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**Article**

## German Companies Do Less Research Abroad

Weekly Report

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# Weekly Report

## German Companies Do Less Research Abroad

*Germany has profited from the internationalization of research and development (R&D) in multinational companies. While the international R&D balance sheet was balanced until 2001, foreign companies now invest more in R&D in Germany than German companies abroad. The share of R&D expenditures of German multinationals abroad is declining, whereas their global expenditures are increasing. This means the internationalization of R&D activities in Germany has slowed down.*

*Strategic restructuring of multinational companies is the decisive factor for internationalizing R&D, not relocation. Against this background, current plans for tax relief for R&D will probably not lead to significant backshoring of foreign R&D activities to Germany.*

In industrialized countries, multinational corporations account for most of the expenditures for research and development (R&D).<sup>1</sup> They are also increasing their R&D activities abroad. Continuing internationalization can be observed *internally* through rising shares of R&D expenditures of foreign companies in total R&D expenditures in the economy. Stronger growth of R&D activities of multinational corporations abroad than in their home country is proof for *external* internationalization.

For globally active companies it is necessary to take on impulse for innovation from the most important markets and leading research institutes worldwide. By doing their own R&D in the target market, companies adapt their products and technologies to the customers' needs and the conditions of local production. Additionally, supply-side motives gain in importance. This includes knowledge acquisition through cooperation with universities and research institutes as well as recruiting qualified engineers and scientists.<sup>2</sup> In certain fields, like for example *red* or *green* biotechnology, another motivation is the possibility to do research without regulation in a number of countries.

<sup>1</sup> In 2007, 80 percent of R&D expenditures of companies in Germany came from multinational corporations with German and foreign majority ownership which also carry out R&D abroad.

<sup>2</sup> See OECD: The Internationalisation of Business R&D, Evidence, Impacts and Implications. Paris 2008; Thursby, J.G., Thursby, M.C.: Here or There? A Survey of Factors in Multinational R&D Location: Report to the Government/University/Industry Research Roundtable, 1 December 2006.

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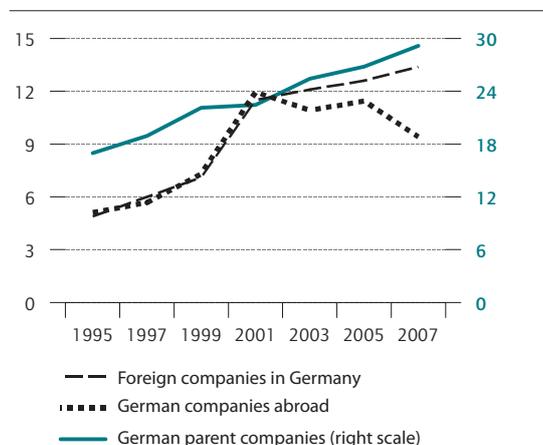
**JEL Classification:**  
F23, L2, O3

**Keywords:**  
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Figure 1

### R&D Expenditures of German and Foreign Companies

In EUR billion



Sources: SV-Wissenschaftsstatistik, calculations by DIW Berlin.

DIW Berlin 2010

German companies are increasing their domestic R&D expenditures but do less research abroad.

An analysis of the development of multinational corporations' R&D expenditures in Germany and abroad gives us an idea whether a research or innovation location is internationally attractive with regard to framework conditions for implementing new products and technologies, qualified personnel and efficient scientific and educational institutes as well as local R&D costs.

Internationalization of R&D also plays a role in the current discussion on the introduction of tax incentives for R&D activities.<sup>3</sup> Proponents expect German companies to relocate their foreign R&D activities back to Germany because of this tax relief. Furthermore, future relocation of domestic R&D activities to other countries could be prevented.<sup>4</sup>

DIW Berlin has analyzed R&D internationalization in Germany and the USA. The analysis is based on sector-specific data on R&D expenditures of German companies abroad and foreign companies in Germany from 1995 till 2007.<sup>5</sup> Internationalization

**3** Germany is (together with Switzerland and Sweden) one of the OECD countries without tax relief for R&D activities. However, the introduction of such a scheme is part of the current government's coalition agreement.

**4** See Spengel, C. et al.: Steuerliche Förderung von Forschung und Entwicklung (FuE) in Deutschland. Berlin, Heidelberg 2009.

