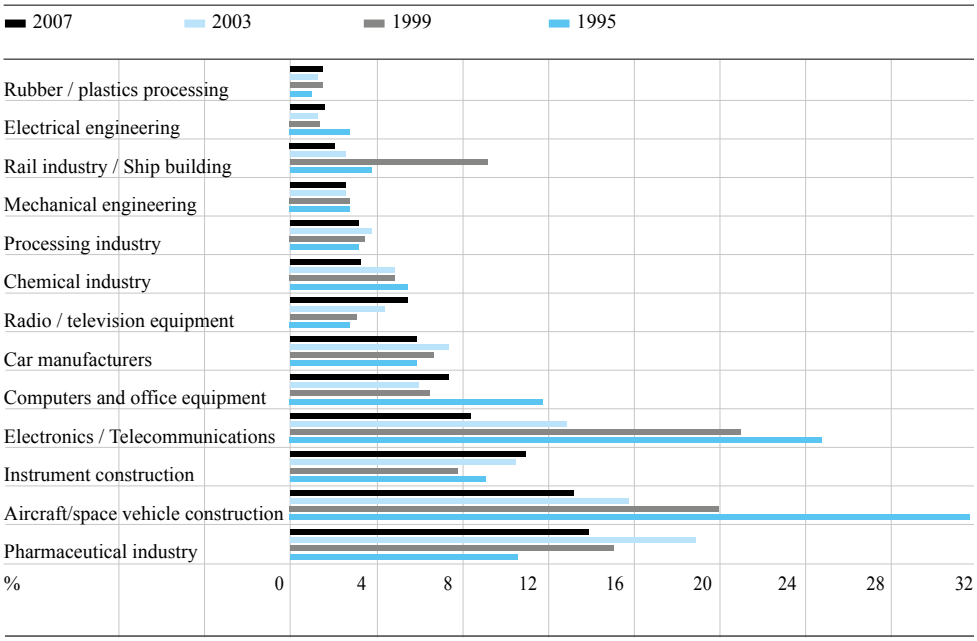
Germany is no closer to the three percent target

In 2008, Germany invested 2.6 percent of its gross domestic product in research and development. Of this, the public sector funded 28 percent. In an international comparison of OECD countries, this puts Germany in a forward midfield position. Sweden was in the lead with an investment of 3.6 percent of gross domestic product in R&D, followed by Finland (3.5 percent), Japan (3.4 percent) and Korea with 3.2 percent. Italy was the trailing western industrialised countries with an R&D intensity of only 1.1 percent. France, the Netherlands and Great Britain were all well behind Germany. The OECD average was 2.3 percent, the EU average was considerably lower. The three-percent target is still a long way away.

The United States dominate the international R&D activities, and 42 percent of R&D expenditure in OECD countries was made by the USA. Germany accounted for 8.1 percent. Above all in recent years, most countries have again been investing considerably more R&D than at the start of the decade. However, western industrialised countries could not keep up with the rate of expansion of the Asian countries. In 2007, China spent US$ 102 billion on R&D, of which more than 70 percent came from the private sector. This puts China in third place among researching countries in absolute terms, although with an R&D-intensity of only 1.4 percent.

TOTAL PRIVATE SECTOR R&D EXPENDITURE RELATIVE TO TURNOVER

C 2 – 2



Source: Stifterverband-Science statistics. Federal Statistical Office, Series 4 - 4.1.1 and 4.3. Calculations by NIW.

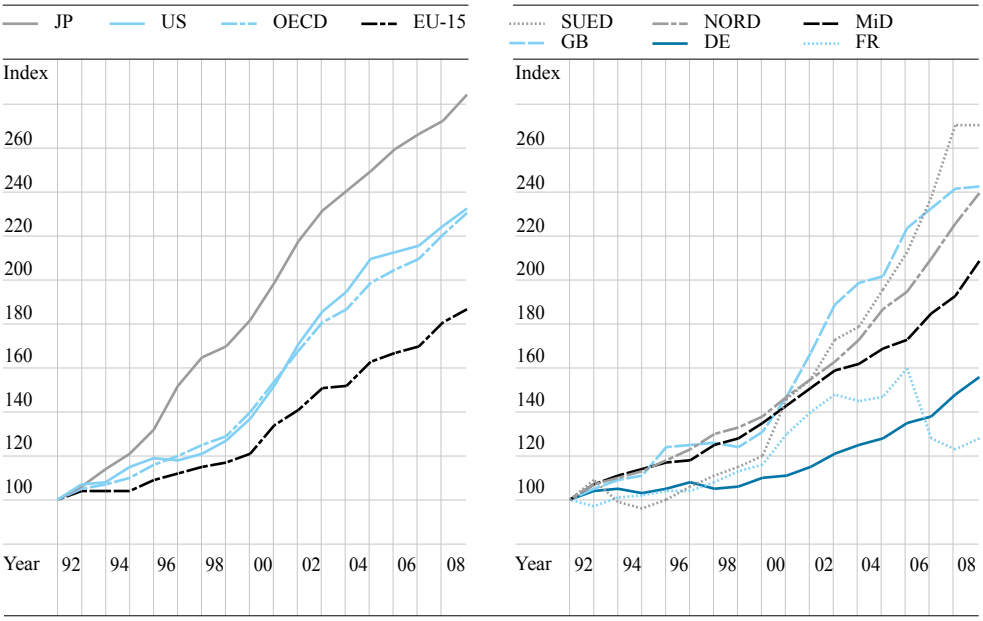
R&D-intensity: Expenditure on research and development as a proportion of turnover of a company or a branch.

The German private sector: high R&D intensity, but low R&D growth rates

In 2008, the German private sector invested 2.9 percent of gross value created in R&D. The OECD average in 2007 was 2.4 percent. Germany ranked eighth among the OECD countries. While at the start of this Millennium the growth rates of real R&D expenditures were very moderate, they began to increase again in 2003. Above all in Asia, but also in southern Europe, larger sums are being spent on R&D. Korean private sector R&D expenditure is increasing by eleven percent annually, that of the German private sector by almost three percent. Although this is based on a high level, the rate of increase is lower than the average for the EU-15 member states (3.8 percent).

R&D involvement and R&D intensity for the private sector vary considerably between industrial sectors. In cutting-edge technology segments an average of more than 13 percent of personnel are involved in R&D activities, but only some three percent in low to medium technology segments. R&D intensity is particularly high for aircraft and spacecraft, pharmaceuticals, and the IT industry. These sectors spend about 10 to 13 percent of their revenue on R&D. However, R&D expenditure is highest for the automotive industry. The R&D intensity of many sectors has changed considerably in recent years. In particular there has been a massive reduction for aircraft and spacecraft construction, but also in electronics and telecommunications. The average over all sectors has also gone down since 2003.