**5** Multinational corporations are classified according to the country where they are managed. Normally this is also the country of majority ownership. See Belitz, H.: Forschung und Entwicklung in multinationalen Unternehmen. Studien zum deutschen Innovationssystem Nr. 6-2010, Expertenkommission für Forschung und Innovation (Hrsg.) Berlin, February 2010.

of R&D activities of multinational corporations is compared with the development in the USA, the only country having long-term data in this field.<sup>6</sup>

### R&D expenditures of German companies abroad declining

Global R&D expenditures of German multinational corporations have only increased by 300 million to EUR 38.6bn between 2005 and 2007. This was almost completely achieved in Germany. Abroad, R&D expenditures even decreased by EUR 2 billion (nearly 18 percent) to EUR 9.5 billion (see Figure 1).

The average proportion of research abroad of German companies was about one quarter (2005: 30 percent).

The significant decrease of R&D expenditures abroad is mainly due to automotive industry and the field of computer industry, electrical engineering and precision engineering (see Figure 2). These and the pharmaceutical industry are the main fields of activity of German companies' foreign R&D (Table 1). German automobile manufacturers only carried out 16 percent of their R&D activities abroad in 2007, compared to 26 percent two years before. In the field of computer industry, electrical engineering and precision engineering this percentage fell from 32 percent to 20 percent. In both sectors this development was determined by demergers and the restructuring of large enterprises. One example is Daimler's separation from its US daughter Chrysler, which significantly reduced their R&D expenditures abroad.<sup>7</sup> R&D expenditures abroad of all German automobile manufacturers went down by EUR 1.8 billion between 2005 and 2007. In the computer industry, electrical engineering and precision engineering, German R&D expenditures abroad went down by EUR 1.1 billion during that time. Siemens alone cut its number of employees in R&D working abroad by one quarter between 2006 and 2007 (6,900 employees).<sup>8</sup> At the same time, the total number of

**6** Data for Germany have been collected by Wissenschaftsstatistik GmbH for Stifterverband für die Deutsche Wissenschaft (SV-Wissenschaftsstatistik) since the mid-1990s, using their standard biannual evaluation of R&D expenditures for special analysis. See also: FuE-Aktivitäten deutscher Unternehmen im internationalen Umfeld 2007. In: facts, Zahlen und Fakten aus der Wissenschaftsstatistik GmbH im Stifterverband, Essen, November 2009. In the USA such data have been collected for a long time by the Department of Commerce. See U.S. Department of Commerce. U.S. Affiliates of Foreign Companies and U.S. Direct Investment Abroad.

**7** The difference in global R&D expenditures in the according annual statements of DaimlerChrysler and Daimler for 2006 is around EUR 1.6 billion.

**8** This has probably caused a decline of R&D expenditures of EUR 600 to 700 million. Since also domestic R&D staff was reduced in this restructuring process (9,500 employees), the percentage of R&D staff working

employees outside of Germany went down by 13 percent. Major reasons for the decrease in foreign R&D activities by Siemens probably include the outsourcing of parts of its communication business in a joint venture with Nokia, outsourcing of computer services in a joint venture with Fujitsu, and sale of most of its industrial logistics business.<sup>9</sup>

These examples show that restructuring processes of single large-scale enterprises greatly influence internationalization of a country's business research. In most cases, research units stay at their respective location. Only in their integration into the new, often international R&D structure of the acquiring company a strategic reorientation and change in R&D capacity are made possible.

For German chemical and pharmaceutical companies, the percentage of foreign R&D expenditures of global R&D expenditures was 44 percent in 2007. This is roughly the same level of internationalization as in 2001. In the pharmaceutical industry foreign R&D expenditures of German companies have been stagnating since 2005; however, domestic R&D expenditures decreased by 50 percent. This has led to a proportion of nearly 70 percent of R&D expenditures abroad (2005: 52 percent).

### R&D share of foreign companies in Germany stays at 25 percent

In Germany, foreign subsidiary companies spent around EUR 13.4 billion on R&D in 2007 (2005: EUR 12.6 billion) and employed 81,100 persons in R&D (2005: 76,600). This means that one quarter of R&D expenditure in Germany has come from foreign companies since 2001.