C 2 – 3 STATE BUDGETS FOR CIVILIAN R&D IN SELECTED WORLD REGIONS



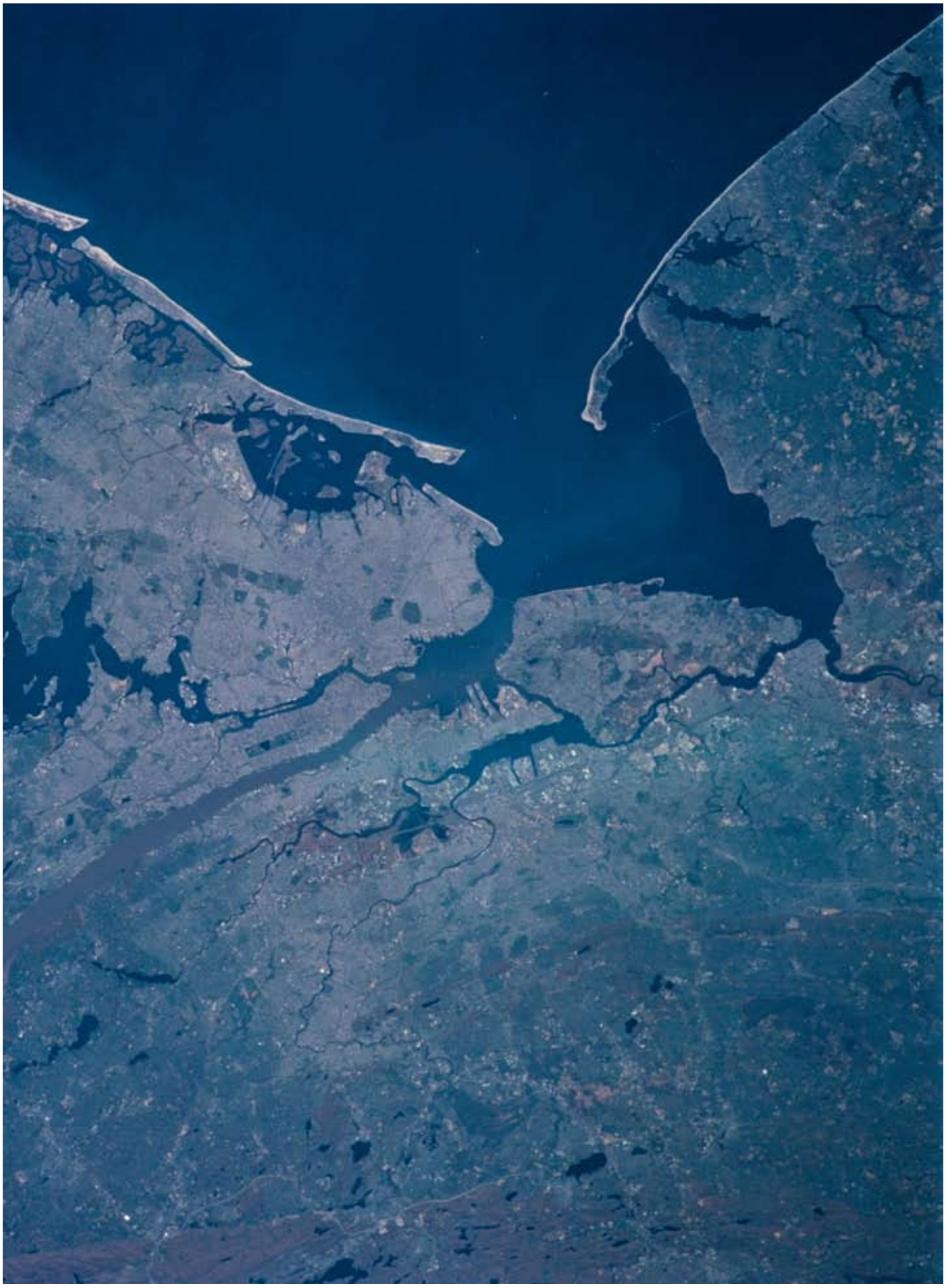
Index: 1991 = 100. Semi-log scale. Data in part estimated. NORTH: SE, FI, NO, DK, IE, IS. SOUTH: IT, PT, ES, GR. MID: BE, NL, AT, CH.
Source: OECD (2009a). Calculations and estimates by NIW.

R&D budget: The amount allocated in the government budget to finance research and development.

Significant increase in state investment in research and development

In Germany, the government budget for R&D has increased markedly since 2004, at an average rate of five percent per annum. Germany has therefore moved ahead of the USA and leading EU member states such as France. However, in the preceding years Germany had shown comparatively weak R&D involvement and lost ground to other industrialised countries. Germany's state R&D expenditure in the civilian sector is still high by international comparisons. It is interesting that government R&D expenditure went down in many EU member countries immediately after the announcement of the three-percent target.

In Germany, 27.7 percent of R&D activities were financed by the state in 2007. The largest part of this (42 percent) went into university research. 30 percent of R&D activities were carried out by state organisations or by universities. This was similar to the level in the USA and corresponded to the average for the OECD countries. This meant that 0.7 percent of Germany's domestic product was used by the state to finance R&D, which is an historic low. Note however that this does not take into account the flow of funds from other countries, such as R&D finance from the EU or the European Space Agency, which have considerable relevance.



New York
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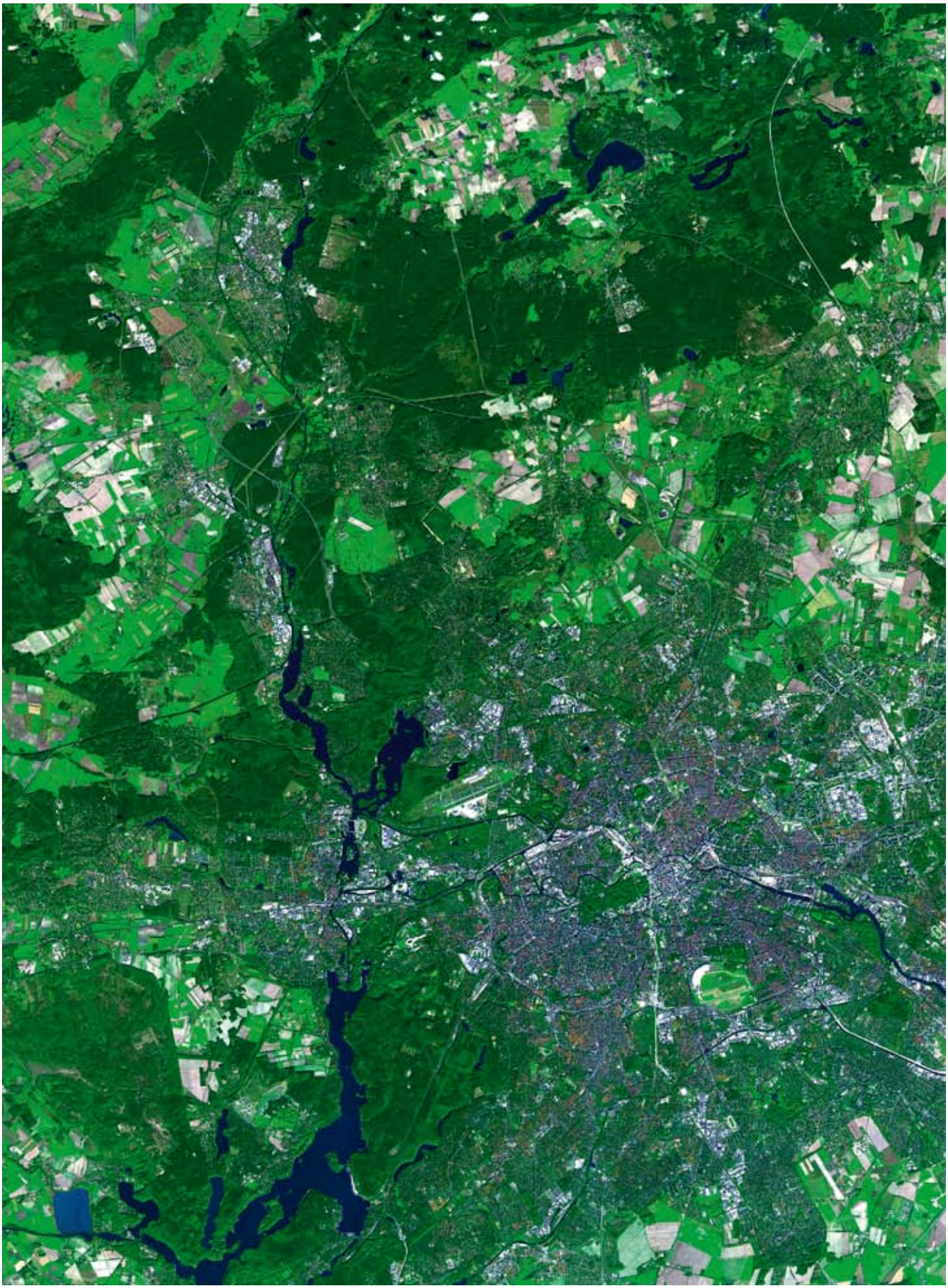
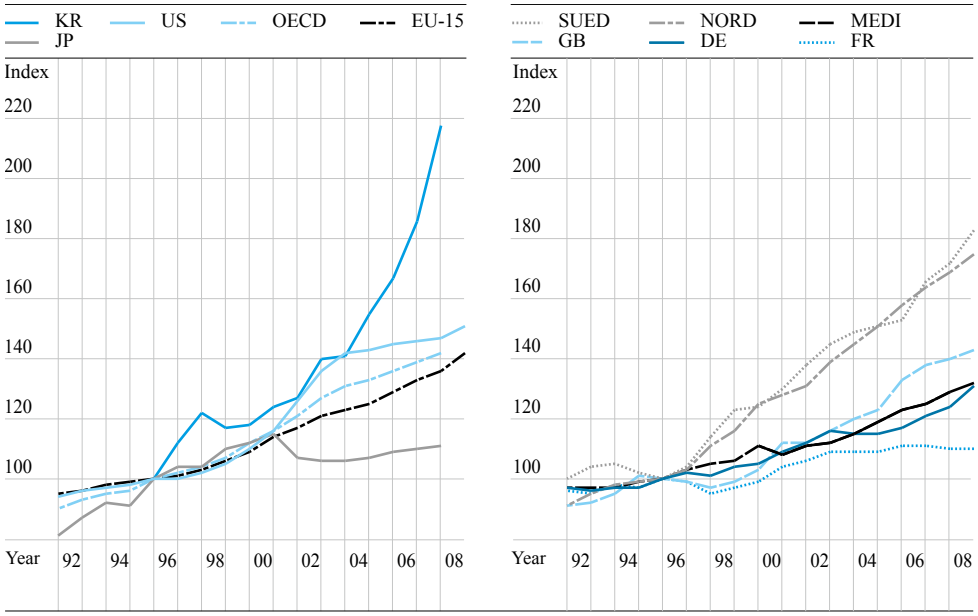