Foreign companies have similar technological and sector preferences in R&D like their domestic competitors. However, they have a stronger focus on pharmaceutical and chemical research as well as the aerospace industry (Table 2).

In Germany, about half of researchers work in the fields of computer industry, electrical engineering, precision engineering and automotive engineering—this applies to foreign companies as well as to domestic ones. The sector with the highest percentage of R&D staff in foreign companies (three quarters) is vehicle construction (aircraft, spacecraft, shipbuilding and railway construction), followed by the pharmaceutical industry with a percentage of around 50 percent.

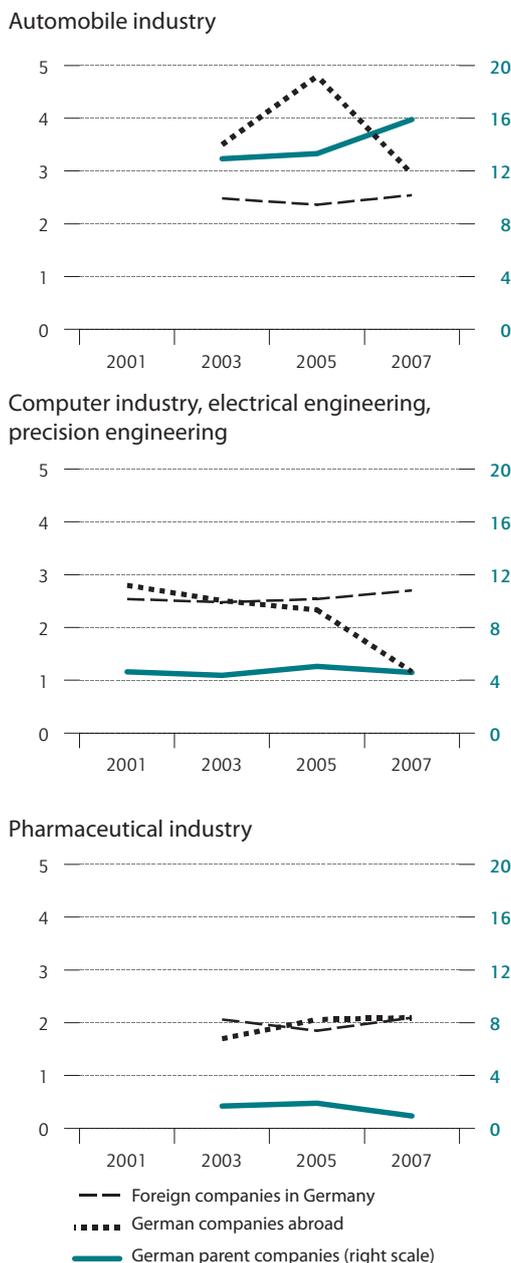
abroad rose from 57 to 64 %.

<sup>9</sup> See Siemens' annual reports of 2006 and 2007.

Figure 2

### R&D Expenditures of German and Foreign Companies by Selected Sectors

In EUR billion



Sources: SV-Wissenschaftsstatistik, calculations by DIW Berlin.

DIW Berlin 2010

*One can observe a strong decline of foreign R&D activities in the automobile industry as well as in electrical engineering.*

Table 1

**R&D Expenditures of Groups of Companies in Germany and the USA in 2007**

In percent

|   | Companies abroad |                   | Foreign companies in respective country |                  | Parent company in home country (with R&D abroad) |             |
|---|------------------|-------------------|---|------------------|--|-------------|
|   | Germany          | USA               | Germany                                 | USA              | Germany  | USA         |
| Automobile industry   | 31.3             | 27.0 <sup>1</sup> | 19                                      | 9.9 <sup>2</sup> | 54.5   | 7.8         |
| Pharmaceutical industry   | 22.3             | 20.3              | 15.7                                    | 37.3             | 3.2  | 20.6        |
| Computer industry, electrical engineering, precision engineering <sup>3</sup> | 12.3             | 15.6              | 20.2                                    | 9.7              | 15.7   | 19.9        |
| <b>Total</b>  | <b>65.9</b>      | <b>62.9</b>       | <b>54.9</b>                             | <b>56.9</b>      | <b>73.2</b>                                      | <b>48.3</b> |

<sup>1</sup> 2005.<sup>2</sup> 2006.<sup>3</sup> For the USA, only figures for the computer and electronic industry are given according to national sector classification.