Berlin

INTERNAL R&D-EXPENDITURE OF UNIVERSITIES AND NON-UNIVERSITY INSTITUTIONS* IN CONSTANT PRICES ACCORDING TO WORLD REGIONS

C 2 – 4



* Including non-profit private organisations. Index: 1995 = 100. Semi-log scale. Data in part estimated. NORTH: SE, FI, NO, DK, IE, IS. SOUTH: IT, PT, ES, GR. MID: BE, NL, AT, CH.
Source: OECD (2009a). Calculations and estimates by NIW.

Internal R&D expenditure: Financial expenditure for R&D personnel, R&D equipment, and in-house investments in R&D.

High private sector participation in German university research

In Germany, expenditure by universities and non-university research institutions on R&D has increased more rapidly since 2004 than the OECD average. However, viewed from a longer-term perspective it can be seen that the R&D expenditure has increased much more in real terms in northern European countries, but also in Great Britain and the USA.

Public sector R&D is not financed solely by the state. In the OECD countries, the private sector financed 6.6 percent of university research in 2007, and 3.9 percent of research in non-university research institutions. In Germany, the contribution by the private sector is particularly high, accounting for 14.2 percent of university research and 10.8 percent of R&D in non-university institutions. Over time, there has been an increase in demand from the German private sector for R&D contributions from the science system.

C 2 – 5 FINANCING R&D IN THE PRIVATE SECTOR ACCORDING TO ECONOMIC SECTOR, SIZE AND TECHNOLOGY CLASSES (2007)

	Private Sector	Public Sector	Other domestic	Foreign
All researching companies				
Unternehmen	**92.9**	**3.1**	**0.1**	**3.9**
Manufacturing industry	93.4	2.6	0.1	3.8
Chemical industry	96.9	0.6	0.0	2.4
Mechanical engineering	94.1	2.4	0.1	3.5
Electric eng. / Electronics	93.3	2.6	0.0	4.0
Motor vehicle construction	91.9	3.6	0.2	4.3
Other industry	94.0	2.0	0.1	4.0
Other sectors	88.0	7.4	0.3	4.2
< 100	85.9	10.1	0.3	3.8
100 to 500	91.9	4.0	0.1	4.0
500 to 1 000	93.2	4.4	0.1	2.3
> 1 000	93.4	2.5	0.1	4.0
Technology classes in industry				
Low and medium technology	94.0	2.0	0.1	4.0
High-value technology	96.2	0.7	0.1	3.0
Cutting-edge technology	88.4	6.2	0.2	5.2

in percentages.
Source: Stifterverband-Science statistics. Calculations by NIW.

State financing contribution: Proportion of total private sector R&D expenditure which derives from public sector sources.

There has been a clear drop in state support for private sector R&D

Both in the EU member states and in the OECD countries there has been a considerable drop in state support for private sector R&D over the past 30 years. It has been reduced from about 20 percent at the start of the 1980s to below 7 percent today. This trend could also be observed in Germany. In 2007, the state supported only 4.5 percent of domestic private sector R&D carried out by individual companies and joint research institutions – which is below-average in an international comparison. Many countries also provide tax incentives for R&D, which widens the gap over Germany even more, because here no such instrument exists at present. On the other hand, the figures do not include support which companies receive mony from the EU or other supra-national organisations, which cannot be quantified accurately.

State support for R&D in Germany benefits in particular the air and space industry, electrical engineering and manufacturers for data processing equipment. The sectors receiving most support also include mechanical engineering. Smaller enterprises now receive a relatively higher state contribution for R&D expenditure than large companies. In companies with fewer than 100 employees, state support covers, on average, 10.1 percent of R&D expenditure, compared with only 2.5 percent in companies with more than 1 000 employees.