Sources: SV-Wissenschaftsstatistik, US Department of Commerce, calculations by DIW Berlin.

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*R&D internationalization in Germany and the USA* is focused on three sectors: Automobile industry, pharmaceutical industry and computer industry/electrical engineering.

If we compare the percentage of R&D employees of total staff numbers, there is no difference between domestic and foreign companies. Their research focus and R&D intensity are similar.

**Strong links to the USA, Switzerland and France**

Cross-border R&D activities of companies in Germany have similar home and target countries

(Table 3). Importance of a country of origin is measured by its share of R&D staff of foreign companies in Germany. Since there was no information on the regional distribution of R&D employees of German companies abroad, the importance of a target country is measured by its percentage in patent applications by German companies at the European Patent Office with place of invention in the respective country.<sup>10</sup>

<sup>10</sup> See Belitz, H., Schmidt-Ehmcke, J., Zlosycsti, P.: *Auslandsforschung deutscher Unternehmen—kaum Belege für Abwanderung*. Wochenbericht no. 46/2008, DIW Berlin

Table 2

**R&D Staff in Companies with German or Foreign Majority Ownership in Germany in 2007**

|  | Total          | German         | foreign       | Proportion of foreign companies in percent | Sectoral structure of |            | R&D intensity <sup>1</sup> of |            |
|--|----------------|----------------|---------------|--|-----------------------|------------|-------------------------------|------------|
|  |                |                |               |  | German                | foreign    | German                        | foreign    |
|  |                |                |               |  | companies in percent  |            | companies in percent          |            |
| <b>Total</b>   | <b>316 599</b> | <b>235 463</b> | <b>81 136</b> | <b>25.6</b>                                | <b>100</b>            | <b>100</b> | <b>7.7</b>                    | <b>8.5</b> |
| <i>Thereof:</i>  |                |                |               |  |                       |            |                               |            |
| Professional services  | 32 649         | 28 396         | 4 253         | 13.0                                       | 12.1                  | 5.2        | 15.7                          | 12.3       |
| Manufacturing industry   | 276 366        | 200 965        | 75 401        | 27.3                                       | 85.3                  | 92.9       | 8.6                           | 8.9        |
| <i>Thereof:</i>  |                |                |               |  |                       |            |                               |            |
| Chemical industry  | 41 299         | 26 927         | 14 372        | 34.8                                       | 11.4                  | 17.7       | 11.5                          | 12.2       |
| Chemical without pharmaceutical industry                         | 22 623         | 17 694         | 4 929         | 21.8                                       | 7.5                   | 6.1        | 10.1                          | 8.1        |
| Pharmaceutical industry  | 18 676         | 9 233          | 9 443         | 50.6                                       | 3.9                   | 11.6       | 16.1                          | 16.5       |
| Machine building   | 41 337         | 33 595         | 7 741         | 18.7                                       | 14.3                  | 9.5        | 7.1                           | 6.6        |
| Computer industry, electrical engineering, precision engineering | 70 481         | 49 718         | 20 763        | 29.5                                       | 21.1                  | 25.6       | 11.3                          | 11.3       |
| Vehicle construction   | 96 896         | 72 055         | 24 840        | 25.6                                       | 30.6                  | 30.6       | 11.0                          | 13.7       |
| Automobile industry  | 85 656         | 69 359         | 16 298        | 19.0                                       | 29.5                  | 20.1       | 11.4                          | 13.8       |
| Other vehicle construction                                       | 11 239         | 2 697          | 8 542         | 76.0                                       | 1.1                   | 10.5       | 5.9                           | 13.6       |

<sup>1</sup> Percentage of R&D staff in relation to all employees of the respective sector.

Sources: SV-Wissenschaftsstatistik, calculations by DIW Berlin.

DIW Berlin 2010

*One in four researchers* is employed by a foreign company. Foreign and domestic companies in Germany have similar sectoral preferences and R&D intensity.

From a German perspective, the USA is the most important origin/target country for R&D activities and knowledge exchange via multinational corporations, followed by Germany's neighboring countries Switzerland, France, the Netherlands and Austria. So Germany's main competitors in the field of best research conditions for companies are still the USA and a couple of Western European neighbors. But it is expected that fast growing countries like China and India will one day become important locations for foreign R&D activities of German companies as well. These countries are currently expanding their research infrastructure and are significantly increasing their number of university graduates.

### Germany's international R&D balance is positive

In 2007, foreign companies invested about EUR 4 billion more in R&D in Germany than German companies abroad. This makes the German research balance positive, after being in equilibrium until 2001. For German multinational corporations, a gap has been opening up since 2001: While domestic R&D expenditures are increasing, R&D expenditures abroad are on the decline.

This development is caused by companies of the automotive industry as well as computer industry, electrical engineering and precision engineering. In both sectors, Germany's international R&D balance sheet was balanced at the beginning of the decade and has become positive because German companies have reduced their R&D activities abroad. At the same time, German automobile manufacturers have considerably expanded their domestic R&D activities. This shows a high attractiveness of Germany as an R&D location in this sector. Also in the computer industry, electrical engineering and precision engineering German companies are withdrawing from R&D abroad. However, their domestic R&D expenditures rose only slightly in the past years, as is the case for foreign companies in Germany.

In the chemical industry, Germany's international R&D balance sheet is less positive. While it is balanced in the research-intensive pharmaceutical industry, domestic R&D expenditures by German companies have halved between 2005 and 2007. Since total domestic R&D expenditures in the pharmaceutical industry have been stagnating since 2005 as well, this points towards a loss of importance of Germany as a location for pharmaceutical research.

Table 3

### Home and Target Country for R&D of Multinational Corporations

In percent

|                             | R&D staff of foreign companies in Germany in 2007 | Patent applications of German companies <sup>1</sup> abroad 2002-2005 |
|-----------------------------|---|---|
| Europe                      | 55.8  | 62.3  |
| <i>Thereof:</i>             |   |   |
| Netherlands                 | 15.0  | –   |
| Switzerland                 | 12.9  | 14.0  |
| France                      | 10.0  | 13.0  |
| Austria                     | –   | 10.0  |
| Asia                        | 3.6   | 4.7   |
| Japan                       | 3.3   | 2.3   |
| South-East Asia             | 0.3   | 2.4   |
| NAFTA (USA, Canada, Mexico) | 38.9  | 30.7  |
| Other countries             | 1.7   | 2.2   |
| <b>Total</b>                | <b>100</b>  | <b>100</b>  |

<sup>1</sup> At the European Patent Office including PCT.

Sources: SV-Wissenschaftsstatistik, European Patent Office, PATSTAT version 1/2008, calculations by DIW Berlin.

DIW Berlin 2010

*Knowledge exchange* mainly happens among affiliated companies in European neighboring countries and with the USA.

In the USA, the international R&D balance sheet has been positive for quite a while (Figure 3). This is nearly completely due to developments in the pharmaceutical industry. In the other two research-intensive sectors with a high level of internationalization, automotive engineering and computer and electronics industry, the international R&D balance sheet is negative (Figure 4).

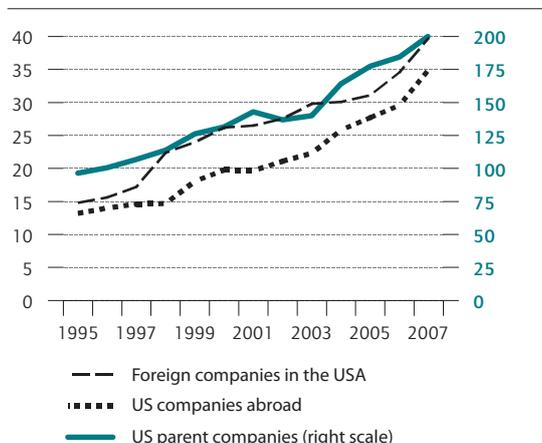
In US pharmaceutical companies, R&D expenditures increased more domestically than abroad in the past years. R&D expenditures by foreign companies in the USA amounted to nearly USD 15 billion in 2007, which was twice the sum of US R&D expenditures abroad. The international R&D balance sheet increased significantly after 2005 in favor of the USA. The situation is different in the American automotive industry, where a negative US international R&D balance is worsening. At the same time, domestic R&D expenditures of US parent companies are stagnating. This points towards disadvantages of this research location in the automobile industry.

Foreign companies invest more in R&D in the USA—and since 2003 also in Germany—than domestic companies abroad. Both research locations are profiting from R&D internationalization in multinational corporations. The USA's positive international R&D balance is mainly determined by the pharmaceutical industry; in Germany, the

Figure 3

### R&D Expenditures of American and Foreign Companies

In USD billion



Sources: US Department of Commerce, calculations by DIW Berlin. **DIW Berlin 2010**

The USA's international R&D balance is positive.

decisive factor is the automobile industry. The most important contributions to the establishment and strengthening of these sectoral centers of gravity for R&D come from the respective domestic parent companies. In the American pharmaceutical industry, foreign companies have also contributed a lot with their strongly increasing R&D expenditures.

### R&D internationalization is not characterized by relocations

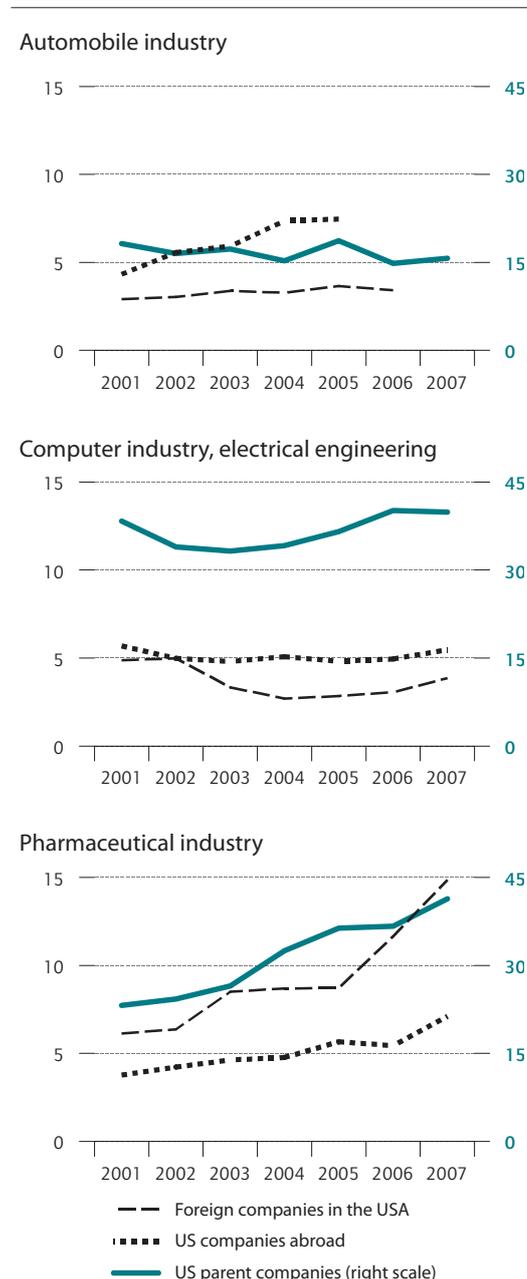
An analysis of the sectoral internationalization pattern of R&D in Germany shows that relocation of domestic R&D capacities to other countries is no important reason for R&D internationalization. Relocations could be assumed if R&D expenditures by German companies abroad increased more quickly abroad than in Germany. This could only be observed between 1999 and 2001. But in this period also domestic R&D expenditures by foreign companies increased significantly. In comparison, domestic R&D expenditures by German multinational companies increased only slightly. The reason for this development could very well be the sale of researching affiliates to foreign owners. The sale of German Hoechst AG to the French corporation Rhône-Poulenc in 1999 alone probably accounts for most of this trend. About half of global R&D expenditures of Hoechst AG in 1998 were made in Germany—nearly EUR 2 billion.<sup>11</sup>

<sup>11</sup> See Eckert, S.: Auf dem Weg zur Aktionsärsorientierung: Shareholder

Figure 4

### R&D Expenditures of American and Foreign Companies in Selected Sectors

In USD billion



Sources: US Department of Commerce, calculations by DIW Berlin. **DIW Berlin 2010**

R&D expenditures of the pharmaceutical industry focus more and more on the USA.

Value bei Hoechst. In: Streeck, W., Höpner, M. (Hrsg.): Alle Macht dem Markt? Fallstudien zur Abwicklung der Deutschland AG. Frankfurt/New York 2003.

However, the decline in R&D expenditures of German companies abroad between 2001 and 2007 was hardly the result of many relocations. R&D expenditures of German companies abroad did go down by EUR 2.5 billion, but their domestic R&D expenditures rose by EUR 6.7 billion until 2007. Internationalization and re-nationalization of R&D in multinational corporations is mainly part of restructuring processes in the context of expanding or downsizing a company. It is takeovers and sales of researching companies that influence this development, not mere *relocation* of R&D capacities between different countries. This is also proven by a 2005 study conducted with representatives of 250 multinational corporations mainly from Western Europe and the USA. They were asked about their motivation for and the type of their new R&D locations. Only one in four of new or planned R&D sites abroad were described as “relocation” whilst the rest were characterized as “expansion” of R&D.<sup>12</sup>

In Germany, *internal* internationalization of R&D has come to a halt since the beginning of the new millennium after a strong increase at the end of the 1990s. *Externally* it has even decreased. Also in the USA, the UK, France and Sweden the process of *internal* R&D internationalization has not significantly improved since 2001 (Figure 5). *Externally* this is at least also true for Sweden and Japan, whose percentage of R&D expenditures of domestic companies abroad in relation to domestic R&D expenditures has not increased since 2001.<sup>13</sup> Only multinational US corporations had a stronger increase of R&D expenditures abroad between 2001 and 2007 than was the case in the USA.

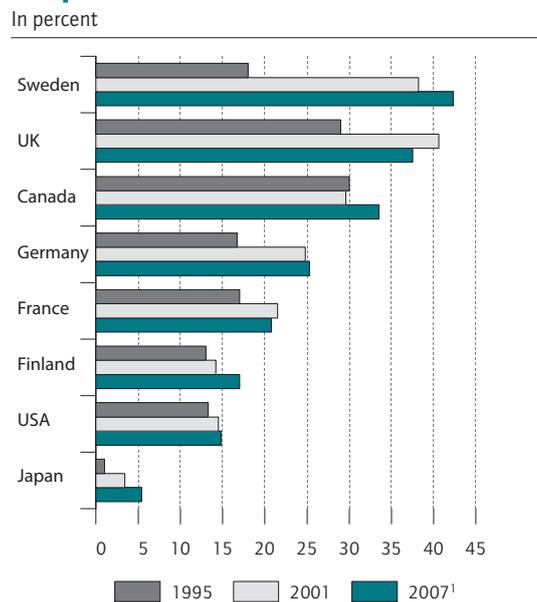
### Conclusion

Over the last years, Germany and the USA have profited from the internationalization of R&D activities of multinational companies. After having a balanced international R&D balance sheet until 2001, Germany now receives EUR 4 billion more of investments by foreign companies in Germany than German companies invest abroad.

Strategic restructuring is at the core of companies’ decision-making, not relocation of research sites. This is why cost reduction for R&D, e.g. through currently discussed tax incentives in addition to existing R&D project funding, will hardly result in backshoring of R&D capacities to Germany.

Figure 5

### R&D Expenditures of Foreign companies in Selected Countries



1 Canada: 2004, Sweden: 2005, Finland, France and Japan: 2006.

Sources: OECD, national sources, calculations by DIW Berlin.

DIW Berlin 2010

In most countries the percentage of foreign companies in business R&D activities have hardly changed since 2001.

The worldwide global and financial crisis has somewhat stopped internationalization if we take direct investment and cross-border company sales and mergers in 2008 as evidence<sup>14</sup> This will curb further internationalization of R&D.

(First published as “Deutsche Unternehmen forschen weniger im Ausland”, in: *Wochenbericht des DIW Berlin Nr. 20/2010.*)

<sup>12</sup> Thursby, J.G., Thursby, M.C., in the place cited

<sup>13</sup> See online OECD database, globalization: stats.oecd.org/index.aspx?r=85052

<sup>14</sup> See UNCTAD: World Investment Report. Geneva 2009.

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